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27,948	588
27,963	1149
28,009	908
28,012	618
28,024	417
28,028	1177
28,036	591
28,057	803
28,060	1016
28,104	1200
28,108	1217
28,124	1035
28,181	495
28,186	1201
28,188	866
28,189	579
28,207	755
28,214	437
28,221	1173
28,266	1016
28,280	1144
28,282	1163
28,297	124
28,364	578
28,390	890
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28,619	1159
28,635	617
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28,687	689
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28,745	449
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1908.	
66	678
69	983
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139	522
207	756
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254	677
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348	1218
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361	553
401	510
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419	944
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467	902
486	1200
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494	740
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517	1105
553	1056
572	620
575	1122
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665	690
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860	629
907	676
921	1204
929	867
993	1017
1021	911
1108	1050
1165	1108
1168	1008
1254	580
1273	625
1330	643
1334	744
1344	1072
1351	869
1352	1113
1353	822
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1461	898
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1764	1103
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2399	742
2405	1209
2509	770
2528	1021
2550	1010
2572	890
2609	1009
2678	1019
2683	1200
2700	847
2702	846
2719	1058
2794	708
2876	1057
2971	1209
2974	906
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3055	848
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3156	1200
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3357	1128
3360	1052
3368	751
3462	848
3467	1033
3480	1025
3504	1072
3507	863
3542	955
3628	911
3655	744
3680	1025
3682	1209
3785	620
3786	847
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3966	1147
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4358	696
4359	470
4385	755
4461	1012
4468	837
4471	898
4527	915
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4541	1055
4546	1074
4622	826
4643	915
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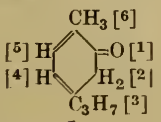
No. of Patent.	Page.	No. of Patent.	Page.	No. of Patent.	Page.	No. of Patent.	Page.	No. of Patent.	Page.	No. of Patent.	Page.	No. of Patent.	Page.
1908.		**1908.**		**1908.**		**1908.**		**1908.**		**1908.**		**1908.**	
5279	816	6179	1079	7583	1015	8715	972	10,129	1223	11,971	1158	15,491	1101
5297	1025	6218	1111	7594	972	8727	996	10,155	931	12,183	1158	15,669	982
5299	1147	6227	918	7703	1145	8746	620	10,221	795	12,252	969	15,670	1062
5316	917	6247	1036	7732	872	8779	1125	10,233	932	12,254	1214	15,768	958
5377	581	6259	940	7836	1007	8838	1204	10,314	1101	12,570	1021	15,797	1206
5387	1104	6265	501	7909	898	8875	1178	10,529	1130	12,809	1011	16,011	1014
5413	1070	6351	1172	7910	770	8876	1017	10,558	1051	12,810	894	16,017	1106
5416	1197	6366	898	8002	978	8903	1108	10,835	985	12,968	1012	16,534	1145
5451	689	6414	755	8012	769	8956	1142	10,938	1058	13,013	1078	16,670	1084
5501	1169	6453	906	8017	902	9083	1162	10,965	1223	13,198	1215	16,725	1173
5506	1069	6573	1029	8023	996	9108	895	11,019	1036	13,210	1222	16,823	1028
5513	917	6655	749	8084	1172	9207	1050	11,062	1021	13,517	1214	16,994	938
5589	1055	6667	1011	8102	940	9233	940	11,140	974	13,599	1163	17,065	1178
5595	1056	6766	682	8104	1145	9246	998	11,141	935	13,699	1209	17,105	1212
5657	891	6783	1173	8267	1050	9268	897	11,335	893	13,777	911	17,419	1145
5674	832	6949	1173	8368	999	9313	956	11,341	1223	13,830	1205	17,609	1153
5801	970	7072	1036	8370	972	9380	1068	11,385	1142	14,515	1035	17,681	1150
5810	872	7090	1028	8387	974	9554	904	11,393	1196	14,686	1142	18,184	1071
5817	1162	7091	751	8397	1011	9563	750	11,415	1019	14,850	1198	18,736	1107
5840	893	7094	847	8408	973	9572	958	11,524	849	14,863	1151	19,070	1153
5943	969	7100	988	8416	1145	9622	620	11,533	1144	15,079	1145	19,563	1200
6019	832	7103	1028	8421	1011	9656	1219	11,546	1141	15,086	1143	19,648	1219
6028	863	7110	988	8542	877	9694	1033	11,590	1113	15,195	1060	19,807	975
6050	756	7126	1150	8548	1101	9744	1073	11,600	1145	15,284	1201	21,091	1214
6051	904	7188	1119	8549	1162	9772	1018	11,603	1104	15,288	1069	21,468	1196
6105	945	7229	889	8550	1122	9773	1112	11,605	1069	15,362	1118	21,483	1214
6131	951	7365	764	8578	931	9868	1050	11,637	1202	15,417	1200		
6153	893	7479	993	8688	1029	10,096	1055	11,732	1018	15,448	977		
6155	810	7505	995	8711	977	10,098	1198	11,851	1142	15,449	977		

ERRATA, 1908.

Vol. XXVII.	Page.	Column.	Line from Top.	Line from Bottom.	Corrigenda.
No. 1—Jan. 15	19	1	28	..	*After* " temperatures " *insert* " at or somewhat."
,, ,,	19	1	29	..	*Delete* semi-colon *and* " it dissolves it."
,, ,,	32	2	12	..	*For* " hydrochloric acid " *read* " acids," *and for* " starch " *read* " modified starch."
No. 5—March 16	196	1	..	37	*In equation, transfer the* " $\rightleftharpoons$ " *from after, to before the* " C_3H_5."
No. 7—April 15	327	1	middle	..	*In title, for* " Phillip " *read* " Philipp."
No. 11—June 15	574	1	middle	..	*In title, for* " Twynham " *read* " Twynam."
No. 12—June 30	622	1	8	..	*For* " Berthem " *read* " Bertheim."
,, ,,	637	1	6	..	*For* " Raux " *read* " Roux. "
,, ,,	640	2	..	31	*Title: For* " F. P. Power " *read* " F. B. Power."
,, ,,	640	2	..	12	*Before* " which," *insert* " the two latter of."
,, ,,	641	1	25	..	*For* " H_{67} " *in formula, read* " H_{57}."
,, ,,	641	1	30	..	*Delete* " the ethyl ester of which is."
No. 16—Aug. 31	852	2	..	37	*For* " moulded " *read* " mounted."
,, ,,	853	2	..	22	*For* " falls " *read* " fills."
,, ,,	854	1	..	11	*For* " Ersk " *read* " Erste."
No. 17—Sept. 15	908	2	..	41	*Title: Insert before* " Eng. Pat." *the words* " From Rutgerswerke A.-G."
,, ,,	909	2	8	..	*For* " Weichmann " *read* " Wiechmann."
No. 19—Oct. 15	1001	1	..	30 and 29	*After* " filtered," *insert* " boiled to expel hydrogen sulphide," *and delete* " the precipitate."
No. 20—Oct. 31	1010	2	27	..	*For* " C. E. H. Medberger " *read* " C. E. H. Medberg."
,, ,,	1014	2	..	15	*For* " 16,011, Oct. 18, 1907 " *read* " 16,011 of 1908."
,, ,,	1021	1	..	27	*For* " Buchler " *read* " Buehler."
,, ,,	1037	2	..	27	*For* " W. H. Havey " *read* " W. H. Harvey."
No. 21—Nov. 16	1075	1	8	..	*For* " F. Jacobson " *read* " F. Jacobsohn."
No. 22—Nov. 30	1094	1	..	26	*For* " somewhat " *read* " further."
,, ,,	1096	1	10	..	*For* " 19,000 tons " *read* " 190,000 tons."
,, ,,	1131	1	..	25	*For* " C. Maugin " *read* " C. Mauguin."
,, ,,	1134	1	..	18 and 19	*Reverse the words* " former " *and* " latter."
No. 24—Dec. 31	1189	1	10	..	*For* " provision " *read* " prevision."
,, ,,	1189	1	51	..	*For* " natural silk " *read* " artificial silk."
,, ,,	1198	1	11	..	*For* " Trenyen " *read* " Trenzen."
,, ,,	1217	2	19	..	*For* " Dec. 10, 1906 " *read* " Dec. 10, 1907."

Page 316.—The structural formulæ for carvacrol should be :—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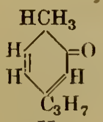
II.

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No. 1. Vol. XXVII. JANUARY 15, 1908. No. 1, Vol. XXVII.

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G. E. Scott-Smith.
G. W. Slatter.

Hon. Local Secretary and Treasurer :

T. Fairley, 17, East Parade, Leeds.

Official Notices.

SUBSCRIPTIONS.

Important Notice.

In consequence of the death of Mr. Samuel Hall, Hon. Treasurer of the Society, Members are requested to make all cheques and Postal Orders payable to the "Society of Chemical Industry," which may then be forwarded to the Hon. Acting Treasurer, East London Soap Works, Bow, E.

ANNUAL GENERAL MEETING.

The Annual General Meeting will be held at Newcastle-on-Tyne on Wednesday, July 22nd, 1908. Full particulars will appear later.

DEUXIÈME CONGRÈS INTERNATIONAL DE SUCRERIE ET DE DISTILLERIE, PARIS, MARCH, 1908.

The Association des Chimistes de Sucrerie et de Distillerie has organised an International Congress to be held in Paris next March, to celebrate the 25th Anniversary of the foundation of the Association. There is no charge for joining the Congress. Full particulars may be obtained from M. E. Silz, General Secretary of the Association, 156, Boulevard Magenta, Paris.

Sydney Section.

Meeting held at Sydney on Wednesday, November 13, 1907.

DR. R. GREIG-SMITH IN THE CHAIR.

SPONTANEOUS COMBUSTION IN A CERTAIN CLASS OF WOOL.

BY ALLISTER MACLEAN WRIGHT.

During the past two years considerable attention has been directed towards the subject of fires occurring on wool-ships, the New Zealand Government appointing a Royal Commission to enquire into the subject. Much evidence has been collected by the Commission, and recently published with their report. Of special interest is the report of Mr. R. J. Friswell,* on the fires on the S.S. Gothic. The wool examined by him, and designated in his report as A, B, C, and E, was prepared and packed by a New Zealand factory, and is termed "cross-bred pelt washings." This class of wool consists of trimmings and pieces of wool saved from the pelt fleshings; and although it contains no undue amount of moisture, yet it does contain an excessive quantity of fatty matter. Moreover, as might be expected from its origin, the fat is not natural wool fat, but of the nature of low-grade mutton tallow.

On January 17th, 1907, an incipient fire was noticed at a fellmongery in a loosely packed heap of this wool, and the author, being on the factory at the time, was afforded an opportunity of noting the conditions. No flames were rising from the heap, but the pungent odour of burning fatty and albuminous material was plainly noticeable; there was no indication of fire on the surface, but on removing the outer wool to a depth of three feet, the mass was charred and smouldering, and in a semi-solid state. The thermometer read 87° F. on the surface, 450° F. just above the charred material, and on insertion recorded over 660° F., which is the highest temperature recorded by this instrument.

From time to time numerous analyses of this class of wool had been made; the following are typical, and for comparison analyses made of other grades of wool are given:—

	Moisture. Per cent.	Fat. Per cent.
Cross-bred pelt washings	6·21	34·45
,, ,, ,, ,, ...	5·39	34·52
,, ,, ,, ,, ...	9·22	36·12
Half-bred greasy	15·92	25·98
Half-bred slipe	9·58	18·45
Three-quarter bred slipe	9·70	15·50
Pieces washed	9·70	15·55
Thirds washed	9·52	8·68

When ordinary wool is completely dried, it readily absorbs moisture on exposure to the atmosphere, but cross-bred pelt washings do so only slightly. The following figures indicate the difference between half-bred slipe, and cross-bred pelt washings in this respect:—Half-bred slipe absorbs in 3 hrs., 8·60 per cent. of moisture; in 8 hrs., 13·05 per cent., and in 24 hrs., 14·42 per cent. Cross-bred pelt washings absorb in 3 hrs., 4·07 per cent. of moisture; in 8 hrs., 5·32 per cent. and in 24 hrs., 5·88 per cent. The melting point of the fat from the cross-bred pelt washings was 38·7° C., and it contained 12·3 per cent. of free fatty acids.

It is probable that this incipient fire was caused by the readily oxidisable fat in this class of wool, and since the fat was spread in a very thin layer upon non-conducting material, an immense surface was available, when chemical action at ordinary temperatures supplied the initial heat required for more rapid oxidation.

Discussion.

Mr. R. Davidson thought the author had made an important distinction in shewing that wool containing natural wool fat was not liable to spontaneous combustion, while the liability to combustion was in wool containing tallow fat in addition.

Mr. T. Steel agreed that in this respect the author had carried the matter further than the Royal Commission that had previously investigated it.

A REMARKABLE DEPOSIT IN THE TUBE OF A LOCOMOTIVE BOILER.

BY T. U. WALTON.

Some of the brass tubes of the boiler of a small locomotive, on being examined after extensive use, were found to be coated on the inner or flame side with a dense, hard, black deposit resembling gas carbon, which was found on analysis to have the following dry composition:—Volatile hydrocarbons, 2·98 per cent.; fixed carbon, 88·89 per cent.; ash, 8·13 per cent., and specific gravity, 1·553. The external diameter of the tubes is 44 mm., the thickness of metal 2·5 mm., and the thickness of the deposit 3·2 to 3·5 mm. The scale is thicker than the wall of the tubes, and is seen to be in concentric layers which have evidently been gradually deposited from the gases passing through the tubes. As the ash of the coal burned in the fires was from 11 to 12 per cent., or nearly 4 per cent. higher than that of the scale, coal dust could only in part be the source of the deposit, having doubtless been mixed with condensed hydrocarbons which have gradually decomposed, leaving practically gas carbon. This coating on the tubes of a material of low heat-conducting power, and thicker than the metal itself, would cause the loss of considerable heat, though opinions differ widely as to the extent of it.

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* Report of Royal Commission to Inquire into Fires on Wool Ships: Exhibit No. 25, p. lviii. Gov. of N. Z.

Schmidt and Snodgrass, who recently investigated this matter at the University of Illinois,* found that for a scale of ⅛-inch thickness the loss of heat was from 10 to 12 per cent., a result much lower than has usually been supposed. They also concluded that the mechanical structure of the scale was of more importance than its thickness, and that chemical composition only influenced the loss in so far as it affected the structure.

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* Bull. No. 11, Engineering Experiment Station, University of Illinois; and "Nature," 1st August, 1907, 335.

Yorkshire Section.

Meeting held at Leeds on Monday, Oct. 28, 1907.

F. W. BRANSON, ESQ., IN THE CHAIR.

THE CONSTITUTION OF THE SALTS OF PHENOL-PHTHALEIN AND QUINOL-PHTHALEIN: A CONTRIBUTION TO THE THEORY OF COLOUR IN THE GROUP OF TRIPHENYLMETHANE DYESTUFFS.

BY ARTHUR G. GREEN, M.SC., F.I.C., AND PERCY E. KING
(Department of Tinctorial Chemistry, University of Leeds).

INTRODUCTION.

Since the year 1876 when O. N. Witt advanced his theory of chromophors and auxochromes, the cause of colour and dyeing properties amongst the aromatic compounds has formed one of the most fascinating problems, which have occupied the attention of organic chemists. Nor indeed has this question been one of theoretical interest alone, for the development of views in regard to it has greatly stimulated and assisted the discovery of new groups of dyestuffs, whilst it is intimately connected with such important practical questions as the production of dyestuffs resistant to soaping, alkalies or acids, and the rendering of colours fast to light. In spite therefore, of its apparently theoretical aspect, the subject is one which is eminently suitable for consideration by this Society.

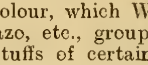
At first sight there would seem to be no absolute necessity to assume an essential difference of structure for coloured, as distinguished from colourless bodies. One might conceive, as was indeed formerly held, that the manifestation of colour in the benzenoid compounds was a function only of increase in the molecular weight or of the introduction of certain elements, such as nitrogen, predisposing to colour production. A mass of facts however, speaks against such a view. Of these facts I will mention one example :—If we increase the complexity of the molecule of benzene by uniting three benzene residues together by means of a CH group, we obtain a hydrocarbon, triphenylmethane, which like the original benzene is still colourless. If further, we introduce three nitrogen atoms into the molecule in the form of NH_2 groups the product triamido-triphenylmethane is still colourless. On the other hand, an additional change of an apparently trivial character, namely, the removal of two hydrogen atoms, which is attended with scarcely any alteration in the molecular complexity, suffices to produce from this colourless body an intensely powerful dyestuff (rosaniline). It is clear therefore, that although the tendency to colour manifestation may be augmented by an increase in the complexity of the molecule, or by the introduction of nitrogen or other elements, the colour itself is not the result of either of these factors. It seems indeed that we must seek an explanation in some deep-seated change in the structure of the benzene ring itself, or in other words that colour in the aromatic series is the result of some peculiar disposition of the bonds in the benzene nucleus. As a further illustration of this view, I may be allowed to cite two or three experiments which go to show that the appearance or disappearance of colour may be the result of very simple tautomeric or hydration changes, which, if not accompanied by a deep-seated alteration in the benzene ring, it would be very difficult, if not impossible, to hold responsible for so great an effect.

(A) If the deeply coloured aqueous solution of Rhodamine B be shaken with ether a portion of the Rhodamine base will pass into the ether, giving however a colourless solution. If the colourless ethereal solution be poured upon filter paper the red colour returns as the ether evaporates.

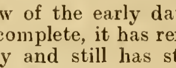
(B) An aqueous solution of Methyl Violet to which a little hydrochloric acid has been added, sufficient to give it a bluish tint, is completely decolourised on saturating the solution with common salt. If however the colourless solution is poured upon filter paper, the paper is stained violet. Silk immersed in the colourless solution is also dyed violet.

(C) Phenol-phthalein is a well-known instance of this class of phenomena. Though colourless itself, it apparently forms coloured salts. We say apparently, because, as will be shown later, these salts are really tautomeric forms of the true phenol-phthalein salts, which are doubtless colourless. On the addition of a large excess of caustic alkali to the coloured alkaline solution of phenol-phthalein, the colour again disappears, and it has been shown by Green and Perkin that if the solution so decolourised is kept at 0° C., the excess of caustic soda may be completely neutralised by careful addition of acetic acid without any return of the colour. If however the neutral solution is heated, the red colour at once returns. Exactly the same observations have been made also with quinol-phthalein.

The first attempt at a theory of colour, was the hypothesis of Witt already referred to. This assumed the existence in all coloured bodies, of certain specific groups responsible for the colour, which Witt termed "chromophors" (the nitro, azo, etc., group), and the additional presence in all dyestuffs of certain salt-forming groups (OH, NH_2, etc.), which intensify the action of the chromophor and give dyeing properties to the compound. These latter groups were termed "auxochromes." Although this theory, in view of the early date of its conception, was of necessity incomplete, it has rendered signal service to colour chemistry and still has strong adherents. It has however been largely supplanted in recent years by the "quinonoid" theory. This latter is not so much a rival theory as an extension of Witt's idea, by which a more definite meaning is given to the term chromophor. It assumes that all coloured bodies belonging to the aromatic series, or at least all dyestuffs, are to be regarded as derivatives of quinones, obtained by replacement of one or both oxygen atoms of the quinone by other groups. Thus dyestuffs of the benzene series may all be represented either as "orthoquinonoid" or "paraquinonoid." The above mentioned instances of the transformation of coloured into colourless bodies or *vice versa*, brought about by simple hydration, reduction, or tautomeric change, are considered as due to a transposition from the benzenoid into the quinonoid type. The quinonoid theory was first put forward by E. and O. Fischer for the dyestuffs of the rosaniline series, to which these chemists assigned a constitution analogous to the formula of quinone,



then in vogue. Nietzki made use of similar formulæ, based, however, on the modern formula of quinone,



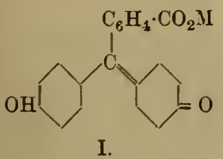
for the dyestuffs of the indamine, indophenol, azine, oxazine and thiazine series; and the conception was shortly afterwards extended by Armstrong to all coloured bodies of the aromatic group. In the most modern form of the theory the colour is regarded not so much as a direct effect of the quinonoid structure, but rather as the result of a condition of oscillatory tautomerism, in the whole or part of the molecule brought about by this structure, which oscillation by synchronising with certain light waves causes their absorption. Though largely accepted by organic chemists, the quinonoid theory has found less favour with physical chemists, who have been more inclined to adopt the view, first advanced by Ostwald, that colour manifestations are the result of ionisation, and that a colourless acid, such for instance as phenol-phthalein, may produce salts the ions of which are coloured.

Another conception is that advanced a few years ago by Baeyer and termed by him "halochromy," which appears to have much in common with the ionic theory of Ostwald. As the result of a long series of investigations upon the compounds of the triphenylmethane group, Baeyer came to the conclusion that, although most of the dyestuffs of this group must be regarded as having a quinonoid structure, yet this explanation cannot be employed to account for the colour of other members of this class, for which a different explanation must be sought. This Baeyer finds in the theory of "halochromy" which assumes the existence in such coloured bodies, of a peculiar form of valency, which he terms the "carbonium" valency and represents by a wavy bond thus C～～Cl. Though this hypothesis is very indefinite, the underlying idea appears to consist in the assumption that, in certain compounds, carbon can function as a strongly basic element, and in this way bring about colour manifestation.

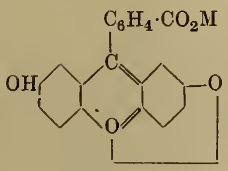
A large part of the numerous investigations which have been undertaken with the object of ascertaining the cause of colour in aromatic compounds, have been carried out in the triphenylmethane group, possibly on account of the fact that it is particularly in this group that we meet with the greatest tendency to pass from a coloured to a colourless condition. Amongst the most interesting and important members of the group, from this point of view, are the phthaleins of phenol and hydroquinone (quinol).

The question of the constitution of the coloured salts of the colourless phenol- and quinol-phthaleins has long been regarded as a convenient "test case" upon which the entire question of the cause of colour in the triphenylmethane and phthalein groups can be appropriately contended. For this reason and also on account of the familiar use of phenolphthalein as an indicator many chemists have devoted themselves to the elucidation of its peculiar behaviour, though so far without arriving at an agreement.

In a communication to the Chemical Society in 1904, one of us in conjunction with Perkin (Trans., 1904, **85**, 398) brought forward evidence which is entirely at variance with the ionic view first advanced by Ostwald and still generally accepted by many physical chemists. This evidence of Green and Perkin, which has been recently characterised by Hantzsch as absolutely disproving the physical theory, is on the other hand completely in accord with the quinonoid formula for phenol-phthalein first enunciated by Nietzki (I).



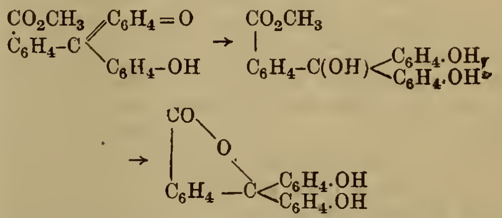
I.



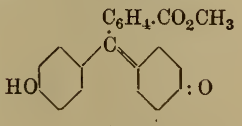
II.

To account for the similar behaviour of quinol-phthalein, Green and Perkin suggested for the salts of the latter the analogous constitution (II.), representing these compounds as derivatives of ortho-quinonoid structure. On the other hand many chemists, notably Baeyer, still adhere to the view that these coloured salts are lactone or carbinol derivatives, and attribute the colour to a "carbonium" valency or "halochromy," that is to some peculiar condition produced by the basic properties of carbon. In a paper in conjunction with Spengler (Ber., 1905, **38**, 1318) Richard Meyer, whose valuable contributions to the chemistry of the phthaleins are well known, criticised the deductions of Green and Perkin and came to the conclusion that there is no evidence of tautomeric change amongst the derivatives of phenol- and quinol-phthalein, but that these compounds are of an entirely different order to those of fluorescein in which such tautomerism is generally admitted. Meyer based this conclusion largely on the fact that in spite of many attempts to obtain quinonoid esters corresponding to the coloured salts of these phthaleins, notably by Herzig, by Haller and Guyot, and by Nietzki, the colourless lactone ethers were always the sole product formed. Moreover in a fresh series of experiments in which the conditions of alkylation were widely varied, he himself again failed completely to obtain any coloured ester, the colourless monoalkyl and dialkyl ethers of undoubted lactone structure being alone produced.* He admitted however that were it found possible to obtain such coloured esters the supposed difference between the phthaleins of phenol and quinol on the one hand and of resorcinol on the other would disappear, and no valid ground would remain for the assumption of a different structure for their respective salts.

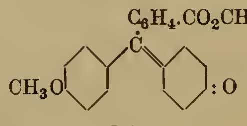
In considering the negative results obtained by the above investigators it has appeared to us that the conditions employed (an alkaline solution) were essentially unsuitable for obtaining the compounds sought, for as is well known whilst an alkaline solution is favourable to alkylation of phenolic hydroxyl groups, a neutral or acid solution is usually required for alkylation of carboxylic hydroxyl. Moreover we have here the further circumstance that there is the strongest possible tendency for these coloured salts to be converted into the colourless carbinol salts by the addition of water, or into the colourless lactone by the splitting off of alkali. Even if the carboxylic ether had been formed it was to be anticipated that under the conditions of the experiment it would be converted into the carbinol carboxylic ether which in turn would split off alcohol giving the lactone:



In view of these considerations we accordingly made a renewed attempt to obtain the carboxylic esters by employing acid conditions for alkylation. This attempt has been successful and we have succeeded in preparing not only the quinonoid esters of phenolphthalein and of quinolphthalein themselves but also those of their monomethyl and dimethyl ethers. The esters thus obtained all possess a deep colour ranging from orange to red. They are of a high degree of instability, being readily saponified not only by the weakest alkalies but also by water alone. They form with acids oxonium salts which are of a deeper colour than the free esters. Whilst the esters of phenolphthalein and of monomethylphenolphthalein (III. and IV.):



III.



IV.

are more stable than the corresponding chlorides, the reverse is the case with the esters of quinolphthalein and of monomethylquinolphthalein, which could only be obtained in a pure state in the form of their chlorides (V. and VI.):

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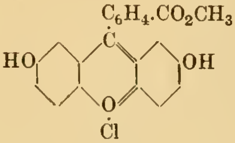
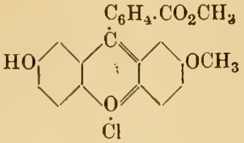
* Since the publication in the Berichte of the German Chem. Soc. (1906, 2365) of a preliminary report on a portion of the work here described, R. Meyer has abandoned his former position and now accepts our views. He has also (Ber., 1907, 3603) succeeded in preparing a coloured di-ethyl ether of phenol-phthalein by the direct reaction of ethyl iodide upon the dry potassium salt and has further confirmed our experiments by a comparison of the absorption spectra of the two phthaleins with that of fluoresceine. Quite recently also Kurt Meyer and Hantzsch (Ber. 1907, 3484) have repeated some of our experiments and completely confirmed our conclusions.

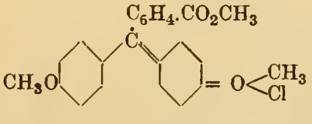


V.

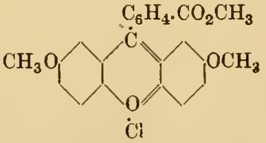


VI.

The free esters corresponding to these chlorides are too unstable to allow of isolation, a fact which fully agrees with the structure here assigned. The esters of the dimethylphenolphthalein and of the dimethylquinolphthalein (trimethyl derivatives) are only capable of existence as salts, which would be anticipated from the following formulæ (VII. and VIII.):



VII.

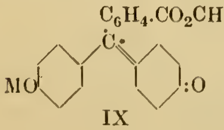


VIII

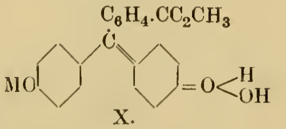
Of the two latter compounds the second is far the more stable and is readily soluble in water, facts which are in complete harmony with the structure suggested. When deprived of their acid radicle both compounds are at once saponified.

In considering the bearing of these results upon the constitution of the metallic salts of the two phthaleins, a remarkable fact has to be taken into consideration. We have found namely that the methyl ester of phenolphthalein dissolves readily in aqueous alkalies giving violet red solutions but distinguished from those of phenolphthalein itself by a purer, deeper, and bluer tint. That solution occurs without saponification is proved by the fact that if the liquid is immediately acidified the orange methyl ester is regenerated. If however the solution is allowed to stand for some time or is gently warmed, saponification takes place and on acidification a white precipitate consisting of phenolphthalein is then obtained. The quinolphthalein ester exhibits an exactly similar behaviour although the alkaline salts are in this case less stable: when the methyl ester chloride is treated with an excess of alkali it dissolves to a bright bluish purple solution, the colour of which is much brighter and more intense than that of the alkaline solutions of quinolphthalein itself. If immediately acidified with hydrochloric acid the ester chloride is regenerated, but if the alkaline solution has previously stood for some time only the colourless quinolphthalein is obtained.

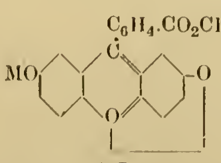
In view of the fact that the methyl group is certainly attached to the carbonyl we are forced to the conclusion that in these coloured salts the atom of the alkali metal replaces phenolic hydrogen. The following formulæ therefore come into consideration:



IX

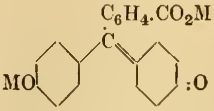


X.

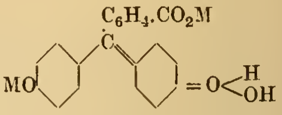


XI.

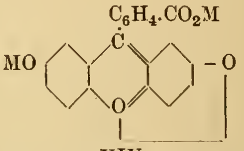
Whilst the alkali salts of the quinolphthalein methyl ester must almost certainly be represented by formula (XI.) those of the phenolphthalein methyl ester may be regarded as having either the structure represented by (IX.) or (X.). Of these we prefer the latter since it gives a better explanation of the great similarity between the two classes of compounds, the presence of oxonium oxygen being assumed in each. Admitting the correctness of these views we should be led to the further conclusion that the coloured salts of the free phenolphthalein and quinolphthalein (for which on account of their similar colour we should anticipate an analogous structure) must have the constitution represented by the formulæ (XII. or XIII.) and (XIV.):



XII

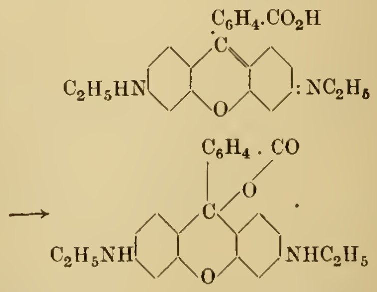


XIII.



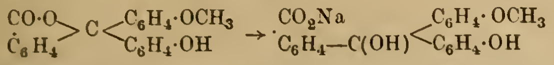
XIV.

These conclusions are well borne out by the respective behaviour of the ester salts and the free phthalein salts towards excess of caustic alkalies and to alcohol. Whilst as is well known, the addition of an excess of caustic alkali causes the entire decolourisation of the ordinary phthalein salts, no such effect is produced upon the ester salts, which beyond assuming a somewhat bluer tint, remain unaffected. A similar difference is apparent in the action of acohol: whereas for instance an ammoniacal solution of phenolphthalein or of quinolphthalein is at once decolourised by the addition of alcohol, similar solutions of the esters only become by such addition more intensely coloured. This is readily explained by the fact that in the latter case lactone formation can only take place by splitting off of alcohol. We have here a complete analogy with the effect produced by etherification in the Rhodamine series. Thus for example, the diethyl-rhodamine cannot be used in dyeing on account of the extreme readiness with which it passes into the colourless and insoluble lactone form:



On the other hand its carboxylic ether (Rhodamine 6G) is perfectly stable and a valuable dyestuff.

As a further deduction from the above formulæ for the phthalein metallic salts we should be led to expect that the lactone monomethyl ethers, both of phenolphthalein and of quinolphthalein, would be incapable of forming coloured salts with alkalies, since the quinonoid forms of these compounds do not contain free phenolic OH groups. This deduction was also supported by experiment. Both lactone monomethyl ethers have been prepared by Meyer and Spengler (*loc. cit.*) although not in a quite pure state. These authors describe the lactone monomethyl ether of phenolphthalein as a colourless crystalline substance of melting point 141°—142°, which dissolves in alkalies with a red colour of less intensity than the free phthalein. We have obtained it, after repeated recrystallisations from a mixture of benzene and ether and from xylene, in flat colourless needles of melting point 148°—149°. The pure substance dissolves in alkalies with only a pale pink colour, which colour is due apparently to its still containing a trace of phenolphthalein, since the more complete the purification the weaker is the colour produced. It appears therefore that this ether is directly converted by alkalies into the colourless carbinol salt



$$\begin{matrix}CO\cdot O\\ \dot{C}_6H_4\end{matrix}>C<\begin{matrix}C_6H_4\cdot OCH_3\\ C_6H_4\cdot OH\end{matrix}\rightarrow\begin{matrix}CO_2Na\\ \dot{C}_6H_4—C(OH)\end{matrix}<\begin{matrix}C_6H_4\cdot OCH_3\\ C_6H_4\cdot OH\end{matrix}$$

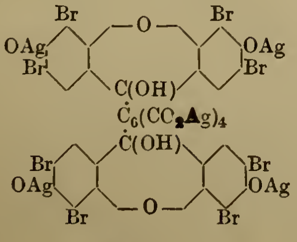
The lactone monomethyl ether of quinolphthalein forms, according to Meyer and Spengler, colourless aggregates of needles of melting point 130°—134°, and dissolves in soda lye with a violet colour. We have obtained it, after recrystallisation from benzene in colourless prismatic crystals containing benzene of crystallisation and melting at 118°—122°. Its purity was established by several methoxy determinations. Contrary to the observations of Meyer and Spengler the substance *dissolves in alkalis without any formation of colour* and gives directly the colourless carbinol salt.

These observations are in complete accord with those of Nietzki and Burckhardt (Ber., 1897, **30**, 175) upon tetrabromophenolphthalein, the quinonoid ester of which, obtained by oxidation of the corresponding phthalin ester, was found to give deeply coloured blue alkali salts; whilst the lactone ether dissolved in alkalies to a colourless solution.

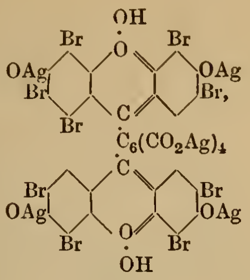
The methyl ester of the monomethyl phenolphthalein and the methyl ester chloride of the monomethyl quinolphthalein are completely insoluble in alkalies. They only dissolve when saponification occurs and then give colourless solutions. This is in agreement with the entire absence of OH groups in the quinonoid formulæ of the free esters.

It will be seen that these facts disclose an exact parallelism between the esters and salts of these phthaleins and those of fluorescein, and there is therefore no longer any ground for refusing to accept a quinonoid structure in the one case whilst admitting its existence in the other, or for questioning the occurrence of tautomeric change in the first series whilst assuming it in the second. There is in fact here the strongest evidence that the appearance of colour is conditioned by a tautomeric change from a benzenoid lactone form to a quinonoid carboxylic form, in correspondence with the general theory advanced by Hanztsch connecting colour with tautomeric or hydration changes.

In a recent paper on the relation of colour and fluorescence to constitution (Chem. Soc. Trans., 1906, **87**, 1787) O. Silberrad has arrived at an opposite conclusion based on the examination of the complex phthaleins formed by condensation of mellitic and pyromellitic acid with resorcinol. From the fact that the silver salts of these phthaleins correspond to the substitution of hydrogen by silver not only in all the carboxyl groups of the mellitic residue but also in the two phenolic hydroxyl groups of each xanthene ring, it is concluded that "neither the colour nor the fluorescence of these compounds is dependent on the presence of quinone linkings, for in many cases a quinonoid structure is impossible." This conclusion Silberrad is inclined to extend to the phthaleins in general. In view of the above results we may be allowed to point out that Silberrad's deductions in no sense follow from his experiments, but that on the contrary the compounds he has prepared may be represented with equal or greater probability upon the quinonoid type. To take one example, the silver salt of the "octabromohexahydroxy-*p*-dixanthylbenzenetetracarboxylic acid" to which this author assigns the formula (XV.) may be better represented by the formula (XVI.):



XV.



XVI.

Experimental.

Phenolphthalein methyl ester (Formula III.).—In our first attempts to obtain this ester an alcoholic solution of phenolphthalein was heated with concentrated sulphuric acid or during passage of a stream of hydrochloric acid gas. In both cases an orange red solution was obtained which on pouring into water gave a pink precipitate. On standing for some time the colour slowly faded and the precipitate became white. A distinct indication of the formation of a coloured ester was here present but the alkylation was very incomplete. Better results were obtained by employing dimethyl sulphate. By boiling phenolphthalein with twice its weight of dimethyl sulphate for one or two minutes the whole went into solution and a clear dark red syrupy liquid was obtained, which undoubtedly contained the quinonoid methyl ester in the form of its sulphate or methyl sulphate. A drop of the liquid diluted with chloroform and placed on filter paper gave a red spot which on exposure to ammonia vapour became orange. This orange spot of the free ester again became red on contact with hydrochloric acid fumes through conversion into the hydrochloride. Unfortunately, although apparently the etherification was complete, all attempts to isolate the ester in a pure state from this mixture proved unsuccessful since no means could be found to remove the excess of methyl sulphate without at the same time saponifying the ester. By pouring the product into a cold concentrated solution of sodium acetate a deep orange sticky mass was obtained which retained its colour in a desiccator but became colourless on exposure to air. This crude ester apparently still contained dimethyl sulphate which prevented crystallisation and could not be removed. Better results were obtained after the preparation of the quinonoid methyl ester of quinolphthalein had been successfully effected. This latter (q.v.) was isolated by passing hydrochloric acid gas through the solution in methyl alcohol. The same means applied to phenolphthalein only produced a partial etherification but we finally succeeded in effecting complete reaction by employing the more anhydrous conditions afforded by the addition to the alcohol of zinc or aluminium chloride or strong sulphuric acid. For instance, phenolphthalein was dissolved in methyl alcohol and saturated hot with zinc chloride. A stream of dry hydrochloric acid gas was then passed through the hot solution and the latter left to stand over night. The dark red alcoholic solution was poured in a thin stream into a large volume of iced water. A bright scarlet voluminous precipitate was thrown down which was quickly filtered off and well washed with ice-cold water. The compound thus obtained was very unstable, becoming completely decolorised when left in contact with water for twelve hours or in a few minutes if dissolved in alcohol. Even in a vacuum desiccator more than half the product becomes saponified during drying and the colour of the powder changes from deep red to pink. For this reason it was necessary to dry the precipitate as quickly as possible by repeatedly pressing between filter paper, and to at once estimate the methyl groups by Zeisel's method, afterwards determining the residual water.*

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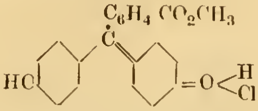
* The analysis of these esters is attended with some difficulty owing to their great instability. In view of the fact that the determination of carbon and hydrogen would give little information as to their composition we have throughout this investigation relied mainly on the determination of methoxyl groups by means of Zeisel's method.

The result calculated on the dry compound gave:—Found, CH_3, 4·09 per cent.; $C_{19}H_{14}O_2Cl(CO_2CH_3)$ requires CH_3 4·07 per cent. This result agrees with the assumption that the product is the quinonoid methyl ester hydrochloride:—

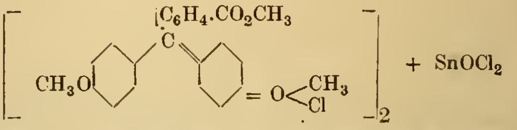


That no lactone ether is formed is proved by the fact that the product dissolves completely in boiling sodium carbonate and gives on acidification the colourless phenolphthalein.

In order to prepare the free ester it was found better not to isolate the unstable hydrochloride first but to proceed instead in the following manner:—4 grms. of phenolphthalein are dissolved in 30 to 40 c.c. of methyl alcohol, 50 grms. of 100 per cent. sulphuric acid are added as dehydrating agent, and a stream of dry hydrochloric acid gas is passed through the mixture whilst it is heated on the water bath with an inverted condenser for about an hour. After standing over night the deep red solution is run slowly from a tap funnel into a dilute ice-cold solution of ammonia, taking care that the solution always remains alkaline, and stirring constantly. The dark red precipitate which is formed is filtered off, washed with cold dilute ammonia, and dried in the desiccator. The substance is then ground up two or three times with cold dry ether. The latter acquires a deep yellow colour whilst the mass, which is at first sticky, becomes hard and leaves a residue which is of a lighter colour (chiefly phenolphthalein). On evaporation of the ethereal solution *in vacuo* a bright orange red substance is left which is further purified by a repetition of the extraction with dry ether. It then forms a bright orange-red glassy solid which slowly becomes crystalline (orange prismatic needles) on standing in the desiccator. Zeisel determinations with different preparations of the substance gave the following results:—Found CH_3, 4·42, 4·68, 4·32 per cent.; $C_{19}H_{13}O_2(CO_2CH_3)$ requires CH_3 4·52 per cent. The free ester is much more stable than the hydrochloride and can be kept without alteration if quite free from acid and perfectly dry. It dissolves in alcohol to an orange solution, which is also stable provided the solution is perfectly neutral. On adding hydrochloric acid to the alcoholic solution, the latter assumes the scarlet red colour of the hydrochloride, and then slowly becomes decolorised as saponification ensues. On saponification phenolphthalein is produced, showing that the methyl group is attached to the carbonyl group. The methyl ester dissolves readily in aqueous alkalies giving intense violet-red solutions of the alkali salts (Formula IX. or X.), which contrary to those of the phenolphthalein salts are not decolorised by an excess of caustic alkali or weakened in intensity by alcohol. For this reason the ester appears to be more suitable as an indicator in alkalimetry than phenolphthalein itself, especially when as in soap analysis titrations have to be conducted in an alcoholic solution.

Monomethyl-phenolphthalein methyl ester (Formula IV.).—This ester was obtained from the lactone monomethyl ether in a precisely similar manner to the ester of phenolphthalein itself. The lactone monomethyl ether was prepared as described by Meyer and Spengler. After repeated recrystallisations from a mixture of benzene and ether and from xylene it was obtained in flat colourless needles of melting point 148°—149° (M. and S. give 141°—142°). Like many derivatives of phenolphthalein it possesses two melting points, for the substance after melting resolidifies to a glassy solid which then melts at 80°. The substance dissolves in alkali with only a pale pink colour, apparently due to its still containing a trace of phenolphthalein. After etherification, pouring into dilute ammonia, and extraction of the dried product with ether, a yellow ethereal solution was obtained which on evaporation *in vacuo* left the ester as an orange-red solid. It is somewhat less stable than the quinonoid ester of phenolphthalein itself, from which it also differs in being insoluble in alkalis. Found:—CH_3, 7·54 per cent.; $C_{19}H_{12}O(OCH_3)(CO_2CH_3)$ requires CH_3, 8·67 per cent. On heating with alkalis the ester is saponified and then dissolves to a colourless solution from which on acidification the original lactone methyl ether is precipitated.

Dimethylphenolphthalein methyl ester chloride (Formula VII.).—This compound was obtained in the form of its tin double salt by the following method of procedure:—Dimethyl-phenolphthalein (prepared either as described by Meyer and Spengler or better by methylation with dimethyl sulphate) was dissolved in methyl alcohol and anhydrous stannic chloride gradually added, whilst the mixture was heated on the water bath and a current of hydrochloric acid gas passed through it. The dark red liquid after standing over night was slowly poured into concentrated hydrochloric acid which was cooled externally by ice. The bright red precipitate obtained, consisting of the tin double chloride, was filtered off, washed well with cold concentrated hydrochloric acid and dried. It gave on analysis results corresponding to the formula:—



Found	CH_3, 8·82, 8·04.	Cl, 14·01.	Sn, 12·36 per cent.
Calculated	„ 8·86.	„ 14·0.	„ 11·72 per cent.

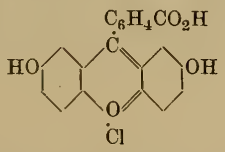
The salt is gradually decolorised by cold water, more quickly on warming. Alkalies and alcohol also quickly remove its colour. In each case saponification occurs with reproduction of the lactone dimethyl ether, which was identified by its melting point.

The corresponding sulphate was also prepared by passing hydrochloric acid gas through a solution of the lactone dimethyl ether in methyl alcohol containing 100 per cent. sulphuric acid. The dark red solution obtained when poured into water gave a scarlet precipitate which quickly became colourless. Greater stability was obtained by pouring into cold concentrated hydrochloric acid, washing the red precipitate with the same, and quickly pressing between filter paper. Methyl determinations and estimations of loss of weight on drying, made simultaneously with the damp substance, gave the following results (calculated on the dry compound):—Found, CH_3, 8·85 per cent. $C_{19}H_{12}(SO_4H)(OCH_3)_2(CO_2CH_3)$ requires CH_3, 9·82 per cent. The sulphate is less stable than the tin double chloride.

Quinolphthalein methyl ester chloride (Formula V.).—The formation of the quinonoid methyl ester of quinolphthalein takes place more readily than that of phenolphthalein and the compound is stabler and more basic. The methylation occurs readily by heating quinolphthalein with dimethyl sulphate, but as in the case of phenolphthalein the ester could not be isolated from the reaction mixture. A successful result was however obtained by passing a stream of dry hydrochloric acid gas for half an hour through a solution of the phthalein in 5 parts of methyl alcohol. On standing over night a mass of dark red crystals had deposited, which were filtered off, washed with ether containing a little alcohol (to remove any quinolphthalein or its hydrochloride) and dried in a vacuum desiccator. Analysis shows the compound to be the chloride of the methyl ester. Found, CH_3, 3·81, 4·04. Cl 9·04, 9·66, 9·35 per cent. $C_{21}H_{15}O_5Cl$ requires CH_3, 3·92. Cl 9·29 per cent. The product forms small red crystals, insoluble in ether, somewhat soluble in water giving a reddish orange solution. It is stable when dry but is partially saponified on boiling with water. On heating it melts at about 215°—220° evolving methyl chloride and hydrochloric acid and leaving a residue of quinolphthalein. It dissolves in cold aqueous caustic alkalis giving intense bluish-violet solutions of the alkali salts (Formula XI.), which contrary to those of the quinolphthalein salts are not decolorised by an excess of caustic alkali or weakened in intensity by alcohol. If the solution is allowed to stand or is warmed, saponification takes place, and on acidification the colourless quinolphthalein is obtained instead of the red ester.

We have not at present succeeded in obtaining the free methyl ester in a pure state. On adding sodium bicarbonate or sodium acetate to an ice-cold aqueous solution of the chloride of the ester a deep chocolate brown precipitate is obtained. This is probably the free ester, but owing to its instability considerable saponification takes place before it can be filtered off and dried. Zeisel estimations (different preparations) therefore gave too low results: Found, CH_3, 2·23, 2·07, 2·7 per cent. $C_{19}H_{11}O_3(CO_2CH_3)$ requires CH_3, 4·33 per cent. The product dissolves in alcohol giving a deep green solution which becomes red on standing for a short time. On treatment with hydrochloric acid it was reconverted into the chloride.

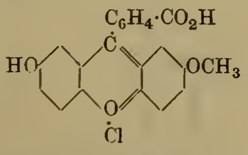
For comparison with the ester chloride we have prepared the hydrochloride of the quinolphthalein itself. This is readily obtained by passing a stream of dry hydrochloric acid gas through a warm solution of quinolphthalein in glacial acetic acid. On cooling the product separates in glittering red crystals which have much outward similarity with the chloride of the methyl ester. $C_{20}H_{13}O_5Cl$ requires Cl 9·66 per cent. Found Cl 10·0 per cent. The compound probably has the constitution:



It differs markedly from the chloride of the ester in being instantly decolorised and dissociated upon contact with water, alcohol, or ether containing alcohol or water.

Monomethyl-quinolphthalein methyl ester chloride (Formula VI.).—This ester was obtained from the lactone monomethyl ether in a precisely similar manner to the preceding ester chloride. The monomethyl ether was prepared in a similar manner to that given by Meyer and Spengler (*loc. cit.*) and recrystallised several times from benzene. It forms colourless cubical crystals containing benzene of crystallisation. It melted at 118°—122°, and after removal of the benzene at 107°—109°. The substance freed from benzene by melting gave the following results on analysis:—Found, CH_3, 4·39, 4·19, 4·46 per cent. $C_{20}H_{11}O_4(OCH_3)$ requires CH_3, 4·34 per cent. The substance dissolves in alkalis without any production of colour. For conversion into the ester it was dissolved in methyl alcohol and saturated with a stream of dry hydrochloric acid gas. On standing the deep red solution deposited red tables of the ester chloride which were washed with ether. The product rapidly lost methyl chloride on keeping as shown by the results on analysis, the lowest numbers being obtained when the substance had been kept longest:—Found, CH_3, 7·45, 6·75, 6·85 per cent. $C_{19}H_{11}O_2Cl(OCH_3)(CO_2CH_3)$ requires CH_3, 7·56 per cent. The ester chloride is somewhat soluble in water giving an orange red solution. It is insoluble in aqueous alkalis by which on heating it is saponified, regenerating the original lactone monomethyl ether.

The corresponding hydrochloride of the free monomethyl hydroquinonephthalein,



is obtained by passing hydrochloric acid gas through a solution of the lactone monomethyl ether in glacial acetic acid. It forms dark red glistening crystals and differs from the ester chloride in being immediately decomposed and decolorised by water or wet ether.

Dimethyl-quinolphthalein-methyl ester chloride (Formula VIII.).—This substance is formed on passing a stream of dry hydrochloric acid gas through methyl alcohol in which the lactone dimethyl ether of hydroquinonphthalein is suspended. The latter was prepared by alkylation of hydroquinonphthalein by means of methyl iodide or dimethyl sulphate in an alkaline solution; when recrystallised from alcohol it melted at 197°—198°. In order to obtain complete etherification, the presence of a dehydrating agent is necessary. On account of the ready solubility of the ester chloride in water its isolation presented at first some difficulty. The separation was finally effected by means of the zinc double chloride which though easily soluble in water is precipitated by a saturated solution of salt. The operation was conducted as follows:—2 grms. of the dimethyl ether were suspended in 40 c.c. of methyl alcohol, sulphuric acid of 100 per cent. was gradually added and dry hydrochloric acid gas was passed through the mixture whilst it was warmed on the water bath. After about two hours heating the dark red liquid was left overnight and then poured into a saturated solution of common salt. After filtering from a small quantity of brownish precipitate, the red filtrate containing the ester chloride was mixed with a strong solution of zinc chloride. This precipitated the zinc double chloride as an orange-red compound, which was washed first with salt solution and then with a limited quantity of water. The product dried in the desiccator gave the following results on analysis (several preparations):—Found, CH_3, 9·70, 9·02; Zn, 7·50, 7·54; Cl, 14·46, 14·42 per cent. $(C_{23}H_{19}O_5Cl)_2\,ZnCl_2$ requires CH_3, 9·40; Zn, 6·79; Cl, 14·83 per cent. The salt is readily soluble in cold water giving an orange solution of considerable stability. On the addition of alkalis the solution is at once decolorised and the lactone dimethyl ether is precipitated. The latter was identified by its melting point. The ready solubility of the trimethyl derivative in water and its stability, compared to the great instability of the corresponding derivative of phenol-phthalein, strongly support the oxonium and orthoquinonoid structure here assigned to it; indeed it is scarcely possible to find any other formula which accords with the experimental facts. If this be admitted a similar structure for the other ester chlorides of hydroquinone-phthalein would also follow.

Discussion.

Prof. A. **Smithells** said he had heard the subject discussed before and had his doubts as to the rights of the matter. He thought it might be possible that both theories were true. He felt convinced that phenolphthalein could assume a quinonoid structure capable of isomeric or tautomeric change but did not see that anything had been brought forward to obstruct the ionic theory where it was applicable. It was a serious thing to suggest that the quinonoid transformation was the only explanation of these changes, since the compound in question was of a saline nature and must be ionised in solution. Physical chemists thought that there was no essential conflict between the two theories.

Mr. A. G. **Perkin** said he agreed with Prof. Green as to the quinonoid theory, having been partially associated with him in this work.

Mr. F. W. **Richardson** said he had intended to try the use of the methyl ether suggested by Prof. Green as an indicator. He had hoped it might be useful in the titration of quinine, but a sample which Prof. Green had given him proved useless when tested. He was not aware at that time that the methyl ether was so unstable that it decomposed on keeping two months. This however was probably the reason of its failure, although it had lost none of its colour and was apparently unaltered.

Mr. T. **Fairley** asked if any of the theories as to the cause of colour threw any light on the tendency of aniline colours to fade away on exposure to light. Was it possible that the fading was due to the production of colourless isomers?

Mr. G. W. **Slatter** also wished to know if it was likely that the fugitiveness of the soluble blues on treatment with soda or soap could be due to a change from the quinonoid to the non-quinonoid form?

Mr. P. E. **King** said that determinations of the amount of the methoxy group had been made both with the dimethyl derivative of hydroquinone phthalein and the methyl derivative of phenolphthalein, and although the latter only contained half the amount of methoxy group, the compounds formed were more unstable. It seemed as if the methyl ester of phenolphthalein might partially decompose without losing colour, but if it were allowed to stand with alcohol for any length of time the colour disappeared.

Mr. H. G. **Bennett** said the subject was of considerable practical importance in leather dyeing. He had tried the methyl ester as an indicator and found that although there was apparently no difference in aqueous solutions it was more sensitive in alcoholic solutions than phenolphthalein. He suggested that some of the higher esters of the series such as the ethyl or propyl ester might be more stable than the methyl compound, and might possibly be equally or more sensitive as indicators.

Mr. C. P. **Finn** said that some years ago some French chemists were working on the absorption spectra of the triphenylmethane dyestuffs, and he would like to know if researches in this direction had thrown any light on the probability of the truth of the quinonoid theory.

Prof. A. G. **Green**, in reply, said that phenolphthalein was of course no exception to the law of ionisation, but colour was not produced by ionisation. Reasoning *a priori*, why should a colourless salt on dissociation give a coloured ion ? Colourless salts of phenolphthalein could be obtained, which might be dissociated in solution but would only give a colourless ion. The physical chemist considered the colour change was due to ionisation, but colour chemists thought that a change in the structure of the benzene molecule took place. The stability of the phenolphthalein ether largely depended on the absence of all acid, but the presence of the merest trace would render it unstable. The colour did not change at first although Mr. King said it might lose methyl. He thought it probable that fading of dyestuffs might be due to a change from the quinonoid form to the benzenoid form. The triphenylmethane dyes were most fugitive, but fading could not take place unless at least a trace of moisture was present. Mr. Bennett had suggested that some of the higher homologues of the methyl ester of phenolphthalein might be more stable and he thought that this would probably be the case. Such a member as the amyl or benzyl derivative would most likely retain exactly the same properties as the methyl ester along with superior stability.

Meeting held at Leeds on Monday, December 9th, 1907.

[MR. F. W. BRANSON IN THE CHAIR.

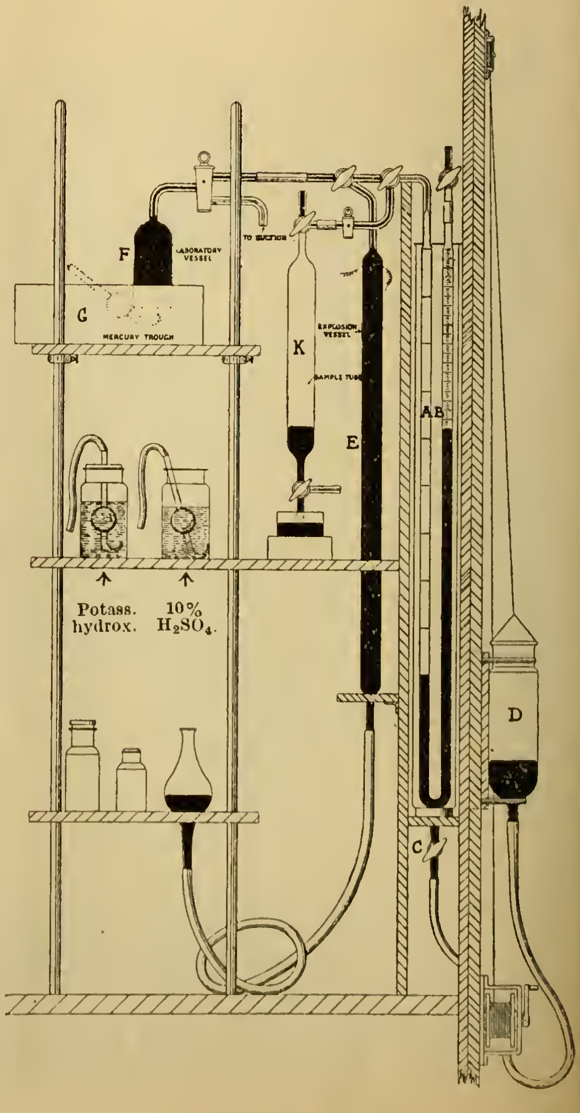
AN ACCURATE FORM OF GAS ANALYSIS APPARATUS FOR COMMERCIAL AND OTHER PURPOSES.

BY WILLIAM A. BONE, PH.D., D.SC., F.R.S. AND RICHARD V. WHEELER, M.SC.

The authors make this communication in response to repeated requests for a convenient and not too costly adaptation of the gas analysis apparatus used throughout their researches on combustion, which shall meet the daily requirements of a commercial research laboratory.

The authors' research apparatus, which was erected ten years ago, (*vide* Bone, Proc. Chem. Soc., 1898, 154), embodied, in its essential features, the principles of that originally devised by the late Sir Edward Frankland, and subsequently modified by Professors Herbert M'Leod and H. B. Dixon. Since its erection it has been in continuous daily use in the laboratories of Owens College, Manchester (1898—1906) and the University of Leeds (1906/7), for upwards of 3000 analyses, including explosion analyses of mixtures of oxygen with such hydrocarbons as methane, ethane, ethylene, acetylene, propane, propylene, trimethylene, butane, and butylene, as well as the analysis of the products of the partial combustion of these hydrocarbons, and of different forms of producer gas, water gas, natural gas, oil gas, coal and coke-oven gas, septic tank gas, blast furnace gases, etc. It has proved to be so admirably adapted to all these varied requirements, that the authors decided to introduce such modifications in details as would, without sacrifice of its essential features, bring it within reach of most technical laboratories, and now after more than a year's daily trial of the modified apparatus, they feel that it can be confidently commended to all who desire a thoroughly reliable instrument.

The essential requirements of a "commercial" apparatus, with any claims to precision are (1) accuracy of measurement, including, of course, the maintenance of a constant temperature in the eudiometer, (2) sufficient capacity to allow, in an explosion analysis, of the proper dilution of the "explosive mixture" ("*Knallgas*") with excess of air or oxygen, (3) absorption arrangements such as will permit of the use of small volumes of freshly prepared (*i.e.* previously unused) reagents, (4) rapidity of action, (5) adaptability to gases of widely different compositions and richness, and (6) simplicity and general convenience of design and working arrangements. Many, if not most, of the forms of apparatus commonly in use are very deficient in regard to the second, third, and fifth of these requirements, however satisfactory they may be in other respects, whilst some of them involve the use of absorption vessels which are either needlessly elaborate or liable to fracture. The authors have duly considered all these points, their aim being to



reduce everything to its simplest terms consistent with convenience and accuracy of working.

The general character and arrangement of the various parts of the apparatus will be readily understood, with the aid of the accompanying diagram, by all who are familiar with the methods of gas-analysis. It comprises, essentially, three parts, *viz.* (1) a water-jacketed combination of measuring and pressure tubes, A and B, communicating, through the glass tap, C, with the mercury reservoir, D, (2) an absorption vessel, F, standing over mercury in a mahogany trough, G, (3) an explosion tube, E, fitted with firing wires, and connected with a separate mercury reservoir, H. All the connections between A, E, and F are of capillary bore throughout, with suitable glass taps wherever necessary. The diagram also shows how connection is made between the measuring tube, A, and the special "sampling tube," K, whenever the latter is employed for the introduction of the sample under examination. The sample may also be introduced into the apparatus, from an ordinary test-tube, under the wide open end of the absorption vessel, F, which has been previously filled with mercury. Before commencing an analysis, the whole of the apparatus, including all the connections between A. E, and F, is completely filled with mercury, and, needless to say, the whole of the subsequent operations are conducted over mercury.

The various parts of the apparatus are suitably mounted on a strong wooden stand (mahogany, oak, or teak), with four vertical steel rods supporting the shelf upon which the mercury trough, G, rests, the same rods also carrying another shelf for reagent bottles. Proper provision is made for the raising or lowering (to the ground level, if required) of the mercury reservoir, D, by means of a wooden carrier with suitable pulley and ratchet wheel. The whole apparatus stands in a wooden tray 2 ft. 4 in. by 1 ft. 6 in. with 1 in. raised sides.

The salient features of the working of the apparatus are as follows :—

(1) The principle of measurement employed is that first introduced into gas analysis by Regnault, and subsequently adopted by Sir Edward Frankland, *viz.*, the measurement of the pressure of the gas (in m.m. of mercury) at constant volume. For this purpose the gas is brought to a certain "constant volume" mark in the measuring tube, A (by suitable manipulation of the mercury reservoir D and the tap C) and its pressure read off on the pressure tube, B. There are a series of such "constant volume" marks on A, each coinciding with a 100 mm. mark on the pressure tube, B (*i.e.*, with 0, 100, 200, &c., mm.), so that the actual pressure of the gas is given by subtracting from the "pressure reading" the numbers 0, 100, or 200, etc., according to the particular constant volume mark selected for the analysis. The tubes A and B are made in one piece, which is surrounded by a water jacket, and their inner surfaces are kept moist with very dilute sulphuric acid (1 in 20) as a precaution against the accidental fouling of the measuring tube, with alkalis, and it is obvious that the wetting of A and B with the same liquid eliminates the influence of water vapour upon the gas measurements, the various pressures representing those of the dry gas under examination. The tap closing the upper end of the pressure tube is connected with it by means of stout rubber pressure tubing, a device which gives a perfectly tight joint with sufficient elasticity to prevent fracture in case the mercury in B is inadvertently allowed to run up the tube with unusual velocity. The tap in question also allows of the vacuum being easily made in B whenever necessary. The advantages of this mode of measurement over the more usual method of determining the volume under atmospheric pressure are twofold, *viz.* (1) it allows of the use of smaller volumes of gas for an analysis—thus from 5 to 10 c.c. of gas can be made to have a pressure of 100 m.m., according to the particular volume mark selected, and this pressure can easily be read off to within 0·2 mm. without employing a telescope, and (2) the measurements are, of course, independent of the barometric pressure and at the same time are unaffected by tension of aqueous vapour.

(2) The length of the pressure tube, B, (about 700 mm.) amply provides for the proper dilution of the "explosive mixture" in an explosion analysis.[*] Thus in the analysis of a coal gas containing (say) carbon dioxide, 0·5, unsaturated hydrocarbons, 5·5, carbonic oxide, 6·0, hydrogen, 55·0, and methane, 33·0 per cent. respectively, if an amount of gas were originally taken corresponding with a pressure of 120 mm. at the constant volume mark, O, then after removal of carbon dioxide and monoxide, and unsaturated hydrocarbons with suitable absorbents, the residual 105·6 mm. of methane and hydrogen would give 217·8 mm. of "*Knallgas*," which could be diluted with the 350 mm. of *excess* oxygen necessary to ensure accuracy in the subsequent explosion. The importance of capacity is, of course, even greater in the case of a rich oil gas, or in the analysis of acetylene, where very large dilutions are necessary.

(3) The arrangements for the various "absorptions" are of the simplest. Instead of using a number of large absorption vessels each containing a particular reagent which is used unchanged many times over in successive analyses, all the absorptions are carried out over mercury in the one absorption vesesl, F, in each case with a comparatively small volume of the particular reagent which is always used fresh and is at once discarded after use.

To facilitate the introduction of the various reagents, and the rinsing out of the absorption vessel with water or dilute sulphuric acid *in situ* between each successive reagent, the wide (open) end of the vessel is immersed under the mercury in the trough, G, whilst the top terminates in a capillary three-way tap, K. One of parallel branches of this tap communicates, through a stout rubber joint, with the measuring vessel, A, and the other with a water pump, a large bottle being inserted between the pump and the absorption vessel to serve as a trap for either the mercury or the reagent which is being discarded after use. The insertion of a tap between the pump and the bottle obviates the necessity of the continuous exhaustion of the latter, a single exhaustion at the outset of an analysis being all that is required.

From 2 to 5 c.c. of the particular reagent to be used is introduced into the absorption vessel (previously filled with mercury), by means of a suitable pipette, from below the surface of the mercury in the trough. Any minute bubble of air accidentally introduced with the reagent can be got rid of by cautiously opening the branch of the tap, K, leading to the above mentioned exhausted bottle ; the same device allows of the complete withdrawal of the reagent after use, without taking down the absorption vessel, and also of the rinsing out of the latter *in situ* with water, or dilute sulphuric acid, before the next reagent is used.

In this way, using small quantities of each successive reagent always in a fresh condition, and washing the vessel out *in situ* between each reagent, a series of absorptions can be quickly carried out without disturbing a single connection in the apparatus. It may also be added that long experience has proved that the use of such reagents as a solution of bromine (in potassium bromide) for the absorption of unsaturated hydrocarbons, is unattended with difficulty.

(4) In point of rapidity of action, combined with accuracy, the apparatus will compare favourably with any other type. An analysis of producer gas can be easily carried out in 45 minutes, and one of coal gas in about an hour.

(5) There are no complicated parts about the apparatus to occasion trouble, and the several parts can be readily detached for cleaning purposes.

(6) The apparatus is well adapted for the analysis of almost every kind of combustible gaseous mixture, ordinarily met with in technical practice.

Discussion.

Mr. J. W. Cobb said that no branch of technical analysis had developed more in the past few years than the analysis of gases, on account of the growing conviction that scientific control was essential for the economical use of fuel. The development was however, mainly in quantity and not in quality. The Hempel apparatus was a good form for control work on ordinary combustion processes, and was easy to manipulate, but others must have felt the need that he himself had experienced, for some more delicate apparatus, what he might call a reference apparatus, for use in determining with certainty the effect of comparatively slight alterations in the conditions of some process. He assumed that this apparatus was intended for reference rather than for control purposes. In comparing the results obtained by the authors in the analysis of producer gases with those generally obtained from the Hempel apparatus, the methane seemed to come out always higher, usually about 1 per cent. Why was this? Could comparison be made between the heating power as calculated from analysis, and the same as determined by gas calorimeter; he had always found the results from gas calorimeters, although comparable with one another, to be low compared with those from analysis, and more so than could be explained by the radiation losses of the calorimeters. Finally he should like to compliment the authors on some of the novel details of the apparatus, and to welcome the paper as the first contribution from the new Fuel and Metallurgical Department of the Leeds University, to the Society of Chemical Industry.

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[*] If the apparatus is required for the analysis of such diluted gases as producer gas or blast-furnace gas only, the length of the pressure tube need not exceed 400 mm., in which case the lengths of the measuring tube, A, and the explosion tube, E, could be correspondingly diminished, with consequent reduction of the total height of the apparatus above the working bench. But such a reduced apparatus would be unsuitable for the analysis of richer gases.

Mr. T. **FAIRLEY** pointed out that the apparatus was by no means a portable one. It was suitable for an expert chemist to use. The washing out of the vessels by means of the vacuum bottle was an advantage, and the use of mercury made possible greater accuracy. Water was very convenient when the apparatus had to be carried about, and for certain work the results were near enough.

Mr. F. W. **RICHARDSON** welcomed the apparatus since he had to suffer a good deal from the shortcomings of other forms of apparatus for gas analysis. He noticed the large number of taps but was pleased to hear these were not likely to get out of order. He asked what lubricant Prof. Bone used, and if the apparatus was suitable for extracting dissolved gases from liquids. Had Prof. Bone found trouble by the action of bromine on the mercury used? Mercury was clean and gave accurate results, and he was surprised to see how often water or brine was recommended in its place.

Mr. W. **LOWSON** inquired what amount of concordance could be obtained between the results obtained by exploding the unabsorbed residue of a coal gas in three or four fractions.

Mr. C. P. **FINN** asked what time was necessary for the gas to remain in contact with the absorbent and if shaking was required. He had always found two treatments with separate lots of ammoniacal cuprous chloride in separate Hempel pipettes necessary to remove carbon monoxide completely.

Prof. W. A. **BONE**, in reply, said that all the points raised during the discussion had been carefully considered in designing the apparatus, and many years' experience with his own research apparatus, of which the present form was an adaptation, had convinced him of its reliability. It was not perhaps an apparatus to put into the hands of a works foreman, or possibly even into the hands of a novice in the laboratory, but anyone with ordinary manipulative skill and practice could be entrusted with it. It had been in daily use as a control apparatus in connection with a large producer plant under Mr. Wheeler's supervision for more than a year, and had given the greatest satisfaction. The Hempel apparatus was, in his opinion, quite unreliable and useless, except for very rough work, and he was not surprised to hear about the low methane results for producer gas obtained with it. He should never think of placing any reliance on results obtained with either the Hempel or the Orsat apparatus, where the estimation of small quantities of any given constituent was concerned, or where small differences in composition had to be detected. He had successfully applied the most rigid tests to his research apparatus with hydrogen containing known small percentages of methane. Moreover, whenever he had had occasion to supplement gas analyses by calorimetric tests during producer trials, he had found close agreement between the two sets of results. Comparative analyses of the same sample of gas with the research apparatus and with the present apparatus shewed good agreement, and although the latter was not quite capable of the same degree of refinement as the research apparatus, which, indeed, was much more costly, it was nevertheless, so far as his experience went, a thoroughly reliable instrument. With regard to the absorption of carbon monoxide by means of an ammoniacal solution of cuprous chloride, everything depended upon the care taken in preparing the solution. He always used a freshly prepared (*i.e.*, unused) solution, containing ammonium chloride, of such activity that it absorbed carbon monoxide almost as rapidly as caustic potash absorbs carbon dioxide. Careful experiments had shown, moreover, that after two successive treatments of a gaseous mixture containing large quantities of carbon monoxide with such an active solution, the amount remaining unabsorbed was negligibly small. He often used a solution of bromine in potassium bromide for the absorption of unsaturated hydrocarbons, but found no difficulty at all with it. With regard to taps, if these were carefully selected by a competent judge, and kept lubricated with a solution of india-rubber in vaseline, and especially if the whole apparatus was regularly washed out with dilute acid after each analysis—an operation which could be performed in less than two minutes—no trouble would arise. People who experienced trouble with stopcocks sticking had largely their own carelessness to blame. There could be no doubt but that gases must be analysed over mercury if accuracy was desired, and he personally never used any other liquid in a gas analysis apparatus: the best substitute for mercury would perhaps be a mixture of equal volumes of glycerin and water. He could not agree that water by itself was "good enough" for even rough work. In these days when gaseous fuels played so important a part in industrial operations the need of exact methods of gas analysis could not be too much insisted on, and the present apparatus was designed to meet that need.

Journal and Patent Literature.

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I.—PLANT, APPARATUS, AND MACHINERY.

PATENTS.

Drying and grinding materials. O. Imray, London. From Soc. of Chem. Industry, Basle, Switzerland. Eng. Pat. 9741, April 26, 1907.

A HORIZONTAL cylinder with open ends closed by perforated plates is surrounded by a heating jacket and is mounted so that it can be rotated within an air-tight casing in which a vacuum is maintained. Within the cylinder are a number of balls, or "grinding bodies" of steel, or other suitable material, which crush the material as the cylinder is rotated. The material to be treated, which may contain any quantity of moisture, is fed by suitable means, continuously and without breaking the vacuum, into one end of the cylinder. It is ground and dried and continuously discharged from the other end of the cylinder into the first of two valved chambers, which form an air-lock, so that the dried material can be continuously extracted without breaking the vacuum. The vapour given off is discharged from that end of the casing at which the moist material enters and it travels in the opposite direction through the cylinder. The supply of steam to, and the extraction of the condensed water from, the jacket is effected by pipes which pass through the axis of the journal-box at the discharge end of the apparatus.—W. H. C.

Drying granular and similar materials. G. D. Moffat, Cold Norton, Essex. Eng. Pat. 10,664, May 7, 1907.

The material to be dried is allowed to fall from a feed-hopper through a vertical chamber or tower where it is heated by steam coils, and is, after drying, removed from the bottom of the tower by a pair of wheels, provided with blades, which are rotated in casings. To facilitate the escape of the steam or vapour given off, rows of inverted gutters are arranged across the tower at various levels. The gutters or collecting troughs are open below and at both ends, and rapidly convey the vapour through openings in the walls to an external jacket, from which it is conducted by pipes to a condenser. To prevent the material under treatment becoming clogged, a series of rows of bars which receive a reciprocating motion from without, are arranged at intervals across the chamber.
—W. H. C.

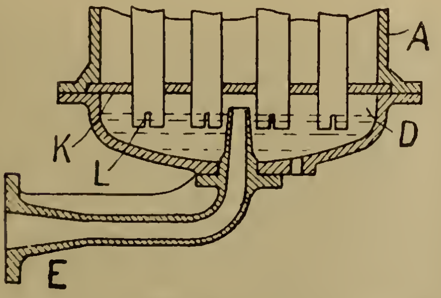
Drying apparatus. A. Huillard, Suresnes, France. Eng. Pat. 14,844, June 27, 1907. Under Int. Conv., July 11, 1906.

See Addition of Aug. 10, 1906, to Fr. Pat. 318,562 of 1902; this J., 1907, 81.—T. F. B.

Boiling easily foaming or frothing substances, more particularly resin size; Apparatus for ——. O. Schmidt, Heidenau, Germany. Eng. Pat. 15,257, July 2, 1907.

A coil of pipe in which at least some of the coils are vertically above one another, is suspended from a chain and pulleys above the open vessel in which the liquid (*e.g.*, resin size) is boiled, and is connected by a flexible pipe to a supply of cold water. When signs of foaming are observed, the coil is lowered to a greater, or lesser degree into the liquid, so that the froth and the upper portions of the liquid are cooled, and boiling over is prevented.—W. H. C.

Concentrating apparatus; Continuously acting ——. P. Kestner, Lille, France. Eng. Pat. 18,576, Aug. 16, 1907. Under Int. Conv., Aug. 16, 1906.



The claim is for improvements in the multiple-effect concentrating apparatus described in Eng. Pat. 6372 of 1903 (this J., 1904, 363). The lower ends of the tubes, B, project beyond the lower surface of the tube-plate, K, into the inlet chamber, D, and the end of the liquid-supply pipe, E, from the previous "effect" projects into this chamber as shown. The object of the arrangement is to keep the level of the liquid above the lower ends of the tubes, so that the steam which is generated owing to the lowering of the pressure as the liquid passes from unit to unit of the apparatus, or which is introduced specially, collects in the trap so formed and is evenly distributed among the tubes, which have slots, L, formed to admit it. It is stated that by this arrangement, both the steam and liquid are very evenly distributed between the tubes, and that a greater degree of efficiency is thus attained.—W. H. C.

Concentrating apparatus with long, vertical tubes. J. F. P. Kestner. Fr. Pat. 380,804, Aug. 13, 1907. Under Int. Conv., Aug. 16, 1906.

See Eng. Pat. 18,576 of 1907; preceding.—T. F. B.

Calcareous fur deposit; Solvent for ——. C. Schmidt, Weser, Germany. Eng. Pat. 19,292, Aug. 27, 1907.

Twenty parts of "soda" and 8 parts of borax are mixed with 8 parts each of the following tanning materials: myrobolans, divi-divi, maletta, mangrove, oak, quebracho, mimosa, pine and vallonea (valonia), all in a state of fine powder. The mixture is added to 300 parts of water for use.—W. H. C.

Filter-press. F. W. von Oven, Aurora, Ill. U.S. Pat. 872,008, Nov. 26, 1907.

The filter-press consists of a stationary and a movable head, and of interposed chamber-forming frames comprising rims with open-work flexible centre-portions. Ears or lugs project from these rims and contain openings aligned in the press to form the feed-passage, and ports lead from this passage into the chambers between the frames. The sides of the frames are covered with filtering-cloth.—A. G. L.

Filtering-plate; Porous ——, *and process of making such filtering-plate.* P. D. Gray, Assignor to T. R. Gray, San Francisco, Cal. U.S. Pat. 872,621, Dec. 3, 1907.

Pure block tin is mixed with some soluble substance and the mixture moulded and pressed into shape. The soluble body is then dissolved out, leaving the plates of block tin in a porous condition.—W. H. C.

Filtering liquids; Apparatus for ——. W. Reeves and B. Bramwell, Belfast. U.S. Pat. 873,458, Dec. 10, 1907.

See Eng. Pat. 3050 of 1904; this J., 1905, 77.—T. F. B.

Filter-press. F. B. Anderson, Cleveland, Ohio. U.S. Pat. 873.482, Dec. 10, 1907.

A casing and a head-piece, or cover, are mounted on a frame so that the latter can be moved towards, or away from the former. The head-piece carries a number of independent filter-plates, or leaves, which are hinged upon it and covered by filter bags, or cloths.—W. H. C.

Mixing fluids and molten metals of different densities; Device for ——. H. Leiser, Thorn, Germany. U.S. Pat. 873,131, Dec. 10, 1907.

See Eng. Pat. 25,108 of 1906; this J., 1907, 1269.—T. F. B.

Still with a movable body. G. Martel. Fr. Pat. 379,857, July 13, 1907.

The body of the still is supported on a carriage running on rails which extend from the charging place, beneath the still-head to the place of discharge. The still-head, swan-neck, and condenser are fixed and supported on pillars. When charged, the body of the still is moved beneath the still-head and brought into contact with it either by raising a platform which carries the rails beneath the still-head, or by lowering the latter by mechanical means. The joint is made tight in any suitable manner, and connection to the steam supply is automatically made at the same time. When the distillation is complete, the platform is lowered and the still-body moved away to the discharging place and another still-body previously charged takes its place. In this way a great deal of time is saved and the cleaning of the still-body is facilitated, for which purpose it may be mounted on trunnions so that it can be tilted.—W. H. C.

Bumping of liquids undergoing distillation in vacuo; Apparatus to prevent ——. E. A. R. Chenard. Fr. Pat. 380,844, Aug. 14, 1907.

The bumping of liquids undergoing distillation *in vacuo* is caused by the complete absence of air in the liquid due to the vacuum. To overcome the difficulty, a very small amount of air is admitted to the vessel by a pipe which passes through the shell and dips into the liquid. The upper end of this pipe is expanded into a funnel which can be completely or partially closed by a tapered rubber plug, guided by a rod and moved by screw with a milled head at the top. The interior of the funnel is grooved to ensure better contact with the rubber.—W. H. C.

II.—FUEL, GAS, AND LIGHT.

Carbon monoxide in coal gas. L. Vignon. Compt. rend., 1907, **145**, 1177—1179.

After allowing for the carbonates and the water contained in the coal, the author finds that :—1. A coal yields on distillation more carbon monoxide and carbon dioxide as it contains more oxygen. 2. When the coal is distilled at 900° C., the gases contain about one-third of the oxygen contained in the coal.—J. T. D.

Carburation of water-gas with mineral oils. E. Graefe. Petroleum, 1907, **3**, 193—199.

The author discusses some properties of mineral oils with reference to the suitability of the oils as carburetting agents, the value of the gas being regarded as depending upon its calorific power rather than on its candle power. The oils used were gasified on an industrial scale in a retort, and the results are considered comparable with those which would be obtained in a carburetting plant. Light constituents in the oil do not render the gas unstable when cold. Ligroïn (petroleum spirit) of which 80 per cent. distilled below 100° C., gave a gas 60 litres of which, corresponding to 8·82 grms. of the spirit, deposited only 3·68 grms. when cooled to − 80° C. The gases made from two crude oils yielding 11 per cent. and 2 per cent. of distillate below 150° C., gave 1·077 grms. and 1·893 grms. of deposit at − 80° C. from 25 litres and 30 litres of gas respectively. 75 per cent. of the heat value of the petroleum spirit mentioned is obtained in the gas. The light constituents of crude oils must generally be separated, however, on account of the low flash point of the crude oils. The sulphur in mineral oils does not greatly affect the sulphur content of the purified gas. On gasifying an oil containing 1·16 per cent. of sulphur, the sulphur was accounted for as follows :—

	I.	II.
In the crude gas as H_2S	35·3 per cent.	75·2 per cent.
In the tar	59·5 do.	21·2 do.
In the purified gas	1·97 do.	1·85 do.
In the coke	3·31 do.	Traces.

The first experiment was carried out at the lower temperature and the yield of gas was about 23 per cent. greater. Crude oils containing asphaltum can be used, but more carbon is deposited, and the heat efficiency of the process is less. Two crude oils containing 4·76 and 4·0 per cent. of asphaltum gave 4·0 and 5·7 per cent. of coke respectively, with heat efficiencies of 59·4 and 56·5 per cent., whilst an oil free from asphaltum gave only 1·8 or 2·5 per cent. of coke, and heat efficiencies of 60·3 or 63 per cent.—A. T. L.

Patents.

Fuel briquettes ; Insoluble ——. A. Tavernier, London. Eng. Pat. 14,795, June 27, 1907.

Briquettes which are smokeless and insoluble in water are made from wood or wood refuse and the liquor obtained from the lixiviating tanks of wood paper mills, with a small quantity of pitch or rosin. The wood is damped with slightly acidulated water and carbonised in one or other of two brick chambers through which the boiler flue gases pass on their way to the stack. The two chambers are used alternately, and a fan is provided in the stack to maintain the draught. The charcoal obtained is made into a paste with the concentrated liquor from the lixiviating tanks, and the mixture is dried and ground, forming a non-porous material which may be briquetted with only a small quantity of pitch or rosin.—A. T. L.

Drying of peat and other vegetable substances containing a large quantity of water. R. Buch, Berlin, Germany. Eng. Pat. 15,150, July 1, 1907.

The peat is fed into one end of a horizontal rotating cylinder provided with an internal helical blade which disintegrates the peat and moves it forward through the cylinder to the other end. The treated material is discharged through apertures in the periphery of the cylinder near one end, which extends into a furnace. The hot gases from the furnace are mixed with steam to prevent the charring of the peat and are introduced into the open end of the cylinder which projects into the furnace by a funnel which penetrates some distance into the cylinder and shields the discharge openings.—W. H. C.

Fuel ; Process for preparing a ——. T. Parker. Fr. Pat. 380,366, July 30, 1907. Under Int. Conv., Aug. 1, 1906.

See Eng. Pat. 17,347 of 1906 ; this J., 1907, 1271.—T. F. B

Coke ovens. W. L. Wise, London. From Soc. Solvay et Cie., Brussels. Eng. Pat. 16,786, July 22, 1907.

In a battery of coke ovens having a regenerator beneath each oven, the flues are arranged so that any oven can be isolated from the regenerator beneath it, without interrupting the heating of the adjacent ovens ; and two adjacent passages are provided for the outlet of burnt gases from the heating flues of each oven, one leading to the regenerator and the other direct to the chimney or to a boiler or other apparatus to be heated, and one or other of these passages may be closed by a common damper. In the construction shown, the hot air from a regenerator passes to four horizontal heating flues in the wall separating two adjacent ovens, two flues being near the right-hand wall of the left-hand oven, and two near the left-hand wall of the right-hand oven. Either pair of flues may be closed by dampers. Similar heating flues with dampers are connected with the other end of the same regenerator. By closing the dampers of the heating flues of any oven, the oven may be isolated, whilst the regenerator beneath it still supplies hot air for the adjacent oven.—A. T. L.

Alcohol ; Denatured —— *for use in motor-cars and -boats and other internal combustion engines and for lighting and heating.* J. Novel. Fr. Pat. 380,310, July 27, 1907.

The best mixture is stated to consist of alcohol, 80 parts ; acetone, 10 ; and petrol, 10 parts, and it is claimed that this mixture can be used in existing types of internal combustion engines without altering the carburettor, or making any other modification, and that the engine can be started cold even at a temperature of − 10° C. —W. H. C.

Gas producers for bituminous coal or other fuel containing volatile matters. J. S. Daniels, E. P. Higgins, and F. L. Daniels, Stroud. Eng. Pat. 1313, Jan. 18, 1907.

The fuel is fed by a screw or other device into the lower end of an open vertical retort passing through the centre of an annular grate and upwards through the hot fuel in the producer. At the upper end of the retort, the fuel is deflected by a spreader depending from the top of the producer, and falls over the top edge of the retort on to the annular fuel bed. The gases from the retort and from the producer fire may pass together to the scrubbing plant through an outlet near the top of the producer, or the gas outlet may be at the level of the fire, and the gases from the retort may be drawn, by an exhauster or by a steam jet, through an outlet near the top of the producer into a down-pipe which delivers them into the producer at the combustion zone or below the grate.—A. T. L.

Gas-producer. E. D. Hopcroft, Assignor to The Hopcroft Gas Producer Co., Bridgeport, Conn. U.S. Pat. 872,625, Dec. 3, 1907.

The claim is for a producer comprising a generator, a gas-washing and cleansing chamber, a steam-generating chamber, and a connection to a gas-engine. The exhaust gases from the latter pass through a chamber in which a fan-wheel is placed, the latter being rotated by the exhaust gases. The rotation of the fan-wheel actuates a governor which controls the supply of steam to the generator.—W. H. C.

Gas-producer. C. Gamer, Fort Worth, Tex. U.S. Pat. 873,037, Dec. 10, 1907.

A VERTICAL generator is connected to a series of vertical cylinders which are connected together alternately above and below by boxes. A rod which passes centrally through each cylinder carries a number of baffle-plates or "separators," and the lower boxes are provided with sealed drain pipes.—W. H. C.

Gas-producer. A. J. Gifford, Assignor to C. H. Morgan, Worcester, Mass. U.S. Pat. 873,039, Dec. 10, 1907.

THE generator has an annular chamber formed in the wall from which tuyères pass into the body of the generator. Vertical, adjustable and removable telescopic pipes are supported within the annular chamber from above, and communicate below with the air, conveying it to the tuyères, and may have their lower ends sealed by water when desired.—W. H. C.

Gas manufacture. H. I. Lea, Pittsburg, Pa. U.S. Pat. 873,250, Dec. 10, 1907.

AIR is passed through a bed of fuel in such quantity that only partial combustion takes place. A portion of the gas so formed is passed into a second chamber where it is mixed with hydrocarbon oil, and sufficient air is admitted to burn the gas and to generate enough heat to decompose the oil and fix the resulting vapours as permanent gases. The enriched gas so produced is then mixed with the remainder of that coming from the generator and forms a fuel gas of high calorific value.—W. H. C.

Carbonising coal for the production of gas; Apparatus for ——. W. Young, Peebles, and S. Glover, St. Helens. U.S. Pat. 873,647, Dec. 10, 1907.

SEE Eng. Pat. 23,650 of 1905; this J., 1906, 1033.—T.F.B.

Gas-producer with oscillating fire-bars. Soc. Menot père et fils et Deneuville. Fr. Pat. 380,340, July 29, 1907.

THIS specification describes a suction gas-producer provided with fire-bars that may be rocked periodically or continuously, to remove the ashes.—H. B.

Carburetted air and analogous gaseous mixtures; Process for increasing the stability of ——. Soc. anon. du Gaz Catalytique. Fr. Pat. 380,532, Aug. 3, 1907.

CARBURETTED air is rendered less liable to condensation by passing it through vessels containing contact substances.—H. B.

Lighting gas; Process and apparatus for the manufacture of ——. E. U. G. Ernst. Fr. Pat. 380,597, Aug. 6, 1907. Under Int. Conv., Aug. 8 and Sept. 14, 1906.

COAL is fed, either with or without oil, into the upper end of a vertical generator, which opens at its lower end into a water-sealed vessel from which the coke or ashes may be drawn. The generator is not heated externally; a limited amount of air, which has been heated by passing through channels in its refractory walls, is delivered into it at a point about 1 metre below the top of the coal, and the combustion of this air generates heat sufficient to effect the continuous carbonisation of the freshly-fed coal in the upper region, as well as the production of water-gas from the steam formed by the hot coke or ashes in the water-sealed pan. The mixed gases produced are led off at the top of the generator.—H. B.

Illuminating gas; Removal of naphthalene from ——. W. Grafton, East Ham, Essex. Eng. Pat. 27,908, Dec. 7, 1906.

AN oily solvent of a spirituous nature, obtained as an early distillate of petroleum oil or of the residue of oil used in the manufacture of carburetted water-gas, is used preferably in a rotary scrubber for absorbing naphthalene. The oil is kept at about 160° F. by means of steam pipes, and when saturated with naphthalene, it is cooled, separated from the solid naphthalene which is deposited, and may then be used again. A suitable solvent of sp. gr. 0·895—0·917 and distilling below 390° F. is obtained from the tar resulting from the manufacture of oil-carburetted water-gas of 18 to 30 candle power. —A. T. L.

Gases; Apparatus for removing solid or liquid particles from ——. F. Sepulchre. Fr. Pat. 380,249, July 25, 1907.

SEE Eng. Pat. 13,510 of 1907; this J., 1907, 1189.—T.F.B.

Oxide of iron [spent]; Revivifying ——, and apparatus therefor. S. Glover, St. Helens, and T. Glover, Norwich. Eng. Pat. 26,039, Nov. 17, 1906.

THE spent iron oxide of gas purification is supplied to a revolving iron cylinder, lined internally with bricks in which blocks projecting inwards are fixed in the form of a helix. As the drum revolves, the oxide is successively lifted by the projecting blocks and dropped again, whilst air and steam are injected, preferably by means of pipes extending along the bases of the projecting blocks. The oxide is discharged into a receptacle, and then mechanically lifted to an elevated hopper, whence it is discharged by an inclined conveyor to re-enter the charging end of the cylinder for repeating the treatment, which is continued as long as necessary. Arrangements are also described for use when a stationary drum or cylinder is used.—E. S.

Mantles; Manufacture of incandescence ——. H. L. Cossard. Fr. Pat. 380,248, July 25, 1907.

THE nitrates of thorium and cerium to be employed are dissolved in a reducing solution, such as a solution of hydroxylamine; fabrics are impregnated with the liquid, then dried and burned off.—H. B.

Electric conductors more especially applicable for use as incandescing bodies for electric lamps; Manufacture of ——. W. D. Coolidge, Schenectady, N.Y., U.S.A. Eng. Pat. 23,334, Oct. 20, 1906. Under Int. Conv., May 9, 1906.

A REFRACTORY element, such as tungsten, molybdenum or boron, is incorporated with an amalgam at such a temperature and in such proportion as to form a plastic mass. The amalgam may consist, for example, of equal weights of mercury and cadmium. The mass is then squirted, whilst warm, into wires of the desired diameter, which are next heated *in vacuo* or in an atmosphere of hydrogen, or are otherwise treated so as to expel the amalgam from the wire, leaving a coherent filament of the refractory element.—H. B.

Electric conductors more especially applicable for use as incandescing bodies in electric lamps; Manufacture of ——. W. C. Arsem, Schenectady, N.Y., U.S.A. Eng. Pat. 23,335, Oct. 20, 1906. Under Int. Conv., May 9, 1906.

A REFRACTORY metal, such as molybdenum, is heated with a less refractory metal, such as copper, until the latter fuses; the alloy produced is rolled or otherwise given the desired shape, and the conductor so obtained is then heated *in vacuo* or in an inert atmosphere, so as to drive out the less refractory metal and leave a coherent conductor of the refractory metal.—H. B.

Electric conductors more especially applicable for use as incandescing bodies in electric lamps; Manufacture of ——. W. D. Coolidge, Schenectady, N.Y., U.S.A. Eng. Pat. 23,336, Oct. 20, 1906. Under Int. Conv., May 9, 1906.

A REFRACTORY element, such as tungsten, is incorporated with a heated ductile metal or alloy having a lower vaporising temperature—*e.g.*, an alloy of 208 parts of bismuth and 112 parts of cadmium. The plastic mass is squirted into wires of the desired diameter, which are then heated *in vacuo* or in an inert atmosphere, so as to expel the alloy from the wire and leave a coherent filament of the refractory element.—H. B.

Incandescence electric lamps; Manufacture of ——. C. H. Stearn, London, and C. F. Topham, Kew Gardens. Eng. Pat. 28,680, Dec. 15, 1906.

To prevent blackening of the glass during the prolonged exhaustion which is necessary in the manufacture of incandescence lamps with metallic filaments, an atmosphere of phosphorus vapour is maintained around the filament during the process, the bulb being kept at such a temperature that no phosphorus is deposited on the glass. Before exhaustion, the contacts between the filament and the leads, and also the central glass stem if such be used, are painted with finely-divided red phosphorus mixed with alcohol or ether. The bulb is heated during exhaustion by an external air-bath kept at 380—400° C.—A. T. L.

Graphite conductors [for incandescence lamps]; Manufacture of ——. Cie. Franç. pour l'Exploitation des Proc. Thomson-Houston. Fr. Pat. 380,378, July 30, 1907. Under Int. Conv., Aug. 1 and 6, 1906.

See Eng. Pat. 19,398 of 1906; this J., 1907, 1131.—T.F.B.

Rare-earth metals, etc. U.S. Pat. 873,205. *See* XX.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

Petroleum; Optical activity of ——, *and its relation to the question of origin.* R. Zaloziecki and H. Klarfeld. Chem.-Zeit., 1907, 31, 1155—1156, 1170—1172.

The authors examined a number of Galician oils and also one each from Pennsylvania, Russia, and Germany. In each case the oil itself was examined and afterwards the fractions obtained by distilling *in vacuo* (12—15 mm.), or up to 250° C. at ordinary pressure and subsequently *in vacuo*, and also the residuum. No optical activity was observed in the case of the Pennsylvanian and Russian oils, the pale Galician oils from Broczków, Kleczany, Kryg and Pagorzyna, or the dark-coloured Galician oils from Bitkow, Urycz, and Wańkowa-Brelikow. Of the dark-coloured Galician oils from Boryslaw-Tustanowice, Harklowa, Kosmacz, Pasieczma, Schodnica, Rogi, and Wojtowa, and also the German oil (from Celle-Wietze), the lighter fractions obtained by distilling at ordinary pressure (up to 250° C.) were inactive, but the heavier fractions obtained by distilling *in vacuo* were optically active. In the case of a Moravian oil (from Ungarisch-Brod), which had the rotation, $[a]_D = +0{\cdot}55$, a value of $[a]_D = 0{\cdot}56$ was obtained by multiplying the percentage yield of each distillation-fraction by its specific rotatory power, adding together the values thus obtained, and dividing by 100. This close agreement leads the authors to conclude that no alteration in the optical properties of the oil is caused by distillation *in vacuo* under ordinary conditions. The results as a whole show that some Galician oils exhibit an optical activity unsurpassed by oils of any other origin. Light pale oils are generally inactive, whilst heavy dark oils are usually active. On distillation, the optical activity is confined to the higher-boiling fractions (above 200° C. at 12—15 mm. pressure). All of the optically-active crude Galician oils are characterised by high viscosity due to a large content of asphaltic and resinous constituents, but there appears to be no relation between the optical activity and the paraffinoid or naphthenic character of the oils. In conclusion the authors discuss various hypotheses as to the origin of petroleum.—A. S.

Petroleum; Radio-activity of ——. D. Hurmuzescu. Petroleum, 1907, 3, 235—236.

Preliminary experiments on the radio-activity of different Roumanian petroleums indicate that the lightest varieties are the most active and that the activity decreases with time.—A. T. L.

Fuller's earth; German —— *as a decolorising agent [for oils].* E. Graefe. Petroleum, 1907, 3, 292—295.

It is stated that the decolorisation of liquids by such substances as charcoal, kieselguhr, and fuller's earth is a physical and not a chemical process. Fuller's earth having proved itself to be a good decoloriser of mineral oil and mineral products, the author has carried out some experiments on deposits of this earth occurring at Fraustadt in Silesia. This earth is a light grey substance, and, in the form sent out by the company working the deposit, it contains 3—5 per cent. of hygroscopic moisture. The fuller's earth in this form gives good results as a decoloriser of mineral oils, vaseline, and fats and fatty oils. It may be used either in the form of a filter or by directly feeding into the liquid which is kept stirred. The earth acts better after being dried, and best of all after it has been heated to 400° C., when the water of constitution is driven off, and the powder becomes yellow. —C. E. F.

Carburation of water-gas with mineral oils. E. Graefe. *See* II.

Patents.

Wurtzilite or elaterite; Process for treating ——. M. Stine, New York. Eng. Pat. 19,629, Sept. 2, 1907.

See U.S. Pat. 864,836 of 1907; this J., 1907, 1099.—T.F.B.

Heavy petroleum; Continuous apparatus for "cracking" ——. E. A. Barbet. Fr. Pat. 380,282, Oct. 3, 1906.

Fig 1

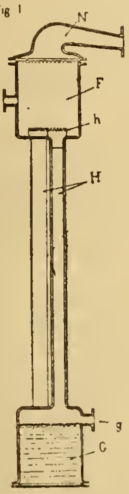
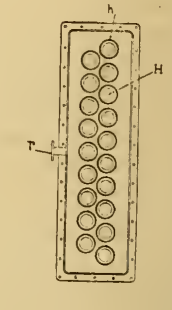


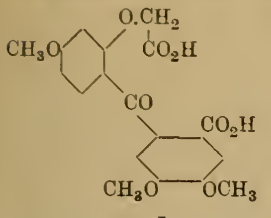
Fig 2



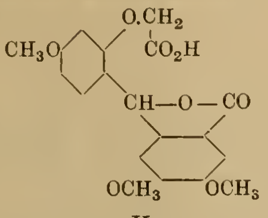
Instead of "cracking" petroleum residues in the usual manner in a cast iron still known as the "black pot,' they are run continuously from the rectifying still into the apparatus shown in Figs. 1 and 2. It consists of upper and lower chambers, F, G, connected by cast iron pipes H, and having the upper chamber, F, surmounted by a still head, N. The apparatus is fixed between the furnace and the boiler of the rectifying still, so that it receives the first impact of the hot gases, the heating effect being further increased by a wall of pigeon-hole brickwork built between the apparatus and the boiler, the latter being heated by the waste flue gases from the apparatus. The oil from the still enters through the pipe, *r*, and is equally distributed between the pipes, H, by the constant-level pieces, *h*. As the oil trickles down the pipes, H, it is "cracked" by the intense heat, and the vapours pass away by the still-head, N, to the condenser. The carbon, or coke formed is deposited in part on the sides of the tubes, but the larger portion is carried down by the excess of oil to the lower chamber, G, from which it is from time to time removed. The excess of oil flows out at *g*, and is returned to the upper chamber by an emulsifying injector actuated by steam. The apparatus is worked in pairs so that one set of tubes can be cleaned without stopping the process. The cleaning which is claimed to be very easy and to be one of the features of the invention, is performed by taking off the still-head, N, removing the pieces, *h*, and boring out the coke from above with an auger. —W. H. C.

IV.—COLOURING MATTERS AND DYESTUFFS.

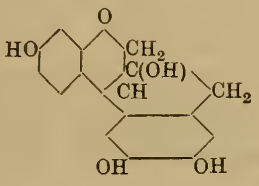
Brazilinic acid and the lactones of dihydrobrazilinic and dihydrohæmatoxylinic acids. W. H. Perkin, jun., and R. Robinson. Chem. Soc. Proc., 1907, 23, 291—293.



I.



II.

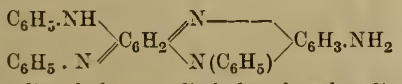


III.

Brazilinic acid is obtained when a mixture of *m*-methoxyphenoxyacetic ester and *m*-hemipinic anhydride is dissolved in carbon bisulphide and treated with aluminium chloride. Brazilinic acid must therefore have the formula, (I.), and this structure is confirmed by the following synthesis of the lactone of dihydrobrazilinic acid. A mixture of resorcinol dimethyl ether and *m*-hemipinic anhydride is treated with aluminium chloride, the product is reduced to hydroxymethoxyphenyl-*m*-meconine, and this substance on treatment with chloroacetic acid and potassium hydroxide, is converted into the lactone of dihydrobrazilinic acid which must therefore have the constitution, (II.). This synthesis also proves that brazilin must be represented by the formula, (III.). The lactone of dihydrohæmatoxylinic acid was similarly synthesised from pyrogallol trimethyl ether and *m*-hemipinic anhydride.—P. F. C.

Phenyl-s-anilidophenosafranine; Synthesis of ——. P. Barbier and P. Sisley. Compt. rend., 1907, 145, 1185—1187.

When an equimolecular mixture of azophenine and *p*-phenylenediamine is heated in alcoholic solution in a closed vessel to 165° C. for 6—7 hours, a blue-violet liquid is obtained from which the hydrochloride of phenyl-*s*-anilidophenosafranine can be isolated. This dyes silk and mordanted cotton violet-blue. The constitution of the dye-base is :—



When *as*-dimethyl- or diethyl-*p*-phenylenediamine is used instead of *p*-phenylenediamine, corresponding alkylated dyestuffs are formed which are soluble in water and are bluer than the dyestuff just described.—J. C. C.

Patents.

Diaminonaphthalene and derivatives thereof; Manufacture of ——. J. F. Thorpe, Manchester. Eng. Pat. 24,553, Nov. 2, 1906.

Claim is made for the manufacture of diamino-compounds, obtained by the action of sulphuric acid upon intermediate products, such as are obtained by the condensation of an aromatic compound containing a cyanogen group in the ring or in a side chain, with itself or with another compound containing a cyanogen group. Ring formation takes place, as exemplified in the following examples. *Example I.*—Two molecular proportions of benzyl cyanide and one atomic proportion of sodium, dissolved in alcohol, are mixed, and the mixture allowed to stand at the ordinary temperature for 10 hours and then heated for 15 minutes on the water-bath. After the addition of water, it is neutralised with hydrochloric acid and the unchanged benzyl cyanide is removed by distillation with steam. A thick gum is left, of β-imino-α-cyano-α-γ-diphenylpropane ($C_6H_5CH_2.C(:NH)CH(CN)C_6H_5$) which is freed from water and dried in a current of air, at 100° C. The dried product is added to twice its volume of strong sulphuric acid (cooling in running water); the mixture is allowed to stand for 3 or 4 minutes, and is then poured into a large volume of water. Upon neutralising with ammonia, 1 : 3-diamino-2-phenylnaphthalene is precipitated. *Example II.*—One atomic proportion of sodium is brought into a fine state of division, by melting in boiling xylene and vigorously shaking. After cooling, more xylene is added together with a mixture of one molecular proportion of tolunitrile and one of acetonitrile, and the mixture maintained at a temperature of 80° C. for 7 hours. Water is then added, and after distilling with steam, the residue is treated with sulphuric acid as in Example I., whereby 1 : 3-diaminonaphthalene is obtained as the final product.—F. M.

o-Oxy-disazo colouring matters; Manufacture of ——. A. G. Bloxam, London. From Act.-Ges. f. Anilinfabr., Berlin. Eng. Pat. 26,508, Nov. 22, 1906.

o-Hydroxymonoazo dyestuffs of the general formula, $C_6H_2(OH)(NH_2)(NO_2)N_2R$, obtained by reducing the corresponding dinitro compound with hydrogen sulphide, are diazotised and combined with a naphthol, a naphtholsulphonic acid, or an amino-naphtholsulphonic acid (R means a naphtholsulphonic acid or dihydroxynaphthalenesulphonic acid). These dyestuffs dye wool from acid baths blue-black shades, converted by chroming into deeper shades, very fast to light and milling. The dyestuffs derived from picramic acid are especially mentioned. —T. F. B.

Safranine dyestuff, and process of making same. H. Heimann, Assignor to Actein-Ges. für Anilin Fabrikation, Berlin, Germany. U.S. Pat. 872,815, Dec. 3, 1907.

Dyestuffs dyeing wool from an acid bath in greenish-blue to reddish-blue shades, fast to light and alkalis, are obtained by first oxidising *p*-nitro-*p*-aminodiphenylamine-*o*-sulphonic acid together with a secondary or tertiary aromatic amine or a corresponding aminosulphonic acid, to the corresponding indamine, and then oxidising this indamine together with an aromatic amine or aminosulphonic acid to the corresponding nitrosafranine and finally reducing the nitro group with a suitable reducing agent such as iron powder and hydrochloric acid. —A. B. S.

Sulphurised dyestuff; Manufacture of a black ——. Chem. Fabr. vorm. Weiler-ter-Meer, Uerdingen on Rhine, Germany. Eng. Pat. 27,213, Nov. 29, 1906. Under Int. Conv., Dec. 5, 1905.

See Fr. Pat. 372,104 of 1906; this J., 1907, 404.—T. F. B.

Azo colouring matters; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 4413, Feb. 22, 1907.

See Addition of April 11, 1907, to Fr. Pat. 368,608 of 1906; this J., 1907, 1044.—T. F. B.

Azo dyestuffs; Manufacture of new ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 10,420, May 4, 1907.

See Fr. Pat. 377,381 of 1907; this J., 1907, 1044.—T. F. B.

Azo dyestuffs; Production of —— and of intermediate products. Farbenfabriken vorm. F. Bayer und Co. Fr. Pat. 380,540, Aug. 3, 1907. Under Int. Conv., Dec. 10, 1906, April 10, 16 and 22, and June 27, 1907.

New disazo dyestuffs dyeing unmordanted cotton in pure bluish-red to blue shades having a good fastness to light are obtained as follows:—The diazo compound of 1.8-aminonaphtholsulphonic acid is combined with another compound which is capable of being subsequently diazotised, the product is rediazotised, and the diazoazo compound combined with 2-amino-5-naphthol-7-sulphonic acid or with 2-amino-5-naphthol-1.7-disulphonic acid or their derivatives. The aminosulphonic acid may be replaced by its acyl derivatives (acyl groups in the hydroxyl) such as the sulphurous acid esters, acetyl derivatives, etc. The acid radicals protect the hydroxyl group. *Example.*—A neutral solution prepared from 341 kilos. of 1.8-aminonaphthol-3.6-disulphonic acid (mono-sodium salt) and sodium carbonate is diazotised, and the diazo compound poured into a solution of 179·5 kilos. of α-naphthylamine hydrochloride, and sodium acetate added to neutralise the hydrochloric acid. The mass is next acidified, and the dyestuff precipitated with salt, filtered off, and converted into the neutral sodium salt. This colour is immediately diazotised at 5° C., and the diazo compound precipitated by salt and collected on a filter, made into a paste with water and poured into a solution of 315 kilos. of 2-phenylamine-5-naphthol-7-sulphonic acid containing an excess of sodium carbonate. The combination is complete after a short time, when the reaction mass is heated and the dyestuff precipitated. It dyes unmordanted cotton in pure blue shades.—A. B. S.

Monoazo dyestuffs ; Process for preparing ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 181,783, April 26, 1906.

Dyestuffs suitable for dyeing leather, paper, straw, and jute are obtained by combining phenylmethylpyrazolone with the diazo derivative of aminobenzimidazole or its derivatives in which hydrogen atoms attached to carbons in the heterocyclic ring are replaced by alkyl groups.—T. F. B.

Monoazo dyestuffs ; Process for preparing yellow, basic ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 187,149, July 6, 1906.

Diazotised aminobenzyldialkylamines are combined with phenylmethylpyrazolone ; the dyestuffs are faster to light than those obtained from the same diazo compounds and phenols or amines, and readily dye tannin-mordanted cotton and leather.—T. F. B.

Colouring matters containing sulphur [Thioindigo dyestuffs] and intermediate compounds ; Manufacture of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 4592, Feb. 25, 1907.

See Addition of Feb. 16, 1907, to Fr. Pat. 373,513 of 1906 ; this J., 1907, 865.—T. F. B.

Vat colouring matters [Thioindigo dyestuffs] ; Manufacture of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 10,541, May 6, 1907.

See Fr. Pat. 374,287 of 1907 ; this J., 1907, 757.—T. F. B.

Azo dyestuffs containing the alkyloxy group ; Process for preparing ——. Badische Anilin und Soda Fabrik. Ger. Pat. 181,782, March 27, 1906.

Dihydroxyazo dyestuffs of the type HO.X.N : N.Y, where X is an aryl group, and Y is β-naphthol or its mono-, di-, or tri-sulphonic acids, are treated with alkylating agents.—T. F. B.

Vat dyestuff ; Orange ——, *and process of making same.* A. Schmidt and C. Pretzell, Assignors to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst a/Main, Germany. U.S. Pat. 872,585, Dec. 3, 1907.

A vat dyestuff dyeing cotton and wool from an alkaline hydrosulphite vat in fast orange shades is obtained by heating *m*-acetylaminophenylthioglycollic-*o*-carboxylic acid with an alkali hydroxide, oxidising the leuco-bodies obtained, and then treating the product with a halogen. The dyestuff is insoluble in water, alkalis, dilute acids, alcohol, and acetone ; slightly soluble in hot nitrobenzene, and soluble in concentrated sulphuric acid with a cornflower-blue colour.—A. B. S.

Sulphide dyestuffs ; Manufacture of concentrated solutions or easily liquefiable pastes from ——. Farbwerke vorm. Meister, Lucius, und Brüning. First Addition, dated Oct. 15, 1906, to Fr. Pat. 361,481, May 17, 1905.

See Eng. Pat. 22,872 of 1906 ; this J., 1907, 1134.—T. F. B.

Anthraquinone derivatives containing nitrogen ; Process of making ——. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 380,673, Oct. 15, 1906.

See Eng. Pat. 22,202 of 1906 ; this J., 1907, 960.—T. F. B.

o-Hydroxymonoazo dyestuffs ; Process for preparing ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 184,689, Sept. 28, 1905. Addition to Ger. Pat. 175,827, July 11, 1905.

Derivatives of nitro-*o*-aminophenol which are also derivatives of *p*-nitraniline, are diazotised and combined with 1.8-dihydroxynaphthalene-3.6-disulphonic acid in presence of calcium hydroxide. The dyestuffs thus obtained give blue and greenish-blue shades on chrome-mordanted wool.—T. F. B.

Gallocyanines ; Production of sulphonated —— *by condensing nitrosomonoalkylarylamines or nitrosodialkylarylamines with pyrogallolsulphonic acid.* Manuf. des Mat. Col. ancien. L. Durand, Huguenin et Cie. Fr. Pat. 380,701, July 8, 1907. Under Int. Conv., June 4, 1907.

See Eng. Pat. 19,002 of 1907 ; this J., 1907, 1194.—T. F. B.

Gallocyanines ; Production of new derivatives of arylated ——. Manufacture des Mat. Col. ancien. L. Durand, Huguenin, et Cie. Fr. Pat. 380,513, July 13, 1907. Under Int. Conv., May 18, 1907.

See Eng. Pat. 19,001 of 1907 ; this J., 1907, 1273.—T. F. B.

Monoazo dyestuffs from o-o-diaminophenol-p-sulphonic acid ; Process for preparing ——. Kalle und Co. Ger. Pat. 182,853, April 29, 1905.

o-Nitro-*o*-acetaminophenol-*p*-sulphonic acid is reduced, diazotised, and the diazo compound heated gently with an acid to remove the acetyl group, when it is combined with a suitable chromogen.—T. F. B.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

Spiders' silk. E. Fischer. Z. physiol. Chem., 1907, **53**, 126. Chem.-Zeit., 1907, **31** [Rep.], 610.

The threads spun by *Nephila madagascarensis*, a large spider found in the woods of Madagascar, closely resemble ordinary silk in external appearance. Each spider produces from 150 to 600 metres of threads. A dried specimen of the silk gave the following results when hydrolysed with acids :—Glycocoll, 25·13 ; *d*-alanine, 23·4 ; *l*-leucine, 1·76 ; proline, 3·68 ; *l*-tyrosine, 8·2 ; *d*-glutaminic acid, 11·7 ; diamino-acids, 5·24 ; ammonia, 1·16 ; and fatty acids, 0·59 per cent. It left 0·59 per cent. of ash on ignition. The orange-yellow colour became intensified by alkalis and was destroyed by acids, so that the colouring matter could be used as an indicator. The silk differed from ordinary silk chiefly in its deficiency in water-soluble substances (silk-glue). It yielded approximately the same amounts of glycocoll, alanine, tyrosine and leucine as silk fibroïn, but glutaminic acid, of which it contained a large proportion, has not yet been obtained from ordinary silk. On the other hand serine, which is an important constituent of silk fibroïn, was not found in spiders' silk. Phenylalanine also appears to be absent from the latter.—C. A. M.

Compounds of acid and basic dyestuffs; Dissociation of —— by adsorbent substances. L. Pelet-Jolivet. Compt. rend., 1907. **145**, 1182—1183.

The author has prepared a number of compounds of acid and basic dyestuffs of which that obtained from Crystal Ponceau and Methylene Blue has the formula,

$$C_{10}H_7.N_2.C_{10}H_4(SO_3)_2.OH,(C_{16}H_{18}N_3S)_2$$

When wool, animal charcoal or precipitated or calcined silica are added to aqueous solutions of such compounds, in neutral or faintly alkaline solution, the compound is dissociated by the adsorbent, which fixes the basic component, the acid component remaining in the solution. In acid solution the compounds are also dissociated, but the adsorbent unites with the acid dyestuff, and the basic component remains in solution. When the concentration of the acid exceeds a certain value, the adsorbent can precipitate a part of the basic component and thus assume a mixed tint. This reaction occurs most readily with silica, but wool always effects complete dissociation. The author considers that his results are readily explained by the colloidal theory of dyeing.—J. C. C.

Sulphide dyestuffs; Dyeing of half-woollen fabrics with ——. H. Levinstein. J. Soc. Dyers and Col., 1907, **23**, 296—298.

When half-woollen goods are dyed with sulphide dyestuffs, it is either the intention to leave the wool undyed or to produce fast solid shades on both cotton and wool. At temperatures below the boiling point, the sodium sulphide in the dye-bath acts on the wool; it dissolves it and causes it to be dyed very strongly. The same has been noticed when hot solutions of caustic soda or of sodium carbonate are employed in place of the sodium sulphide. Weak solutions of the dyestuffs, to which sodium bicarbonate or any suitable acid or acid salt has been added to such a point that the addition of a further quantity just causes precipitation, are not of practical importance, for although the wool is scarcely dyed, there is not sufficient dyestuff present to produce a full shade on the cotton. When dyeing with such a solution, it is observed that some of the dyestuff is precipitated; this is probably due to some of the sodium sulphide being drawn from solution and retained by the fibre. If wool and cotton are steeped in a weak solution of sodium sulphide and then introduced into the dye-liquor just mentioned, the wool is dyed darker than the cotton, but the former is impaired in quality by the action of the sulphide. It has further been found that the depth of the shade to which the wool is dyed depends on the extent to which it has been affected by the sulphide. Formaldehyde "hardens" wool, decreasing its reactivity, and enabling it to resist the destructive actions of alkalis and of alkaline sulphides to a considerable extent. Thus in the dyeing of half-woollen goods with sulphide dyestuffs, a previous treatment of the fabric with formaldehyde causes the wool to remain undyed. (See Kann, this J.; 1903; 904.) The treatment with formaldehyde does not interfere with the subsequent dyeing of the wool with other dyestuffs in either neutral or in weakly acid solutions, and, further, the cotton is not affected by the treatment.
—S. H. H.

Chrome Yellow; Printing of —— on Paranitraniline Red. E. Podreschetnikoff. Z. Farben-Ind., 1907, **6**, 401—402.

An improved method is given of reducing Paranitraniline Red by means of hydrosulphite, and, at the same time, fixing Chrome Yellow. The following discharge is printed on the red ground: 200 grms. of Rongalite, 190 grms. of gum tragacanth (60 : 100), 10 grms. of formaldehyde, 100 grms. of glycerin ("white"), and 500 grms. of basic lead carbonate (in paste).

After printing, the goods are steamed, when by the interaction of the sulphoxylate and the lead carbonate, greyish lead sulphide is produced on the discharged places. A passage through a bath containing 2 grms. of sodium carbonate and 0·5 grm. of sodium peroxide per litre oxidises the lead sulphide to sulphite, and after washing for 20 minutes in the rope form, the prints are chromed. If the peroxide bath is not used, a dirty yellow results and the chrome bath turns from a yellow to a green colour owing to reduction. Chlorine may be used for the oxidation, but in the case of indigo prints, this is undesirable and, further, the lead sulphate which is then produced does not react readily with alkali chromates. Another method of obtaining a good yellow discharge consists in printing with a mixture of 200 grms. of hydrosulphite-formaldehyde (31 per cent. $NaHSO_2,CH_2O,2H_2O$) and 300 grms. of gum senegal solution, then steaming, passing in the open width through a hot solution of lead nitrate (20 grms. per litre), washing well, passing through sodium carbonate solution (2 grms. per litre), washing and chroming.—S. H. H.

Patents.

Wool, artificial; Production of —— from jute, ramie, cotton, and other vegetable fibres. J. Schmitt, Belfort, France. Eng. Pat. 12,033, May 24, 1907.

See Fr. Pat. 377,979 of 1907; this J., 1907, 1088.—T. F. B.

Filaments of fibroïn, cellulose, etc.; Process for the manufacture of ——. P. Follet and G. Ditzler, Verviers, Belgium. Eng. Pat. 22,753, Oct. 15, 1907. Under Int. Conv., Oct. 16, 1906.

It has not been possible to prepare solutions of fibroïn in ammoniacal solutions of metallic oxides, of sufficient strength to permit of the fibroïn being precipitated therefrom in filament form, and when strengthened by the addition of dissolved cellulose, the thread obtained has been wanting in elasticity. Claim is now made for a process whereby solutions of fibroïn, cellulose, or analogous matter (containing 30 per cent. of dissolved substance) may be obtained. Pure fibroïn or cellulose is dissolved, with a little caustic soda, in a solution obtained by the action of ammonia upon the sulphate of a metal, for example nickel sulphate. To prepare such a solution, ammonia is passed into a 20 per cent. solution of nickel sulphate, whereby small violet crystals separate out; these are collected and dissolved, together with 3 to 4 grms. of caustic soda in 100 c.c. of water. This solution will dissolve fibroïn to the extent of 25 to 30 per cent., and after the addition of 3 to 4 grms. of glycerin and filtering, it may be treated in the ordinary manner for spinning artificial silk. In treating fibres, *e.g.*, cellulose, other than fibroïn or silk waste, the nickel sulphate is replaced by copper sulphate.—F. M.

Bleaching, dyeing, scouring, etc.; Machines for ——. L. S. d'Iszoro, Stockport. Eng. Pat. 25,781, Nov. 15, 1906.

Claim is made for a machine, for dyeing, scouring, bleaching and sizing yarn in the cop, bobbin or cheese, in which the cops tubes are supported in a closed chamber, which is mounted in an open tank, and which is connected with a reversible rotary pump. The tank is filled with the liquor required for treating the yarn, and the pump is made to rotate first in one direction, then in the other, so that the liquid is alternately sucked and forced through the yarn, whereby the time required for thorough treatment is much shortened and very regular results are obtained.—F. M.

Washing, impregnating or drying fabrics and other goods; Apparatus for ——. H. Hey, J. Smith, L. Mitchell and W. H. Askham, Dewsbury, and H. Heymann, Bradford. Eng. Pat. 26,843, Nov. 26, 1906.

The invention relates to an apparatus applicable in the removal of grease from piece goods, in impregnating fabrics in the process of waterproofing, in dry cleaning and for the removal of solvents from goods, after dry cleaning. The device consists of a cylindrical wire cage, mounted on an axle, and capable of being slowly or rapidly rotated by means of pulleys. It is divided longitudinally into four chambers, each provided with a door (in the side opposite to that on which the driving pulleys are) for the purpose of introducing and removing the goods. The periphery of the cage is strengthened by steel bands, which encircle it at short distances apart, so that it may be rapidly rotated without danger. The cage is enclosed in a stationary casing (which is made gas- and liquid-tight), through one end of which the axle of the cage is carried in bearings. The other end carries a bearing for supporting the free end of the axle of the cage, and also a hinged door through which the cage is filled and emptied. Means are provided for creating a vacuum inside the casing, or filling this with an atmosphere suited to the process being carried out.—F. M.

Mordanting of cotton piece goods; Dunging and ——. The Calico Printers' Assoc., Manchester, and J. Hadfield, New Mills, Derby. Eng. Pat. 29,135, Dec. 21, 1906.

Hitherto, in the dunging or fixing of the mordant, it has been customary to pass the mordanted cloth through a succession of large tanks, in which large quantities of fixing solution had to be maintained at a high temperature; these liquors had to be run off fairly often on account of the danger of contamination, much fixing agent being thus wasted. It is proposed to pass the cloth through a small tank in which the liquid is kept at a constant level (by means of a pipe connected with a reservoir), the flow being regulated by a ball tap. The excess of liquor is squeezed out of the cloth by passing between rollers, and the fixing is completed by giving a short steaming, after which the pieces are well washed and dyed in the usual way.—F. M.

Dyeing machine. D. F. Waters, Philadelphia, Pa. U.S. Pat. 872,597, Dec. 3, 1907.

Claim is made for a dyeing machine for yarn, in which the yarn sticks are connected to gearing so that alternate sticks rotate independently of the intermediate ones.
—A. B. S.

Dyeing [with sulphide dyestuffs]; Process of ——. G. A. Waldinger and C. F. Iserloth, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 873,277, Dec. 10, 1907.

See Addition of Oct. 19, 1906, to Fr. Pat. 367,921 of 1906; this J., 1907, 253.—T. F. B.

Dyeing [with sulphide dyestuffs]; Process of ——. H. Toepfer, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 873,636, Dec. 10, 1906.

See Fr. Pat. 367,921 of 1906; this J., 1906, 1218.—T. F. B.

Cotton and wool; Production of effects on mixed goods composed of ——. G. Rudolph, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 873,613, Dec. 10, 1907.

See Fr. Pat. 374,677 of 1907; this J., 1907, 870.—T. F. B.

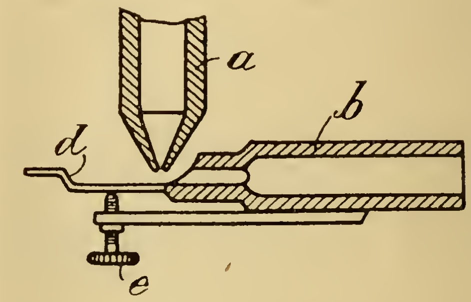
Dyeing of yarns; Arrangement for the —— in cops or cheeses. H. L'Huillier. 3rd Addition, dated June 15, 1907, to Fr. Pat. 350,981, Jan. 24, 1905. (See this J., 1905, 888; 1906, 475; 1907, 92.)

The present addition refers to improvements in the apparatus (and means of manipulating the same) described in the original patent and previous additions thereto. The wooden core upon which the cheeses are wound is displaced by a hollow, perforated metal tube, by placing the latter upon a mandril which is fixed to a lever, and, whilst the cheese is held in position (on a perforated table) by means of a semi-circular holder, forcing the wooden core out, so that the metal tube takes its place. The mandril is then withdrawn, and the cheeses are slipped over perforated spindles which fit into holes in the cover of the closed vessel containing the dye-liquor. Between those cheeses on the same spindle, circular plates are inserted and upon the topmost cheese is placed a plate carrying a hollow cup into which, on pressing the cheeses down, the apex of the spindle fits. By this arrangement, the dye-liquor, forced up through the perforated spindle, is evenly distributed between the cheeses, the pressure which it has to overcome being about equal throughout the mass of yarn, so that even dyeings are obtained. The apparatus described permits of the easy and rapid displacement of the wooden core by the metal tube, and its replacement upon the conclusion of the dyeing operation.—F. M.

Dyeing machine with circulating bath. L. Mascelli. Fr. Pat. 380,671, Aug. 10, 1907.

The machine consists of a dye-vat in which the material to be treated is placed between two horizontal perforated plates. This dye-vat is connected by suitable pipes and valves with a closed heater fitted with a closed steam coil and also with a perforated steam pipe. Both these vessels are connected with a tank for holding the dye-liquor. When in use, the material is placed on the lower perforated plate, and the upper plate screwed down upon it. The dye-liquor, which has been previously heated in the heating vessel, is forced by the pressure of steam from the open steam pipe into the dye-vat and passes through the material. The open steam is then turned off, and the steam remaining in the heater condenses, causing a vacuum, which makes the dye-liquor flow back through the material into the heating tanks. By opening suitable valves the liquor can be forced into the dye reservoir.
—A. B. S.

Colour spraying apparatus. W. E. Evans, London. From The Minimax Consolidated Co., Ltd., Berlin. Eng. Pat. 11,412, May 15, 1907.



Atomisers or sprayers with abutting surfaces, for the disintegration or spraying of dyestuffs, have already been suggested and used, but their main function has been to deflect an already atomised jet from its original direction. In the present invention the dashing plate, *d*, is arranged approximately vertical with respect to the air-current, so as to assist in the production of as fine a mist as possible. The dashing plate is arranged near to the colour- and air-delivery nozzles, *a* and *b*, respectively, so that the mist produced remains under the influence of the air-current after it has passed the plate. The angle at which the air-current strikes the plate may be altered by turning a set-screw, *e*.—F. M.

Silk finish or embossings; Calenders for producing —— on woven fabrics. C. T. Tredup, Barmen, Germany. Eng. Pat. 401, Jan. 7, 1907.

The hard texture of cotton goods treated by the Schreiner or goffering calender, is said to be due to the moisture remaining in the goods after drying, or absorbed between drying and calendering. The breaking machines, through which the fabric passes after calendering, do not always give the desired texture, and the present specification describes an arrangement, consisting of three steam-heated brass tubes over and under which the cloth passes just before being calendered, for the purpose of freeing the fabric more or less completely from the moisture it contains.—F. M.

VII.—ACIDS, ALKALIS, AND SALTS, AND NON-METALLIC ELEMENTS.

Nitrate of soda statistics. Shipments, consumption stocks, and prices, from 1905 *to* 1907. W. Montgomery & Co., Dec. 31, 1907. [T.R.]

					1905.	1906.	1907.
Shipments from South American Ports to all parts for the six months ending 31st December	Tons				934,000	991,000	889,000
Ditto do. for the twelve months ending 31st December	,,				1,623,000	1,700,000	1,628,000
Afloat for Europe on 31st December	,,				491,000	543,000	489,000
Stocks in U.K. Ports :—		1905.	1906.	1907.			
Liverpool	Tons	8,400	7,500	7,200	18,000	17,000	14,000
London	,,	1,400	2,400	1,700			
Out Ports	,,	8,200	7,100	5,100			
Stocks in Continental Ports on 31st December	Tons				165,000	173,000	188,000
Consumption in U.K. for the six months ending 31st December	,,				34,000	37,000	37,000
Do. in Continent do. do.	,,				269,000	283,000	275,000
Do. in U.K. for the twelve months do.	,,				101,000	108,000	112,000
Do. in Continent do. do.	,,				1,089,000	1,135,000	1,145,000
Do. in United States do. do.	,,				308,000	355,000	349,000
Do. in other Countries do. do.	,,				49,000	38,000	56,000
Do. in the World do. do.	,,				1,547,000	1,636,000	1,662,000
Visible supply on 31st December (including the quantity afloat for Europe and Stocks in U.K. and Continent)	,,				674,000	733,000	691,000
Price on 31st December	per Cwt.				10/9	11/1½	11/3

Metallic oxides ; Auto-reduction of —— in the cathode-light vacuum. Volatility of the corresponding sulphides. F. Damm and F. Krafft. Ber., 1907, **40**, 4775—4778.

Various metallic oxides, when heated in the cathode-ray vacuum, dissociate into metal and oxygen. This is the case with cadmium oxide at 1000° C., lead oxide at 758—800°, bismuth oxide at 650°—750°, and antimony oxide at 1050° C. The reaction possibly consists in the formation and decomposition of higher oxides, *e.g.*, $4Sb_4O_6 = 3Sb_4O_8 + 4Sb$. The sulphides are more stable, perhaps because they are more volatile, and escape more easily to cooler regions of the furnace. Different sulphides show great differences in their volatility in the vacuum, and quantitative separations (of arsenic from antimony, antimony from bismuth, mercury from lead sulphide) can be effected by making use of this fact. Similar separations of sulphur, selenium, and tellurium are also practicable. Cupric sulphide at 400° and stannic sulphide at 250° C. are converted respectively into cuprous and stannous sulphides ; and silver sulphide dissociates rapidly at 810° C. into metal and sulphur.—J. T. D.

Sodium monosulphide ; Volumetric determination of ——. E. Podreschetnikoff. Z. Farben-Ind., 1907, **6**, 388.

The volumetric method of determining sodium monosulphide which is based on its decomposition by the action of water into sodium hydrosulphide and sodium hydroxide, has the drawback that commercial sodium monosulphide almost invariably contains free sodium hydroxide. In the author's method this is obviated by first titrating the solution with $N/10$ sulphuric acid, with phenolphthalein as indicator, then adding formaldehyde solution in excess which acts upon the sodium hydrosulphide according to the equation—$NaHS + H.COH + H_2O = H_2COH.HS + NaOH$, and continuing the titration with the standard acid until the liquid again becomes colourless. The first titration gives the amount of free alkali in the salt together with that liberated by the action of the water, whilst the second gives the amount of sodium hydroxide formed by the action of the formaldehyde on the sodium hydrosulphide. Thus one mol. of sodium monosulphide yields two mols. of sodium hydroxide. Results thus obtained are stated to agree closely with those given by the iodine and zinc methods.—C. A. M.

Calcium sulphate ; Solubility of —— in aqueous solutions of sodium chloride. F. K. Cameron and W. C. Taber. J. of Phys. Chem., 1907, **11**, 495—496.

Determinations were made of the solubility of calcium sulphate in solutions of sodium chloride of different concentrations at 80° C. The maximum solubility occurred with a solution containing about 7·3 grms. of calcium sulphate and 155 grms. of sodium chloride per litre. None of the solutions was alkaline or acid. In solutions containing more than 290 grms. of sodium chloride per litre, the solid phase consisted exclusively of calcium sulphate. Thus, no appreciable hydrolysis of calcium sulphate takes place, and the latter forms no double salts in solutions of sodium chloride between 25° and 80° C. The results obtained in the determinations of calcium were usually too high, as the calcium oxalate precipitate carried down some sodium chloride with it ; for accurate results, it is necessary to dissolve the calcium oxalate and re-precipitate. The solubility of calcium oxalate in the mother-liquor is so small as to be negligible ; on the other hand, the solubility of barium sulphate in sodium chloride solutions is considerable. (See also this J., 1902, 257 ; 1906, 1043.)—A. S.

Hydrated salts ; Application of vacuum to drying ——. F. Krafft. Ber., 1907, **40**, 4770—4774.

Hydrated salts give off their water with great rapidity in a high vacuum (one in which cathodic discharge can take place). As absorbent of the water given off, barium oxide should be used ; sulphuric acid is useless, on account of its vapour pressure. The sulphates of magnesium, zinc, iron and copper give off their "crystallisation water" after a few hours at the ordinary temperature ; after longer exposure the "constitutional water" is also partly expelled, but complete dehydration is only secured by heating in the vacuum to practically the same temperature at which it would occur under ordinary pressures. Many organic salts can thus be deprived of their associated water at the ordinary temperature, without fear of decomposition such as might occur at 100° C.—J. T. D.

Phosphorus ; Effect of heating yellow —— in ammonia gas. W. G. Llewellyn. Chem. News, 1907, **96**, 296—297.

Dry ammonia gas passed through a flask containing yellow phosphorus had no action upon the latter between 10° C. and 290° C. (the boiling point of phosphorus). Above that temperature, however, the phosphorus distilled in the form of the white modification, having the same melting point as ordinary yellow phosphorus. When exposed to the air, its surface became yellow, and it was slowly transformed into the ordinary modification when warmed with water. It was soluble in carbon bisulphide. Ammonia gas had apparently no action upon red phosphorus between 10° and 100° C.—C. A. M.

Red and white phosphorus ; Non-existence of a common solvent for ——. A. Colson. Compt. rend., 1907, **145**, 1167—1168.

Contrary to the statements of former observers, neither oil of turpentine nor its polymers dissolve red phosphorus, even when heated with it under pressure. A saturated

solution of white phosphorus in oil of turpentine, heated with red phosphorus, dissolves none, but deposits white phosphorus on cooling. No common solvent can exist, for if it did, the solution would be identical, no matter which variety had been dissolved—one or other variety would undergo allotropic modification on solution.
—J. T. D.

Nitric oxide formation in high-tension arcs. F. Haber and A. Koenig. *See* XIA.

Patents.

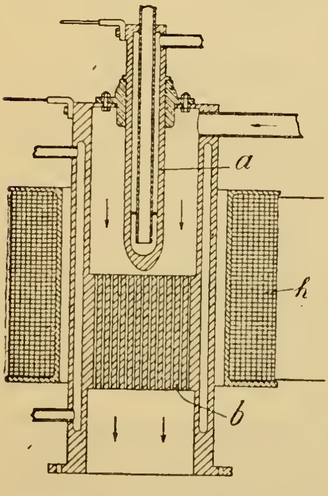
Oxides of nitrogen; Apparatus for producing —— by electric process. I. Moscicki, Fribourg, Switzerland. Eng. Pat. 27,006, Nov. 28, 1906. Under Int. Conv., Aug. 8, 1906.

See Fr. Pat. 380,614 of 1907, following —T. F. B.

Nitric acid and nitrates; Manufacture of —— from atmospheric nitrogen. O. H. U. Brünler and G. H. Kettler. Fr. Pat. 380,467, Aug. 2, 1907.

A mixture of combustible gas and air or oxygen is burnt under water (or alkali solution) in such a manner that the flame issues into the liquid. The quantity of nitrogen is so regulated that the temperature of the flame lies, in its interior, within the limits of stability of nitric oxide, and, in its exterior portion, within the limits of stability of nitrogen peroxide. Under these conditions, nitric oxide is formed in the hot interior of the flame and in the cooler mantle combines with oxygen to give nitrogen peroxide, which in the presence of water and oxygen is converted into nitric acid (or alkali nitrate). Burning the mixture under increased pressure is found to improve the yield.
—F. Sodn.

Nitrogen oxides; Apparatus for the production of ——, by electric means. I. Moscicki. Fr. Pat. 380,614, Aug. 7, 1907. Under Int. Conv., Aug. 8, 1906.



The electrodes, *a* and *b*, are cooled by a refrigerating liquid, and *b* is provided with a number of channels for the passage of the gas, so that the latter after treatment is rapidly cooled by contact with the metal. The electrode, *b*, is placed in a magnetic field produced by the coil, *h*, the lines of force cutting the upper surface of the electrode at right angles, and the arc is thus spread out over the surface of the electrode.—B. N.

Platinum contact substances; Manner of producing —— and application to the production of nitric acid from ammonia and air. Chem. Fabrik Griesheim-Elektron. Fr. Pat. 380,884, Aug. 17, 1907.

Objections to the use of platinum sponge, or of platinised platinum, as contact substances for the purpose described in the title, are stated, and it is directed that a very thin layer of platinum should be deposited on such surfaces as those of quartz, porcelain, or the like, the bodies so treated being then subjected to a temperature at which the platinum will soften. The platinum then takes the form of brilliant microscopic drops, which are stated to be very effective for the described application. It is preferred to coat the surfaces to be so platinised with a varnish, such as a mixture of felspar with potassium hydroxide, the subsequent treatment being conducted as above.—E. S.

Sodium carbonate; Manufacture of partially hydrated ——. A. Vergé. Fr. Pat. 380,562, Oct. 10, 1906.

The troublesome process of recovering anhydrous sodium carbonate from solution (as in the preparation of alumina from bauxite) may be replaced, as a rule, by one yielding sodium carbonate containing about 3 molecules of water. This salt does not undergo aqueous fusion before melting, but merely softens. The crystals also are readily separated from the mother liquor and dried, yielding a friable mass. It is found, therefore, to be a successful substitute for the anhydrous substance for all industrial purposes. The concentration is carried out by Kestner's method (this J., 1903, 788), at 60°—65° C. *in vacuo*, until the specific gravity of the solution reaches 1·26, and is then completed at 100° C. at ordinary pressure, when the crystals separate.—F. Sodn.

Caustic soda; Reaction vat for the manufacture of ——. L. Devaucelle. Fr. Pat. 380,272, July 26, 1907.

In order to bring about more perfect and speedy reaction between a liquid and solid (as in the manufacture of caustic soda), the reaction vessel is made as an inverted cone with steeply sloping sides. Steam is blown in at the apex of the cone, and keeps the solid continually agitated, at the same time serving to heat the liquid. The reaction is thus facilitated and the yield increased. A pressure of 2 atmospheres suffices.—F. Sodn.

Metallic silicides; Process for the production of ——. L. E. Muller and L. Baraduc, Paris. Eng. Pat. 27,209, Nov. 29, 1906. Under Int. Conv., Nov. 29, 1905.

See Fr. Pat. 361,950 of 1905; this J., 1907, 207.—T. F. B.

Oxide fumes from ores and furnace products; Method of obtaining ——. B. Oettinger, Berlin. Eng. Pat. 29,156, Dec. 21, 1906. Under Int. Conv., Jan. 3, 1906.

See Fr. Pat. 372,567 of 1906; this J., 1907, 533.—T. F. B.

Tungsten dioxide; Production of ——. The Westinghouse Metal Filament Lamp Co., Ltd., London. Eng. Pat. 18,922, Aug. 22, 1907. Under Int. Conv., Nov. 23, 1906.

Tungsten trioxide (tungstic acid) or other high oxide of tungsten, is intimately mixed with from one-tenth to one-fifth of its weight of glycerol, ethylene-glycol, or other equivalent organic hydroxyl compound. Water, or other easily vaporisable solvent fluid, may be added, to facilitate the mixture of the glycerol with the trioxide, the water or other solvent being subsequently removed by careful heating, without loss of the glycerol. The dried mixture is then heated in an air-tight closed vessel to a "bright red heat" for some hours. On cooling, brown tungsten dioxide remains.—E. S.

Silicates of magnesia; Manufacture of ——. H. Herrenschmidt, Paris. Eng. Pat. 20,378, Sept. 12, 1907. Under Int. Conv., Sept. 24, 1906.

See Fr. Pat. 369,987 of 1906; his J., 1907, 203.—T. F. B.

Evaporating apparatus [for brine]. A. H. McDonald, Wyandotte, Mich. U.S. Pat. 872,533, Dec. 3, 1907.

The apparatus consists of upper and lower brine chambers connected by evaporator pipes as in an ordinary vertical evaporator, but the pipes are water-jacketed, the water jackets forming a steam-generating and water-circulating system or space entirely separated from the brine spaces. The water pipes and consequently the evaporator pipes, which pass centrally through them, are heated by the combustion gases from an external furnace, these gases passing around the pipes through the chamber enclosing them, which is covered with non-conducting composition to prevent loss of heat.—W. H. C.

Carbon dioxide; Apparatus for the manufacture of ——. J. C. Stead, London. U.S. Pat. 872,588, Dec. 3, 1907.

See Eng. Pat. 26,659 of 1904; this J., 1905, 1171.—T.F.B.

Carbonic acid gas; Manufacture of ——. A. E. Knowles. Fr. Pat. 380,631, Aug. 8, 1907. Under Int. Conv., Jan. 23, 1907.

In the manufacture of carbon dioxide by the ordinary combustion process, in which the alternate formation and decomposition of alkali bicarbonate is utilised, it is found that a great economy of heat is effected, and loss of carbon dioxide by non-absorption is much reduced, by using a more dilute solution in the decomposing apparatus and working this under reduced pressure (the liquid being sucked into the heater, instead of being pumped in, and the gases being drawn away by the compressor, instead of passing to a gasometer), but using a more concentrated solution in the absorption apparatus. During decomposition, the bicarbonate solution is retained with advantage for a longer period in the apparatus, and this is conveniently arranged by causing the liquid to pass over a series of superposed shallow trays, heated directly or by a steam coil.—F. Sodn.

Sulphur dioxide; Process of making ——. J. G. Jones, Carthage, N.Y. U.S. Pat. 872,822, Dec. 3, 1907.

Sulphur dioxide, obtained by burning commercial sulphur, is introduced, together with a regulated quantity of air, into a kiln, in which sulphide ore is being roasted, thereby enriching the gas obtained from the ore, besides heating the latter as it is fed into the kiln.—F. Sodn.

Sodium sulphate and sulphuric acid; Recovering ——. A. W. Nibelius, Hackettstown, N.J. U.S. Pat. 873,070, Dec. 10, 1907.

A solution of nitre cake (sodium bisulphate) is treated with a volatile solvent or a mixture of such solvents, "capable of dissolving the acid but in which the sodium sulphate is insoluble," and the solution is removed from the separated sodium sulphate, and is distilled under diminished pressure to recover the volatile solvent or solvents, sulphuric acid remaining behind.—E. S.

Carbon, amorphous; Process and apparatus for producing ——. J. Machtolf, Böblingen, Germany. U.S. Pats. 872,949 and 872,950, Dec. 3, 1907.

See Fr. Pat. 364,034 of 1906; this J., 1906, 894.—T. F. B.

Nitrogen oxides, etc. Eng. Pat. 22,201. *See* XIA.

Rotary kilns, etc. Eng. Pat. 26,150. *See* IX.

Sewage and ammoniacal liquids, etc. Fr. Pat. 380,489. *See* XVIII*B*.

VIII.—GLASS, POTTERY, AND ENAMELS.

Patent.

Glass-melting; Process and apparatus for ——. A. Peters and Soc. Naamlooze Vennootschap Glasfabrik voorheen Jeekel Nijnssen and Co. Fr. Pat. 380,733, Aug. 9, 1907.

Both the preliminary and the final fusions of the glass are carried out in pots provided with double walls, between which air circulates in order to keep the walls cold and so to prevent their breaking. The first fusion takes place in an upper crucible separated by a slab of refractory material from a second larger crucible placed below the first. Both crucibles are directly heated by the furnace gases, and are open. The molten glass runs from the upper crucible into one compartment of the lower one, which is separated by an inner partition into the two usual compartments for melting and working. The melting compartment is further strengthened by another internal partition at right angles to the first.—A. G. L.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Patents.

Timber; Method for preparing or treating —— *for joinery and kindred trades.* K. K. Schmidt, Dresden, Saxony. Eng. Pat. 18,558, Aug. 16, 1907.

Raw timber is buried in earth to which an alkaline lye has been added, and is exposed to the action of "ground gases" for from one to three months, to improve its colour and to render it more resistant to external influences. The colour obtained varies with different woods, and may be modified by the addition to the earth of metallic salts, more particularly those of iron.—A. T. L.

Wood; Impregnating —— *with insoluble materials.* Soc. Anon. des Etablissements Carel ainé, Fouché et Cie. Fr. Pat. 380,533, Aug. 3, 1907.

The wood is impregnated first with a solution of one substance (copper sulphate, barium chloride) and then with a solution of another substance (soap, sulphuric acid) which will give an insoluble precipitate with the first. The second solution may be replaced by a gas having a similar action.—A. G. L.

Marble; Making artificial ——. E. E. Hippe, Copenhagen. U.S. Pat. 873,371, Dec. 10, 1907.

See Fr. Pat. 370,105 of 1906; this J., 1907, 204.—T. F. B.

Brick; Method of treating ——. A. Magoon, Logan, Ohio. Assignor to J. W. Jones, Haydenville, Ohio. U.S. Pat. 873,568, Dec. 10, 1907.

Coloured bricks are treated whilst in the kiln by introducing large volumes of air under pressure into the latter, when it is at its maximum temperature, in order to oxidise the colouring matter.—A. G. L.

Stone and marble; Manufacture of artificial ——. The Lithographic Stone and Marble Co. Fr. Pat. 380,438, Aug. 1, 1907. Under Int. Conv., April 25 1907.

See Eng. Pat. 9633 of 1907; this J., 1907, 1281.—T. F. B.

Rotary kilns for burning and calcining lime, cement, chemicals and the like. C. von Radlowski, Gut Ray Kowce, Russia. Eng. Pat. 26,150, Nov. 19, 1906.

The kiln comprises a preliminary heating cylinder, a calcining cylinder, and a cooling cylinder, each of which is constructed so as to bring the material into intimate contact with the gases passing through the kiln. The calcining cylinder is in two sections which rotate in opposite directions. Each section is provided with an inner perforated cylinder supported by distance pieces forming longitudinal partitions in the annular space between the inner and outer cylinders. The material in the annular space is continuously raised as the cylinder rotates, until it falls through the perforations and through the current of hot gases. The heating and cooling cylinders are formed in a number of sections, successive sections rotating in opposite directions. Each section carries internal projections forming scoops which raise the material and allow it to fall through the current of air or gases.—A. T. L.

Cement kilns; Rotary ——. T. M. Morgan, Longue Pointe, Quebec. Eng. Pat. 8760, April 15, 1907.

The rear or feed end of a rotary cement kiln is provided with an end wall having oblique openings at its circumference for the discharge of the hot gases and the introduction of the cement material. The kiln is of gradually increasing diameter towards the rear end and is supported with its lower surface horizontal and its axis inclined. To prevent a too rapid passage of the material through the large part of the kiln, the thickness of the lining is increased at intervals in order to reduce the diameter of the kiln. The heat of the gases is more fully utilised owing to their retardation and their passage through the openings in the end wall. The end wall may be built into ordinary cylindrical kilns.—A. T. L.

Magnesium cement and process of making the same. E. Rueff, New York. U.S. Pat. 872,375, Dec. 3, 1907.

Crystallised magnesium sulphate is slowly heated until dehydrated, when it is mixed with magnesia; water and filling material are then added.—A. G. L.

X.—METALLURGY.

Graphite and "temper carbon"; Identity of ——. G. Charpy. Compt. rend., 1907, **145**, 1173—1174.

Graphite and temper carbon, separated from two portions of the same melted pig, by slow cooling, and by rapid cooling and reheating respectively, behaved in exactly the same manner when oxidised with nitric acid and potassium chlorate; and when the metals containing them were heated at 1000° C. in a stream of carefully purified hydrogen, the carbon gradually disappeared at the same rate from both, no free carbon being left in either after 14 hours. Contrary to former statements, then, both graphite and temper carbon are completely gasified under these circumstances, and the two are identical, and are rightly regarded as one phase in Roozeboom's diagram of iron-carbon systems.—J. T. D.

Eutectic mixtures; Change of the melting point of ——. C. Benedicks and R. Apri. Die Metallurgie, 1907, **4**, 416—419.

"COMMERCIALLY pure" tin and lead, in a comminuted form, were sifted, and a series of powders obtained, from which eutectic mixtures (70 per cent. of tin and 30 per cent. of lead) composed of different sized particles were prepared. These were heated very slowly in a crucible, and, by means of a Le Chatelier pyrometer and a chronograph, the time required for the galvanometer to indicate a given interval of temperature was recorded. Generally it was found that the longest period of time for the galvanometer to pass a given scale-interval was required at the highest temperature in the case of the mixture composed of the largest particles. With particles of less than 0·15 mm. diam., the maximum time interval occurred at 180° C., whilst with particles of 0·15—0·52 mm. diam., it was 183° C. When particles of tin of 2—4 mm. diam. were mixed with particles of lead of 0·15—0·52 mm. diam., the corresponding point was 183° C., whilst with particles of lead of 2—4 mm. mixed with particles of tin of 0·15—0·52 mm. diam., it was 191° C. From the results of these experiments, the authors infer that the discrepancy between the melting point (1200° C.) and setting point (1130° C.) of slowly-cooled cast iron, is due to retardation of melting caused by the presence of large plates of graphite in the slowly-cooled solid iron.—A. S.

Telluride ores; Assay of ——. G. T. Holloway and L. E. B. Pearse. Inst. of Min. and Met., Dec. 19, 1907. [Advance proof.]

WHEN telluride ores are roasted under proper conditions, the loss of gold by volatilisation is very slight, even when mercury is present. In cupelling lead rich in gold and tellurium, it was found that the losses of gold in the cupel and by volatilisation were large, but when the proportion of tellurium to gold is small in comparison with the lead in the alloy, the cupellation losses are not great. Cupellation after a moderate amount of scorification gives a better result than the direct cupellation of the lead button, although if scorification be carried too far, or if the lead be allowed to remain long in contact with the slag, the subsequent loss on cupellation is increased. The cupellation losses are very large after excessive scorification, and are probably caused by a re-absorption of tellurium which is reduced by the lead from the litharge in the scorifier. In the pot assay there is more loss of gold with an acid than with a basic slag, and it is important that the temperature be kept as low as possible, the addition of fluorspar being for this reason recommended. The method of assay which is considered by the authors to give the best and most uniform results is a pot assay employing a charge containing excess of sodium carbonate, which yields a basic slag fusible at a low red heat, and sufficient red lead or litharge and reducing agent to yield a large lead button (not less than 50 grms.). In the case of very basic ores, borax is preferable to silica as a flux, but otherwise the amount of borax should not be excessive. The lead button from the pot assay should be scorified to reduce its weight by one-third, but not more than one-half, and then cupelled, using a somewhat high temperature for the commencement of both cupellation and scorification. The authors also find that combined wet and dry methods except in certain cases, such as with highly cupriferous ores, give results inferior to those of the ordinary pot assay.—O. F. H.

Copper; Annealing of ——*: with special reference to dilatation.* T. Turner and D. M. Levy. Proc. Roy. Soc., 1907, A **80**, 1—12.

THE authors show that the change of the ordinary hard copper (tensile strength, 20—28 tons) into soft annealed copper (tensile strength, 10—14 tons), which takes place by simply heating the hard copper to a temperature of about 580° C., is not accompanied by any change in volume such as is observed when one form of an element changes into an allotropic modification. Similar results were obtained with brass (copper, 70 or 66 per cent.), gun-metal and phosphor-bronze. For their experiments the authors measured the extension obtained by the uniform heating of rods 35 in. long and ¼ in. in cross-section. The extensometer used was tested by means of steel and wrought-iron rods, with which normal results were obtained. Bars of brass with 60 per cent. of copper twisted so much on heating as to render the results useless. The authors conclude that mechanical working produces changes of a different order from those due to allotropic or dimorphic transformations, the changes probably consisting only in a rearrangement of the metallic grains or molecules.—A. G. L.

Oxides of lead, cadmium, and bismuth; Velocity of reduction of the —— *by carbon monoxide, and the existence of the suboxides of these metals.* F. J. Brislee. Chem. Soc. Proc., 1907, **23**, 286—287.

THE production of lead, cadmium, and bismuth suboxides by the reduction of the higher oxides with carbon monoxide has been investigated. The velocity of reduction of the oxides was determined by heating the latter, contained in a porcelain boat, to 300° in an apparatus in which carbon monoxide was circulated. The boat was withdrawn from time to time and the loss in weight observed. The time interval varied from one and a half to six hours. The results were then plotted as time-reduction curves, and these showed a distinct break at the point at which the analytical composition of the product was near that required for the suboxide. The position of the break was not always at the suboxide point, the position depending on the relative velocities of the two reductions, namely:

(1) Oxide → suboxide.
(2) Suboxide → metal.

When the velocity of (1) is very different from (2), then the break will occur at the point when the oxide is entirely reduced to suboxide. When these two velocities are not very different, the first stage of the reduction is (1*a*) Oxide → suboxide → metal, and the second is: (2*a*) Suboxide → metal, and then the break will occur below the point corresponding to complete reduction of the oxide to suboxide. The experiments made on the velocity of reduction of the oxides of lead, cadmium, and bismuth confirm Tanatar's results (Z. anorg. Chem., 1901, **27**, 304) that the suboxides of these metals are definite chemical compounds, but do not prove the stability of these compounds. The suboxides of lead, cadmium, and bismuth are formed as intermediate phases in the reduction of the oxide to metal by carbon monoxide.

Aluminium titanide. W. Manchot and P. Richter. Annalen, 1907, **357**, 140—144.

ALUMINIUM titanide, Al_3Ti, was prepared by fusing a mixture of potassium titanofluoride (24 grms.) and aluminium (45·5 grms.) for about ¾ of an hour. On gently heating the regulus with $N/1$ sodium hydroxide solution (care being taken to prevent access of air), the excess of aluminium was gradually dissolved, leaving the titanide in the form of silvery, glistening quadratic laminæ of sp. gr. 5·5. The titanide is very brittle. It readily dissolves in strong alkalis and acids with evolution of hydrogen; on solution in hot, dilute sulphuric acid (air being excluded), the sulphate corresponding to the oxide, Ti_2O_3, is formed, indicating that the titanium is present in the compound in the tervalent state.—L. E.

Minerals in Western Australia. Board of Trade J., Dec. 19, 1907. [T.R.]

Antimony.—Workable lodes occur at Mosquito Creek, Mallina Peewah, and Sherlock Crossing, in the North-West. The latter are now being opened up. The others are not being worked on account of distance from port and market, and irregular prices of the metal. Most of these ores are more or less gold bearing.

Bismuth occurs at Yalgoo, but has never been worked for similar reasons to those above.

Zinc is now being raised for export at Mundijong. It is known to occur also in important quantities at West Kimberley, Roebourne, Croydon, Northampton, Murrin, &c. Neglected at present owing to cost of placing on European markets.

Manganese.—Very pure manganese ores occur on the Upper Ashburton, at Pinyalling (Yalgoo), at Ravensthorpe, and elsewhere on the south coast. These are well suited for use as a flux at general smelting works or for the preparation of high quality iron and steel from iron ores, Nothing is being done with any of them at present so far as is known.

Tungsten ores which should pay to work at present rates occur at Mosquito, Wodgina, Northampton, Coolgardie, Higginsville, Southern Cross, Brookton, and Ravensthorpe. A small quantity of ore has recently been exported from the last-named place, but elsewhere it has been neglected, largely owing to a lack of knowledge of its value.

Aluminium.—Large deposits of bauxite occur amongst the so-called ironstone gravels of the Darling Ranges, from Wongan Hills on the north to Bridgetown on the south. These will no doubt be utilised at no very distant date.

Tantalum ores are probably more abundant in Western Australia than anywhere else in the world. As the use of this metal is in the experimental stages, the demand is very irregular as yet.

Molybdenum occurs at several localities, *e.g.*, Toodyay and Wagin.

Asbestos.—Chrysotile asbestos of the highest quality, worth up to 60*l.* a ton, occurs in quantities near Tambourah, and is now about to be exploited. Lower grades are abundant in very many parts of the State, and though in the past valueless, will shortly be of much value for paper making, the demand for this purpose increasing daily.

Mica deposits of excellent quality occur on the Gascoyne, and will be opened up when transport is not so difficult as at present. Mica has also been raised for export at Bindoon, Mullalyup, and Londonderry.

Infusorial earth is very abundant in the Swan district, in the valley of the Irwin River, and on the south coast.

Monazite occurs at Moolyella with the tin ore. It is there of exceptionally high grade of a present value of 120*l.* per ton.

Copper is very widely distributed throughout the State.

Iron ore.—The Yampi Sound iron ore is extremely pure, and similar to that at the Weld Ranges. It should be possible to export ore from Yampi at a profit, as the deposit is near the coast.

Lead is abundant in the North-West and Northampton districts.

Manganese production of the United States. Board of Trade J., Dec. 19, 1907. [T.R.]

According to a report by the United States Geological Survey the year 1906 witnessed a marked revival of the American manganese industry, the output exceeding that of 1905, 1904 and 1903, and closely approaching the production of 1902. In 1906 the production of manganese ores amounted to 6,921 tons (of 2,240 lb.), valued at 88,132 dols., as compared with 4,118 tons, valued at 36,214 dols., in 1905. All of this increase came from Virginia and Utah, for no other States produced any notable quantity of manganese in 1906. In addition to the output of relatively high grade manganese ores, there is in Arkansas and Colorado a very important production of iron ores carrying 20 to 40 per cent. of manganese, amounting to 41,300 tons, valued at 122,400 dols., in 1906.

Besides the manganese ores and manganiferous iron ores, an important source of manganese in recent years has been the residual product from certain zinc oxide works using New Jersey ores. The crude ore as shipped to the zinc oxide plant consists of a mixture of franklinite and willemite, the former being predominant. After roasting off the bulk of the zinc, the residue is a mass of manganese and iron oxides. The production of this manganiferous residuum in 1906 was 93,461 tons, as compared with 90,289 tons in 1905. The production of ferromanganese and spiegeleisen in the United States in 1906 amounted to 300,500 tons, as compared with 289,983 tons in 1905.

Tungsten and vanadium production of the United States. Board of Trade J., Dec. 19, 1907. [T.R.]

The United States Geological Survey report the production in the United States in 1906 of 928 short tons of tungsten ores, estimated at 348,867 dols. in value. The output for the year is a gain of 125 tons over the known production of 1905. Boulder County, Colorado, produced 565 tons, valued at 221,627 dols. During 1906 the production of vanadium from its ores was begun in Colorado, and a small output was made. A reduction plant was established at Newmire, and another plant, at which some vanadium concentrates were made, was put up on Dolores River. A company has built a plant at Pittsburg for the manufacture of ferro-vanadium from ores imported from near Cerro de Pasco, Peru. The ore is a remarkable vanadium sulphide called patronite, containing about 15 per cent. of vanadium. The deposits are said to be large.

Monazite mine in Carolina ; New ——. Mining World, Dec. 7, 1907. [T.R.]

The British Monazite Co., representing the South Metropolitan Gas Light Co. of London, has reopened a monazite mine about three miles north-east of Shelby, N.C., with improved machinery and methods.

The proposition at this mine is different from that of any other mine being operated in the region, and consists in crushing a monazite-bearing rock and separating out the monazite with concentrating tables. The product of the mill contains from 90 to 95 per cent. of monazite.

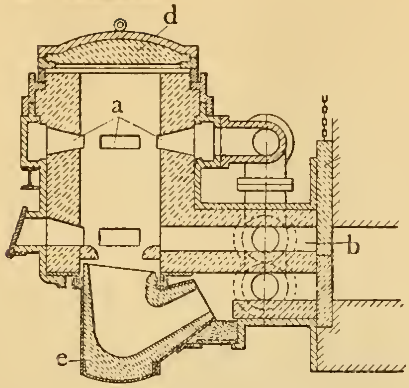
Patents.

Rotary furnace for use in roasting ores and the like. W. Hommel, Lee, Kent. Eng. Pat. 27,639, Dec. 4, 1906.

The furnace comprises an ore-chamber, the hearth of which consists of a rotating central part, and of an outer stationary part ; a series of scrapers set obliquely, arranged above the central portion of the hearth and adapted to work gradually towards the circumference of the latter ; and one or more scrapers, arranged above the annular portion of the hearth, which are attached to the central rotating portion and which sweep the ore in a circumferential direction towards the discharge orifice in the floor of the stationary portion. Flues are so arranged that the heating gases circulate below and above the stationary part of the hearth, on which part the roasting of the ore is effected. The central part is not heated by flues, and receives only heat evolved by the roasting of the ore itself. With ores poor in sulphur, however, the central part also may be heated by furnace gases.—A. G. L.

Furnaces ; Metallurgical ——. J. A. Fletcher, Ashton-under-Lyne, Lancs. Eng. Pat. 604, Jan. 9, 1907.

The patent relates to furnaces of the cupola type, so arranged as to give a downward instead of an upward flow of the blast and hot gases. Beneath the lower end, the receiver for molten metal is fixed so that it can easily be detached. To heat up the furnace, the cover, *d*, is removed and a suitable quantity of coke placed on the grate above the receiver, *e* ; on top of this is placed the metal to be melted. Air is passed in through an aperture, *b*, just above the grate. As soon as the material is uniformly heated, the cover is replaced and the direction of the blast altered so that the gases now pass away through *b*, being admitted through apertures at *a* at the top of the furnace. As the molten metal falls into the receiver,



the aperture at *b* is closed, and the gases are allowed to escape through the receiver over the surface of the metal. If necessary, hot air, steam, or any other gas can now be blown through the molten metal.—C. A. W.

Furnace for malleable cast-iron or for cementation. Soc. des Aciéries de Paris et D'Outreau. Fr. Pat. 380,609, Aug 7, 1907.

The furnace is characterised by having a movable hearth of masonry carried on wheels or rollers moving on rails. A number of furnaces are grouped together, and any hearth can be introduced into any furnace. The hearth is removed from the furnace for charging and discharging, and to promote rapid cooling.—A. G. L.

Steel ; Manufacture of ——. A. Reynolds, London. Eng. Pat. 28,030, Dec. 8, 1906.

Molten over-oxidised iron is poured into a ladle from which the slag is decanted. For this purpose, the ladle is given a spout, and the upper part of the ladle is lined with magnesite, chromite, or with water-cooled steel. The molten iron is then run into an electrically heated "dead-melting" furnace, in which it is treated with carbon, or with previously melted highly carbonaceous pig-iron, in very small excess. The reduced iron is then run into a ladle, into which are also run known amounts of molten ferro-silicon, ferromanganese, and slag.—A. G. L.

Cementation process. M. Ruthenburg, Lockport, N.Y. U.S. Pat. 872,755, Dec. 3, 1907.

See Eng. Pat. 19,547 of 1907; this J., 1907, 1286.—T. F. B.

Manganese steel ; Manufacture of high per cent. ——. C. H. Kelsall, Horwich. U.S. Pat. 873,556, Dec. 10, 1907.

See Fr. Pat. 375,148 of 1907 ; this J., 1907, 874.—T. F. B.

Copper from copper residues ; Process for extracting ——. D. Crispo, Antwerp. Eng. Pat. 6730, March 20, 1907.

See Fr. Pat. 375,899 of 1907 ; this J., 1907, 929.—T. F. B.

Copper ; Process for separating —— from acid or neutral solutions. A. J. Boult, London. From J. B. du Faur, Mount Morgan, Australia. Eng. Pat. 7698, April 2, 1907.

The liquid, which may contain the metal as sulphate, chloride, or both, must contain at least 5 grains of ferric sulphate or chloride per gallon. The metal is precipitated on to thin sheets of copper, graphite or carbon by suspending these in the solution in metallic contact with intermediate masses of scrap iron. If gold or silver should be present, they will be precipitated during the process.—C. A. W.

Cleaning metal [silver] Method of ——. J. Hawthorne, New York. U.S. Pat. 871,994, Nov. 26, 1907.

Tarnished silver articles are immersed in a solution of sodium carbonate contained in a tin vessel, to which vessel the silver articles are also connected electrically. The cleaning is effected by the electric current set up between the silver (cathode) and tin (anode), no outside source of energy being employed.—A. G. L.

Silver-plating ; Process of ——. D. Rouilly. Fr. Pat. 380,886, Oct. 22, 1906.

The process consists in reducing silver from silver resinate, either by the action of light, or by means of reducing agents. Silver resinate may be obtained by double decomposition of an alkali resinate and a silver salt in aqueous solution ; or by heating resin with an easily decomposable silver salt, or with silver oxide. Silver resinate is soluble in cold benzene, oil of turpentine, ether, chloroform, etc., and on heating, in different oils. The process of plating may be carried out by applying a solution of silver resinate in benzene to the surface to be coated, allowing the benzene to evaporate (in the dark), and then either exposing the article to the light for some time, or else treating it with a solution of quinol (hydroquinone) or pyrogallol in ethyl or methyl alcohol (in which silver resinate is insoluble, but resin itself is soluble). The resin is finally washed away from the reduced silver by means of a solvent. Interior surfaces may be silver-plated by filling the article with the benzene solution of silver resinate, and exposing to light, if the article is transparent, or else treating with a reducing agent as above.—A. G. L.

Detinning and recovering merchantable iron from tin-plate scrap ; Process for ——. E. A. Sperry, Brooklyn, N.Y. U.S. Pat. 872,092, Nov. 26, 1907.

The reagent employed, is first dried by refrigerating it, and is then heated and allowed to act on the scrap. The black scrap resulting is washed with a previously dried hot gas and then with a liquid. (See U.S. Pat. 872,205 of 1907 ; this J., 1907, 1279.)—A. G. L.

Detinning ; Process of ——. E. A. Sperry, Brooklyn, N.Y. U.S. Pat. 873,699, Dec. 10, 1907.

The dry material to be detinned is subjected to the prolonged action of a mixture of gaseous stannic chloride, hydrated and anhydrous, and chlorine, at a temperature "above the solidifying point of hydrated stannic chloride." —A. G. L.

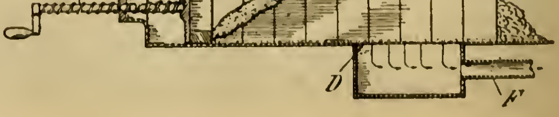
Ores ; Apparatus for separating the metallic particles of —— from the rocky constituents thereof. D. H. Norris, New York. U.S. Pat. 873,586, Dec. 10, 1907.

The apparatus consists of a tank having contracted ends, the upper end being open, whilst the lower end is provided with a discharge pipe for the gangue and water. A pipe discharges a mixture of powdered ore and water into the upper part of the tank. Another pipe introduces water, previously saturated with air in another vessel, into the lower part of the tank. The nascent air-bubbles formed in the tank adhere to the metallic particles, which rise to the surface and overflow into a cup arranged at the upper end of the tank.—A. G. L.

Minerals [finely-divided] ; Process of roasting and concentrating ——. F. Bennitt. Fr Pat 380,343, July 29, 1907.

The finely-divided minerals (galena, pyrites, etc.) are agglomerated into lumps by heating them in a current of air or other gas capable of supporting combustion. During the roasting, the mineral is prevented from moving by means of partitions, which may be perforated, and between which it is packed. The current of air may be passed through the mineral in various directions, according to the type of roasting furnace used.—A. G. L.

Minerals [finely-divided] ; Process of roasting and concentrating ——. F. Bennitt. Fr. Pat. 380,344, July 29, 1907. Under Int. Conv., July 30, 1906.



The finely-divided sulphide mineral is charged into the receptacles, *g*, separated from each other by perforated partitions. The receptacles are given a to-and-fro motion by means of a screw, C, and pass over a grill, D. Whilst in this position, a flame produced by burning oil or gas, and containing excess of oxygen, is drawn through the mineral by means of a fan at the end of the pipe, F, the flame entering through the aperture, J. The mineral is charged into the receptacles at a^1 and discharged at *a*. The partial combustion whilst in a fixed position is designed to agglomerate the mineral into lumps.—A. G. L.

Metals ; Manufacture of certain molten ——, and the materials employed therein. B. H. Thwaite and W. Defries. Fr. Pat. 380,552, Aug. 3, 1907. Under Int. Conv., Dec. 14, 1906.

See Eng. Pat. 28,573 of 1906; this J., 1907, 1282.—T. F. B.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(*A.*)—ELECTRO-CHEMISTRY.

Nitric oxide formation in high-tension arcs. F. Haber and A. Koenig. Z. Elektrochem., 1907, **13**, 725—743.

An alternating current arc flame was maintained in water-cooled glass or quartz tubes through which the air or other mixtures of oxygen and nitrogen were slowly passed. The glass or quartz tubes were constricted for the greater part of their length so as to maintain a uniform column of flame. The analysis of the gases was effected by dissolving the nitric oxide in water containing hydrogen peroxide and then titrating with baryta; whilst as a check, the nitrate thus produced was reduced to ammonia, which was distilled off and estimated in the usual manner. All the experiments were carried out under diminished pressure, which varied in the individual cases from 25 to 140 mm. of mercury. Under identical pressures, within these limits, the concentration increases with the current in the arc; whilst if the current is kept constant, the concentration is found to increase with the pressure. The most favourable results were obtained with oxide electrodes, such as Nernst filaments, and in general, it was found that the hotter the electrodes, the more readily could a high percentage of nitric oxide be obtained. With a pressure of 100 mm., the highest concentrations of nitric oxide were reached, and the results quoted below were obtained at this pressure with the different gas mixtures indicated. The same table gives the temperatures of the arc flame calculated according to the thermodynamical considerations of Nernst. The authors consider that in their apparatus a mean temperature not exceeding 3000° C. was attained, and they are thus led to conclude that the high concentrations noted could not have been the result of purely thermal reaction, but must be ascribed, as suggested by Warburg and Leithauser, to electronic collisions.

Gas mixture.		Content of NO in vols. per cent.	Thermo-dynamically calculated abs. temp.	
Oxygen.	Nitrogen.		Haber.	Nernst.
20·9	79·1	9·8	4365	4334
48·9	51·1	14·4	4686	4650
44·4	55·6	14·3	4686	4650
75·0	25·0	12·77	4805	4767
81·7	18·3	12·1	5042	5000

—R. S. H.

Zinc ; Detection of small quantities of —— electrolytically. W. Neumann. *See* XXIII.

Patents.

Negative pole plates [electrodes] ; Process of treating —— and the product thereof. J. Bijur, New York, U.S.A. Eng. Pat. 29,367, Dec. 24, 1906.

A Planté negative plate is soaked in a solution of an organic substance, such as sugar, capable of penetrating the pores of the plate, and the latter is then heated to carbonise the deposited material. The finely-divided carbon, incorporated within the active material, is inert to the electrolyte, and gives an increased porosity and constant capacity during use. An arrangement is described for heating the framework to a lesser degree than the material, if the former is composed of a more easily fusible antimony alloy.—B. N.

Insulating materials. J. Connolly, Blackley, Lancs. Eng. Pat. 1678, Jan. 22, 1907.

Stearine pitch, used in the manufacture of insulating compounds, is purified by dissolving it in a suitable solvent, such as carbon tetrachloride, carbon bisulphide, etc., and agitating three parts of the solution with one part of a solution prepared by dissolving 1 part of caustic soda in eight parts of water. The liquid containing the stearine pitch is separated from the mixture in a centrifugal separator, or by settling. It is preferable to heat the pitch to 150° to 200° C., for one to four hours, before dissolving it in the solvent.—B. N.

Insulating materials and method of producing them. Asbestos Wood Co. Fr. Pat. 380,871, Aug. 17, 1907.

See U.S. Pat. 865,606 of 1907; this J., 1907, 1097.—T. F. B.

Nitrogen oxides ; Manufacture of —— [electrically]. F. Spitzer, Essen on the Ruhr, Germany. Eng. Pat. 22,201, Oct. 8, 1907. Under Int. Conv., Oct. 12, 1906.

Nitrogen oxides are obtained from air, or from a mixture of nitrogen and oxygen, by passing the gases into an electric arc, and withdrawing the treated gases from the central or inner zone of the arc, thus practically excluding the gases in the outer zone. The gases are drawn off through a tube, in which they are rapidly cooled, in order to prevent dissociation of the oxides of nitrogen. —B. N.

Electric furnace. E. R. Taylor, Penn Yan, N.Y. U.S. Pat. 871,971, Nov. 26, 1907.

The resistance furnace described consists of a wall of fire-bricks enclosing a central working chamber; an outer shell surrounding this wall and enclosing an annular feed-space between the wall and the shell; means for supplying the working chamber and the feed-space with "self-moving" material (*e.g.*, sulphur) for treatment; metallic electrodes extending downward into the feed-space; and carbon electrodes attached to the lower ends of these stems, and at right angles to them, the carbon electrodes extending into the working chamber and towards each other.—A. G. L.

Calcium carbide, etc. ; [Electrical] Manufacture of ——. J. C. King, Assignor to The Willson Carbide Works Co., Ltd., St. Catharines, Ontario, Canada. U.S. Pat. 872,351, Dec. 3, 1907.

The entire mixture is fused and reduced by passing it through a zone of fusion, and afterwards through a "die," acting as one of the electrodes, which separates the unreduced mixture above from the solid carbide beneath. The carbide hardens sufficiently in the "die" to determine its shape, and it is withdrawn progressively from the "die" as a pig devoid of crust.—B. N.

Furnace ; Electric ——. J. C. King, Assignor to The Willson Carbide Works Co., Ltd., St. Catharines, Ontario, Canada. U.S. Pat. 872,352, Dec. 3, 1907.

An electric furnace for the production of calcium carbide. [See preceding abstract.]—B. N.

Galvanic battery ; Reversible ——. T. A. Edison, Llewellyn Park, Assignor to Edison Storage Battery Co. U.S. Pat. 873,220, Dec. 10, 1907.

See Eng. Pat. 26,948 of 1904; this J., 1905, 280.—T. F. B.

Accumulator, with nickel alloy. Nya Ackumulator Aktiebolaget Jungner. Fr. Pat. 380,655, Aug. 9, 1907.

In accumulators, employing an alkaline electrolyte, the inactive supports or other metallic parts are composed of nickel alloyed with metals, the oxygen compounds of which are practically insoluble in the electrolyte. At the beginning of the electrolysis, a thin protective layer of nickel hydroxide is produced. In certain cases, it is advantageous to alloy the nickel, or the alloy described above, with a small proportion of a metal, the oxygen compound of which is soluble in the electrolyte.—B. N.

Electric conductors, etc. Eng. Pats. 23,334—23,336. *See* II.

Incandescence electric lamps, etc. Eng. Pat. 28,680. *See* II.

Nitrogen oxides, etc. Fr. Pat. 380,614. *See* XIA.

(*B.*)—ELECTRO-METALLURGY.

Patents.

Copper; Electrolytic refining of ——. S. O. Cowper-Coles, London. Eng. Pat. 27,740, Dec. 5, 1906.

Arsenic, bismuth and antimony are removed from the electrolyte by passing through it a current of high density and of a voltage sufficient to decompose the water of the electrolyte, according to Eng. Pat. 21,974 of 1898 (this J., 1899, 1132). Bismuth and antimony are oxidised, and arsenic is removed as arseniuretted hydrogen.—A. G. L.

Copper and other metals; Electro-deposition of ——. S. O. Cowper-Coles, London. U.S. Pat. 873,508, Dec. 10, 1907.

See Eng. Pat. 8924 of 1906; this J., 1907, 158.—T. F. B.

Electrolytic deposits; Process for producing ——, *free from pores and adherent to the metallic support.* Fabrik Elektrischer Zünder, G.m.b.H. Fr. Pat. 380,430, Aug. 1, 1907. Under Int. Conv., Sept. 5, 1906.

The metallic support is first coated with a layer of metal or alloy, the melting point of which is lower than that of the metal to be deposited, and after the deposition of the latter, the object is heated so as to melt the intermediate layer. The pores of the outer layer are thus filled up, and it is made to adhere more firmly to the metallic support.—B. N.

Metallic deposits; [Electrolytic] Process for the preparation of ——. Fabrik Elektrischer Zünder, G.m.b.H. Fr. Pat. 380,601, Aug. 7, 1907. Under Int. Conv., Aug. 10, 1906.

In order to obtain a metallic deposit, which may be separated from its support, the latter, which serves as cathode, is used as an anode, before the precipitation of the metal, either in the same or in an auxiliary bath, the tension of the current not being sufficient to produce any visible effect at the anode. A rotating cylinder or disc may be used as the cathode, a part only of this being polarised as an anode, for the production of tubes or bands of thin metal.—B. N.

Metallic coatings; Process for the electrolytic production of lustrous —— *upon metals.* A. Classen. Second Addition, dated Aug. 8, 1907, to Fr. Pat. 350,964, Jan. 23, 1905 (this J., 1905, 806).

Organic acids are added to the electrolytic bath.—B. N.

Metallic coatings; Process for the electrolytic production of lustrous —— *upon metals.* A. Classen. Third Addition, dated Aug. 8, 1907, to Fr. Pat. 350,964, Jan. 23, 1905 (this J., 1905, 806).

Lustrous deposits, black or dark blue in colour, are obtained, by first producing a brilliant white deposit, as described in the main patent, and then suddenly reducing the tension of the current.—B. N.

Metallic coatings; Process for the electrolytic production of lustrous —— *upon metals.* A. Classen. Fourth Addition, dated Aug. 8, 1907, to Fr. Pat. 350,964, Jan. 23, 1905 (this J., 1905, 806).

The objects to be covered are polished, then treated with acid or with a sand blast, and the metal afterwards deposited, as described in the main patent, first with a current of normal tension and afterwards with a reduced tension.—B. N.

Aluminium and other metals; Art of producing —— *[electrolytically].* H. S. Blackmore, Mount Vernon, N.Y. U.S. Pat. 872,985, Dec. 3, 1907.

A compound, containing the metal to be extracted, in combination with two or more non-metals (*e.g.*, oxygen and a halogen), is employed as the electrolyte, and a more electropositive metal, in the form of a carbide, is used as an electrode. On passing the current, reaction takes place between the carbide and the electrolyte, with liberation of the metal from the latter.—B. N.

Silicides; [Electrical] Process of producing ——. E. F. Price, Niagara Falls, N.Y., Assignor to Central Trust Co., N.Y. U.S. Pat. 873,328, Dec. 10, 1907.

Silicides, such as ferrosilicon, containing 40 per cent. and upwards of silicon, are obtained by employing a charge, which is practically a non-conductor of electricity. The charge comprises a silicon compound, an alloying metal, such as iron, and carbon, the silicon compound being in such proportion as to make the charge of relatively low electrical conductivity. An electric arc is established within the charge, and the zone of reduction is surrounded by a considerable body of the charge, thus protecting the electrodes from the oxidising and cooling effect of the atmosphere. The product is withdrawn, and the charge materials supplied as required.—B. N.

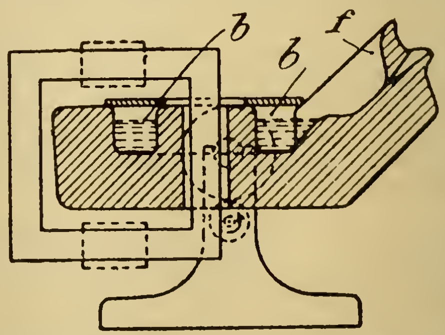
Iron from metallic sulphides; Making —— *[electrolytically].* R. H. Aiken, Winthrop Harbor, Ill. U.S. Pat. 873,648, Dec. 10, 1907.

The material, containing iron and nickel sulphides, is first fused in a suitable retort, and the fused mass electrolysed to deposit nickel and copper. The residual material is "segregated" together, and then further electrolysed until the iron is deposited from its sulphide.—B. N.

Furnace; Electric ——. E. Viel. Fr. Pat. 380,610, Aug. 7, 1907.

The metallic envelope of the furnace forms the shell for the sheathing electromagnets, and the cores of the latter are cooled by a circulation of water.—B. N.

Furnace; Electric induction ——, *and process for the metallurgy of steel.* H. Biewend. Fr. Pat. 380,800, Aug. 13, 1907. Under Int. Conv., Aug. 14, 1906.



The metal is heated in the usual manner in the annular fusion channel, *b*, which acts as the secondary of the furnace, but for the decantation of slag, or for the addition of the necessary fluxes, the furnace is tilted so that the metal is transferred to an outer crucible, *f*.—B. N.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

Japan wax; Acids of high melting point in ——, *and especially nonadecamethylenedicarboxylic acid.* R. Schaal. Ber., 1907, **40**, 4784—4788.

On distilling the fatty acids of Japan wax under a pressure of 15 mm., crystallising the residue from 75 per cent.

alcohol to separate resinous substances, and redistilling the product in the vacuum of a cathode light, the residual palmitic acid distilled between 135° and 180° C. under a pressure of 0 mm. Subsequently a fraction melting at 98°—100° C. passed over between 180° and 210° C., and another melting at 107°—112° C. between 210° and 245° C. The first of these fractions, after redistillation and recrystallisation from chloroform, yielded a dicarboxylic acid, $C_{21}H_{40}O_4$, melting at 117°—117·5° C., and forming an ethyl ester (m. pt. 53° C.) and a diamino-derivative melting at 174°—175° C. On dry distillation with barium hydroxide under a pressure of 13 mm., it yielded normal nonadecane, $C_{19}H_{40}$, which distilled between 189° and 191° C., and after recrystallisation from alcohol, melted at 31·5° to 32·5° C. The dicarboxylic acids of Japan wax were therefore chiefly nonadecamethylenedicarboxylic acid, $CO_2H.(CH_2)_{19}.CO_2H$, about 10 grms. being obtained from one kilo. of the fat. Lower homologues of this acid were also isolated, *viz.*, $CO_2H.(CH_2)_{18}CO_2H$, and $CO_2H.(CH_2)_{17}.CO_2H$, the first yielding normal octadecane, $C_{18}H_{38}$, (m. pt. 27°—28° C.), and the second normal heptadecane, $C_{17}H_{36}$, (m. pt., 20·5—22·5° C.) on dry distillation with barium hydroxide under reduced pressure.—C. A. M.

Fuller's earth; German —— as a decolorising agent [*for oils*]. E. Graefe. *See* III.

Cocoanut oil; Detection of —— in butter fat. T. R. Hodgson. *See* XVIII*A*.

Propolis; Constituents of ——. P. Borisch. *See* XIII*B*.

Patents.

Fish, fish offal and the like; Apparatus for the treatment of ——, for the extraction of oil and production of fertilizers. A. C. Pearson, Lee, Kent. Eng. Pat. 25,882, Nov. 15, 1906.

A stationary steam pipe forms the axis of a revolving perforated tube or receptacle, provided with a worm conveyor or blade adapted to agitate and propel the material through the tube. High-pressure steam, preferably superheated, is delivered through stationary jets attached to the steam pipe. An unperforated drum surrounds the perforated tube, and is arranged to revolve with it, the oil and other liquid passing into the space between the drums, and being drawn off continuously. The casing of a stationary feed hopper extends into the inner perforated tube, a stuffing-box serving to make a tight joint, and the discharging end of the perforated tube fits in a similar manner into the wall of a stationary chamber into which the material is discharged after treatment. A modification is described in which a rotary drying chamber encloses the perforated and unperforated drums, the chamber being heated by a steam-jacket or coil surrounding the unperforated drum, or by the passage of a hot gas through it. The material, after being discharged from the cooking chamber, is compressed, in order to extract oil, and is then returned through the drying chamber in a direction opposite to that which it previously travelled, and agitated in a suitable manner during its passage. For the purposes of compression and transference of the material from one chamber to another, three cylinders are provided, one being opposite to the outlet of the cooking chamber during the time that the others are opposite to a stationary resistance plate and the entrance to the drying chamber respectively. Each cylinder is provided with a "follower" or piston, this being displaced by the material as it enters the cylinder, afterwards advanced to a limited extent for compressing the material against the resistance plate, and finally further moved forwards for ejecting the compressed material from the cylinder into the drying chamber, suitable knives being placed at the entrance to the latter in order to cut up the material. The three cylinders are mounted on a frame, adapted to be moved intermittingly, by suitable mechanism, through an angle of 120°, and thus bring the cylinders successively opposite to the outlet of the cooking chamber, the stationary resistance plate, and the entrance to the drying chamber.—B. N.

Saponification; Process of ——. M. R. A. Samuel, Assignor to The Karsam Soap Co., Ltd., London. U.S. Pat. 873,615, Dec. 10, 1907.

See Eng. Pat. 7380 of 1906; this J., 1907, 476.—T. F. B.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(*B.*)—RESINS, VARNISHES.

Copals; Solubility of "semi-hard" African ——. C. Coffignier. Bull. Soc. Chim., 1907, 1, 1131—1143.

The solubilities of the semi-hard African copals have been determined by methods previously described (this J., 1903, 808). The figures given below against each solvent represent the percentages insoluble in that liquid, when boiling.

	Benguela.	Angola (white.)	Angola (red.)	Congo.	Sierra Leone.
Sp. gr.	1·058 at 16° C.	1·055 at 17° C.	1·066 at 17° C.	1·061 at 17° C.	1·072 at 19° C.
M. pt.	165° (softens at 65°)	95° (softens at 45°)	>300° (softens at 90°)	195° (softens at 90°)	130 (softens at 60°)
Acid value	123·1	127	128·3	132·3	110·2
Saponif. value	157·1	159·9	131·8	131·8	123·4
Ethyl alcohol	16·5	15·1	38·6	25·3	62·3
Methyl alcohol	46·9	46·7	68·0	55·3	49·2
Amyl alcohol	0·9	1·4	7·0	2·2	4·8
Ether	43·7	27·3	51·2	48·3	47·8
Chloroform	47·3	43·7	65·7	59·6	52·4
Benzene	65·6	50·5	70·0	60·1	56·9
Acetone	24·8	5·4	5·5	45·8	40·3
Oil of turpentine	68·8	69·4	77·0	68·2	71·4
Benzaldehyde	14·1	4·3	Soluble	48·7	1·5
Aniline	0·9	3·5	2·3	Soluble	0·7
Amyl acetate	1·2	2·7	4·2	0·9	Soluble
Carbon tetrachloride	74·0	61·3	77·7	66·1	70·9
Oil of cajeput	—	9·9	15·6	—	—

In the table it will be noticed that there are three cases of complete solubility, whereas the hard copals (Zanzibar, Madagascar, and Demarara) will not dissolve completely in any of the above solvents (compare this J., 1906, 939).—F. Sodn.

Alnus glutinosa; Alcohols and resin acids of the leaf-varnish of ——. H. and A. Euler. Ber., 1907, 40, 4760—4764.

The leaves of the alder (*Alnus glutinosa*), gathered in September, were washed with a warm mixture of benzene and toluene, which removed the coating of dry varnish. This solution was dried, and the solvent distilled off. The following substances were found in the residue. A colourless, saturated alcohol, *glutinol*, $C_{14}H_{28}O$, soluble in ether, alcohol, and benzene. It crystallises from alcohol in masses of small leafy crystals, and when crystallised from light petroleum melts at 70°—71° C. *Glutanol*, $C_{14}H_{26}O_2$, is a saturated, crystalline alcohol resembling glutinol, but of smaller solubility, and melting at 76° C. Neither of these alcohols gives the cholesterol reaction. Two amorphous resin acids were obtained and were separated by their different solubilities in light petroleum. The less soluble was *glutinic acid*, $C_{28}H_{44}O_7$, the other being *glutinolic acid*, $(C_{28}H_{48}O_5)x$. Both acids give the cholesterol reaction.—F. Shdn.

Propolis; Constituents of ——. P. Borisch. Pharm. Zentralh., 1907, **48**, 929—934.

The specimen of bees' propolis examined contained:—Propolis resin, insoluble in hot light petroleum spirit, soluble in 96 per cent. alcohol, 43·6 per cent.; propolis balsam, soluble in hot light petroleum spirit and in 70 per cent. alcohol, 8·7 per cent.; beeswax, 27·9 per cent.; essential oil and water, 6·9 per cent. The residue consisted of foreign impurities. Propolis resin is brownish black, soft, and very aromatic, and can be kneaded in cold water; m. pt. about 67° C. After exposure for several hours to a temperature of 101° C., it assumes when cold the consistence of hard Tolu balsam. Propolis balsam is a syrupy, golden yellow fluid. with a very aromatic odour. (See also this J., 1903, 227.)—J. O. B.

Patent.

Driers for paints, varnishes and oils, and the manufacture of such driers. G. Guittet, Paris. Eng. Pat. 6717, March 20, 1907.

See Addition of March 18, 1907, to Fr. Pat. 367,989 of 1906; this J., 1907, 1020.—T. F. B.

(*C.*)—INDIA-RUBBER, &c.

Plantation rubber; Vulcanisation tests with ——. C. Beadle and H. P. Stevens. Chem. News, 1907, **96**, 187—188.

Criticisms of the results published by the authors in a previous paper (this J., 1907, 935) have led them to extend their vulcanisation tests to a sample of hard-cure Parà rubber, washed and dried by a manufacturer, and not in the authors' laboratory. This sample contained: moisture, 0·5; protein, 2·0; resin, 2·9; ash, 0·6; and caoutchouc (by difference), 94 per cent. The results obtained indicate that the sample when vulcanised was inferior in tensile strength to the sample of hard-cure Parà previously examined (*loc. cit.*), in the earlier paper it was shown that the latter sample of hard-cure was not equal in strength to the vulcanised plantation (" block ") rubber with which it was compared.—E. W. L.

India-rubber; Decomposition point of vulcanised ——. R. Ditmar. Le Caoutchouc et Gutta-Percha, 1907, **4**, 1553—1569.

The author has determined the temperatures of decomposition of a large number of specimens vulcanised with and without filling materials, and arrives at the following conclusions:—The decomposition temperature rises with the sulphur-content up to 25 per cent., and is also raised by magnesia, zinc oxide, and litharge. Barytes does not affect it, nor yet pitch, which exudes at a temperature well below that of decomposition. Fatty substitute, in quantities up to 10 per cent., lowers the decomposition point. The effect of natural resins is masked by the varying behaviour of the rubbers themselves.—W. A. C.

Caoutchouc; Determination of —— *as tetrabromide.* T. Budde. Gummi-Zeit., 1907, 22, 333—334.

The author replies to the criticisms of Fendler and Kuhn (see this J., 1907, 1287) on his tetrabromide method for the determination of caoutchouc, and holds that these are not justified, provided the conditions laid down in the original paper be adhered to.—A. S.

Ozonides from African rubbers. K. O. Gottlob. Gummi-Zeit., 1907, 22, 305—308.

Harries (this J., 1904, 830; 1905, 448; 1906, 33) found that the ozonide of caoutchouc (from Para rubber) yielded, on decomposition, much more levulinic aldehyde than levulinic acid, whilst, on the other hand, the ozonide of the hydrocarbon of gutta-percha yielded more of the acid than of the aldehyde. The author prepared ozonides from the caoutchouc hydrocarbons separated from 8 West African (Congo) and 8 East African (Uganda) rubbers, and examined their decomposition products. In all cases the ozonides behaved in approximately the same manner as that prepared from the hydrocarbon of gutta-percha, yielding more levulinic acid than levulinic aldehyde; in most cases, about twice as much. This difference in the behaviour of the ozonides affords a means of distinguishing Para rubber from African rubbers.—A. S.

XIV.—TANNING, LEATHER, GLUE, SIZE.

[*Gelatin*]; *The tanning action of certain colloidal oxides on* ——. Lüppo-Cramer. *See* XXI.

Patents.

Hides; Substance for treating —— *and process of making same.* O. H. Nowak, Assignor to Nowak Manufacturing Co., Chicago. U.S. Pat. 873,074, Dec. 10, 1907.

See Fr. Pat. 360,854 of 1905; this J., 1906, 647.—T. F. B.

Hides and skins; Process of carroting ——. C. and E. Pichard, Paris. U.S. Pat. 873,594, Dec. 10, 1907.

See Addition of Aug. 8, 1906, to Fr. Pat. 355,121 of 1905; this J., 1907, 93.—T. F. B.

Hides; Tanning ——. J. Inouye and T. Dogura. Fr. Pat. 380,411, July 31, 1907.

After the usual preliminary treatment, the hides are tanned with a solution of ferrous sulphate, potassium nitrate, and potassium bichromate in water. This method is stated to give smooth and strong leather, and the time of tannage is materially reduced.—H. G. B.

Leather, artificial; Manufacture of ——. A. J. Boult. London. From A. Sylvestre, Courbevoie, France, Eng. Pat. 28,806, Dec. 17, 1906.

See Fr. Pat. 360,152 of 1905; this J., 1906, 488.—T. F. B.

Leather, artificial; Process of manufacturing ——. L. Gevaert-Naert, Assignor to Soc. Anon. des Cuirs et Courroies d'Audenarde, Audenarde, Belgium. U.S. Pat. 873,582, Dec. 10, 1907.

See Fr. Pat. 378,807 of 1907; this J., 1907, 1207.—T. F. B.

Leather, artificial; Method of making ——. F. Baum. Fr. Pat. 380,302, July 27, 1907.

The muscles, guts, stomach, etc., of animals are tanned, preferably with formaldehyde, and the tanned pieces are pasted together to the required thickness.—H. G. B.

XV.—MANURES, &c.

Patents.

Nitrated superphosphate; Process of making ——. J. Schlutius, Karow, Germany. U.S. Pat. 872,757, Dec. 3, 1907.

See Eng. Pat. 26,886 of 1905; this J., 1907, 60.—T. F. B.

Fish, etc. Eng. Pat. 25,882 *See* XII.

XVI.—SUGAR, STARCH, GUM, &c.

Sugar beet; Peroxydases from the ——. A. Ernest and H. Berger. Ber., 1907, **40**, 4671—4679.

The pulp prepared from the exterior portions of a number of beetroots was treated with 80 per cent. alcohol; after the lapse of four days, the alcoholic extract was poured off, and the pulp was subjected to a slight expression. The pulp was then extracted with 40 per cent. alcohol for eight days; the combined extract thus obtained, after concentration at 40°—50° C., was precipitated with absolute alcohol and ether. The precipitate was filtered off and dried at 50° C., the hard mass thus obtained being ground to fine powder. The substance was also isolated from the juice expressed from the original pulp. The preparation was found to give the purpurogallin reaction on treatment with hydrogen peroxide and pyrogallol and therefore contained peroxydases. Quantitative experiments, in which the amounts of (1) peroxydase preparation, (2) pyrogallol, (3) hydrogen peroxide, were varied, the other two reacting substances being kept constant in each case, showed that the amount of purpurogallin formed increased with increasing amounts of peroxydase or hydrogen peroxide, but decreased with increasing amounts of pyrogallol (within the limits of the experiments). A peroxydase preparation from immature beetroot was found to possess catalytic properties (see this J., 1907, 107); on dissolving in water and reprecipitating with absolute alcohol and ether, the preparation lost its catalytic power. The amounts of carbon dioxide liberated by the action of another peroxydase preparation (from seed beetroot) on pyrogallol, both before and after addition of hydrogen peroxide (see this J., 1906, 708), were also determined. The experiments showed that carbon dioxide was produced in absence of hydrogen peroxide, and that it was produced in much larger quantity when hydrogen peroxide was added. The same peroxydase preparation, after being dried at 140° C. for 8 hours (whereby its weight decreased from 1·1067 to 1·0257 grms.), liberated much smaller quantities of carbon dioxide than before.—L. E.

Beetroot juices; Darkening of ——. M. Gonnermann. Z. Ver. Deut. Zuckerind., 1907, 1068—1087.

The author's earlier work on this subject led him to the conclusion that the darkening of beetroot juice sometimes observed, is due to the presence of homogentisinic acid formed by the action of tyrosinase upon tyrosine. His present investigations, however, show that this theory is incorrect and he now considers that the phenomenon is due to the presence of pyrocatechol. He succeeded in isolating a small quantity of this substance from a sample of beetroot pulp which possessed the property of rapidly darkening on exposure to air. He considers that the pyrocatechol is formed by the action of tyrosinase upon tyrosine, and that it reacts with the ferrous salts present in the beetroot and with atmospheric oxygen to give the dark coloration; ammonium carbonate, also formed by the action of tyrosinase on tyrosine, neutralises the acidity of the beetroot juice sufficiently to allow of the production of the dark coloration. The author's experiments with pyrocatechol, tyrosinase, and iron salts, confirm the above theory of the colour formation.
—L. E.

Sucrose; Polarimetric determination of ——. *III.* F. Watts and H. A. Tempany. West Ind. Bull., 1907, **8**, 111—119 (see this J., 1905, 817, 1906, 957).

In Herzfeld's modification of Clerget's method for determining sucrose, slight deviations from the conditions prescribed for inversion may introduce errors, and, since it is necessary to double the polarimeter reading obtained after inversion, any error is correspondingly increased. By employing a smaller quantity of hydrochloric acid and a normal solution for inversion, the authors have eliminated these difficulties. Several samples of sugar were used and the method employed was as follows:—A normal solution of the sugar was prepared at a temperature of 30° C. (which is about the usual temperature in cane sugar producing countries), and polarised in a 200 mm. water-jacketed tube at the same temperature; 50 c.c. of the solution were measured into a 50—55 c.c. flask at 30° C., treated with 1 c.c. of fuming hydrochloric acid, and the mixture thoroughly stirred; the solution was then heated in a water bath, its temperature being raised to 68° C. in five minutes and maintained at this point for a period, varying in individual experiments, of 15—25 minutes. The solution was kept constantly stirred during the heating; it was subsequently cooled and made up to 55 c.c. at 30° C., and polarised in a 220-mm. tube at the same temperature. The polarimeter employed was standardised, and corrections were made for: (a), expansion of the polarimeter tubes; (b), influence of temperature on the quartz wedge of the saccharimeter; and (c), influence of temperature on the specific rotation of sucrose (in the case of the direct reading). The average factor was found to be 128·08 at 30° C., and the individual results (ranging between 127·95 and 128·20) showed that the variations in the times of heating had no material effect. In two further experiments, the solutions were maintained at 68° C., for 10 and 30 minutes respectively, the temperature being attained in 5 minutes as before. The factors obtained were 127·90 and 127·91, *i.e.*, practically identical. With Clerget's method, or with Herzfeld's modification of it, heating the solution for 30 minutes would cause considerable reversion. The authors also determined the factor for a temperature of 30° C., using Herzfeld's method, and found this to be 127·70; this agrees closely with the value, 127·66, obtained by calculation from the factor 132·66 for 20° C. (on the usual assumption that every rise of 2° C. above the standard lowers the factor by 1° V.). In analyses of a sample of muscovado sugar: (1), by Herzfeld's method; (2), by the authors' modified method (the solution being kept at 68° C. for 15 minutes), identical results were obtained.
—L. E.

Sugar group; Dissociation processes in the ——. *I. Behaviour of sugars towards Fehling's solution and other oxidising agents.* J. U. Nef. Annalen, 1907, **357**, 214—312.

The following method was adopted for the oxidation of various sugars with cupric hydroxide in alkaline solution: A solution of 382·5 grms. of crystallised copper sulphate was mixed, in the cold, with a solution of 163·8, 171·65, or 183·9 grms. of sodium hydroxide in 688 c.c. of water (*i.e.*, with 41·2, 49·05 or 61·3 grms. more than the calculated amount for the formation of copper hydroxide), and then with the previously estimated quantity of the sugar (dissolved in 250 c.c. of water) required to reduce all the copper to the cuprous state. The mixture was thoroughly agitated and heated in a water-bath until reduction was complete, then filtered and treated with a known, slight excess, of hydrochloric acid. The amounts of the acid oxidation-products were then determined as accurately as possible. In the case of dextrose and lævulose it was found that reduction began at 40° C., and was complete in 10 minutes and before the temperature within the flask had reached 80° C.; reduction was slower with *l*-arabinose and still more so with *d*-mannose; with the latter, no reduction occurred until the temperature had risen to 92° C. The following results were obtained:—*l-Arabinose.*—In the presence of 171·65 grms. of sodium hydroxide, 51 grms. of *l*-arabinose were required for reduction; under these conditions the following products were obtained from 102 grms. of *l*-arabinose:—Carbon dioxide, 3·46; formic acid, 15·3; *l*-arabonic-ribonic acid lactone, 6; glycollic acid, about 38; and a mixture of much *dl*-erythritic acid and a small quantity (8—10 grms.) of *dl*-glyceric and *dl*-threonic acids, 35·9 grms. In the presence of 163·8 grms. of sodium hydroxide, 55 grms. of arabinose were required for reduction and a much larger quantity of *l*-arabonic-ribonic acid lactone (22 grms. from 109 grms. of *l*-arabinose) was formed. *Lævulose.*—In the presence of 171·65 grms. of sodium hydroxide, 59 grms. of lævulose were required for reduction. With this degree of alkalinity, the following products were obtained from 119 grms. of lævulose:—Carbon dioxide, 2·38; formic acid, 13·8; glycollic acid, 22; glyceric acid, 18; trihydroxybutyric acids (erythritic and threonic), 35; hexonic acids (*d*-gluconic and *d*-mannonic), 30 grms. *Dextrose.*—In this case 183·9 grms. of sodium hydroxide were employed, with 114 grms. of dextrose of m.pt. 148°—149° C., and two reductions were carried out. The following products were obtained from the 114 grms. of dextrose:—Carbon dioxide, 3·83; formic acid, 14·71; glycollic acid, 22; glyceric acid, 14; trihydroxybutyric acids, 30; hexonic acids 30 grms. *d-Mannose.*—Here again 183·9 grms. of sodium hydroxide were used and two reductions were carried out. The following products were obtained from 106 grms. of *d*-mannose:—Carbon dioxide, 4·64; formic acid, 13·35; glycollic acid, 25; glyceric acid, 14; trihydroxybutyric acids, 28; hexonic acids, 24 grms. Hence the qualitative difference between the oxidation products of *l*-arabinose and the above-mentioned hexoses consists in the presence of pentonic acids in the former case and hexonic acids in the latter. The author discusses the theory of the formation of the various oxidation products at length. All sugars, on treatment with excess of silver oxide in dilute alkaline solution in the cold, are converted into carbon dioxide, and formic and oxalic acids. The author has determined the proportions of these substances formed by acting with excess of silver oxide in presence of barium hydroxide on dextrose, lævulose, *d*-galactose, *l*-arabinose, erythritol (which on oxidation is first converted into aldo- and ketotetrose), glycerol, glycolyl aldehyde, ethyleneglycol, and glycollic acid.

Action of caustic alkalis on sugars.—The hexoses, on treatment with caustic alkalis, are converted, in part, into lactic acid. This reaction includes the successive formation of a 1,2-enol, a 2-ketohexose, a 2,3-enol, a 3-ketohexose, and a 3,4-enol, the decomposition of the 3,4-enol into glyceric aldehyde, and the rearrangement of the latter into *d-l*-lactic acid. The author shows that dextrose yields more *d-l*-lactic acid than does *d*-galactose; this is readily explained on the ground that the 3,4-enol formation occurs more readily in the case of dextrose than with *d*-galactose. The hexoses also yield isomeric saccharinic acids on treatment with alkalis; according to Kiliani, calcium hydroxide is the only alkali which produces these acids, but the author has shown that any alkali hydroxide may be used. The metasaccharinic acids are formed from the aldohexoses, the iso-acids are formed from the 2-ketohexoses, and the saccharinic and parasaccharinic acids are formed from the 3-ketohexoses. By the action of alkali on dextrose and *d*-galactose, ten isomeric saccharinic acids are theoretically obtainable in each case; of these, the author has obtained eight and six in the respective cases. All the space isomeric parasaccharinic acids may be regarded as *α*-*ω*-hydroxyethyltrihydroxybutyric acids, $CH_2OH.CHOH.C(OH)(COOH)(CH_2CH_2OH)$, and, hence, are quite analogous to the *d*- and *l*-erythritic and *d*- and *l*-threonic acids obtained by the action of Fehling's solution on pentoses and hexoses.—L. E.

Caramel and the intermediate coloured substances formed on heating sucrose; Bleaching action of hydrosulphite on ——. A. Herzfeld. Z. Ver. Deut. Zuckerind., 1907, 1088—1097.

For these experiments the author prepared a sample of caramel from pure sugar, the undecomposed sugar being removed from the preparation by fermentation. Portions of the caramel were extracted with absolute ethyl alcohol, 96 per cent. ethyl alcohol, and 95 per cent. methyl alcohol, respectively. The extracts and residues thus obtained, the original caramel, and three commercial caramels, were then treated with: (1) sodium hydrosulphite; (2), sulphurous acid, under various conditions. The experiments showed that the various caramel substances are more or less bleached, both in acid and in alkaline solution, and that hydrosulphite is a much stronger bleaching agent than sulphurous acid. The bleaching effect is more or less permanent. With respect to the nature of the colouring matters of caramel, the experiments on the extracts and residues of the prepared caramel were quite inconclusive. —L. E.

Patents.

Sugar purification; Process of ——, *and apparatus therefor.* J. Ost, Buenos Aires, Argentine. Eng. Pat. 25,860, Nov. 15, 1906.

Crude sugar is treated with porous material (woven or spun material, ceramic or unglazed products, etc.) in a rotating drum, the sugar and porous material thus being brought into intimate contact. The mixture then passes to a rotatory sifter which allows the sugar to pass, but retains the porous material and absorbed syrup. The sugar thus obtained is practically white and dry, and is ready for refining. The porous substances may be freed from syrup and used again.—L. E.

Sugar syrups or crystals; Process of refining ——. J. C. F. Lafeuille. Fr. Pat. 380,549, Aug. 3, 1907.

The mass containing the crystals and mother-liquor is placed in a rectangular tank provided with a stirring apparatus. Clairce solutions of gradually increasing density are injected into the bottom of the tank through perforated pipes. The upper part of the tank is surmounted by another tank containing a chamber formed of sloping screens. The sugar crystals collect on these screens, and means are provided for removing them, whilst the liquid portion is drawn off through taps placed at different heights in the side of the upper chamber. —W. P. S.

Syrup [*starch*]; *Process of refining* ——. C. B. Duryea. Fr. Pat. 380,680, May 21, 1907.

The dilute syrup obtained by the action of diastase or hydrochloric acid on starch, is treated with tannin, heated to a temperature of 90° C., and then filtered. A quantity of animal charcoal (1 part of charcoal to every 50 parts of syrup of 42° B.) is added to the filtrate which is again filtered and, finally, concentrated. About 1 part of tannin is sufficient for the treatment of 4800 parts of syrup.—W. P. S.

Dextrose and alcohol; Process for the manufacture of —— *from substances containing cellulose.* G. Ekström. Fr. Pat. 380,358, July 29, 1907.

Wood, sawdust, peat, moss, straw, or other substance containing cellulose, is treated at the ordinary temperature with 95 per cent. sulphuric acid. After the lapse of 20 minutes, the gelatinous residue is diluted with water until it contains about 1 per cent. of free sulphuric acid. This acid mixture is then heated in an autoclave under a pressure of 3 to 8 atmospheres for from 30 minutes to 5 hours. The solution is now neutralised with chalk, filtered, and concentrated to obtain the dextrose, or submitted to alcoholic fermentation. The acid-cellulose may also be converted into dextrose by heating it with concentrated sulphuric acid to a temperature not exceeding 100° C., and further heating it, after dilution with water, at the ordinary atmospheric pressure. It is claimed that from 55 to 75 per cent. of the cellulose is converted into dextrose.—W. P. S.

XVII.—BREWING, WINES, SPIRITS, &c.

Storage of inflammable substances in Berlin; Regulations governing the ——. Oil, Paint, and Drug Rep., Dec. 16, 1907. [T.R.]

To reduce to a minimum the fire risks from alcohol and other inflammable and explosive compounds, police regulations have been framed as follows:—

The stock of denaturing compounds should not exceed 2 tons at one time. They should be stored at a distance of 50 feet from other buildings or from any open flame. The floors of the rooms should be constructed of stone, brick, or other fireproof materials. They should have a slant of 1 to 100, draining into one or more catch-basins, which should be covered with a substantial fireproof grating. The catch-basins should drain into a cistern outside of the storeroom or into a natural watercourse or sewer. When drained into either of these, there should be a water connection, with a stop, made with the drain pipes, so that the escaping fluid may be diluted at the junction of the pipes to 30° Tr. before entering the watercourse or sewer. The cistern should be of sufficient size to hold the maximum contents of the storeroom. The walls of the room should be solid, and well constructed, and for about 14 inches above the floor should have no breaks. There should be no smoke ducts or fireplaces. Openings in walls should be so constructed that nothing could be thrown into the rooms from the outside. Doors must be substantial and made so as to close tight automatically; they must also be fireproof. The fluids should be stored in closed tanks which will prevent the escape of vapours, and these receptacles should be legibly marked. Tanks must be so constructed as to leave a space of 4·9 feet between the tank and the walls or ceiling.

The storage place should not be accessible to unauthorized persons. It should be protected by an inclosure, kept permanently under lock and key when not in actual use, and the key placed in the keeping of a reliable person.

Fire and lights may never be used in or near the storage place, except with the following exceptions, and no smoking is allowed:—For lighting purposes only electric lamps covered with globes which inclose the holders and protected by wire cages, and Davy safety lamps may be used. The switches for the electric lights must be placed outside the storage room. If the latter is located in a completely isolated shed or inclosure, illumination from the exterior may be effected by tight-shutting storm lanterns securely attached in front of the windows, which are so arranged as not to be opened. Lamps should never be placed on the ground on account of the danger from heavy benzol vapours.

The denaturing materials hereafter mentioned may be used either in the room in which they are stored or in another isolated place where the above regulations are strictly carried out, whether in the open air or in an inclosed room. The room should be on a level with the ground and only accessible from the outside by a door opening outward. It should be well ventilated, with no communication with adjacent rooms. The windows should be tightly closed, and should preferably be made of wire glass. Only the denaturants which are required for immediate use should be brought into the room. It may only be heated by a central heating system, the boilers or furnace of which are located outside.

In the police regulations of the city of Berlin regarding the use and storage of petroleum and its derivatives, the fluids are divided into two classes, namely (1) those which at a barometric pressure of 760 mm. give off inflammable vapours below 21° C., and (2) all others. Quantities of more than 10 tons of Class 2, or more than 1 ton of Class 1, may only be stored in special places, and only with the permission of the police authorities. The permission is made dependent on certain conditions. The storage yard must be surrounded by a wall at least 8·2 feet high, and so located that it may be approached from all sides with fire-extinguishing apparatus. The liquids must be stored at least 197 feet from all buildings located outside of the storage yard. The provisions as to the construction of the building and floors are the same as for other inflammable compounds. The rooms should be well ventilated, with plenty of daylight, as artificial light may not be used about the building. Work may only be done in the daytime, and during the night no one is permitted to enter except the watchmen or authorized officials. No dwelling rooms may be located in the storage yard, except one for the watchmen, and it must be isolated from other parts of the storage yard by a wall.

Quantities of not over 1 ton but more than 661 lb. of Class 2 and quantities of not over 220 lb. but more than 33 lb. of Class 1 may only be stored in cellars, or in rooms on a level with the ground. In sale rooms only quantities of 110 lb. of Class 2 may be kept, but if the liquids are in metal vessels provided with stopcocks for pouring, the quantity may be increased to 661 lb. Only quantities up to 33 lb. of liquids of Class 1 may be kept; quantities less than a pint may be sold in glass packages. Not more than 44 lb. of liquids of Class 2 and 4·4 lb. of Class 1 may be kept in rooms regularly inhabited by people.

Maltings; Fires at —— and their prevention. J. Saunders. Brewers' J., 1907, **43**, 695—696.

Fires in maltings are often caused by the ignition of dust and malt culm which have settled in the cavities of the walls surrounding the fire baskets, the wooden joists frequently inserted in these walls becoming extremely inflammable. In the erection of new maltings, the use of wood should be abolished as far as possible. The walls may be of brickwork or cement-concrete reinforced with steel work. The roof should be built with cement-concrete, expanded metal or some other form of steel being used to strengthen the concrete and embedded in the latter to take up the tensile strains. For the malt and barley stores, bins erected in cement-concrete should be built, with conical bottoms and domed roof, so that there is no timber work at either the top or the bottom. The whole of the drying kiln should be built with a combination of brickwork, cement-concrete and steel work, even to the roof and cowls at the top. The windows throughout should be of iron or steel, with sheet iron shutters, and the doors either of sheet iron or of solid wood covered with sheet iron. In designing flues, care should be taken to keep them well away from any loose grain; and the engine and boiler house should be entirely isolated from the central block. If gas is employed, the brackets should be carefully placed and the jets fitted with wire guards and shields. Safety compartments should be constructed, so that each section of the malting may be separate and distinct.—T. H. P.

Patents.

Malt-house and apparatus. W. P. Rice, Chicago. Reissue No. 12,728, dated Dec. 3, 1907, of U.S. Pat. 826,886, July 24, 1906.

See Eng. Pat. 14,103 of 1905; this J., 1905, 1318.—T. F. B.

Brewing beer and other beverages; Process of ——. Ozonair, Ltd. Fr. Pat. 380,558, Aug. 5, 1907. Under Int. Conv., Aug. 9, 1906.

See Eng. Pat. 17,909 of 1906; this J., 1907, 630.—T. F. B.

Alcohol, denatured, etc. Fr. Pat. 380,310. *See* II.

Dextrose and alcohol, etc. Fr. Pat. 380,358. *See* XVI.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

(*A.*)—FOODS.

Sulphurous acid and sulphites; General results of the investigations showing the effect of —— upon digestion and health. H. W. Wiley. U.S. Dept. of Agric., Bureau of Chemistry, Circular No. 37, 1907.

From the results of the administration of sulphurous acid solution and sulphites (sodium sulphite) to twelve young men, it is concluded that the use of these substances as food preservatives is objectionable and causes serious disturbances of the metabolic functions, injury to digestion and health, and impoverishment of the blood in respect of the number of red and white corpuscles contained therein.—A. S.

Cocoanut oil; Detection of —— in butter fat. T. R. Hodgson. Chem. News, 1907, **96**, 273—274, 288, 297.

The method is based upon the oxidation of the total fatty acids by means of potassium permanganate solution, the amount of oxygen consumed by butter fatty acids being practically a constant. One grm. of the melted and filtered fat is saponified with 25 c.c. of $N/2$ alcoholic potassium hydroxide solution, the alcohol expelled, and the soap dissolved in a litre of water. Twenty c.c. of this solution are heated for 30 minutes on the water bath with 50 c.c. of $N/10$ potassium permanganate solution and 50 c.c. of approximately 50 per cent. sulphuric acid, and the excess of permanganate solution then titrated back with $N/10$ oxalic acid solution or standard ferrous ammonium sulphate solution. Nineteen samples of butter of known purity thus examined required from 41·8 to 41·9 c.c. of permanganate solution, corresponding to an "oxygen equivalent" of 167·2. The oxidation is complete in 30 minutes and there is no further consumption of permanganate when boiling is continued for an additional 30 minutes. A sample consisting of 90 per cent. of pure butter fat (oxygen equivalent, 167·2) and 10 per cent. of cocoanut oil (oxygen equivalent, 87·2) gave an oxygen equivalent of 160·8, whilst with 20 per cent. of cocoanut oil, the value fell to 152·0, and with 90 per cent. to 95·2.—C. A. M.

Food products and beverages in Brazil; Regulations respecting ——. Board of Trade J., Dec. 26, 1907. [T.R.]

Wines, lard, and all other alimentary products condemned by the National Laboratory will be destroyed, and a fine of 500 milreis (about 31*l.* 5s.) will be imposed on the importers.

Wines and alimentary products are considered harmful to public health, and condemned, when they contain boric or salicylic acid, "inferior alcohol," free mineral acids—sulphuric, sulphurous, nitric or hydrochloric—sulphites, alum, alkali fluorides and fluosilicates, saccharin, salts of strontium, lead, zinc, tin, arsenic, or antimony, sulphate of potash, to the extent of 2 grms. per litre of wine (except in the case of wines of an alcoholic strength exceeding 20° for which the limit is 4 grms. per litre); in beers: hop substitutes such as absinthe, bitter quassia, colchicum, picrotoxin, colocynth, nux vomica, picric acid, aloes, and essences prepared with fatty esters, colouring matters derived from coal tar or with basis of lead, mercury, copper, arsenic, antimony, barium or any other substance which is or may in future be recognised as harmful to health.

In any case, the importation of artificial wines is prohibited, even when they do not contain harmful substances, and they will be destroyed if not re-exported within a period to be fixed by the Customs inspector.

Cognacs, whiskies, rums, gins, and other imported alcoholic beverages, genuine or factitious, will be condemned as harmful to health when they contain more than 3 grms. of poisonous impurities, aldehydes, fatty esters, furfural, higher alcohols, acetic acid, &c., per 1,000 grms. of alcohol at 100°, or 1·50 grms. of the same per 1,000 grms. of alcohol at 50°.

The importation of alcoholic beverages containing absinthe or any other harmful essences is prohibited by the Budget Law dated 30th December, 1905.

Patents.

Edestin from cotton seeds or pressed compositions of same; Process for obtaining ——. R. Levi, Hamburg, Germany. Eng. Pat. 19,392, Aug. 29, 1907.

Cotton seeds or pressed cotton-seed cakes are washed with salt solutions (5—10 per cent. solution of aluminium sulphate, alum, etc.) or with solutions containing free acids (sodium chloride solution mixed with hydrochloric acid) as long as a solution is obtained which becomes yellow on addition of alkali. After rinsing the seeds or cakes with water, the edestin is extracted with a solution containing 0·3 per cent. of hydrochloric acid.—L. E.

Apples; Method of producing a beverage from the juice of ——. K. G. Andersson and C. J. Lindblad, Kristinehamn, Sweden. Eng. Pat. 21,783, Oct. 2, 1907. Under Int. Conv., Nov. 1, 1906.

A mixture of apple juice and water is boiled for about an hour and skimmed during the boiling; the hot liquid is filtered and cooled, and should now contain 9 per cent. of extract. The cooled liquid is subsequently filtered again, and then boiled for 15 minutes. During this second boiling, pure sugar is added (2 kilos. of sugar per 3 litres of liquid, more or less). After again cooling, the liquid is ready for bottling.—L. E.

[*Foodstuffs*] *Animal and vegetable substances; Process of dehydrating* ——. E. W. Cooke, Waukesha, Wis., Assignor to American Dehydrating Co., Wis. U.S. Pat. 871,982, Nov. 26, 1907.

The foodstuffs are placed on stationary trays in a closed chamber, through which a current of dry air is passed in one direction (upwards). The moisture taken up by the air is removed from it outside the chamber, and the same air is again passed through the chamber, but in the opposite direction (downwards).—A. G. L.

Flour; Process of treating —— [*to increase its power of absorbing water*]. M. Silberberg. Fr. Pat. 380,321, July 29, 1907.

The starch cells are burst or subdivided so that the treated flour is capable of absorbing a large quantity of water when used for bread making. The process consists in heating the flour for several hours at a temperature of 105°—120° C., care being taken that charring does not take place; or the flour may be passed 15 or 20 times between smooth rollers. The treated flour will absorb from 120 to 130 per cent. of its weight of water.

—W. P. S.

(*B.*)—SANITATION; WATER PURIFICATION.

Clay as a semi-permeable membrane, and its use for purifying factory effluents and sewage. P. Rohland. Z. Chem. und Ind. Kolloide, 1907, 2, 177—179.

Highly plastic clays possess the capacity of acting as semi-permeable membranes, in that they readily permit the diffusion of crystalloid substances but prevent or strongly retard the passage of colloids. Crystalloid substances of complicated structure, such as dyestuffs, are adsorbed by the colloidal constituents of the clay. For laboratory experiments, the air-dried, finely powdered clay is stirred with the solution or emulsion to be tested, until the mixture "breaks"; if the liquid be alkaline, coagulation may be assisted by the addition of a little acid. After several days, water is added, and the liquid is filtered off. In this way the colloidal constituents may be separated from solutions or emulsions of oils, gums, albuminoids of various kinds, soaps, beer (dextrins isomaltose, resins, and caramel colouring matters), urine and stable-drainings. Colouring matters are adsorbed by the clay, the adsorption being more pronounced the greater their complexity; for this reason larger proportions are removed from concentrated than from dilute solutions, even when the quantity of dyestuff is the same. The adsorption-capacity of clays increases with their plasticity, and it is proposed to utilise highly coloured plastic clays, which are unsuitable for pottery purposes, for the purification of sewage and industrial effluents. Satisfactory results have already been obtained in the treatment of waters from wool-combing and the recovery of fat from them, also for the treatment of acid effluents from paraffin factories. These clays ought also to be suitable for treating the waste waters from starch factories, tanneries, dye-works, glue and sugar factories, and particularly from breweries and distilleries, in fact all wastes which contain objectionable colloidal matters, but they would not be suitable for mineral impurities such as occur in the wastes from metallurgical and chemical works.

—J. F. B.

Sand, contact and sprinkling filters; Comparative disposition of organic matter by ——. H. W. Clark. Eng. News, **57**, 607.

A general and comparative article on the operation of these three types of sewage filters, accompanied by careful summaries based upon the work and upon the present condition of sand filters that have been operated nineteen years, contact filters that have been operated six years, and sprinkling filters that have been operated nearly eight years, each and all receiving Lawrence (Mass.) sewage. From 50 per cent. to 75 per cent. of the matter in suspension in sewage is organic, and the nitrogen content of this is less than 8 per cent. The total organic matter in the sewage at Lawrence has amounted on the average to 2800 lb. per million galls., and the suspended matter to 2080 lb. The suspended matter is composed of 70 per cent. of organic or volatile and 30 per cent. of mineral matter. Each filter performs a different office. The sand filter produces a practically odourless and highly nitrified effluent. The rate of filtration, however, can rarely exceed 100,000 galls. per acre when strong sewage is being dealt with. Contact filters allow rates six to eight times as great as sand filters, but only the best give non-putrescible effluents. Trickling filters can be operated with normal sewage at rates at least 3 or 4 times as great as contact filters and 20 times as great as sand filters. They produce highly nitrified, practically odourless and non-putrescible effluents, containing, however, considerable suspended matter which must be removed in many cases. The organic matter which is applied to the filters with the sewage is of two kinds, stable and unstable. The stable matter accumulates to a greater or less degree in all filters, but most of all, in the sand filter and least in the trickling filter. The accumulation in the sand filter has to be removed by scraping, while in the trickling filter it is dislodged from the filtering material and passes through with the effluent in large quantities. Contact filters are very apt to accumulate organic matter, but there is some chance that part of it will be oxidised, especially that part which putrefies in the filter.

Patents.

Sewage and ammoniacal liquids ; Process of treating —— [*removal of ammonia*]. J. Jean et Cie. Fr. Pat. 380,489, Oct. 8, 1906.

The liquid is sprayed or atomised on a dispersing cone placed at the outlet of a ventilator, so that the spray is mixed with a large volume of air moving in the same direction. The mixture of air and spray is then passed into a separating chamber provided with baffle-plates ; the water is thus condensed, whilst the air charged with the ammonia is discharged through a suitable opening. The liquid, before treatment, is rendered slightly alkaline by the addition of sodium hydroxide, lime, baryta, etc. —W. P. S.

Liquids, especially sewage ; Process for removing suspended matter from ——. T. Lewicki. Fr. Pat. 380,333, July 29, 1907.

See Eng. Pat. 17,325 of 1907 ; this J., 1907, 1252.—T. F. B.

Ozone ; Process for the solution of —— *in water.* Comp. Franç. de l'Ozone. First Addition, dated July 26, 1907, to Fr. Pat. 354,298, May 15, 1905.

According to the present addition, a number of the emulsifiers described in the main patent (this J., 1905, 1080) are mounted between two transverse plates in a vertical cylinder, the walls of which rest in a water-seal. The cylinder is mounted on a masonry reservoir, and is surmounted by a dome provided with an inlet pipe for the water to be purified or sterilised.—A. S.

Ozone ; Generation of —— *in water.* S. Luczak and A. Neumann. Fr. Pat. 380,667, Aug. 9, 1907.

An induction coil is provided with a tertiary coil in which low-tension currents are set up, and in water these give rise to the formation of ozone. Water is freed from all bacteria by such means.—F. Sodn.

XIX.—PAPER, PASTEBOARD, &c.

Bamboo as raw material for paper-pulp. W. Raitt. Paper Making, 1907, **24**, 502—508, 539—541. (Compare Sindall, this J., 1907, 1157.)

The author regards bamboo as the papermaking raw material of the near future, the supply being practically unlimited in Burma and over the whole of south-eastern Asia. From this point of view he has made a long study of the conditions of growth and reproduction of this prolific grass. By taking stems of less than one year's growth, the cellulose is more easily purified, but the yield is less than in the case of stems of 3 years' growth. After 3 years the cost of separating the cellulose increases without a compensating increase in the yield. The cropping of the stems in the first year is not desirable, because they have no independent root system, and the parent root would soon die out. Stems of 3 years' growth, on the other hand, have developed new roots, and cropping at this period rather increases the vigour of the growth, which is quite permanent Studies carried out on bamboo jungle land, with triennial cuttings, showed that, according to the luxuriance of the growth, the yield ranged between 11 and 44, tons of air-dry bamboo, freed from knots, per acre. At a moderate estimate the average yield would be 15 tons per acre, or 5 tons yearly. Small bamboos with 30 ft. stems give a heavier crop than the larger species with stems of 50 ft. or more. At a yield of 45 per cent. of cellulose, a mill making 200 tons per week would be served by a forest area of about 8 square miles. It is calculated that the bamboos required to make a ton of pulp could be delivered at Rangoon for 25s., and that the pulp itself, prepared by the bisulphite process, would cost £5 per ton unbleached. The author emphasises the point that in these remote countries the soda process of boiling the bamboo is not a commercial proposition: the yield of cellulose is too low and the consumption of soda and bleach is too high. The bisulphite process, on the other hand, is admirably adapted for bamboo ; the yield is approximately 51 per cent. and the pulp is sufficiently white for the manufacture of newspapers ; when a fully bleached pulp is required it may be obtained with a consumption of about 15 per cent. of bleaching powder. The conditions for successful working are summed up as follows :—Select bamboos not over 3 years old; cut out the knots by means of twin-saws, and manufacture within a few months of cutting.—J. F. B.

Blotting papers ; Nature of non-absorbent ink-zones in ——. C. Beadle and H. P. Stevens. Chem. News, 1907, **96**, 285—288.

In a previous paper (this J., 1905, 102) the authors pointed out that when a blot of ink is allowed to dry on blotting paper, a non-absorbent zone is generally produced round the edges of the blot, whilst the interior preserves its absorbent properties. The ratio of the area of the non-absorbent zone to that of the whole blot increases with the percentage of basic mineral matters in the paper, particularly the calcium salts, and the tendency to produce zones can be prevented by removing these substances by previous digestion with dilute acids. The area-ratio of the zones varies with different inks on the same paper, but it has no connection with the absorptive power of the paper as measured by the rise of liquid in a vertical strip. The zone phenomenon may be studied by employing a solution of ferric chloride instead of ink, and the area-ratio of the zones varies inversely as the concentration of the ferric chloride solution. Papers which are "zoneless to ink" may be made to show a zone by introducing a salt of calcium of a basic nature into the paper, *e.g.*, hard water, lime-water or calcium carbonate. When ferric chloride or ferrous sulphate is employed instead of ink, the absorbent interior of the blot possesses the colour of the solution employed, but the non-absorbent zone assumes the buff colour of a basic ferric salt. In the interior portion of the blot the iron salts are still largely soluble in water, but in the zone they are insoluble. In the case of ink-blots the colouring matters may be bleached with hypochlorites, and the iron salts are then converted into ferric hydroxide. The ferric hydroxide of the interior of the blot is readily soluble in dilute hydrochloric acid, but that of the zone is only removed on treatment with a more concentrated acid. After bleaching, the zone is still non-absorbent and the interior absorbent ; the colour of the ferric hydroxide frequently only appears in the bleached blots after heating. Analysis of a blot after washing with water showed 4·6 per cent. of iron in the zone and 2·0 per cent. in the interior portion. The interior portion of a dried blot shows a distinctly acid reaction towards methyl orange, whilst the zone is neutral. Thus it is concluded that the non-absorbent zone is produced by the progressive neutralisation of the acidity of the ink by the basic constituents of the paper as the blot spreads outwards, with the deposition of an insoluble basic salt of iron, probably in a colloidal condition, which clogs the pores of the paper.—J. F. B.

Hydrocellulose and cellulose hydrates [*Determination of water of hydration*]. C. G. Schwalbe. Z. angew. Chem., 1907, **20**, 2166—2172.

The author deals in greater detail with the matters discussed in a previous paper (this J., 1907, 1291). The method adopted for the separate determination of the hygroscopic moisture and the more intimately combined water of hydration is described. The hygroscopic moisture is first determined in the ordinary way by drying in a toluene-bath at an internal temperature of 100°—105° C. until the weight is constant. The total moisture, hygroscopic and combined, in the cellulose is determined by heating another portion of the sample in a flask, preferably of metal, with a hydrocarbon of high boiling point, such as toluene. The flask has a capacity of 500—750 c.c. and carries a tubulure on the side for the introduction of the substance. The neck is continued like that of a retort and is connected by a ground-in joint with a Voit's absorption flask containing dry calcium

chloride, which is weighed before the experiment. This is kept cool by a stream of water, and the entrance of moist air is prevented by a guard-tube. The whole of the water in the cellulose distils over with the first portions of the toluene into the absorption flask and is absorbed by the calcium chloride after standing for 24 hours. The toluene is then poured off and the residual traces are removed by repeated extraction of the calcium chloride by light petroleum spirit, the flask being weighed again after drying at 40°—60° C. Care must be taken to remove all traces of non-volatile constituents from the hydrocarbons employed; this is best effected by steam-distillation. The water of hydration is expressed by the difference between the total water and the hygroscopic moisture. The following results are quoted:—Water of hydration in cotton cloth, 0·23; new cotton beaten into paper pulp, 1·56; mercerised cotton beaten to pulp, 6·31; hydrocellulose (reduces Fehling's solution), 1·2 per cent. Experiments are in progress with a view to simplifying the determination by measuring the volume of water distilled over with the toluene (compare Hoffmann and Schulze; this J., 1902, 1088 and 1903, 655).
—J. F. B.

Patents.

Viscose; Manufacture of ——. Soc. Franç. de la Viscose, Paris. Eng. Pat. 8179, April 8, 1907. Under Int. Conv., April 9, 1906.

See Fr. Pat. 374,123 of 1906; this J., 1907, 775.—T.F.B.

Boiling easily foaming or frothing substances, etc. Eng. Pat. 15,257. *See* I.

Dextrose and alcohol, etc. Fr. Pat. 380,358. *See* XVI.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

Yohimbi bark and yohimbine [; *Characteristic reactions of* ——]. G. Weigel. Pharm. Zentralh., 1907, **48**, 967—972, 985—990.

Yohimbi bark.—True yohimbi bark is derived from *Corynanthe yohimbe*, indigenous to the Cameroons. It contains at least four alkaloids: Yohimbine $C_{22}H_{28}N_2O_3$ or $C_{21}H_{28}N_2O_4$, sparingly soluble in ether, more soluble in absolute alcohol, readily dissolved by chloroform; yohimbenine, readily soluble in ether and other solvents; an alkaloid, sparingly soluble in ether, but easily dissolved by alcohol and by chloroform; and a base, insoluble in ether and only sparingly soluble in alcohol and in chloroform. The amount of "total alkaloids" present in the bark ranges from 0·3 to 1·5 per cent. Yohimbine alone has the peculiar aphrodisiac properties of the drug. Another yohimbi bark, derived from the closely allied *Pausinystalia trillesii*, indigenous to the French Congo, has also been imported. It differs somewhat in structural characters from the true drug. Another false yohimbi bark, obtained from *Corynanthe macroceras*, yields only a little yohimbine, and much yohimbenine; it is, in consequence, of less medicinal value than the true drug. True yohimbi bark gives a bulky powder, a few particles of which impart a red colour to dilute potassium hydroxide solution, which deepens on standing. About 1 grm. of the powder, when shaken with 20 c.c. of 1 per cent. hydrochloric acid solution, and filtered, affords a copious white precipitate with Mayer's reagent. The characteristic reaction for yohimbine is obtained thus:—From 2 to 3 grms. of the bark are macerated with frequent agitation for 30 mins. in a mixture of 25 c.c. of ether, 5 c.c. of chloroform, and 2 c.c. of ammonia solution; the liquid portion is then filtered and shaken with 1 per cent. aqueous hydrochloric acid. The acid solution is separated and gently warmed to drive off any ether, and, when cold, made alkaline with ammonia. The alkaloids are thus thrown down as a bulky precipitate, which is washed with a little water, and dissolved in 1 c.c. of strong sulphuric acid. On adding a particle of potassium bichromate to the acid solution, and moving the liquid backwards and forwards, a deep, characteristic, bluish-violet colour is at once given in the presence of yohimbine.

Characters and tests for yohimbine.—The free base crystallises from dilute alcohol in silky needles, m.pt. 231° C.; from benzene, in colourless needles, m.pt. 234° to 234·5° C. It is readily soluble in most organic solvents, but less so in benzene, and is almost insoluble in water. Its sparing solubility in benzene is characteristic. Its alcoholic solutions are dextro-rotatory. On exposure to the air and light, it is coloured yellowish, but its salts, especially the hydrochloride, are not so affected. Yohimbine is a tertiary base, of an aldehydic character, strongly reducing ammoniacal silver nitrate solution. It contains one methoxyl group. By oxidation with permanganate in alkaline solution, Spiegel (this J., 1899, 394) has obtained several acids; one of which occurs in fine colourless needles m.pt. 85°; he names two of these yohimbinic and noryohimbinic acid respectively. Winzheimer (Ber. Pharm. 1902 [2]) has obtained another acid, yohimboaic acid, m.p. 259—260° by saponifying the base with 30 per cent. alcoholic potash. By methylation this is reconverted into yohimbine, so that the base is the methyl ester of yohimboaic acid. Spiegel (this J., 1903, 228) atrributes the formula, $C_{20}H_{26}N_2O_4$, to the acid formed by hydrolysis, which he names noryohimbine. Yohimbine hydrochloride is the salt chiefly employed in medicine; in this the base, $C_{22}H_{30}N_2O_4$, occurs as the anhydride, the hydrochloride having the formula, $C_{22}H_{28}N_2O_3.HCl$. It forms white crystals, m.pt. 287° C. (other authorities give 290° C.). It is stable in the light and air, and sparingly soluble in boiling water. Yohimbine is precipitated by most alkaloidal reagents. The solution in strong nitric acid, is at first colourless, but soon acquires a deep yellow tint, which is permanent on heating; on adding excess of sodium hydroxide, the colour is changed to orange-red. With Erdmann's reagent (nitric and sulphuric acids), it gives at first a dark bluish-black colour, passing to greenish, then to yellowish-brown. The blue-violet colour reaction with sulphuric acid and potassium bichromate described under yohimbi bark, is characteristic. Since yohimbine hydrochloride has, like cocaine hydrochloride, an anæsthetic action, the following reactions serve to distinguish the two salts. With gold chloride solution, a 0·5 per cent. aqueous solution of cocaine hydrochloride gives a bright yellow micro-crystalline precipitate, sparingly soluble in strong hydrochloric acid; yohimbine hydrochloride gives a greyish-violet amorphous precipitate, soluble in hydrochloric acid. With Nessler's reagent cocaine gives a white crystalline precipitate; the yohimbine precipitate is amorphous. When heated with strong sulphuric acid, cocaine gives an odour like that of methyl benzoate; yohimbine, a menthol-like odour. Cocaine gives no colour reactions with strong nitric acid even when subsequently treated with excess of alcoholic potassium hydroxide. Cocaine also gives no colour with strong sulphuric acid and bleaching powder; yohimbine gives an intense orange colour. With strong sulphuric acid and potassium bichromate, cocaine gives only a green colour on warming. With mercurous chloride, cocaine gives a black colour; yohimbine does not react. Cocaine does not reduce ammoniacal silver nitrate. Reichard has described other reactions of yohimbine (this J., 1907, 1213).—J. O. B.

Belladonna; Alkaloidal value of American cultivated ——. J. Rippetoe. Amer. J. Pharm., 1907, **79**, 523—524.

The dried leaves of the first year's growth of belladonna plants, cultivated in Virginia, gave 0·32 per cent. of total mydriatic alkaloids. In the following year, the leaves, in July, when the plants were flowering, gave 0·68 per cent., and in October, 0·48 per cent.; the root, at this time, gave 0·38 per cent. of total alkaloids. One such plant yielded 7 ounces of dried leaves and 5 ounces of dried root. Although the amount of alkaloid in the root is below the U.S.P. standard (0·5 per cent. of total alkaloids) it is superior to the bulk of the root at present imported from Europe to America, which has shown a marked deterioration in quality during recent years.
—J. O. B.

Sparteïne. Isomerisation of α-methylsparteine. C. Moureu and A. Valeur. Compt. rend., 1907, **145**, 1184—1185.

When α-methylsparteine dihydriodide is heated in a sealed tube at 125° C., with twice its weight of water, and the product decomposed with sodium carbonate, a white crystalline monomethiodide, $C_{15}H_{26}N_2.CH_3I$, is obtained which has the optical rotation, $\alpha_D = -16\cdot8$, and differs from the two known sparteine methiodides. The authors show that this is the methiodide of a new base which they call *iso*sparteine. The same methiodide is produced in a small yield when α-methylsparteine dihydriodide is decomposed by an alkali. If α-methylsparteine is heated on the boiling-water bath with a slight excess of *N*/1 sulphuric acid until the liquid no longer reduces permanganate, and the product neutralised with baryta water and treated with barium iodide, the compound of *iso*sparteine of formula, $C_{15}H_{26}N_2.CH_3I.HI+H_2O$, may be isolated. When this is heated, methyl iodide is expelled, and *iso*sparteine hydriodide is formed; this is also obtained by the action of heat on α-methylsparteine dihydriodide at 225—230° C. —J. C. C.

Barbaloïn; Transformation of —— into an isomeric aloïn; β-barbaloïn, and occurrence of the latter in certain aloes. E. Léger. Compt. rend., 1907, **145**, 1179—1181.

When barbaloïn is heated for 3 hours at 160—165° C., it loses its water of crystallisation and is transformed into an optically isomeric form to which the name β-barbaloïn is given. β-Barbaloïn does not crystallise, but a crystalline tetrachloro-derivative is obtained when the crude product is treated with boiling absolute alcohol to extract barbaloïn, and the residue acted on with hydrochloric acid and potassium chlorate. Yellow, prismatic needles of formula, $C_{21}H_{16}O_9Cl_4+5H_2O$, are produced differing from the corresponding chloro-derivative of barbaloïn which forms prisms. β-Barbaloïn was found to occur in aloes from Cape Colony, Uganda, and Socotra.—J. C. C.

Rottlerin. F. Herrmann. Arch. Pharm., 1907, **245**, 572—585.

The results of the author's examination of rottlerin differ from those of A. G. Perkin (this J., 1893, 672). Perkin's iso-rottlerin appears to be identical with rottlerin, but Perkin's formula, $C_{33}H_{30}O_9$, for the latter substance is confirmed. The oxidation of rottlerin in alkaline solution by means of hydrogen peroxide led to the formation of benzoic and cinnamic acids. When decomposed by sodium or potassium hydroxide in the presence of nascent hydrogen, rottlerin yields methylphloroglucinol and dimethylphloroglucinol. If the resinous by-products of the decomposition of rottlerin in alkaline solution be cautiously oxidised by hydrogen peroxide, a new dibasic carboxylic acid, $C_{17}H_{16}O_4$, is produced, which melts at 184° C. It appears to have the constitution, $CH_3(1)COOH(4)C_6H_3(2)CH_2(2)C_6H_2CH_3(1)COOH(4)$. —F. Shdn.

Vanillin; Methylation of —— by means of methyl sulphate. H. Decker and O. Koch. Ber. 1907, **40**, 4794—4795.

The method devised by the authors for the methylation of vanillin, avoids the use of a large excess of methyl sulphate. Vanillin (1 mol.) is dissolved in ten per cent. less than the equivalent amount (1 mol.) of methyl sulphate on the water-bath. Whilst this liquid is hot, a solution of one molecular proportion of potassium (not sodium) hydroxide is added in drops. After the reaction has subsided, the liquid is made slightly alkaline, causing the separation of two layers. The upper layer is removed with ether, and the ether distilled off, leaving pure colourless veratraldehyde. The yield is about 97 per cent. of the theoretical.—F. Shdn.

Cholesterol; Salicylic acid ester of ——. L. Golodetz. Chem.-Zeit., 1907, **31**, 1215.

Cholesteryl salicylate was prepared by heating a mixture of one part of pure cholesterol and two parts of salicylic acid for 4 hours at 160°—170° C. until the fused mass became blackish-brown. It was then boiled with 10 times its volume of 90 per cent. alcohol, the liquid filtered whilst hot, and the residual cholesteryl salicylate repeatedly washed with hot alcohol and finally recrystallised from a mixture of equal volumes of alcohol and ether. The yield of pure ester was about 60 per cent. of the theoretical. It contained no water of crystallisation, and its weight remained constant when dried at 110° C. It melted at 173° C., and had a composition corresponding to the formula, $OH.C_6H_4COO.C_{26}H_{43}$. It dissolved with difficulty in alcohol (about 1 in 500), but was much more soluble in ether and chloroform, and in a hot mixture of equal parts of alcohol and ether (1 in 100). It could be quantitatively separated into its constituents by saponification with alcoholic potassium hydroxide solution.—C. A. M.

Spirosal. [*Glycol salicylic ester*]. Pharm. Zentralh., 1907, **48**, 568; J. Pharm. Chim., 1907, **26**, 543.

The glycol ester of salicylic acid (spirosal), $OH.C_6H_4.CO_2.CH_2.CH_2.OH$, is a colourless, oily liquid, b. pt. 169—170° C. at 12 mm.; soluble in water, 1 : 110, in olive oil, 1 : 8, readily soluble in ether, alcohol, chloroform and petroleum spirit; miscible in all proportions with oils. Spirosal is readily hydrolysed. It should not be coloured by sulphuric acid.—J. O. B.

Mercury peroxide. G. Pellini. Atti R. Accad. Linc. 1907, 408. Apoth.-Zeit., 1907, **22**, 1022.

Five c.c. of a solution of 32 grms. of mercuric chloride in 100 c.c. of alcohol are mixed with 10 c.c. of 30 per cent., hydrogen peroxide, diluted with a little alcohol, the mixture being cooled to 0° C.; the requisite quantity of an alcoholic solution of potassium hydroxide is then added. The yellow precipitate at first formed becomes red on shaking; this is washed with ether cooled to 0° C. Mercury peroxide, HgO_2, thus obtained is a bright red amorphous substance, decomposed by contact with water, forming mercuric oxide and hydrogen peroxide; soluble in acids, with formation of hydrogen peroxide and the corresponding mercuric salts.—J. O. B.

Patents.

Dichloro-ethylene from symmetrical tetrachloro-ethane; Process for the manufacture of ——. P. Askenasy and M. Mugdan, Nürnberg, Germany. Eng. Pat. 19,576, Aug. 31, 1907.

Half of the chlorine is almost quantitatively removed from symmetrical tetrachloro-ethane (see Eng. Pat. 18,602 of 1904; this J., 1905, 150) by treatment with zinc, iron, or aluminium, or their alloys, in presence of water. Tetrachloro-ethane may, for example, be heated with half its volume of water, under a reflux condenser, to 60° C., and zinc dust added, with agitation, dichloro-ethylene being at once formed.—T. F. B.

Rare-earth metals; Method of making a solution of ——. C. Baskerville, New York, Assignor to Welsbach Light Co., Ltd., Gloucester, N.J. U.S. Pat. 873,205, Dec. 10, 1907.

Substances containing a rare earth metal or metals, or Welsbach mantle remnants, in a finely-divided state, are heated with an excess of hydrochloric acid, under high pressure, at a temperature of from 140° to 200° C., in order to obtain such rare earth metals in solution.—E. S.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

[*Gelatin*]; *The tanning action of certain colloidal oxides on ——.* Lüppo-Cramer. Z. Chem. und Ind. Kolloide, 1907, 2, 171—173.

Silver oxide, formed in gelatin by the action of sodium hydroxide on an excess of silver nitrate, converts the gelatin into a white opalescent substance which is insoluble in boiling water. After heating for some time, the colloidal silver oxide is reduced, and the gelatin dissolves

Silver peroxide possesses this tanning property in a stronger and more permanent degree; the compound may be formed by steeping a film of gelatin in a solution containing silver nitrate and ammonium persulphate. When 50 c.c. of a 10 per cent. solution of gelatin are mixed with 4 c.c. of a 2·5 per cent. solution of ammonium persulphate and then with 1·5 c.c. of 10 per cent. silver nitrate solution, the mixture remains fluid sufficiently long to be spread on a glass plate. After 5—10 minutes it coagulates and becomes insoluble in hot water. The compound is remarkably stable and resists the moderate action of alkalis, acids and the specific solvents of silver salts; it is only partially reduced by photographic developers. A similar condition of the gelatin is brought about by treating a silver negative with persulphate. Silver peroxide will coagulate solutions of gum arabic, provided they are sufficiently concentrated. Mercuric oxide and copper oxide, when formed in gelatin, behave in a similar manner to silver oxide. Lead oxide has no tanning action, but ferrous oxide causes a temporary coagulation. Soluble albumin withdraws silver oxide from a solution of silver nitrate forming the insoluble silver albuminate, and the silver is not entirely removed from the compound on fixing in thiosulphate. The resistance of the silver albuminate to fixing may account for the rapidity with which prints on albumin paper become discoloured. Treatment of the fixed silver-albumin print with photographic developers causes a darkening which may be cleared with nitric acid, but even then the albumin remains insoluble and still contains silver. Albumin coagulated by copper sulphate, on the other hand, becomes soluble again when the copper is removed by potassium oxalate or by ammonia.—J. F. B.

Patents.

Photographic dry plates; Manufacture of ——. L. Husson and A. F. Bornot, Philadelphia. Eng. Pat. 25,728, Nov. 14, 1906.

An ordinary photographic dry plate, sensitive to colour, is coated with a thin layer of wax or similar repellent substance, and a solution of a colouring matter and glycerin or glucose in alcohol, etc., is applied to the surface and dried, thus providing a colour filter on the plate itself.—T. F. B.

Fixing photographic images; Agent for ——. A. G. Bloxam, London. From Act.-Ges. f. Anilinfabr., Berlin. Eng. Pat. 25,869, Nov. 15, 1906.

The use of ammonium thiosulphate as a fixing agent in photography is claimed. It is stated that, under similar conditions, its action is twice as rapid as that of sodium thiosulphate, and also that its solutions keep their fixing power after being used several times, better than the sodium salt. The ammonium salt need not be used as such, it being sufficient to add a suitable quantity of an ammonium salt to a solution of sodium thiosulphate: the sodium salt may also be present in excess in the fixing bath.—T. F. B.

Photographic emulsion. J. T. Gateau. Fr. Pat. 380,188, July 24, 1907. Under Int. Conv., Sept. 19, 1906.

Emulsions for pigment papers are prepared from caseins, globulins, or acid albumins or alkali albumins, sensitised with ferric, ceric, or uranic salts in addition to the pigment. They are stated to be far more stable when sensitised than the chromated gelatin or gum emulsions, and quite as rapid. After exposure behind a negative, the paper is developed by means of a solvent for the albuminoid, *e.g.*, ammonia, alkali carbonate, or potassium oxalate solution.—T. F. B.

Gelatin solutions; Stable —— *and preparation of the same.* J. C. G. Larguier des Bancels. Fr. Pat. 380,410, July 31, 1907.

Neutral solutions of gelatin, imputrescible, and stable at ordinary temperatures, may be obtained by employing as solvents, solutions of neutral salts of polyvalent metals, especially nitrates, in mixtures of alcohol and water, or acetone and water. The solutions are specially suitable for use in photography.—H. G. B.

XXII.—EXPLOSIVES, MATCHES, &c.

Safety explosives; Aluminium instead of carbon for ——. J. A. Fürstenhoff. Eng. and Min. J., 1907, **84**, 1058.

It is proposed in using liquid-air explosives, to replace the carbon or carbonaceous matter by aluminium or other suitable metals, whilst in order to increase the rapidity of the reaction between the metal and the oxygen, a metallic hydroxide or a mixture of hydroxides is also added. For example, powdered aluminium is mixed with a certain quantity of the mixed hydroxides of calcium and sodium, and filled into a cartridge which is then put in place, and the necessary quantity of liquid air or liquid oxygen introduced. Detonation is effected by means of fulminate, or the cartridge is ignited by the flame from magnesium ribbon. No noxious products are formed, and there is no flame.—A. S.

Red and white phosphorus; Non-existence of a common solvent for ——. A. Colson. *See* VII.

XXIII.—ANALYTICAL CHEMISTRY.

INORGANIC—QUALITATIVE.

Zinc; Detection of small quantities of —— *electrolytically.* W. Neumann. Z. Elektrochem., 1907, **13**, 751—752.

The author finds that the electrolytic separation of zinc from an alkaline zincate solution upon a polished copper wire, which serves as a cathode, enables exceedingly small quantities of this metal to be detected. The zinc is deposited in a bright metallic form even from very dilute solutions, although the time taken for the deposition increases greatly with the dilution. A simple form of apparatus is described, consisting of a glass tube closed at one end, a platinum anode sealed into a capillary tube, and a copper wire one-tenth of a millimetre diameter. Taking 1/10 c.c. of a 1/40,000th molar solution of zinc, the metal was recognisable although it amounted to only 0·16 millionth of a gram.—R. S. H.

INORGANIC—QUANTITATIVE.

Titanium; Separation of —— *from zirconium and from thorium.* M. Dittrich and S. Freund. Z. anorg. Chem., 1907, **56**, 344—347.

On adding a solution of ammonium salicylate to a neutral solution of titanium and zirconium salts, basic salicylates of these metals are precipitated. But, while the basic salicylate of titanium is completely soluble in hot water and does not come down on boiling a dilute solution, a solution of a zirconium salt gives an ammonium zirconium salicylate which is quantitatively precipitated under these circumstances. In practice the carefully neutralised solution of the nitrates is added, drop by drop, to a boiling solution of ammonium salicylate (about 10 grms. in 50 c.c.). The liquid is boiled for some time, concentrated somewhat, and filtered as hot as possible. The precipitate is then washed with a strong boiling solution of ammonium salicylate till only a faint colour appears, dried, ignited in the blowpipe flame and weighed as zirconium dioxide. If it be shown to still retain titanium, the precipitation, from a solution of the nitrate, must be repeated. In the filtrate titanium may be estimated by boiling for a long time with excess of ammonia, and igniting and weighing the titanic acid so produced.

By precisely similar means, thorium can be separated from titanium in a solution containing the nitrates of the two metals. The basic salicylate of thorium, like that of zirconium, is precipitated by ammonium salicylate from a boiling dilute solution of the neutral nitrate. The same precautions must be taken, reprecipitating if necessary.—C. A. W.

Thorium, titanium, and zirconium from iron; Separation of ——. M. Dittrich and S. Freund. Z. anorg. Chem., 1907, **56**, 348—352.

It has been shown that if sodium acetate be added to a boiling dilute solution of the salts of titanium, thorium, zirconium, and iron, the iron alone will remain in solution, provided it be present in the ferrous condition, the other metals being precipitated as basic acetates. This gives a method for their separation from iron or manganese. In practice weighed quantities of the oxides are converted into sulphates by extracting the sodium pyrosulphate melt with water. After reduction with sulphuretted hydrogen and subsequent neutralisation, a solution of sodium acetate is added, the whole made up to 500—600 c.c., and boiled for 1—2 hours in a current of carbon dioxide, water being replaced as it evaporates. The precipitate is allowed to settle, filtered off quickly, and well washed with hot water. After drying, it is mixed with ammonium carbonate and ignited, gently at first, finally in the blowpipe flame. It consists of the mixed oxides of titanium, thorium, and zirconium, and should be free from iron; if this is not so, the precipitation must be repeated. In order to separately estimate the three metals, the sulphates obtained from the sodium pyrosulphate melt, after removal of iron, are dissolved in water, and the oxides, obtained by precipitation with ammonia, dissolved in the least quantity of nitric acid. The thorium and zirconium are now precipitated as described in the preceding abstract, and titanium is precipitated from the filtrate with ammonia. In order to separate thorium and zirconium, regard is had to the greater solubility, under certain conditions, of zirconium oxalate as compared with the corresponding salt of thorium.—C. A. W.

Metallic oxides; Auto-reduction of —— in the cathode-ray vacuum. Volatility of the corresponding sulphides. F. Damm and F. Krafft. *See* VII.

Sodium monosulphide; Volumetric determination of ——. E. Podreschetnikoff. *See* VII.

Telluride ores; Assay of ——. G. T. Holloway and L. E. B. Pearse. *See* X.

ORGANIC—QUALITATIVE.

Yohimbi bark and yohimbine [; Characteristic reactions of ——. G. Weigel. *See* XX.

ORGANIC—QUANTITATIVE.

Sucrose; Polarimetric determination of ——. III. F. Watts and H. A. Tempany. *See* XVI.

Cocoanut oil; Detection of —— in butter fat. T. R. Hodgson. *See* XVIII*A*.

Hydrocellulose and cellulose hydrates. [Determination of water of hydration.] C. G. Schwalbe. *See* XIX.

XXIV.—SCIENTIFIC & TECHNICAL NOTES.

Alcohols; Action of metallic calcium on ——. F. Mollwo Perkin and L. Pratt. Chem. Soc. Proc., 1907, 23, 304.

It has been stated that metallic calcium has no action on alcohol, and may therefore be employed as a dehydrating agent for alcohols. The authors find, however, that, when metallic calcium is allowed to remain in contact with ethyl or methyl alcohol for from thirty to sixty minutes, reaction ensues and may become very vigorous. Once started the reaction continues to completion, according to the equation: $2CH_3{\cdot}OH + Ca = (CH_3{\cdot}O)_2Ca + H_2$.

If the mixture is heated to the boiling point of the alcohol, the reaction proceeds much more rapidly. With propyl, isobutyl, amyl, and benzyl alcohols, the reaction takes place exceedingly slowly at the ordinary temperature, but is complete in the course of a few hours at the boiling point of the alcohol. Analysis shows the white, amorphous powder obtained in all cases to be $(Alk{\cdot}O)_2Ca$.

Patent.

Heat; Composition for storing ——. J. P. Serve. Fr. Pat. 380,608, Aug. 7, 1907.

The claim is for the use of a solution of calcium chloride in glycerin for this purpose. The best proportions are said to be 40 parts by weight of the former to 100 of the latter.—W. H. C.

New Books.

Valentin's Practical Chemistry. By W. R. Hodgkinson, Ph.D., Professor of Chemistry and Physics in the Ordnance College, Woolwich, etc. Tenth edition. J. and A. Churchill, 7, Great Marlborough Street, London. 1908. Price 9s.

8vo volume, containing a frontispiece, a map of spectra, 464 pages of subject matter, with 95 illustrations, including a series of micro-photographic plates representing the sectional structures of various alloys and metals, and an illustration of Crookes' Lemniscate diagram of the synthesis of the elements. The work ends with an alphabetical index of subjects. The subject matter is classified somewhat after the following scheme:—I. Nature and composition of atmospheric air. II. Rusting or oxidation of metals. III. Composition of water, etc. IV Carbon and its compounds. V. Sulphur. VI. Quantitative exercises. VII. Volumetric analysis. VIII. Molecular weight. IX. Analytical groups. Reactions of metals of group V. Classification of metals. X. Reactions of metals of groups IV., III., II., and I. XI. Non-metallic elements. XII. Reactions of the acids. XIII. Qualitative analysis, including schemes of separation of metals, metals of the alkali group, and rare metals. XIV. Qualitative analysis of organic acids and other organic compounds, with plan of separation of some organic (liquid) compounds. XV. Alkaloids; alkali and colour reactions of non-volatile alkaloids. XVI. Table of solubility of salts, in water and acids. XVII. Methods of writing formulæ. XVIII. Reagents.

A Textbook of Organic Chemistry. By A. F. Holleman, Ph.D., Professor ord. in the University of Amsterdam. Translated from the third Dutch edition by A. Jamieson Walker, Ph.D., B.A., assisted by O. E. Mott, Ph.D., with the co-operation of the Author. Second Edition in English; rewritten. John Wiley and Sons, New York, U.S.A. Chapman and Hall, Limited, London. 1907. Price 10s. 6d.

8vo volume, containing 562 pages of subject matter, with 78 illustrations, and an alphabetical index. The subject matter is classified as follows:—I. Introduction. Development of organic chemistry. Qualitative and quantitative analysis. Molecular weight determination. Laboratory methods. Classification of organic compounds. First Part. The fatty compounds. Second Part. The aromatic compounds and substances related to them. Orientation of aromatic compounds. Hydrocyclic or hydroaromatic compounds. Condensed benzene rings. Heterocyclic compounds. Condensation products of benzene and heterocyclic nuclei. Alkaloids. Proteids.

Organic Chemistry, including certain portions of Physical Chemistry, for Medical, Pharmaceutical, and Biological Students. (With Practical Exercises.) By H. D. Haskins, B.A., M.D., Professor of Chemistry, Cleveland School of Pharmacy, and J. J. R. Macleod, M.B., etc., Professor of Physiology, Western Reserve University. First Edition. John Wiley and Sons, New York, U.S.A. Chapman and Hall, Limited, London. 1907. Price 8s. 6d. net.

Small 8vo volume, containing 351 pages of subject matter, including 7 pages of tabulated matter, and an alphabetical index. There are 24 illustrations. The subject matter is subdivided and classified as follows:—I. Nature and composition of organic compounds. II. Purification and identification of substances. III. Elementary analysis. IV. Molecular weight determination. Colloidal solutions, etc. V. Fatty compounds. VI. Saturated hydrocarbons. VII. Ethers. VIII. Primary alcohols. IX. Fatty acids and esters. X. Secondary alcohols. Ketones. XI. Diacid alcohols and dibasic acids. XII. Triacid alcohols, fats, and soaps. XIII. Nitrogen derivatives (also phosphorus and sulphur compounds). XIV. Hydroxy-acids. Amino acids and acid amides. XV. Carbohydrates and glucosides. XVI. Unsaturated hydrocarbons and derivatives. XVII. Cyclic compounds. Camphors and terpenes. XVIII.

Aromatic hydrocarbons; halogen and hydroxy compounds. XIX. Aromatic acids; also nitrogen and sulphur derivatives, &c. XX. Aromatic bases with nitrogen in the nucleus. XXI. Alkaloids and drug principles.

The Manufacture and Comparative Merits of White Lead and Zinc White Paints. By G. Petit. Translated from the French by Donald Grant. Scott, Greenwood and Son, "Oil and Colour Trades Journal" Offices, 8, Broadway, Ludgate Hill, London, E.C. 1907. Price 4s. net. The Copp Clark Co., Ltd., Toronto, Canada. D. van Nostrand Co., New York, U.S.A.

Small 8vo volume, containing 90 pages of subject matter, and an alphabetical index. The matter is classified as follows:—I. Fundamental principles of painting in oil basis; colouring principle; vehicle; thinners; driers. II. Different varieties of white lead. Dutch, French, and English processes. Hot chamber process. Krem's process. Grinding white lead in oil. III. White lead substitutes, etc. Lithopone. Zinc sulphide. Various whites, etc. IV. White lead paints—merits and defects. V. Toxicology of white lead. VI. Zinc white. Manufacture. Various brands. Manufacture from metal and ore. VII. Grinding zinc white with oil. Livache's law. VIII. Zinc white paint—merits and defects.

Patent List.

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

Applications.

27,713. Wegener. Composition for preventing scale in boilers. Dec. 16.

27,798. Ruthenberg. Wood-wool for filtering purposes.* Dec. 17.

27,927. Boult (Fritzsche und Co., and Verona Chemical Co.). Oxidation processes.* Dec. 18.

27,932. Wack. Oxidising process.* Dec. 18.

28,116. Peat. *See under* X.

28,163. Wollaston. Apparatus for evaporating and concentrating corrosive liquids. Dec. 21.

28,356. Williamson. Centrifugal drying machines.* Dec. 24.

Complete Specifications Accepted.

28,698 (1906). Clauss and Lewisson. Storing and handling liquids. Dec. 27.

1692 (1907). Kunick. Apparatus for drying liquids. Dec. 27.

2800 (1907). Krepper. Continuous stills. Dec. 27.

15,256 (1907). Worsley. Filters. Dec. 27.

17,056 (1907). Ilges. Apparatus for rectifying mixtures of liquids. Dec. 27.

II.—FUEL, GAS, AND LIGHT.

Applications.

27,794. Vivian. Manufacture of artificial fuel. Dec. 17.

27,833. Cowper-Coles. Furnaces for producing smokeless fuel.* Dec. 17.

27,923. Wilton. Distillation or carbonisation of coal. Dec. 18.

27,939. Huber. Incandescent gas mantles. [Ger. Appl., Dec. 18, 1906.]* Dec. 18.

28,039. Hammond and Cash. Production of water gas. Dec. 19.

28,049. Fieschi. Coke furnaces. [Belg. Appl., Dec. 19, 1906.]* Dec. 19.

28,181. Rusby. Water gas apparatus. [U.S. Appl. Jan. 31, 1907.]* Dec. 21.

28,290. Von Bauer. Coke ovens for the recovery of by-products.* Dec. 23.

28,387. Kirkham, Hulett, and Chandler, Ltd., and Hersey. Washer-scrubbers for purifying coal and other gases. Dec. 24.

28,390. Feld. Treatment and purification of gases. [Ger. Appl., June 14, 1907.]* Dec. 24.

28,407. Delage. Refractory bodies for heating by radiation. [Fr. Appl., Feb. 27, 1907.]* Dec. 24.

28,429. Lane. Production of ethylene. Dec. 24.

28,692. White. Treatment and distillation of coal. Dec. 31.

Complete Specifications Accepted.

21,504 (1906). British Thomson-Houston Co. (General Electric Co.). Manufacture of electric conductors of refractory metal especially incandescing bodies in electric lamps. Dec. 31.

29,396 (1906). Barker and White. Production of gas for power purposes. Dec. 31.

29,752 (1906). Feld. Treatment of coal gases, etc., in recovering tar and ammonia. Dec. 31.

7076 (1907). Bellamy and Bellamy. Production of gas. Dec. 27.

8022 (1907). Dingler. Production of compressed carburetted air suitable for transport. Dec. 31.

17,137 (1907). Jones. Coke ovens. Dec. 27.

17,986 (1907). Carroll. Water gas apparatus. Dec. 27.

IV.—COLOURING MATTERS AND DYESTUFFS.

Applications.

27,944. Bloxam (Act.-Ges. f. Anilinfabr.). Manufacture of polynitrated halogen derivatives of the aromatic series. Dec. 18.

28,104. Newton (Bayer und Co.). Manufacture of anthracene derivatives. Dec. 20.

28,266. Newton (Bayer und Co.). Manufacture of a yellow colouring matter. Dec. 23.

28,492. Newton (Bayer und Co.). Manufacture of diphenylnaphthylmethane dyestuffs. Dec. 27.

28,493. Newton (Bayer und Co.). Manufacture of an anthracene dyestuff. Dec. 27.

28,514. Johnson (Badische Anilin und Soda Fabrik). Manufacture of compounds and colouring matters of the anthracene series. Dec. 27.

Complete Specification Accepted.

9546 (1907). Imray (Soc. Chem. Ind. in Basle). Manufacture of chlorinated derivatives of indigo. Dec. 31.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

Applications.

27,737. Gottlieb. Obtaining coloured patterns in textiles. Dec. 16.

27,863. Read Holliday and Sons, Ltd., and Whittaker. Dyeing mixed fabrics. Dec. 18.

27,963. Yates. Apparatus for mercerising, bleaching, and dyeing yarn. Dec. 19.

28,057. Dowie. Treatment of wool combers' effluents. Dec. 19.

28,060. Pugh and Read. Dyeing cotton and the like. Dec. 20.

28,186. Fitchett and others. Scouring, dyeing, and analogous machines. Dec. 21.

28,315. Rothwell-Jackson. Kiers for bleaching. Dec. 24.

28,510. Rothemann. Apparatus for dyeing and bleaching spools with paper sleeves. [Ger. Appl., Dec. 27, 1906.]* Dec. 27.

Complete Specifications Accepted.

592 (1907). Lilienfeld. Producing impressions fast to water on textile fabrics. Dec. 27.

845 (1907). Hoffmann. Manufacture of an elastic fibrous tissue. Dec. 27.

6434 (1907). Calico Printers' Assoc., and Hindle. Printing textile fabrics. Dec. 27.

16,715 (1907). Evans and Sons, and Evans. Wood rollers for use in dyeing, finishing, and bleaching. Dec. 31.

VII.—ACIDS, ALKALIS, AND SALTS.

Applications.

27,738. Petersen. Lead chamber process of making sulphuric acid. [Ger. Appl., Dec. 15, 1906.]* Dec. 16.

27,965. Warner. Stills for ammoniacal liquor. Dec. 19.

28,058. Radcliffe. Distillation of ammoniacal liquor. Dec. 20.

28,063. Radcliffe. Distillation of ammoniacal liquor. Dec. 21.

28,064. Radcliffe. Apparatus for treating spent liquor from ammoniacal liquor. Dec. 21.

28,065. Thwaites. Treating liquors containing zinc. Dec. 21.

28,280. Bauke. Purification of sulphur containing water.* Dec. 23.

Complete Specifications Accepted.

29,752 (1906). Feld. *See under* II.

8476 (1907). Johnson (Chem. Fabr. Griesheim-Elektron). Manufacture of chlorine compounds of lime. Dec. 27.

8653 (1907). Bender. Making oxygen compounds from the elements at a high temperature. Dec. 27.

20,868 (1907). Fischer. Manufacture of hydrogen peroxide. Dec. 31.

VIII.—GLASS, POTTERY, AND ENAMELS.

Application.

27,714. Andris. Glass melting furnaces.* Dec. 16.

Complete Specifications Accepted.

28,297 (1906). Meakin and Jackson. Kilns for firing or drying ceramic and similar wares. Dec. 27.

18,162 (1907). Milliron and Irwin. Glass working furnaces. Dec. 31.

20,975 (1907). Oppermann. Manufacture of sheet glass. Dec. 31.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Applications.

28,020. Greville. Kilns or furnaces for making cement. Dec. 19.

28,180. Bos, and Delastre et Cie. Manufacture of agglomerates for building. [Fr. Appl., Dec. 26, 1906.]* Dec. 21.

28,188. Jensen. Manufacture of cement.* Dec. 21.

28,216. Greville. Manufacture of cement.* Dec. 21.

28,355. Whitehead. Preserving and drying timber. Dec. 24.

28,555. Chateau and Merklen. Impregnating wood and like material. Dec. 28.

28,745. Schruf. Artificial stone and mortar impermeable to water.* Dec. 31.

Complete Specifications Accepted.

41 (1907). Barnett. Cement. Dec. 31.

8161 (1907). Schnell, Mayer, and Hartwich. Wood substitute. Dec. 27.

15,764 (1907). Collos Portland Cement Co. (Colloseus). Manufacture of cement from slag. Dec. 31.

X.—METALLURGY.

Applications.

27,922. Angel. Treatment of complex sulphide and other ores. Dec. 18.

28,048. Burden. Coating metals with metals or metallic compounds. Dec. 19.

28,056. Fogarty. Solder for aluminium. Dec. 19.

28,116. Peat. Retorts or ovens for retorting ores, shale, or other substances. Dec. 20.

28,191. Ruthenburg. Ore separating process. Dec. 21.

28,207. Rübel. Manufacture of steel alloys.* Dec. 21.

28,342. Griffiths. Separation of lead from zinc vapours. Dec. 24.

28,511 Guggenbühl. Solder for aluminium.* Dec. 27.

28,637. Johnson (Fellner und Ziegler). Preparation of efflorescent ores for smelting. Dec. 30.

28,650. Burden. Furnaces and muffles for coating metals with metals. Dec. 30.

28,687. Wibrin and Wibrin. Aluminium solder.* Dec. 31.

Complete Specifications Accepted.

906 (1907). Cowper-Coles. Removal of scale or oxide from metallic surfaces. Dec. 31.

1431 (1907). Boult (Brokelt und Nordböhmische Automobil Zentrale). Soldering aluminium or its alloys. Dec. 27.

4313 (1907). Cowper-Coles. Removing scale and oxide from metallic surfaces. Dec. 27.

6010 (1907). Morgan Crucible Co. (Herbert.) Separation of the constituents of ores and the like. Dec. 27.

13,978 (1907). Cowper-Coles. Production of vanadium alloys. Dec. 31.

14,157 (1907). Fitz Payne. Soldering aluminium. Dec. 27.

14,538 (1907). Wedekind (Dünkelberg). Briquetting ores, blast furnace flue dust, etc. Dec. 27.

14,924 (1907). Lindemann. Crucible furnace. Dec. 31.

15,419 (1907). Wilfley. Ore roasting process. Dec. 27.

16,351 (1907). Juppont and Teil. Metallic alloy. Dec. 31.

17,613 (1907). Plathner and Dorn. Coating metals. Dec. 27.

18,398 (1907). Biewend. Manufacture of steel and electric induction furnaces therefor. Dec. 27.

21,961 (1907). Von Zelewski. Mechanical roasting furnace. Dec. 31.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

Applications.

27,790. Helbig. Oxidising atmospheric nitrogen by electricity.* Dec. 17.

27,830. Gibbs. Electrolytic cells.* Dec. 17.

28,106. Tate. Storage battery plates.* Dec. 20.

28,132. Tate. Storage battery plates.* Dec. 20.

28,542. Hiorth. Electric induction furnace. [Appl. in Norway, Jan. 4, 1907.]* Dec. 28.

Complete Specifications Accepted.

29,019 (1906). Gröndal-Kjellin Co., and Härdén. Electric induction furnaces. Dec. 27.

29,300 (1907). Cowper-Coles. Electrodeposition of iron. Dec. 27.

29,655 (1906). Ruthenburg. Electrolytic apparatus. Dec. 31.

1197A (1907). British Thomson-Houston Co. (General Electric Co.). Treatment of refractory materials by electricity. Dec. 27.

5574 (1907). British Thomson-Houston Co. (General Electric Co.). Insulating material. Dec. 27.

16,098 (1907). Cowper-Coles. Apparatus for electroplating. Dec. 27.

17,492 (1907). Finlay. Anode for electrolysis. Dec. 27.

18,398 (1907). Biewend. *See under* X.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

Applications.

28,364. Bernard. Carbon tetrachloride plant for extraction of fatty matters.* Dec. 24.

28,373. Rademacher. Preparation of fat with vegetable flavour.* Dec. 24.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc.

(*A*.)—Pigments, Paints.

Applications.

27,747. Albert. Production of zinc colours indifferent to the action of light. Dec. 16.

28,109. Horn. Ships' paints. [Ger. Appl., Dec. 28, 1906.]* Dec. 20.

28,189. Wegelin A.-G. f. Russfabr. und Chem. Ind. Manufacture of lamp black.* Dec. 21.

28,424. Winter. Manufacture of pigmental lakes.* Dec. 24.

(*B.*)—Resins, Varnishes.

Application.

28,009. Wetter (Knoll und Co.). Manufacture of resinlike products from phenol and formaldehyde.* Dec. 19.

(*C.*)—India-Rubber.

Application.

28,365. Immisch. Manufacture of ebonite and vulcanite. Dec. 24.

Complete Specifications Accepted.

10,848 (1907). Sandmann. Obtaining rubber, gutta percha, and balata from lactescent plants. Dec. 31.

16,325 (1907). Gammeter. Vulcanising rubber. Dec. 31.

22,640 (1907). Olsson. Manufacture of resilient substances. Dec. 27.

XIV.—TANNING, LEATHER, GLUE, SIZE, Etc.

Application.

28,743. Pianko and Knaster. Manufacture of waterproof, fast-coloured leather from split leather.* Dec. 31.

Complete Specifications Accepted.

16,887 (1907). Inouye and Dogura. Manufacture of leather. Dec. 27.

19,019 (1907). Weiss. Extracting glue from mineral dressed leather. Dec. 27.

XVII.—BREWING, WINES, SPIRITS, Etc.

Applications.

27,854. House. Process of brewing. Dec. 17.

28,153. Johnson. Obtaining clear distillers' wash from mohwa flowers. Dec. 21.

28,509. Stead and Palmer. Purifying carbon dioxide evolved in fermenting wort or mash. Dec. 27.

XVIII.—FOODS; SANITATION, WATER PURIFICATION; AND DISINFECTANTS.

(*A.*)—Foods.

Applications.

27,905. Atkinson. Preserving milk, etc. Dec. 18.

28,024. Justice (Cooke). Process of obtaining butterfat.* Dec. 19.

28,418. Wislocki. Manufacture of coffee extract.* Dec. 24.

Complete Specifications Accepted.

23,121 (1906). Tuite and Dederich. Sterilising and preserving processes. Dec. 27.

6636 (1907). Williams. Bleaching and ageing cereals and cereal products. Dec. 27.

16,664 (1907). Caverhill. Food product. Dec. 27.

(*B.*)—Sanitation; Water Purification.

Applications.

27,753. Candy. Treatment of sludge or deposit from sewage and the like. Dec. 17.

28,247. Radcliffe. Purification of effluents containing compounds of lime. Dec. 23.

Complete Specification Accepted.

29,596 (1906). Howard. Purification of water. Dec. 31.

XIX.—PAPER, PASTEBOARD, Etc.

Applications.

27,707. Verein Glanzstoff-Fabr. Manufacture of cellulose products. [Ger. Appl., April 22, 1907.]* Dec. 16.

27,948. Schopper. Testing paper pulp.* Dec. 18.

Complete Specification Accepted.

14,983 (1907). Scherf. Machines for treating paper. Dec. 31.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

Applications.

27,735. Boult (Radiogen Ges.). Radioactive preparations.* Dec. 16.

28,028. Schmitz und Co. Manufacture of isoborneol. [Ger. Appl., Dec. 19, 1906.]* Dec. 19.

28,036. Schmitz und Co. Manufacture of camphor. [Ger. Appl., Dec. 19, 1906.]* Dec. 19.

28,638. Clayton Aniline Co., Weizmann, and Friedl. Manufacture of isobornyl esters. Dec. 30.

28,646. Imray (Meister, Lucius, und Brüning). Manufacture of ethylthiosalicylic acid and its salts. Dec. 30.

28,723. Nitritfabrik Akt.-Ges. Production of formines. [Ger. Appl., Jan. 5, 1907.]* Dec. 31.

Complete Specifications Accepted.

5429 (1907). Goldsmith, and British Xylonite Co. Treatment of camphene. Dec. 31.

16,532 (1907). Zeitschel. Manufacture of esters of cyclic terpene alcohols. Dec. 31.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Applications.

28,397 and 28,398. Sefton-Jones (Nolan). Production of photographs in colours. Dec. 24.

28,614. Schwarz. Colour photography.* Dec. 30.

Complete Specifications Accepted.

2156 (1907). Cooper. Photographic printing-out papers. Dec. 31.

12,304 (1907). Wellcome, Bates, and Starnes. Photographic processes of toning and intensifying. Dec. 27.

19,889 (1907). Boerner. Producing pictures, photographic printing plates, etc. Dec. 27.

XXIII.—GENERAL ANALYTICAL CHEMISTRY.

Application.

28,316. Thorp. Calorimeters. Dec. 24.

Complete Specification Accepted.

1562 (1907). Wise (Jones-Julia Manuf. Co.) Method and apparatus for analysing gases. Dec. 31.

Journal of the Society of Chemical Industry.

No. 2, Vol. XXVII. JANUARY 31, 1908. No. 2, Vol. XXVII.

Official Notices.

APPOINTMENT OF HON. TREASURER.

Mr. Thomas Tyrer, Stirling Chemical Works, Stratford, London, E., has been appointed Hon. Treasurer of the Society.

ANNUAL INDEX, 1907.

In reply to numerous inquiries, the Index, 1907, will be issued with the February 15th number of the Journal.

DRAFT BY-LAWS.

AS FINALLY SETTLED BY THE COUNCIL.

Take Notice that in pursuance of the provisions of Clause 37 of the Charter a General Meeting of the Society will be held at the House of the Society of Arts, John Street, Adelphi, London, on Friday, the 13th day of March, 1908, at 3.30 o'clock in the afternoon, for the purpose of considering and adopting the draft By-laws, which, after due consideration of the observations received from members in response to the invitation in that behalf, have been finally settled by the Council, and a print of such finally settled By-laws is sent to each Member of the Society in this number of the Journal.

By order of the Council.

Charles G. Cresswell,
Secretary.

Liverpool Section.

Meeting held at University on Wednesday, Nov. 13, 1907.

DR. JAMES T. CONROY IN THE CHAIR.

THE HEAT-TREATMENT OF COPPER-ZINC ALLOYS.

Part I.—Muntz Metal.*

BY GUY D. BENGOUGH, M.A., AND O. F. HUDSON, B.SC.

The objects of the present investigation were three in number:

(*a*) To determine the effect of annealing at different temperatures and for different lengths of time, upon the mechanical properties of rolled Muntz metal.

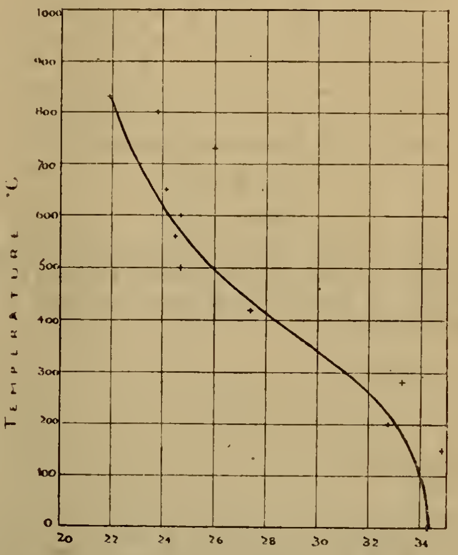
(*b*) To correlate the microstructures of the heat-treated bars, with the mechanical tests.

(*c*) To determine the behaviour of the heat-treated alloy under an impact test, and in particular, to ascertain how far the impact test corresponds with the elongation as determined in the tensile testing machine, which latter test is usually regarded as the measure of the ductility of an alloy.

Incidentally the work done under the above headings, affords additional evidence of the correctness of Shepherd's views as to the constitution of the copper-zinc alloys—views which the authors had arrived at independently as far as the copper-rich end of the series is concerned, but which are much at variance with those of the earlier workers on the same subject, notably Charpy, Le Chatelier, Roberts-Austen, and Behrens.

It is well known that, in general, the effect of work on cast metals and alloys is to strengthen and improve them. This change in properties is expressed in the ordinary mechanical tests by increases in the maximum stress and the elongation. The effect on alloys of the brass type has been recognised qualitatively since the early days of its manufacture. Charpy, in 1896,(1) attempted a quantitative investigation of this matter, and his results are plotted on Diagram No. 1. He used hard rolled Muntz metal of the best commercial quality, containing copper 59·2 per cent., zinc 40·4 per cent., and other impurities 0·4 per cent., chiefly lead, tin and iron. The bars were annealed at the temperatures shown on the diagram for 30 minutes for temperatures below 400° C., and 10 mins., with slow heating for temperatures above 400° C. The time of annealing would seem to be too short to bring the bars of alloy to the crystalline and mechanical state characteristic of the various temperatures, and this may be the explanation of the irregularities in Charpy's results. It is evident that the matter required further investigation, and this the authors have endeavoured to supply.

Diagram No. 1.



Charpy's Results.

Note.—The curve has been drawn by the authors. Its form has been determined partly from the results of their own experiments.

Preparation of material.—The alloy was made in the presence of the authors by Messrs. Chas. Clifford & Sons, of Birmingham. 60 lb. of Rio Tinto Best Select Copper and 41½ lb. of Silesian spelter (P.H. Brand) were used, and two bars were cast in 3 in. iron moulds, the material used in this investigation being rolled from the first bar cast. The cast bar was taken out of the mould while still red hot and rolled to 1¾ in. diameter at a dull red heat, the finishing temperature being a barely visible red heat (about 650° C.). The bars, after annealing, were again rolled hot, down to nearly the required diameter, straightened out and allowed to cool down on the mill floor to a temperature of about 250° C. The bars were then pickled in dilute sulphuric acid to remove oxide scale, and finally cold-rolled for four or five passes to exactly ¾ in. diameter. The metal on analysis was found to have the following composition:—Copper, 60·43 per cent.; zinc, 39·21 per cent.; lead, 0·33 per cent.; iron, 0·08 per cent.; tin, 0·03 per cent.; bismuth, 0·01 per cent. A cooling curve of the alloy is given in Diagram 2. It shows the freezing point to be 895° C. The curve was taken by means of a Le Chatelier pyrometer, and the deflections of the galvanometer were observed by means of a telescope

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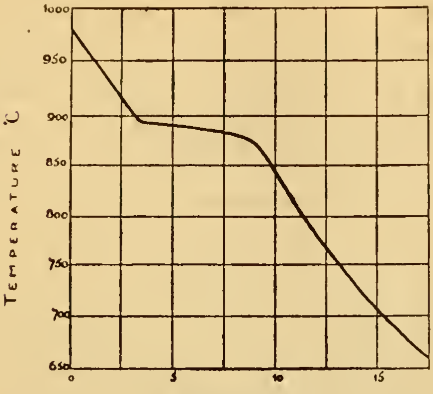
* The authors use the general term "brass" to include any copper-zinc alloy; the term "Muntz metal" refers to the particular brass which contains 40 per cent. of zinc and 60 per cent. copper.

Diagram No. 2.

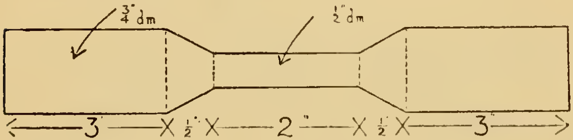


Time, Minutes.

Cooling Curve.

and scale, and plotted directly against the time in seconds.

Test bars.—The original bar, described above, was cut up into 9 in. lengths. These were machined to the following sketch :—



For the tests on cast bars, several portions were cut from the original bar and melted down in a crucible furnace. With a suitable arrangement of "riser" and "git," and the use of plenty of metal, no special difficulty was experienced in casting perfectly sound bars. Each cast bar was, of course, analysed separately. This was necessary owing to the volatility of zinc at furnace temperatures.

Heat treatment.—The furnace used, and the method for the heat-treatment work is described later.

The authors' preliminary tests gave the following results :—

TABLE I.

	Maximum strength tons per sq. in.	Elongation per cent. on 2″.	Impact test. in foot pounds.
As cast	(α) 23·1	20·1	4·25
,, ,, ...	(β) 23·4	17·1	2·9
			4·45
As rolled	(δ) 30·2	37·7	5·35
,, ,, ...	(ε) 29·39	36·6	4·8
			5·25
			5·5

From these it will be evident that the effect of rolling is to raise the tensile strength considerably,(2) the elongation by 50 per cent., and the shock strength appreciably, and that both cast and rolled Muntz metal have only a moderate shock strength.

The improvement in mechanical properties due to rolling may readily be explained by reference to the microphotographs, Figs. 3 and 4. Fig. 3 shows the coarsely crystalline, open structure of the cast bars. In general it may be said that for the same alloy, the coarser the structure, the weaker it will be. The effect of work begun at a comparatively high temperature and continued as the temperature falls, is to retard the growth of crystals in the solid. The worked metal will thus have a finely crystalline interlocked structure accompanied by improvement in strength.

Work however, may have another effect besides retarding the growth of crystals. If continued below a certain temperature (somewhere in the neighbourhood of 600° C.) the effect will be to distort the crystals that have been formed, and subsequent undisturbed cooling will begin at too low a temperature to allow them to regain completely their normal shape, for the lower the temperature the less active the crystalline growth. Hence, work done on the metal below this temperature may be called "cold work." On the other hand, "hot work" is work stopped above about 600° C. In this case the distortion of the crystals is automatically readjusted by subsequent crystalline growth. "Cold work," in addition to its strengthening, has an embrittling effect, and in this it differs from "hot work." As will be understood from the details of its manufacture, comparatively little "cold work" was done on the authors' bars.

This distinction between "hot" and "cold" work has been defined by the authors as a result of their micrographic studies to be referred to later, and in practice work done on the alloy at just below 600° C., would probably not be called cold work. Nevertheless, we have observed that in works practice the foreman is careful to stop rolling at temperatures in the neighbourhood of 600°, and return the metal to the reheating furnace. The final small amount of cold work put upon the metal is to ensure that the diameter of the bar should be exactly that required, as it is difficult to make an exact allowance for contraction on cooling. In certain cases, however, "cold work" may be used specifically for its strengthening effect.

The limiting temperature between the two, namely about 600° C., was determined indirectly in the following way. Transverse and longitudinal sections were cut from rolled bars that had been annealed at different temperatures, and the temperature at which no difference could be detected between the two sections of the same bar after it had been allowed to cool in the air (as it would do after rolling) was taken to be the limiting temperature. For example, Figs. 5 and 6 show transverse and longitudinal sections of a bar heated to 470° C. Figs. 10 and 11 show similar sections of a bar heated to 685° C., *i.e.*, well above the temperature limit.

The distinction between hot and cold work, and the limiting temperature between the two, will be raised or lowered by the shorter or longer time for which the metal is held at that temperature. There is, however, probably a lower temperature limit below which an indefinitely long annealing would be necessary to eliminate completely the effects of cold work. Thus Figs. 7 and 8 show that a week's annealing at 335° C. was not quite sufficient, and Fig. 9 that 2 days at 450° C. was also insufficient. On the other hand, half an hour at 824° C. was adequate, as seen in Fig. 17 (A), while the cold rolling effect still appears in a bar that had been heated for that period to 765° C. (Fig. 12).

In general, the effect of annealing on worked metal may be said :—(*a*) To reduce the maximum strength. (*b*) To increase the ductility, as measured by elongation. (*c*) In the case of steel, to increase considerably the impact or shock strength. Beilby(3) has done much work which seems to show that the effect of cold work on the mechanical properties of metals may be due to the formation of a film of a hard allotropic modification of the metal, or, in the case of an alloy, of one or all of its constituents; also that this hard allotropic modification of the metal is converted to the soft variety by annealing, the change being completed at a definite temperature for each metal (*e.g.*, 260° C. for silver). Heyn(4) has also studied this question in the case of steel, and considers that the distortion or inequiaxing of the crystals is in itself sufficient to account for the strengthening and embrittling effect of cold work, and the re-equiaxing by annealing for the restoration of toughness and low tensile strength. The general study of the structure of pure metals and alloys seems to point to the conclusion that, other things being equal, a coarsely crystalline structure is inferior in maximum tensile strength to a fine structure. A coarse structure is, however, not incompatible with good ductility, as measured by elongation and shock strength. An examination of the plates of microstructures, will show the effect of annealing at various temperatures on the coarseness of the structure, and Table II. gives the corresponding mechanical tests.

TABLE II.

Temperature.	No. of Bar.	Time.	T.S.	Elongation.
As rolled	1 s.c.	—	30·2	37·7
As cast	1 a.s.c.	—	23·4	17·1
310°	2 s.c.	7 hrs.	28·6	43·0
335°	16 s.c.	7 days	27·4	45·1
400°	12 s.c.	4 hrs.	28·1	46·3
410°	15 s.c.	7 hrs.	27·4	48
450°	20 q.	2 days	24·8	45·7
470°	17 s.c.	½ hr.	28	44·4
490°	30 s.c.	7 hrs.	26·1	56
540°	21 s c.	7 hrs.	24·4	57·7
590°	13 q. 14 s.c.	7 hrs. 7 hrs.	26·4 23·8	45·7 52·5
605°	06 s·c·	7 hrs.	23·3	53·3
650°	25 s.c.	½ hr.	25·1	48·0
685°	23 s.c.	7 hrs.	23·5	53·5
690°	03 q. 50 q. 60 q. 05 s.q.	½ hr. 4 ,, 7 ,, 7 ,,	26·15 23·76 26·55 26·00	14 10 14 45
765°	8 s.c. 9 s.c.	½ hr. 4 hrs.	26·5 25·8	54·9 56·5
795°	26 s.c.	7 hrs.	23·4	44
820°	4 s.c. 28 s.c.	4 hrs. ½ hr.	24·1 24·11	55·7 52·0
840°	7 q.	½ hr.	25·4	12

The annealings were carried out on the rolled bars, and after they had been held at the temperatures given in the tables for the time indicated, the bars were allowed to cool in air or in the furnace. This is indicated in the tables by the letters s.c. for slowly cooled. Others were quenched in water immediately on withdrawal from the furnace; the letter q indicates this treatment. It is evident that annealing tends to coarsen the structure, and so to weaken the metal, but also to make it more ductile. Hot work, by preventing crystalline growth, and so giving a fine structure, will act in the opposite direction as far as the maximum stress is concerned.

Heat treatment may exert, however, another and special effect on Muntz metal in addition to the removal of the strengthening effect of work and the growth of crystals, which latter effects are common to many metals and alloys. As will be seen later, this second or special effect becomes of more and more importance as the temperature of annealing rises, but at temperatures below 600° C. is hardly appreciable. This special effect will now be explained. Reference to the equilibrium diagram of the copper-zinc alloys, due to Shepherd(5) and independently checked by the authors(6) will enable this to be clearly understood. Muntz metal consists normally of two constituents, known as α and β, each with its own crystalline habit and behaviour towards etching agents. These two constituents are solid solutions of zinc in copper of different, but within limits, definite concentrations. If a brass containing both α and β be heated to successively higher temperatures, the α constituent will be dissolved by the β, *pari passu* with the temperature; in other words, the higher the temperature to which the alloy is heated, the greater will be the proportion of β present till at 720° C., the transition point, the proportion of β will reach 100 per cent. If the alloy be allowed to cool slowly the reverse set of changes will take place, the α gradually crystallising out. Thus each temperature is characterised by a distinct and definite proportion of these two constituents. The proportion of β characteristic of any temperature can be determined by heating the alloy to that temperature for a length of time sufficient to allow equilibrium to be attained throughout the bar, and then quenching it. The size of the bar and the rate of change $\alpha \rightarrow \beta$ determines the period for which the alloy must be kept at the temperature investigated. In the case of bars of the small section as used in this investigation, it was found by experiment that in most cases half an hour's treatment in the furnace was sufficient to bring the whole bar to the temperature required and also to allow the $\alpha \rightarrow \beta$ change to take place. The rate of change, however, will be less at the lower temperatures than at the higher; hence, in the case of low annealing temperatures, a considerably longer period than that stated above is necessary.

From the foregoing it will be seen that the strength of a Muntz metal bar depends on the following factors:—(*a*) The size of the crystals, (*b*) the relative proportion of the constituents α and β, and (*c*) the work that has been put on it. (*a*) and (*b*) are determined principally by the heat treatment. (*c*) may be again divided into: (*c*1) cold work, (*c*2) hot work. (*c*1) probably affects the strength in the manner indicated by Beilby, and its results may be removed by heating to temperatures varying from 800° C. in the case of short heat treatment to 600° in the case of 7 hours' treatment, as has been already shown. Hence we may say that all the factors upon which the strength of the bar depends are determined directly or indirectly by the heat treatment. The effect of (*b*) is well shown by Figs. 13 and 14, and the accompanying mechanical tests. These two bars were heated together for 7 hrs. at a constant temperature of 590° C. The bar shown in Fig. 14 was then withdrawn and quenched in water, while that shown in Fig. 13 was allowed to cool slowly in the furnace. Fig. 14, the quenched bar, exhibits the proportions of α and β that are in equilibrium at that temperature; Fig. 13 shows that during the slow cooling the $\beta \rightarrow \alpha$ change has been continued, and that consequently, the proportion of β present in the cold bar No. 13 is much less than in the cold bar No. 14. The mechanical properties of these bars are given in the table.

The best method of determining quantitatively the effect on the mechanical properties of brass of this change in the proportions of the constituents, would be to determine first the properties of the constituents separately. It will be seen from the equilibrium diagram that it is impossible by any heat treatment whatsoever to convert a sample of Muntz metal into a material consisting of pure α. Lewis(7) states that "a long heating at 450° causes the CuZn + xCu (α apparently) to dissolve some of the CuZn + xZn (apparently β)," and "by heating to this temperature for 30 hours, the CuZn + xZn constituent has disappeared." In other words, the whole of the β is dissolved. The authors, however, are in agreement with Shepherd that the β is not dissolved at this temperature, as is shown by Fig. 9, already referred to. On the other hand, it would seem to be readily possible to convert a bar into pure β by heating it to a temperature above 720° C., holding it there for a sufficient length of time for the change to take place, and then quenching it. The mechanical properties of the quenched bar should then give the mechanical properties of pure β. Unfortunately it is not easy with brass of any considerable section to retain by quenching, the whole of the alloy in the β condition, though it is easy to do so with pieces of small section.

The mechanical properties of pure saturated β, could be obtained by casting a brass bar containing 52 per cent. of zinc, as will be seen from Shepherd's equilibrium diagram. Roberts-Austen(8) gives the strength of a cast brass bar of approximately this composition as 33 tons per sq. in., and of a brass bar containing 70 per cent. of copper and 30 per cent. of zinc, *i.e.*, a brass bar consisting entirely of saturated α solution, as 21 tons per sq. in. We may safely assume that the α solution in Muntz metal is saturated with zinc, but the β constituent (the concentration of which may vary as much as several per cent. of zinc) has probably not reached its maximum concentration. Hence the difference between the strengths of the two constituents as they occur in Muntz

The Mechanical Tests of all the bars photographed are given in Table II. All the photographs are of slowly cooled bars unless the contrary is stated.

MAGNIFICATION 80 IN EACH CASE.
Illumination vertical.

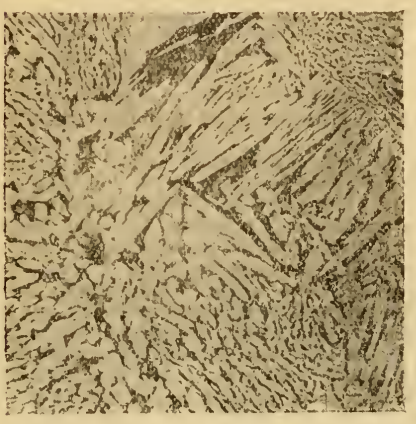


FIG. 3.—Bar as cast.

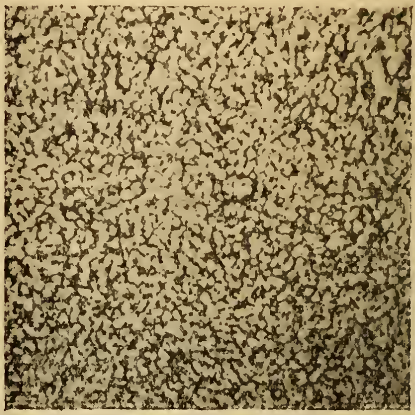


FIG. 4.—Bar as rolled.

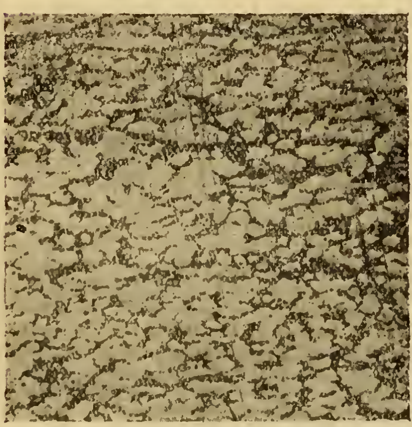


FIG. 5.—½ hour at 470°. Longitudinal Section.
BAR No. 17.

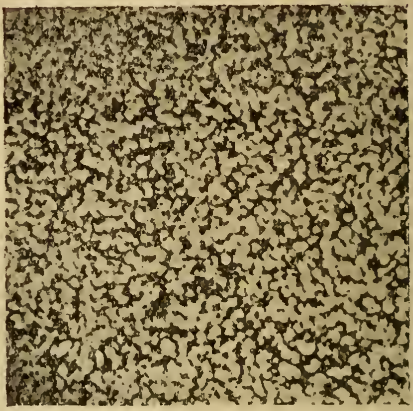


FIG. 6.—½ hour at 470°. Transverse Section.
BAR No. 17.

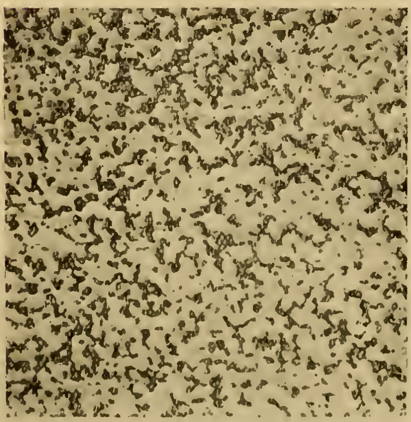


FIG. 7.—1 week at 335°. Transverse,
BAR No. 16.

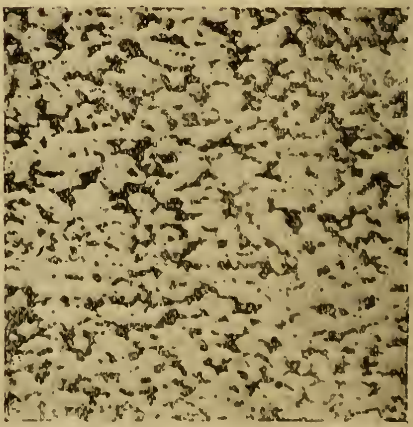


FIG. 8.—1 week at 335°. Longitudinal.
BAR No. 16.

Magnification, 80 in each case.
Illumination vertical.

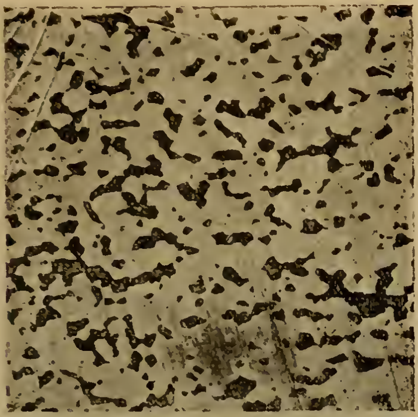


Fig. 9.—2 days at 450°. Longitudinal.
Bar No. 20.

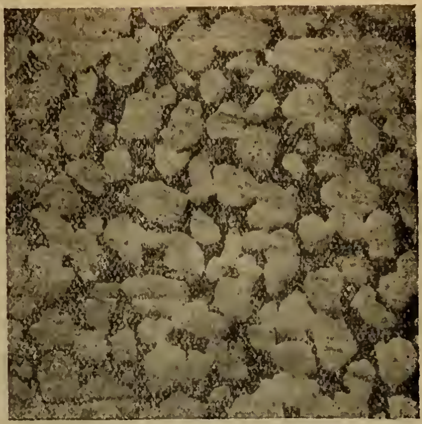


Fig. 10.—7 hrs. at 685°. Transverse.
Bar No. 23.

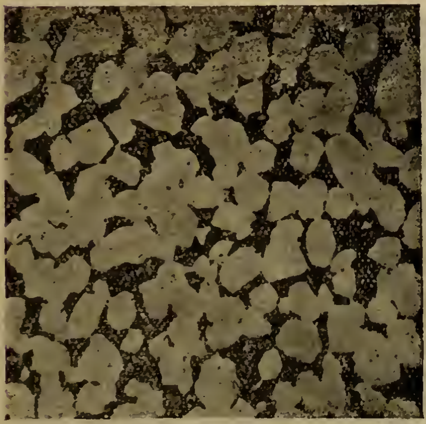


Fig. 11—7 hrs. at 685°. Longitudinal.
Bar No. 23.

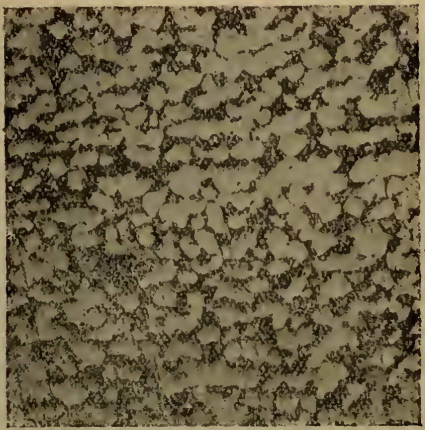


Fig. 12.—½ hr. at 765°. Longitudinal.
Bar No. 8.

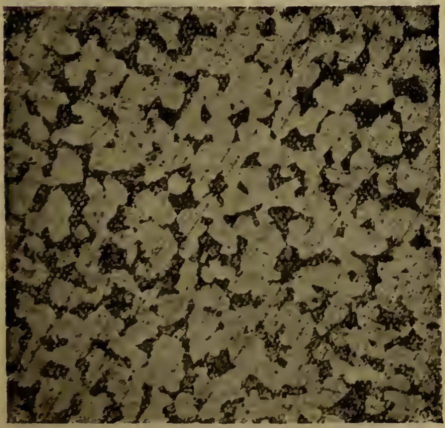


Fig. 13.—7 hrs. at 590°. Transverse.
Bar No. 14.

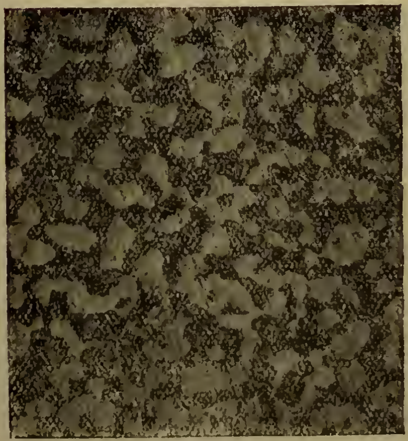


Fig. 14.—7 hrs. at 590°. Transverse. Quenched.
Bar No. 13.

MAGNIFICATION GIVEN IN EACH CASE SEPARATELY.
Illumination vertical.

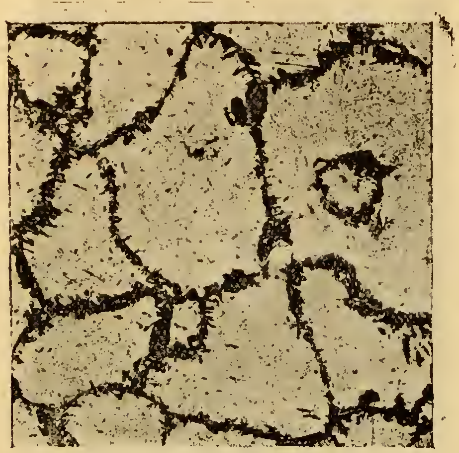


FIG. 15.—7 hrs. at 690°. Quenched. × 30.
BAR NO. 60.

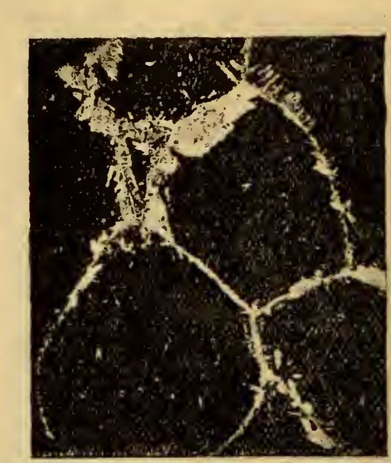


FIG. 16.—7 hrs. at 690°. Quenched. × 30.
BAR NO. 60.

Figs. 15 and 16 show "reversed etching."

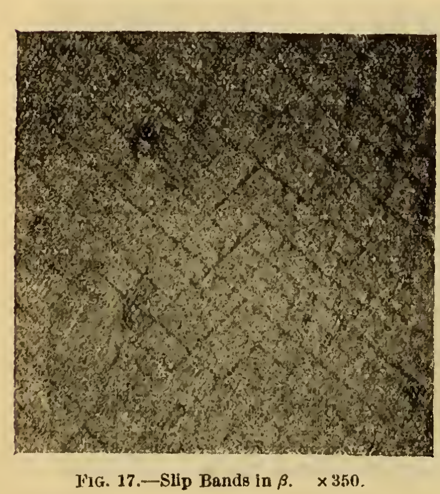


FIG. 17.—Slip Bands in β. × 350.

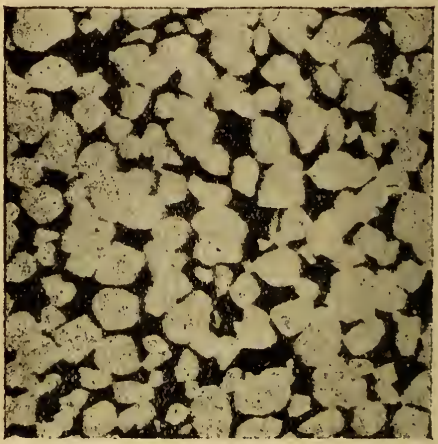


FIG. 17(A).—½ hr. at 820°. Longitudinal. × 80.
BAR NO. 28.

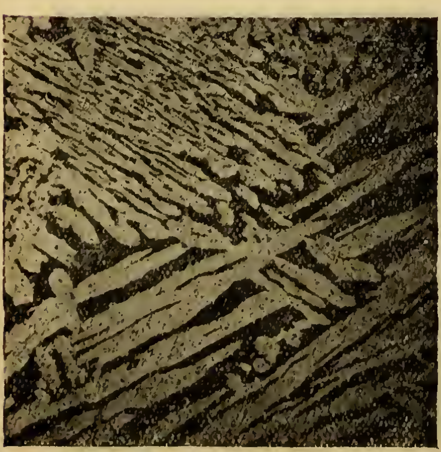


FIG. 18.—7 hrs. at 795. × 80.
BAR NO. 26.

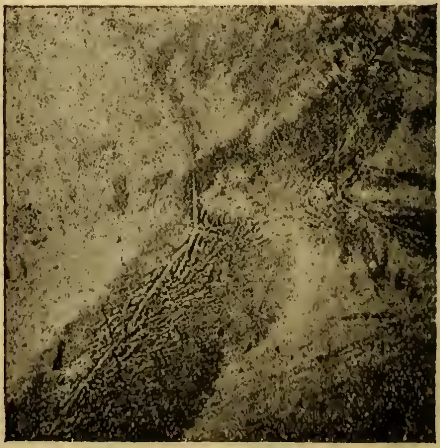


FIG. 19.—½ hr. at 840°. Quenched. × 120.
BAR NO. 7.

Illumination vertical.

The deposited copper is at the bottom in all the Figs.

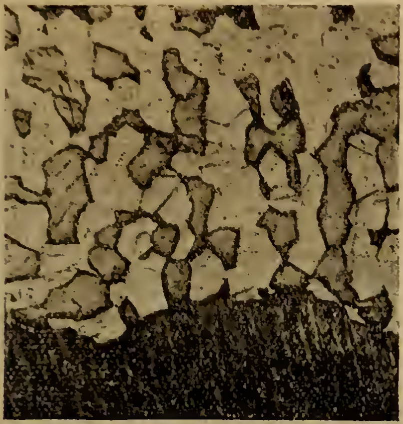


FIG. 20.—Impact fracture. × 250. 4 hrs. at 400°.

BAR NO. 12.

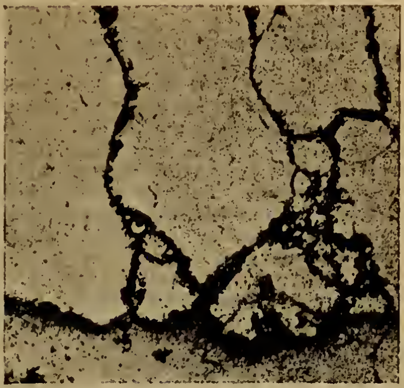


FIG. 21.—Impact fracture. × 10. ½ hr. at 840° C. Quenched.

BAR NO. 7.

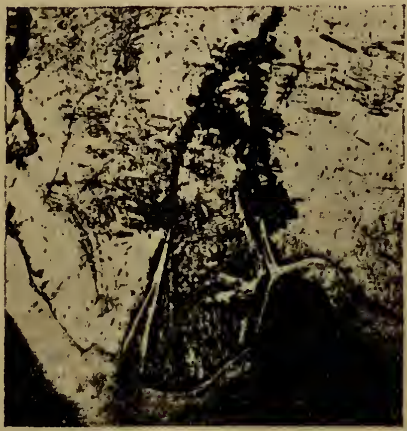


FIG. 22.—Tensile fracture. × 10. ½ hr. at 840°. Quenched.

BAR NO. 7.

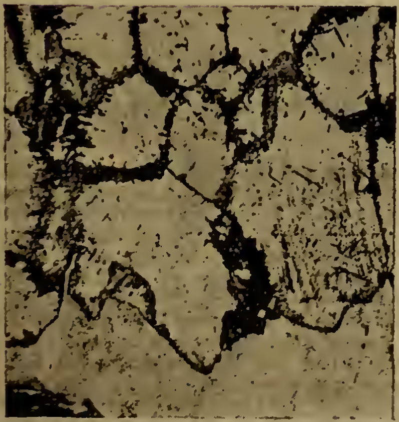


FIG. 23.—Tensile fracture. × 12. 4 hrs. at 765°. Quenched.

BAR NO. 9.

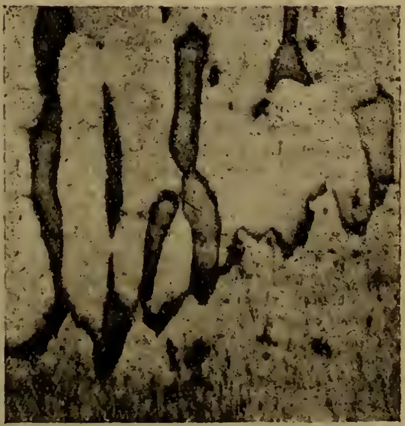


FIG. 24.—Tensile fracture. × 400. ½ hr. at 650°

BAR NO. 25.

metal is probably less than that given above. The tests of bars Nos. 13 and 14 (Figs. 13 and 14) show that an increase in the proportion of β is actually attended by a slight increase in strength and decrease in ductility. Bars quenched at a much higher temperature so as to retain a large amount of β indicate that this constituent has a very low ductility indeed. Take bar No. 60 quenched at 690° C., for example; Fig. 15 shows that the bar consists almost entirely of large crystals of β surrounded by thin envelopes of α. When the bar is pulled in the testing machine, the α, the most ductile constituent, will elongate to its maximum extent, and then any further elongation must be due to β. The elongation due to α will be a very small percentage, measured on 2 in. of the bar, as this constituent is present in such very small amount. But even with the assistance rendered by the β, the quenched bar, consisting essentially of β, only gives an elongation of from 10—14 per cent. Hence we may conclude that β has a very low ductility. This has been confirmed by laboratory rolling tests on pure β; the alloy was found to crack and flake very readily under the pressure applied. This loss of ductility is important in work's practice. It may be the cause of what may be called, "burnt" Muntz metal.(9)

It would seem probable that such metal has been poured at too high a temperature, and has been rapidly chilled in the iron ingot moulds. By this means an undue amount of β is retained in the bar, which consequently has a low ductility with consequent cracking in the rolls. The subsequent reheatings during the rolling process are insufficient both in time and temperature to bring back the bar to the state in which it contains the normal quantities of α and β. Also the same undesirable state of things (*i.e.*, low tenacity and brittleness) might be obtained by reheating a bar that is otherwise normal to too high a temperature, say over 700° C., and for an unduly long time. By this means the bar will contain an excess of β, even if merely taken out of the furnace and treated in the ordinary way, which is, in effect, a moderately rapid cooling—too rapid to allow equilibrium to be attained at the lower temperatures. Such a state of things could probably be remedied by merely placing the spoilt bar in a furnace at a normal temperature, say 600° C., for a few hours. The term "burnt metal" is however, applied very loosely to metal that is defective in any way, and doubtless the above is the explanation of only one of these defects.

Although the general effect of quenching Muntz metal after reheating is to harden and embrittle it, it should be pointed out that unless the reheating temperature has been high enough to cause the complete solution of α, this effect is not very great. In the case then of metal upon which a great amount of "cold work" has been put, such as *small* rods, reheating to a moderate temperature, will soften the metal. This softening is due to the fact that the crystals in the cold worked and consequently hardened metal are much distorted and drawn out, and probably also "slip banded" in the manner shown in Fig. 17. Being in a highly abnormal (possibly allotropic) state, they will take the first opportunity of recrystallising and assuming their normal condition. This opportunity is afforded them by the heating process. As already pointed out, heating to only moderate temperatures will, if continued long enough, completely remove all traces of cold work. Heating to a still higher temperature, such as a bright red, will, of course, operate in the same way, only much more quickly. Further, the more abnormal the state of the original rod, the greater will be its tendency to return to its usual crystalline form. Hence, heating for quite a short time, a few seconds in the case of very thin rods or wire, which the heat can readily permeate, will effect the softening change in the crystalline structure, and this softening may mask the slight stiffening due to the retention of an excess of β, even if the metal be quenched.

In the authors' bars the amount of cold work put on the alloy was small. Consequently the softening effect of the recrystallisation was the less in amount and was masked by the hardening effect of the increased proportion of β obtained by quenching. It seems probable that in most cases of rolled bars and rods the hardening effect will be the greater, and that it is only in the case of very small rods, upon which an unusual amount of work has been put, that the softening effect will prevail. Nothing very definite can be said here, however, for it is not easy to measure the amount of work that has been put on a bar or wire.

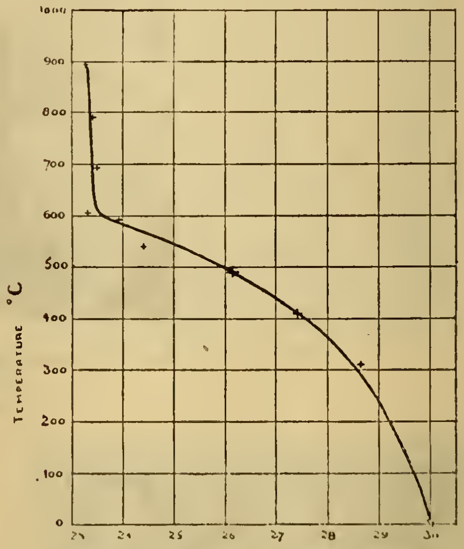
Detailed consideration of the curves exhibiting the mechanical properties of the annealed bars.

Two series of bars were annealed, one for ½ hour, and the other for 7 hours, and their mechanical properties carefully studied afterwards. The reasons for choosing these lengths of time were as follows. The shorter period corresponds approximately to usual works practice, and should be interesting on that account. It was thought however, that equilibrium would not be attained in the bar, in such a short space of time, and the second series was carried through for the longest time that could be conveniently arranged in a day's work after allowing for the time necessary to bring the furnace to the required temperature. A few bars were treated for four hours.

The seven-hours series.

Tensile strength curve. (*Diagram No.* 3): 1. *Slowly cooled bars.*—This appears to consist of two approximately straight lines. One of these begins at 0° and ends at 600° C., the other meets it at 600° C. and rises almost vertically to the melting point. It will be noticed that in this and subsequent curves the tests of the cast bars have been plotted, since a cast bar may be regarded as having been annealed at the melting point, and in this case the annealing temperature is so high that the time factor is unimportant.

Diagram No 3.



TENSILE STRENGTH. TONS PER SQ. IN.

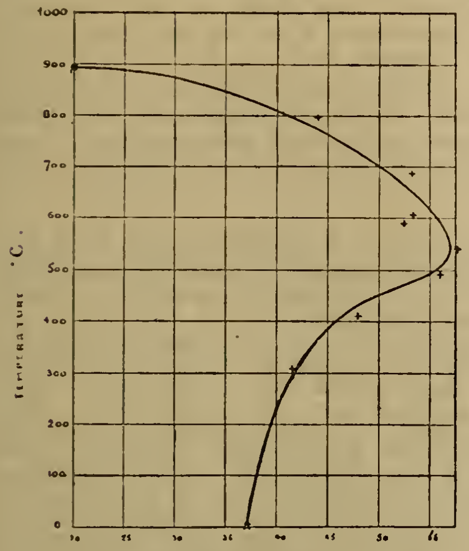
7-Hour Annealings. Bars s.c.

The explanation of the change in direction of the curve at 600° C. and the subsequent constant value of the maximum stress at higher temperatures seems to be as follows:—(*a*) Up to 600° C. the principal effect is the removal of "cold work." At 600° the "cold work" effect has been entirely removed. Consequently, as far as this factor is concerned, the strength will remain constant. (*b*) The proportion of the constituent β increases somewhat, hence the maximum strength will rise slightly; but this is counterbalanced by (*c*) The crystalline structure becomes coarser. This effect, however, is also small since the crystals have nearly attained their maximum size. Hence above about 600° C., no further effect can be obtained, as far as maximum stress is concerned, by the annealing process. Reference to Fig. 18 will show that the structure of the rolled and annealed metal at 795° C. is now of the cast type, and resembles Fig. 3 in its general features, and the tensile strength of the two bars is very nearly the same.

2. *Quenched bars.*—The strength of bars quenched above about 550° C. is considerably greater than that of s.c. bars, as will be seen from the diagram and table. This is due to the fact that there is a large increase in the proportion of β present; as far as the structural arrangement is concerned, these bars differ very widely from s.c. bars, and the new structure though coarse, is still strong. (See Fig. 15.)

Elongation curve (*No.* 4): 1. *Slowly cooled bars.*—This, again, appears to consist of two approximately straight lines meeting at about 550° C. At this temperature the ductility reaches a maximum and after that falls rapidly. The reasons appear to be as follows: (*a*) At 550° C., the effect of "cold work" has been nearly removed, and up to this temperature the curve is approximately a straight line. (*b*) Above 550° C., β increases to an important extent, and though it has only a slightly greater maximum stress than α, and so would alter the direction of the tensile curve but slightly, it has very much less ductility, consequently the ductility falls off rapidly with increased proportion of β. (*c*) The crystalline structure tends to coarsen. This of itself is not incompatible with good ductility; at the same time it is not especially characteristic of good ductility. This effect appears to have little influence.

Diagram No. 4.



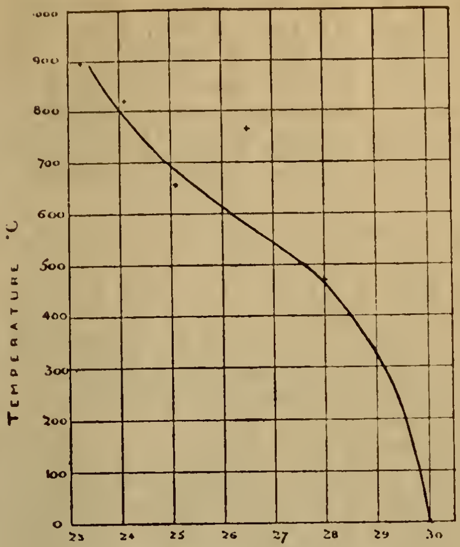
Elongation, Per Cent. on 2 in.
7-*Hour Annealings. Bars s.c.*

2. *Quenched bars.*—As might be expected, the quenched bars have a much lower elongation than the slowly cooled bars. This is due of course to the greater proportion of β present.

The half-hour series.

Tensile strength curve. (*Diagram No.* 5): 1. *Slowly cooled bars.*—The curve appears to show a regular falling off in tensile strength. This seems to be due to the facts that: (*a*) The strengthening effect of cold work is removed *pari passu* with rise of annealing temperature, but the removal is not quite complete till a temperature of about 824° C. is reached, as already indicated. (*b*) The effect of the increase in β due to high annealing temperatures, should be much the same as in the case of the 7 hour annealings, *i.e.*, the increased strength due to the increase of β is approximately balanced by the weakening effect of the coarsened structure. Hence the net result of (*a*) and (*b*) together on the strength should be *nil* from 824° to 895° (the melting point of the alloy), *i.e.*, the curve should be a vertical straight line through this range of temperature. No annealings however, have been carried out in this range, and in consequence the curve (Diag. 5) has been joined up to the cast bar result.

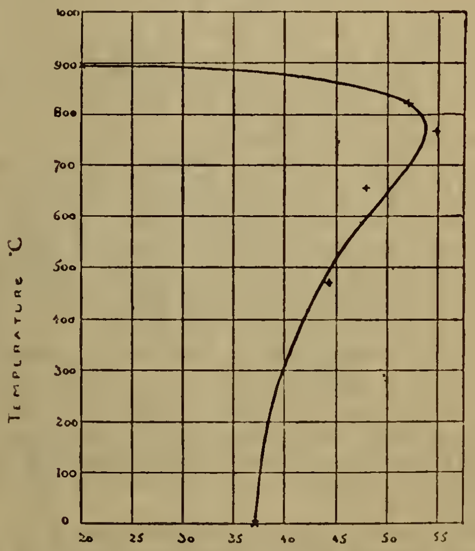
Diagram No. 5.



Tensile Strength. Tons per sq. in.
½-*Hour Annealings. Bars s.c.*

Elongation curve.—Up to about 820° C. the curve appears to be approximately a straight line, *i.e.*, the effect of cold work is removed and the elongation increased proportionately with the temperature. At 820° C. the effect of cold work has been entirely removed, and possibly there may result thereafter a reduction in elongation due to increase in β, as indicated in diagram No. 6.

Diagram No. 6.



Elongation, Per Cent. on 2 in.
½-*Hour Annealings. Bars s.c.*

Experimental Details.

Impact tests.—Particular attention has been paid to this section of our scheme of work. The importance of an impact test depends upon the idea that it may give an indication of the behaviour of metals and alloys under sudden shock. Their characteristic powers of resisting such sudden shearing stresses may be of quite a different order from their power of resisting a slowly applied stress, such as is used in the ordinary tensile testing machine.

Upwards of 50 impact tests were carried out with Izod's pendulum type of impact testing machine on notched bars. The results appeared to give a measure of the ductility of the alloy as determined by the elongation, but in some cases considerable differences were found between pairs of tests made on the same material. Enquiries have shown that the same difficulty has been experienced by other experimenters working on steel.(10) It would seem that there is some disturbing influence at work, and the authors are now conducting a detailed investigation on this matter.

Microscopic examination.—The etching agent used was a dilute solution of ammonia, and care was taken in all cases, to etch for a uniform length of time and with a definite strength of ammonia. By varying the strength of ammonia a completely reversed effect may be produced; this is seen in Figs. 15 and 16. In Fig. 15 the α is the dark constituent, the β the light, while in Fig. 16 the β is the dark and the α the light; otherwise, in all cases (except in the quenched specimens, Figs. 15, 16, 19) the α is the light and β the dark.

It was thought that it would prove of interest to determine the course of the fracture for the tensile and impact tests. To this end photographs (Figs. 20, 21, 22, 23, 24) were taken in the following manner. On the face of the fracture a thick layer of copper was deposited electrolytically. A longitudinal section was then cut through the copper and alloy, and the specimen polished and etched. This course of procedure (which is rendered necessary by the fact that the actual edge of the fracture will be worn away or rounded off by the polishing process) is due to Rosenhain.(11) Fig. 20 (magnification 250) will show the course of the impact fracture in Bar No. 12; the darkest portion is the copper, the half tone is the β and the light is the α. It will be seen that the fracture goes by preference through the β. This is interesting, as one would expect the impact fracture to go through the constituent with low ductility rather than through one with a much higher one, even though the former be stronger.

Fig. 21 shows the course of impact fracture in the case of Bar No. 7, which has been heated to 840° for half an hour and quenched. The copper is seen at the bottom of the photograph: the large light areas are α, the black network, β. Here again the fracture passes through α. Figs. 22 and 23 show the course of tensile fracture in the case of bars Nos. 12 and 7, and here again the fracture passes by preference through the α. In Fig. 22 cracks are seen running into the β network.

Tests were made by means of Turner's sclerometer on the relative "hardness" of the α and β constituents. It was found that there was practically no difference between the true or scratch-hardnesses of the two. The term hardness has, however, been extended to include those properties of a metal in virtue of which it exhibits a high tensile strength and low elongation. The authors were unable to find any appreciable differences in the scratch-hardness of any of the test-bars used in this research. It is evident, therefore, that the true hardness or resistance to penetration has not necessarily any relation to the so-called mechanical hardness. The latter property would perhaps be better expressed by the term rigidity, and its opposite by toughness. The terms hardness and softness have become so firmly established in the literature of the properties of metals that it is difficult to displace them.

Method of annealing.—The bars were embedded in sand, in a large wrought iron box which was heated by a Fletcher-Russel muffle furnace burner with seven jets. Loss of heat by radiation was reduced to a minimum by building in the iron box on all sides with firebricks of suitable shape and size. The temperature of the bar was measured by a platinum : platinum-iridium thermo-couple introduced through a special hole made in the lid of the box, and the protecting fireclay tube was in direct contact with the centre of the test bar. This method of heating was adopted after a number of trials, as it was found that a uniform and constant temperature was easily maintained. The limit of accuracy of the pyrometer readings was ± 5° C.

Discussion.

Prof. F. G. **Donnan** said that the authors had stated that the effect of hot rolling was to retard the growth of crystals; he did not see how the pressure and distortion produced by rolling could in any way retard crystallisation, but he could understand it breaking up the crystals when formed. Concerning the effect of heat-treatment in removing the deforming action of cold work or of rolling on the crystals, it seemed to him that the question might not be entirely one of re-crystallisation; might not surface tension phenomena come into play in connection with this recovery from distortion? The growth of the crystals might also be a surface tension phenomenon, but it seemed to him that where a crystal had not perceptibly grown, the interplay of surface tension forces was probable.

In connection with the ductility, he wondered whether microphotographs would exhibit any distinction between the two phases. In a complex or aggregate of that sort the two phases might exist in very different ways. One might be continuous, the other discontinuous; in other words, the former was like the solvent from which crystals had separated. It was possible that that might play a very important part, if the continuous phase was the medium possessing ductility. If, however, the ductile medium formed the discontinuous phase, one might expect great brittleness, provided the continuous phase was brittle. He did not know whether these remarks would apply to any of the photographs shown. It seemed to him that that point might be important in connection with the engineer's interpretation of photographs of that sort.

Mr. J. **Fenwick Allen** asked whether the α and β were actually different chemically constituted compounds, or was the percentage of copper and zinc the same in the α as in the β? Was there any question of the quantity of oxygen in the alloy?

Mr. **Bengough** in reply to Mr. Allen said that the α was richer in copper and the β richer in zinc, but the exact concentrations of these solid solutions of zinc in copper depended partly on the temperature. The α solution varied in composition from 100 to 63 per cent. of copper, whereas the β only varied from 54 to 51 per cent. copper, at a temperature of 400°. At high temperatures the limits for β were wider, but the β could never be richer in copper than 63 per cent. The β at a high temperature might consist of copper 60 per cent., zinc 40 per cent., *i.e.*, the Muntz metal composition. Reference to Shepherd's diagram would make these points clear. With respect to oxygen, the difficulty was that nobody had found oxygen in the metal before the addition of the so-called deoxidiser. That was a subject requiring further investigation, and the improvement after the addition of the reducing agents might then very likely be explained definitely on the lines indicated by Mr. Allen.

Mr. O. F. **Hudson** said in reply to Professor Donnan that he was of opinion that hot rolling retarded crystallisation, although doubtless the small size of the crystals was due partly to the breaking up of crystals already formed. He was afraid he was not prepared to say very definitely what effect surface tension had on the growth of crystals. He thought, however, that the recovery of a regular form as well as the increase in size of the crystals was due to ordinary recrystallisation in the solid.

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[1] Bull. Soc. d'Encouragement, 1896, 180—234.

[2] See also Fourth Report to the Alloys Research Committee of the Institute of Mechanical Engineers: Feb., 1897.

[3] Electro-chem. and Metall., 1904, 806—819; This J., 1904, 788.

[4] Stahl und Eisen, 1906, 580—597.

[5] J. Phys. Chem. ,June, 1904.

[6] This Journal, 1906, 503.

[7] This J., 1903, 12.

[8] Fourth Report to the Alloys Research Committee, Proc. Inst. Mech. Eng., 1896.

[9] The "burning" of brass containing copper 70 per cent. and zinc 30 per cent. is, of course, due to a different cause altogether.

[10] Harbord, J. I. and S. Inst., I. 1907.

[11] J. Iron and Steel Inst., 1906, 217.

London Section.

Meeting held at Burlington House on Monday, Dec. 2nd, 1907.

MR. R. J. FRISWELL IN THE CHAIR.

THE POLARIMETRIC DETERMINATION OF SUCROSE.

THE EFFECT OF CLARIFICATION WITH BASIC LEAD ACETATE ON THE OPTICAL ACTIVITY AND COPPER REDUCING POWER OF SUGAR SOLUTIONS.

BY FRANCIS WATTS, C.M.G., D.SC., F.I.C., AND H. A. TEMPANY, B.SC., F.I.C.

At the present time no more vexed question exists in the province of applied chemistry devoted to the sugar industry than that regarding the validity of the simple direct polarimetric reading of a standard solution of a commercial sugar as a measure of the actual amount of sucrose contained in it. It has been urged, and justly, that this method is liable to serious sources of error, that under certain conditions such a determination is likely to be very considerably wide of the truth, yet at the same time the hold which the method has obtained over the sugar industry of the western hemisphere, combined with its utility and simplicity in practice render it extremely unlikely that it can ever become eradicated in favour of more accurate but at the same time more laborious analytical processes. On this account it becomes a matter of prime necessity that the conditions under which the determination is carried out shall be as accurate as possible, and that standard methods of performing the test shall universally prevail so that any two analysts situated in any parts of the world, shall be able, working under these conditions, to obtain identical results when working on identical samples.

The attention of sugar chemists is now being largely directed towards the securing of such uniformity, and the work here to be recorded is a continuation of efforts by ourselves in this direction. In previous communications suggestions have been put forward by us for the unification of methods of performing this determination. These have appeared in the West Indian Bulletin as follows:—Vol. VI, pp. 52—60, Vol. VII, pp. 132—140, Vol. VIII, pp. 111—119; two of these have been reproduced in the International Sugar Journal:—Vol. VII. pp. 391—398, and Vol. VII, pp. 446—454, and abstracts have appeared in this Journal, 1905, 817; 1906, 957, and 1908, 31.

The results arrived at in these papers may be briefly summarised thus:—

1. Rise in temperature occasions a lowering of the specific rotation of sucrose which, with the normal weight for the Ventzke scale, amounts to 0·000148.t.N, where t is the difference between the temperature of observation and that at which the polarimeter was standardized and N the Ventzke scale reading. If this is combined with the effect of temperature on the quartz wedge, Jobin's formula, and on the polarimeter tube it becomes 0·00031.t.N.
2. Clarification of commercial sugar solutions with solutions of basic lead acetate is productive of error owing to the volume occupied by the precipitate.
3. The error may be avoided by the use of anhydrous basic lead acetate as a clarifying agent, as proposed by Horne.
4. In the method of Clerget as adapted to tropical conditions we advocated the use of smaller concentrations of acid than those used by Clerget and Herzfeld, whereby the fear of reversion during heating is obviated.

Our recommendations consequent on these results were—

1. Use a weight of 26 grms. of the sample of sugar under examination, dissolve in distilled water and make up to 100 true c.c.
2. Clarify by means of anhydrous basic lead acetate, avoiding excess.
3. Polarise at the temperature at which the solution is prepared and correct for temperature by the formula, polarisation—0·00031tN, where N is the Ventzke scale reading and t is the difference between the temperature of observation and that at which the instrument was standardised.
4. In the Clerget process, use 2 c.c. of hydrochloric acid to 100 c.c. of normal sugar solution; invert by heating for 15 minutes at 68° C., and in tropical working polarise at air temperature, 30° C. being the standard; the formula for that temperature is $\dfrac{d}{128{\cdot}08 \pm \frac{t}{2}}$, t being the difference between the temperature of observation and 30° C.

The results arrived at by Horne and ourselves in favour of the use of anhydrous basic lead acetate have given rise to a certain amount of criticism. Prominent among these critics have been H. and L. Pellet, who have maintained that the dry defecation method, as applied to sugar solutions, is erroneous, by reason of the fact that in the case of sugar solutions clarified by means of a solution of basic lead acetate the precipitate absorbed sufficient sugar from the solution to neutralise the concentrating effect occasioned by its presence, and that in consequence the polarisations of solutions clarified by the *dry* defecation method are liable to be too low by reason of the sugar absorbed from the solution by the precipitate. These criticisms have been met by Horne, who in a paper recently published in the Journal of the American Chemical Society and reproduced in the International Sugar Journal (IX, 227—233), showed that the lead precipitate, instead of absorbing sugar, took up a small amount of water, which, however, was so small as not to affect materially the validity of the determination.

Apart from these special considerations, the process of defecating sugar solutions by means of basic lead acetate is, at the present time, considered to possess fundamental inaccuracies by reason of the interaction of the lead salt with the various organic impurities contained in commercial sugars, juices and liquors. Chief among these disturbing minor reactions is the interaction of the lead salt with any invert sugar contained in the sugar solution, which, it is held, is liable to occasion serious derangement of the determination by reason of the formation of lead levulosate from which material alteration of the rotation is liable to result.

The influence of lead salts on the specific rotation of invert sugar was first pointed out by C. H. Gill in 1871 (J. Chem. Soc., 24 (1871) 91). His results were repeated by Bittmann in 1880 (Zeits. für Rübenzucker-Ind., 1880, 876). The following table of Bittmann's results is taken from Landolt's "Optical Rotation of Organic Substances," 1902 (American edition), p. 595.

Invert sugar solution.	Water.	Basic lead acetate, sp. gr., 1·222	Polarisation.
c.c.	c.c.	c.c.	°V.
50	50	—	—2·3
50	40	10	—1·0
50	30	20	3·7
50	10	40	7·6
10	40	—	—2·2
10	30	10	1·5
10	—	40	6·4
5	5	40	7·6

Gill's original results were not accessible to us, and the results of Bittmann deal with the effect of quantities of basic lead acetate much larger than the excesses likely to be met with in actual analytical practice.

At the present time ideas on the subject appear to be of the vaguest description; by some it is believed that the effect of basic lead acetate on levulose is to precipitate an insoluble compound, and it has been suggested that the reason for the assertion that the reducing sugars in cane juice are optically inactive is, that in cane juice clarified with basic lead acetate, the optically active excess of levulose is rendered inactive by precipitation as lead levulosate (H. Pellet, Int. Sugar J., VIII, p. 458).

On this account it appeared to us that it might be profitable if a critical investigation were made of the action of lead salts (and especially of small quantities thereof) on the various constituents of raw cane sugars and cane juices with the idea that the total effect of lead on sugar solutions might best be gauged by a study of its influence on the various individual components. In undertaking this work the starting point was the action of basic lead acetate on pure solutions of invert sugar.

Experimental.

A solution of invert sugar was prepared by inverting an approximately 20 per cent. solution of pure cane sugar with oxalic acid at 70° C., the end of the reaction being ascertained by means of the polariscope. The oxalic acid was neutralised by barium hydroxide, the point of neutrality being ascertained by means of phenolphthalein, the precipitated barium oxalate was filtered off.

The basic lead acetate solution employed was prepared according to the directions in Allen's Commercial Organic Analysis, Vol. I, p. 251, 1898 edition, and had a sp. gr. of 1·242 at 29°/26·7° C., and a solid content of approximately 32 per cent. by weight.

Excess of basic lead acetate solution was added to a measured quantity of the invert solution and the mixture was left for several days; at the end of that time no trace of precipitation had occurred, thus effectively negativing the suggestion than an insoluble lead levulosate is formed by the action of basic lead acetate on invert sugar solutions.

In studying the effect on the optical activity, 25 c.c. of the invert sugar solution were in each case measured out, by means of a double-marked 25 c.c. standardised pipette, into a 50 c.c. standardised flask, and the required amount of lead solution added from a burette; the solution was made up to 50 c.c. at 30° C. and polarised in a 200 mm. jacketed polarimeter tube, round which a stream of water at 30° C. was kept flowing during the course of taking the observations.

The results obtained were as follows (in all cases the figures given for the polarisation are the means of a number of readings):—

No. of experiment.	Lead acetate added.	Polarisation of solution.
	c.c.	°V.
1	—	—10·40
2	0·5	—10·34
3	1·0	—10·15
4	2·0	— 9·55
5	3·0	— 9·05
6	4·0	— 8·28
7	5·0	— 7·68
8	10·0	— 4·77
9	15·0	— 1·59

The effect of the lead salt on the optical activity is shown in a marked degree. It has been stated that this effect can be neutralised by the addition of acetic acid to the solution whereby the compound of basic lead acetate with levulose is destroyed and the original rotation of the solution is restored. G. F. Spencer has on this account proposed the addition of a small amount of acetic acid to sugar solutions and juices clarified in this manner as a means of eliminating this error.[*] To investigate this point, 50 c.c. of the solution from experiment No. 6 above were taken, to it was added 1 c.c. of glacial acetic acid, the mixture made up to 55 c.c. at 30° C., and, read at that temperature in a 220 mm. jacketed polarimeter tube, gave a polarisation of —10·41. This shows that the addition of acetic acid had overcome the effect of the lead salt. In order to ascertain the minimum amount of acetic acid required to effect the decomposition of an amount of lead levulosate similar to the above, a solution was prepared by taking 100 c.c. of invert sugar solution adding to it approximately 20 c.c. of basic lead acetate and making up to 200 c.c. at 30° C. To equal portions of 50 c.c. each of this solution, increasingly large amounts of acetic acid were added until the original opticity of the solution was restored, the solutions being made up to 55 c.c. at 30° C. and polarised in a 220 mm. tube. A control solution was prepared by making up 25 c.c. of the invert sugar solution to 50 c.c. at 30° C. without addition, and polarising in a 200 mm. tube. All polarisations were performed in tubes jacketed with water at 30° C. The results obtained were as follows:—

No. of experiment.	Acetic acid added.	Polarisation of solution.
	c.c.	°V.
1[*]	—	—10·44
2	—	— 7·92
3	0·2	— 9·90
4	0·3	—10·25
5	0·4	—10·46

[*] Control; no lead.

These results show that 0·4 c.c. of glacial acetic is sufficient to neutralise the effect of 5 c.c. of basic lead acetate solution.

Assuming that the formula of basic lead acetate is $Pb(C_2H_3O_2)_2PbO$ and the content of the dry salt in the solution to be 32 per cent., 5 c.c. of this solution would contain 0·81 grm. of lead oxide and to neutralise this would require 0·44 grms. of acetic acid equivalent to 0·42 c.c. at 30° C., the amount actually found being 0·4 c.c. Hence it appears that the effect of the lead salt is simply due to direct combination of the basic portion of the lead salt to form a levulosate, or levulosates. This conclusion was confirmed by preparing a solution of invert sugar and polarising it in a 200 mm. tube; 50 c.c. of this solution were then taken, made up to 55 c.c. with a solution of neutral lead acetate (sp. gr. 1·185, approximately 26 per cent. strength), and polarised in a 220 mm. tube; the polarisation without lead acetate was —11·3° V., whilst with lead acetate it was —11·3° V.

In the above results the most striking feature is the exceedingly small effect which the initial smaller amounts of lead acetate have on the optical activity of the solution. Thus, 0·5 and 1·0 c.c. of lead in 50 c.c. of solution only affect the rotation by 0·06° V. and 0·25° V. respectively, and it must be remembered that these amounts would correspond to excesses of 1 and 2 c.c. respectively on 100 c.c., excesses which are much larger than should occur in practice. Why the effect is so small is not at first clear, but the fact that it is so emphasises the necessity of avoiding large excesses of lead acetate in practice. The results appear to indicate, therefore, that when excess of lead is avoided, the error due to the influence of lead acetate on invert sugar is practically negligible in the case of the ordinary run of normal sugar solutions and juices which contain from 0·2 to 3·0 per cent. of reducing sugar.

In careful working it is only in the case of low grade products, such as second molasses, etc., which may contain from 20—30 per cent. of reducing sugar, that serious errors are likely to arise from the presence of excesses of lead acetate, since, with substances of this description, it is generally necessary to employ a considerable excess of basic lead acetate to effect satisfactory clarification.

In view of the above conclusions it becomes necessary to ascertain how far they hold good in practice. With this object an endeavour was made to reconstruct a solution which should approximate in composition to the average run of cane juices and sugar solutions ordinarily met with, and to study the effect of lead clarification thereon.

A quantity of lead precipitate from the defecation of cane juices during the preceding crop was collected. The practice was to scrape the precipitates into a large beaker filled with water; this was allowed to stand, and the accumulating lead compound washed daily by decantation. When a sufficient quantity had accumulated it was filtered off through filter paper, and washed with distilled water till free from sugar as judged by the α-naphthol reaction. The lead compound was then suspended in water and decomposed with sulphuretted hydrogen in the manner described by the Messrs. Pellet and W. D. Horne (Int. Sugar J., 1905, 529), and the resulting solution of organic matter was subsequently concentrated to a relatively small bulk on the water bath. This solution of organic non-sugar was of a clear, deep brown colour, and yielded a dense precipitate on treatment with basic lead acetate. About 15 c.c. were diluted to 100 c.c., and the diluted solution, which was clear and bright, was examined in the polarimeter and found to possess no optical rotation. With the aid of this solution, the effect of the lead used in clarification of solutions corresponding to the average run of raw cane sugars and cane juices was investigated. The procedure was as follows:—A solution of pure cane sugar was prepared of approximately 40 per cent. strength; two equal portions of 50 c.c. each were measured out by means of a standard double marked pipette into two accurately standardised 100 c.c. flasks, and to each of these was added 4 c.c. of the invert sugar solution already mentioned. To one of these a measured quantity of the above solution of organic matter was added, to the other no such addition was made. Both these solutions were thoroughly mixed and made up to 100 c.c. at 30° C. By this means two solutions were obtained, approximating in sucrose and reducing sugar contents to the average run of cane juices and normal sugar solutions obtained in the Leeward Islands; furthermore, the solution to which non-sugar had been added may be safely said to have represented, with some approach to exactitude, cane juices occurring in actual practice. The solution to which non-sugar had been added was clarified by means of dry basic lead acetate, prepared according to Horne's directions, care being taken to ensure that the amount used was similar to that ordinarily employed in actual practice by us. The precipitated solution was filtered, with due precautions to prevent loss by evaporation during filtration. We were thus in possession of two solutions, each containing the same amounts of sucrose and invert sugar, but from one of which organic non-sugar of the type normally occurring in cane juices had been precipitated by basic lead acetate; if, now, the optical activity is influenced either by the excess of lead or by the act of precipitation, these two solutions should differ in optical activity. These experiments were repeated on three several occasions, using freshly prepared sucrose solutions. The resulting polarimetric readings are detailed in each case.*

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[*] Handbook for Sugar Manufacturers (1893), p. 32.

In experiments Nos. 1 and 2, 5 c.c. of the solution of organic non-sugar were added; in experiment 3, 10 c.c. were added.

No. of experiment.	Solution without non-sugar and not precipitated by lead.	Solution with non-sugar and precipitated by lead.
	Polarisation, °V.	Polarisation, °V.
1	75·69	75·69
2	76·21	76·20
3	76·15	76·16

From this it is clear that the optical activity remains unaffected by the excess of basic lead acetate occurring in ordinary practice and by the act of precipitation.

In order to obtain information on the magnitude of the error likely to be involved in the case of solutions containing relatively large amounts of invert sugar, a further pair of experiments was carried out in which considerably larger quantities of invert sugar solution were employed. The sucrose solution used was also somewhat stronger, being of 52 per cent. strength, of which 50 c.c. were taken. The volume of invert sugar solution employed was 20 c.c. The amount of organic non-sugar solution used was 10 c.c. The following are the results:—Solution without non-sugar, not precipitated by lead = 94·15° V.; solution with non-sugar, and precipitated by lead = 94·0° V. The amount of lead solution used was somewhat in excess of that required to complete clarification. These results show that, in the case of cane juices and the ordinary run of Muscovado sugars, the optical activity of the constituents is not likely to be affected by clarification with basic lead acetate when excess of that reagent is avoided. Further they bear out those of Horne in showing that the lead precipitate does not absorb sugar from the solution. In this connection it may be mentioned that, with cane juices as occurring in the Leeward Islands, it is a simple matter to judge when a sufficient quantity of lead solution has been added to the juice, as a slight excess of the reagent invariably produces a greenish tint, owing to the presence in the juice of small quantities of a body which functions as an indicator, yielding yellowish green bodies with alkalis. (It is a somewhat curious fact that such an indicator should exist in cane juices, as most of the usual indicators give precipitates or colourless solutions with this compound.)

As regards the case for molasses it appears that there is liability to a small amount of error unless very great care is taken to avoid excess. In connexion with this question, attention may be called to the exceedingly diverse methods at present prevailing in the simple polarimetric reading of molasses. As far as can be ascertained, the most usual method with low grade products of this description is to weigh out the normal weight, dissolve it in water, add between 20 and 30 c.c. of basic lead acetate solution, make up to 100 c.c., filter, and polarise. This process involves large errors owing both to the excessive volume occupied by the precipitate, and also to the reaction of the excess of lead with the large amounts of levulose contained in the solution.

Another method is that given in Allen's Commercial Organic Analysis (Vol. I, p. 257, 3rd ed.), wherein a double normal weight is taken, dissolved in water, partially clarified with basic lead acetate and sodium sulphite solutions, made up to 100 c.c. and filtered; of the filtrate 50 c.c. are taken saturated with sulphur dioxide, made up to 100 c.c.; animal charcoal added, filtered and polarised. This method is liable to serious errors also, by reason of precipitate volumes.

In our experience we have found it impossible to clarify molasses solutions by means of the simple addition of dry basic lead acetate, since the salt rapidly becomes coated with insoluble matter and refuses to dissolve further. We have therefore devised a modification of Allen's method which we think is a considerably nearer approach to accuracy than that usually obtained. In our method, a double normal weight of molasses is weighed out dissolved in water and made up to 100 c.c. Partial clarification is effected with dry basic lead acetate and the solution filtered. Of the filtrate, which is dark in colour, 50 c.c. are taken and saturated with sulphur dioxide, all lead in solution being precipitated as sulphite. This solution is made up to 100 c.c. and filtered and the filtrate, which is lemon yellow in colour and quite bright,* polarised. This method is, we claim, a distinct advance on any of the older methods in the direction of accuracy. It is true that there is still a slight source of error in the volume of lead precipitated as lead sulphite, but this is small compared with those formerly introduced. The use of animal charcoal we have discarded, its employment being, at the present time, universally condemned as introducing large sources of error. It may be further pointed out that the use of sulphur dioxide is efficacious in decomposing lead levulosate.

In order to illustrate the differences occurring in the results obtained by the old process and that now brought forward, three pairs of polarisations of actual commercial samples of second molasses by the old and the new methods are quoted.

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* The polarimeter readings given are the means of a number of ndividual readings by two observers.

* If any difficulty is experienced in getting a bright filtrate, this can be overcome by the addition of kaolin in small quantity, to the solution.

No.	Defecated with 25 c.c. basic lead acetate solution and made up to 100 c.c.	Defecated with dry basic lead acetate and sulphur dioxide. (New method.)
	Polarisation °V.	Polarisation °V.
1	23·8	20·2
2	28·9	25·8
3	30·8	33·4

The above results show a difference between the two methods amounting, on the average, to about 3° Ventzke, and emphasise the extreme magnitude of the errors likely to arise from the employment of defective methods with products of this class.

In connection with the question of the actual mechanism of the process of clarification with basic lead acetate, it appeared to us that it might be of some interest if some information were forthcoming as to the composition of the precipitate obtained in clarifying cane juices, and accordingly the amount of lead oxide contained in the precipitate from the juice of five different West Indian cane varieties, grown in Antigua, was determined. The precipitates were obtained by treating the juices with basic lead acetate solution of the usual strength; no special selection of the canes was made, they being simply chosen haphazard during the course of the sugar campaign; the precipitates were washed with distilled water till free from sugar, as judged by the *α*-naphthol reaction. The amount of lead oxide contained in them was determined by the method given in Fresenius' Quantitative Analysis (Vol. I, p. 246, ed. VII.).

The following results were obtained:—

No.	Variety.	Lead oxide in the precipitate.
		Per cent.
1	Burke	54·2
2	D. 625	53·3
3	White Transparent	51·8
4	Mt. Blanc	53·4
5	Red Ribbon	52·7
	Mean	53·08

It will thus be seen that the amount of lead in the various precipitates varies but little, and, if the above five cases are accepted as representative, averages 53·08 per cent. This is in striking contrast to the results obtained by Horne, Wiechmann, and ourselves for the density of lead precipitates from solutions of raw sugars, which vary between wide limits.[*] The lead oxide content of basic lead acetate, according to the formula, $Pb(C_2H_3O_2)_2,PbO$, is 81·4 per cent., so that 100 parts by weight of lead acetate would, if the compound formed be purely additive in character, carry down 53·34 parts of organic matter.

As a result of clarification with basic lead acetate, cane juices yield a clear, bright, lemon-yellow filtrate, provided that the clarification has been properly performed.

It had been frequently observed by us that clarified cane juices invariably contain lead salts. On the other hand, if further addition of basic lead acetate is made to the clarified juice, a precipitate of a light lemon-yellow colour is always produced: addition of neutral lead acetate, on the other hand, does not occasion such precipitation. This phenomenon appeared of some interest, and an attempt was made to investigate it. It was at first thought that the phenomenon might be in some way due to the presence in the juice of phenol, which it is our practice to employ as a preservative, in accordance with observations by ourselves recorded in a former paper ("The Fermentation of Cane Juice," West Indian Bull., 6, 387—393; see this J., 1907, 329). Accordingly the filtrate from freshly expressed cane juice to which no phenol had been added was examined and found to present a similar phenomenon. It therefore appeared that the effect observed is due to some constituent, or constituents, normally occurring in cane juices in Antigua. A considerable quantity of this precipitate was prepared from the residues of juices clarified for polarisation during the last sugar campaign, the practice being to transfer the clarified residues from each day's work to a large beaker, add sufficient basic lead acetate solution thereto to effect precipitation, allow the precipitate to subside over-night, and in the morning pour off the clear supernatant liquid and half fill the beaker up with water; the next day's residues were accumulated in a similar manner, and so on. When a sufficient quantity of this precipitate had been collected, it was filtered and washed with distilled water till free from sugar as judged by the *α*-naphthol reaction. A portion of this precipitate was suspended in water and decomposed with sulphuretted hydrogen, the resulting solution of organic matter being concentrated to small bulk on the water bath, as described in respect of the primary lead precipitate. The solution obtained was practically colourless. With moderate amounts of acid, alkali or alcohol, this solution did not yield a precipitate. With solutions of basic lead acetate, a flocculent, colourless precipitate was at once obtained, but solutions of neutral lead acetate occasioned no precipitation. Evaporaton of the solution to dryness showed that very small quantities of organic matter were obtained from relatively large amounts of the lead compound. The amount of lead oxide contained in the lead precipitate was determined by the method given above for the primary precipitate, and was found to be 81·63 per cent., an amount differing very slightly from that calculated for basic lead acetate itself.

From the above observations it would appear that the substance is probably related to pectin. It would appear likely that its presence in cane juice may be accounted for by solution in the juice of portions of the vegetable cells of the cane, which are disrupted by the process of milling, and one would, in consequence, expect to find larger quantities of it present in juices obtained in factories where heavy milling and maceration are practised, than in juices obtained from lighter mills. (See Prinsen-Geerligs. The Sugar Cane, 30, 91 and 124).

As to the presence of lead in the clarified juice, the only feasible explanation, so far as we can see, is that the slight acidity of the cane juice is sufficient to neutralise the alkalinity of a portion of the basic lead acetate, which is thereby converted into neutral lead salts, some of which may be precipitated and the remainder remain in solution. That these lead salts are not removed from solution by combination with the precipitable matter present is, we think, due to the fact that there is already a sufficient quantity of the basic salt present to remove this. This phenomenon is not shown to nearly such a marked extent in juices which have been clarified with lime in the process of manufacture, or with the majority of raw sugars, though it is true that it is markedly evidenced in some cases, and in most others slight evidences appear on standing.[†] It would seem, therefore, that the heating of limed juice in clarifiers, defecators, and eliminators removes much of this interesting impurity.

Having observed that lead is normally present in lead-clarified juices, it remained to be seen what effect, if any, it could have on the subsequent analytical operations. To begin with, if present as the neutral acetate, it would not be likely to affect the optical activity of any levulose present, since, as has been shown in the present paper, the effect of basic lead acetate on the optical activity of levulose is occasioned by the basic portion of that salt, and is not due to the action of the neutral compound.

The next point to be investigated was whether any effect could be exerted on the determination, by Fehling's solution, of the reducing sugars present in cane juice. It is a common practice among sugar house chemists to perform the determination of the reducing sugars by Fehling's solution on the lead-clarified juice; it has, however, been the practice in this laboratory to perform the test on the raw juice without clarification. In view of this, it appeared desirable to us to ascertain what differences, if any, existed between the reducing sugar contents of cane juices as determined on the raw and clarified juices respectively, especially so as clarified juices have been shown to contain lead salts in solution and it is known that the presence of lead in solution is liable to affect the validity of the Fehling determination, (See Tucker, Manual of Sugar Analysis, 1890 ed., p. 196.) Accordingly such a series of determinations was undertaken during the course of the last sugar campaign. The determinations were performed by the volumetric process; the actual method employed will be described in a subsequent paper. 10 c.c. of Fehling's solution were used in each case. In one series, the determination was performed direct on the raw juice, and in the other on a quantity of the same juice clarified by means of anhydrous basic lead acetate. The results were as follows:—

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[*] West Indian Bulletin, 6, 52—60. This J., 1905, 817.

No.	Name of cane variety.	Reducing sugar per 100 c.c. raw juice.	Reducing sugar per 100 c.c. clarified juice.	Difference.
1	White Transparent	0·402	0·392	—0·010
2	Mt. Blanc	0·841	0·805	—0·036
3	Red Ribbon	0·402	0·399	—0·003
4	Burke	0·741	0·713	—0·028
5	Sealy Seedling	0·866	0·847	—0·019
6	B. 208	0·273	0·275	+0·002
7	B. 156	0·345	0·335	—0·010
8	D. 130	0·295	0·284	—0·011
9	D. 116	0·316	0·293	—0·023
10	D. 95	0·454	0·462	+0·008
11	D. 74	0·309	0·277	—0·032
	Mean	0·477	0·462	—0·015

From the above results we see that there is an average difference in the reducing sugar contents in favour of the raw juice over the clarified juice amounting to 0·015 per cent. This amount is so small that it is of no great importance in actual practice, in connexion with cane juice, and from the standpoint of practical sugar chemistry it appears that it is immaterial whether the determination is performed on raw or clarified juice. As it has been shown, however, that small quantities of lead do occur in the clarified juice, it becomes worthy of enquiry whether the amount of lead present in the juice was sufficient to account for the observed small differences between the reducing sugar contents of raw and clarified juices.

Equal quantities of the invert solution already referred to were made up to a standard bulk of 100 c.c. with the addition of increasingly large amounts of basic lead acetate solution, and the apparent reducing sugar contents were determined by means of titration against 10 c.c. of Fehling's solution. These solutions remained bright on the addition of the lead solution, with the exception of No. 6, where a slight turbidity appeared, due in all probability to the carbonatation or hydrolysis of the basic portion of the lead salt. The results are given below.

No.	Amount of basic lead acetate added c.c.	Volume of reducing sugar solution required for the titration c.c.	Apparent reducing sugar content of solution per 100 c.c.
1	nil.	10·05	0·560
2	0·5	10·0	0·563
3	1·0	10·1	0·556
4	2·0	10·25	0·548
5	4·0	10·4	0·541
6	8·0	11·1	0·508

From the above results we see that, on the average, the presence of 1 c.c. of basic lead acetate solution of the strength commonly employed in analytical practice is equivalent to the apparent removal of 0·006 grm. per 100 c.c. of reducing sugar from the solution, and that to occasion an effect equal to that observed in the case of actual clarified cane juices would require the presence in the juice of an excess of lead equal to that contained in at least 2 c.c. of basic lead acetate solution. It may be stated that the total amount of lead solution required to effect clarification very rarely exceeds this amount, and as the greater part of the lead appears in the precipitate the amount remaining in the solution must be far below this. We are, therefore, forced to conclude that the excess of lead present in the clarified juice is not responsible for the small difference observed, and that this is rather owing to the removal of a small amount of some reducing substance in the course of defecation with basic lead acetate. Of what this substance, or substances, consist we cannot say; that it is not either dextrose or levulose appears certain from the results described in this paper. It does not appear improbable to us that the organic non-sugar removed from the juice may contain, however, obscure bodies capable of affecting the determination by the amount observed.

In the course of this paper no mention has been made of the possible effect of basic lead acetate on the specific rotation of sucrose itself. F. Bates and J. C. Blake have recently brought forward the results of experiments made by them in this direction (Zeits. Ver. f. Deuts. Zucker Ind., 1907, 314—323; J. Amer. Chem. Soc., 1907, **29**, 286—293; this J., 1907, 333, 541). These workers find that addition of small quantities of basic lead acetate solution, sp. gr. 1·25 (from 0·5 to 2·0 c.c.) to a 26·048 per cent. solution of pure cane sugar, caused a progressive reduction of the polarimeter reading (the maximum reduction being slightly over 0·1 per cent.); with larger quantities of the reagent (from 2 to 6 c.c.) the reduction became less; the solution to which 6 c.c. of basic lead acetate had been added gave the same polarimeter reading as one to which no lead had been added: addition of still larger quantities of basic lead acetate (from 7 c.c. to 63 c.c.) caused a progressive increase of the polarimeter reading (maximum about 1 per cent.). According to Bates and Blake, "the influence of the basic lead acetate appears to be due to the formation of soluble lead saccharates having rotatory powers different from that of sucrose." According to these results, small excesses of lead would operate in a contrary direction to that in which they do on invert sugar, and hence the two effects would tend to neutralise one another.

One point in our observations which appears to militate somewhat against the theory of Bates and Blake regarding the formation of a soluble lead saccharate, is that with normal solutions of pure sucrose we have always found that basic lead acetate, when added thereto in small quantities, invariably produces turbidity on short standing, due, in our opinion, to carbonatation or hydrolysis* of the basic portion of the salt; on the other hand with solutions of invert sugar, where a soluble lead levulosate is undoubtedly formed, through the interaction of levulose with the basic portion of the lead salt, no such turbidity is experienced.

General Conclusions.—To put the matter briefly, we have arrived at the following conclusions:—

1. Excessive amounts of basic lead acetate exercise an appreciable effect on the optical activity and reducing power of solutions of invert sugar.

2. Where excess is avoided, and it easily is avoided in analytical practice, clarification by means of dry anhydrous basic lead acetate involves no appreciable error.

In the case of low grade products, such as second molasses, a greater approach to accuracy than that usually attained, is got by clarification with dry basic lead acetate followed by sulphur dioxide, and this is especially so with regard to determinations by the Fehling method.

In view of these results, it appears unnecessary to search for more complicated methods of clarification, for the use of solid anhydrous lead acetate gives results which are well within the limits of accuracy of ordinary methods of analysis.

DISCUSSION.

Mr. **JULIAN L. BAKER** said the authors were to be congratulated on the manner in which they had elucidated many obscure points in the use of lead acetate as a defecation agent for sugar solutions. The literature on the subject was voluminous and the opinions of different investigators were contradictory. He was not aware that other clarifying agents such as phospho-tungstic acid had ever been employed for sugar solutions. This acid could be used with safety for pale and dark worts and for caramels, and he would suggest that it might be worth consideration by sugar chemists.

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* An exactly similar phenomenon is shown on dilution with water.

Mr. E. **Grant Hooper** regarded the addition of anhydrous basic lead acetate as a distinct improvement on the use of a solution. It seemed to him that in many cases there was a tendency to use too strong acid for the inversion of sugar, and to unduly prolong the period of inversion. It would generally be found that a four minutes' boiling with 5 c.c.'s of half-normal hydrochloric acid effected complete inversion of cane sugar, and had no action on other carbohydrates present. He understood that the authors carried out the inversion for 15 minutes, but at a lower temperature. In a laboratory devoted to the sugar industry, arrangements would be devised for carrying on inversions at temperatures controlled by a thermostat, and no criticism need be offered of such practice, but where occasional sugar inversions were being made he thought it was an advantage to carry out the operation in the shortest time, and under direct personal supervision.

Mr. J. F. **Briggs** said he thought the authors believed that the alkalinity of the lead solution occasioned the action on the rotary power of levulose, and it was quite reasonable that the addition of a few drops of acetic acid to the filtered solution would save the trouble of removing the lead from the solution. But with regard to the use of solid basic lead acetate, it seemed to him it was a question of what other people were doing. If someone else, whose analysis was going to be compared with one's own, used the solution, and one used the solid acetate, it did not matter which was the more accurate, the price was fixed by what was usually done, and if such an alteration was going to be made, it would have to be made by the consent of all the chemists in the industry.

Dr. L. T. **Thorne** said he knew it was a commonly adopted plan now to boil the solution for inversion for a short time, but although that might be suitable with fairly pure sugars, he did not think it was quite so reliable in raw sugars, as there was a liability for secondary reactions to occur. Personally, he never liked to carry out inversion at a temperature higher than 70° C.; 5 to 10 minutes was ample time in all cases, 5 minutes when a small amount of sucrose was present, and 10 minutes as a maximum. With reference to what Mr. Briggs said, the authors referred to their work as being carried out largely with a view to helping on unification of the methods. Of course that was to a considerable extent being carried out by the International Commission for Uniform Methods of Sugar Analysis. He thought there should be no difficulty if this clarification by anhydrous basic lead acetate was shown to be the best, as it seemed to be shown now, in getting that process adopted generally. Of course these determinations were of great importance from the commercial point of view, because, with the large duties on sugar in various countries, especially in America, a difference of 0·2 or 0·3 per cent. on an importation of 5,000 or 10,000 tons would run into large figures, and therefore it was necessary to have uniformity of analytical methods.

Manchester Section.

Meeting held at Manchester, on Friday, December 6th, 1907.

MR. R. H. CLAYTON IN THE CHAIR.

THE DETERMINATION OF PHENOLS IN GAS LIQUORS, AND THE DISTRIBUTION OF SUCH PHENOLS IN THE LIQUORS OBTAINED IN VARIOUS PARTS OF THE GAS PURIFYING PLANT.

BY F. W. SKIRROW, M.SC., PH.D.

The determination of phenol in gas liquors.—For this purpose a method was employed which was similar to the one used by Korn for the estimation of phenol in effluents (Zeits. anal. Chem., 1906, **45**, 552). This is based on the volumetric method of Messinger and Vortmann (Ber., **22**, 2313; Zeits. anal. Chem., **31**, 220). *See also* Kossler and Penny (Zeits. physiol. Chem., **17**, 117). In applying the method to gas liquors certain modifications are necessary in order to obtain reliable results, and in the following the method so amended is described.

The phenol is distilled off with water and then converted into tri-iodophenol by means of an excess of iodine, which is titrated back with thiosulphate.

The reactions involved are the following:—$2NaOH + 2I = NaIO + NaI + H_2O$. (1); $C_6H_5OH + 3NaIO = C_6H_2I_3OH$* $+ 3NaOH$. (2) These reactions are equivalent to:—$C_6H_5OH + 6I = C_6H_2I_3OH + 3HI$. On acidification the following reaction takes place:—$NaIO + NaI + H_2SO_4 = I_2 + Na_2SO_4 + H_2O$ and thus the whole of the unused iodine is set free and can be titrated. The following precautions must be adopted:—(1) Sulphuretted hydrogen and sulphides must first be removed. (2) Hydrocyanic acid and cyanides must be eliminated. (3) On evaporating the liquor it must be permanently and strongly alkaline.

100 c.c. of the filtered gas liquor is first treated with an excess of ammonium polysulphide to convert any cyanide present into thiocyanate. This is allowed to stand, and the solution then made up to 200 c.c. The sulphides are then precipitated, most conveniently by lead carbonate, and the lead sulphide and the excess of lead carbonate filtered off. An excess of sodium hydroxide (25 c.c. of 50 per cent. solution) is then added to 100 c.c. of the filtrate, and the solution evaporated until the salts begin to separate out. The residue is washed into a litre distilling flask and diluted to about 150 c.c. with distilled water, and when cold is acidified with sulphuric acid. The liquid is distilled until the salts begin to crystallise out; we thus obtain "distillate 1." 100 c.c. of water is added to the distilling flask, and the acid liquor again distilled into a second receiver, giving "distillate 2." This is repeated a third time giving "distillate 3." The whole of the phenol will usually be in these three distillates, a control test having shown that the amount of phenol in a fourth distillate was negligible. In order to get rid of any acid which has distilled over, and which would upset the subsequent titration, each of these distillates is then shaken with about 1 grm. of calcium carbonate (and a small quantity of lead carbonate to keep back any hydrogen sulphide), and redistilled. In doing this, distillate No. 1 is distilled first, No. 2 is then added to the distilling flask and distilled, No. 3 being distilled last. The final distillates are then united and made up to 500 c.c., when they are ready for titration.

It was found that if cyanide were present, the hydrocyanic acid which distilled over on the first set of distillations was not retained by the calcium carbonate, and thus passed into the final distillates, and caused too large an amount of iodine to be taken up. In the case of thiocyanate, however, it was found that the thiocyanic acid which distilled over, being a stronger acid than hydrocyanic acid, was practically completely retained by the calcium carbonate. Thus, on converting the cyanide into thiocyanate all trouble on this score was avoided.

The titration of the final distillate was carried out as follows:—100 c.c. of the united distillates was made alkaline with sodium hydroxide and warmed to 60° C. An excess of iodine was then run into the flask, which was immediately stoppered and allowed to cool with frequent shaking. The contents were then titrated back with *N*/10 sodium thiosulphate after acidifying the liquid, starch being used as indicator. The end point is marked by the transition from blue to a rose pink. If much phenol is present, a flocculent rose pink precipitate is obtained. If we combine the two equations, (1) and (2), we see that for every molecule of phenol which is present, three molecules of sodium hydroxide are permanently converted into sodium iodide. Therefore, at least three molecules of sodium hydroxide must be present for one molecule of phenol. The titration was tried using a large excess of sodium hydroxide ($6NaOH : C_6H_5OH$) but it was found that in this case the end point was not quite as sharp as with a smaller excess. The amount of iodine used was enough to colour distinctly the liquid. It was found advisable to do a preliminary titration using a large excess of sodium hydroxide (2 c.c. of normal NaOH) in order approximately to determine the amount of phenol present, and then to carry out the main titration using 4 molecules of sodium hydroxide to each molecule of phenol, as so approximately estimated.

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* Messinger and Vortmann state that the body actually formed is more probably $C_6H_3I_2.OI$.

Trial tests with known amounts of phenol.—(*a*) Direct titration of pure phenol solution gave 99·5 and 99·5 per cent. of the amount of phenol taken.

(*b*) Analysis of a mixture of pure phenol and ammonium polysulphide, carried out by the method described, gave the following results:—Wt. of phenol taken, 0·427 grm.; Wt. of phenol found, 0·418 grm.; *i.e.*, 97·8 per cent. of amount taken.

Blank tests were then carried out to find the influence of the presence of thiocyanate and thiosulphate on the accuracy of the test. A solution of 0·27 grm. of sodium thiocyanate in 30 c.c. of water was taken and treated just as in the phenol test. It was found that the iodine taken up was equivalent to 0·0005 grm. of phenol. Tests were also made on the influence of sulphur dioxide. If thiosulphates or sulphites were present in the liquor, sulphur dioxide would pass over in the first distillation with acid. A solution of sulphur dioxide was therefore treated with calcium carbonate and immediately distilled. No measurable amount of sulphur dioxide was found in the distillate. It is thus evident that the presence of thiosulphates, sulphites, and thiocyanates in the gas liquor will have no influence on the accuracy of the test as described.

In the first set of analyses which was carried out, the amount of sodium hydroxide used on titration with iodine was only about equivalent to the phenol present, whilst the iodine was only added until sodium hypoiodite was present (as ascertained by acidifying a drop of the solution and testing with starch solution). The titrated solution was colourless, and a white precipitate was formed if much phenol was present. A sample of pure phenol was dissolved in water and the solution titrated in this manner. The found percentage of phenol, calculated as the tri-iodophenol, was as follows:—66·9, 74·6, 70·2, 71·5 per cent. Thus, under these conditions, the amount of iodine taken up appeared roughly to correspond with the formation of di-iodophenol.

The following tables contain the analyses of a number of liquors from various points of the condensing and washing plant at several gas works, the phenol being determined as described. The results in every case are given directly without correction.

Works "*A.*"—Table 1.

Point of sampling.	Twaddell.	Oz. strength.	Grms. per 100 c.c.	
			Ammonia.	Phenol.
Hydraulic main ..	4·1	6·7	1·45	0·341
Scrubber outlet ..	5·6	8·6	1·87	0·292
Standard washer outlet*	6·2	10·2	2·21	0·317
Well	3·9	6·5	1·41	0·262

* In all cases when dealing with liquors the "inlet" or "outlet" refers to the *liquor inlet* or *liquor outlet*.

In this works, the standard washer is fed with pure water, whilst the scrubber is fed with the liquor from the well, which then runs into a small tank and is circulated through the scrubber up to the desired strength, when it is pumped into a separate tank for delivery. The sample from the scrubber outlet was taken from this delivery tank.

Works "*B.*"—Table 2.

Point of sampling.	Grms. of phenol per 100 c.c.
Livesey washer outlet	0·03
Standard washer outlet	0·02
Livesey washer outlet	0·04
Clapham washer outlet	0·03

In the above works the standard and Clapham rotary washers are fed with water, whilst the Livesey washers are fed from the corresponding rotary washer, no liquor from the well being used at all.

Works "*C.*"—Table 3.

Point of sampling.	Phenol per 100 c.c.
	Grms.
Livesey washer inlet	0·21 } sampled on same date.
Livesey washer outlet	0·20
Standard washer outlet	0·02
Standard washer outlet	0·04

At works "C," the Liveseys are fed from the well, and the liquor from the Liveseys flows back to the well.

In Table 4 the results are given of analyses of the liquors from various points at Works "C," the samples being taken simultaneously.

Works "*C.*" Table 4

Point of sampling.	Phenol.	Free ammonia.	Fixed ammonia.	Sulphur as hydrogen sulphide.	Sulphur as thiosulphuric acid.	Carbon dioxide.	Twaddell.
	Grms.	Grms.	Grms.	Grms.	Grms.	Grms.	
Hydraulic main*	0·327	0·702	0·780	0·126	0·256	0·594	2·9
Primary condenser	0·245	2·862	0·130	1·148	0·128	2·266	4·5
Livesey washer inlet (well)	0·211	1·552	0·568	0·521	0·160	1·408	3·8
Livesey washer outlet	0·215	2·588	0·572	1·285	0·172	1·969	5·0
Standard washer outlet ...	0·033	2·311	0·030	1·088	0·096	2·332	4·6

* The sample from the hydraulic main was taken 12 hours after flushing out with liquor from the well.

The above figures are given in grms. per 100 c.c.

In the determination of the sulphur, the liquor was titrated directly with iodine, and the sulphide precipitated as zinc sulphide and titrated separately, the difference being calculated on the assumption that it is present as thiosulphate.

The flow of the liquor through the Livesey washers at works "C" amounted to about 3000 galls. per million cub. ft. of gas passed. At works "B," on the other hand, the flow through the Livesey washers, being simply the liquor from the standard washers, amounted to about 500 galls. per million cub. ft. of gas passed, or only about one-sixth of that at works "C."

From 4 and 5 we see that the concentration of the phenol in the liquors from the hydraulic main and condensers (*i.e.*, in the condensed liquor) is about ten times the concentration in the liquor from the standard washers (*i.e.* in the added water).

Taking into account that the amount of condensed liquor is about five times the amount of water added, the phenol washed out in the condensed liquor must be about 50 times the amount of phenol washed out by the added water. The concentration of the phenol in the liquors from the standard washers at works "B" is of the same order as that at works "C." The case at works "A," however, seems to be different. (*cf.* Table 1.) Another sample of the liquors from works "A" was therefore taken. The following results were obtained:—

Works "A."—Table 5.

Point of sampling.	Phenol Grms. per 100 c.c.
Tower scrubber (after circulation)	0·335
Standard washer outlet	0·159
Well	0·374

The percentage of phenol in the washer liquor is thus considerably less than in the case of the previous sample taken. It is, however, still considerably greater than in the case of the washer liquors at works "B" and "C."

Taking the amount of condensed liquor at works "A" as being five times the amount of the added water the total amount of phenol in the former is from 5 to 10 times the amount of phenol in the added water. The reason for the larger amount of phenol in the added water in the washer liquor was not further investigated, but it is possibly connected with the variation in the amount of carbon dioxide in the gas, the amount of this at the time of investigation being excessive. At this works, the Chance polysulphide cyanide process was in use, the cyanide washer being immediately before the tower ammonia scrubber. At the time of these tests, the thiocyanic acid was also being driven forward (probably by the carbon dioxide) into the washer liquor, and the liquor from this washer contained more thiocyanate than any other washer liquor we have investigated.

The analyses of liquors from another gas works are given in Table 6; in this case the amount of phenol in the liquors from the washer is even smaller than at works "B" and "C."

Works "D."—Table 6.

Point of sampling.	Phenol Grms. per 100 c.c.
Hydraulic main	0·239
Scrubber inlet	0·197
Scrubber outlet	0·202
Standard washer outlet	0·013

Determination of the phenol in various deliveries of gas liquor.—The samples analysed were the average of January and February deliveries.

Table 7.

	Phenol Grms. per 100 c.c.
(1) Yorkshire liquor	0·303
(2) Derbyshire liquor	0·328
(3) Lancashire liquor	0·213
(4) Ditto	0·213
(5) Ditto	0·363
(6) Ditto	0·323

The following tables contain analyses of coke-oven liquors.

Ammonia liquor from Yorkshire Simon-Carvès ovens.

Table 8.

Tw.	2·26.
Phenol	0·103 grm. per 100 c.c.
Ammonium thiocyanate.............	0·074 ,,
Free ammonia	0·764 ,,
Fixed ammonia	0·20 ,,

Table 9.

Ammonia liquor from Lancashire Semet-Solvay ovens.

Tw.	1·8.
Phenol	0·191 grm. per 100 c.c.
Ammonium thiocyanate	0·065 ,,

Determination of the amount of phenol vapour in the gas at works "C."—The determination was carried out by passing the gas through a train of washers containing sodium hydroxide solution, the gas being first freed from tar fog by filtering through cotton wool as in the tar fog tests (*cf.* Clayton and Skirrow, J. Gas Light., June 4th, 1907, p. 660). The gas passed through a tube containing cotton wool, which was placed inside the main in order to be at the same temperature as the gas. From this it passed through two gas washers containing 500 c.c. of 20 per cent. sodium hydroxide solution, and finally through a test meter. About 20 cub. ft of gas was passed through in each case, and it was found that at the end of the experiment about half the caustic soda was left unchanged, thus being always in large excess. Much more cyanide was absorbed than in the case of gas liquor, and it was found advisable to first convert this into ferrocyanide and remove it before proceeding to estimate the phenol. A check test showed that practically no phenol was lost in the process. The amount of phenol in the solutions obtained was too small to be estimated accurately in the usual way, and the following method was therefore adopted in order to estimate the phenol present. A determination was made of the concentration of phenol at which, on titration in the usual way with iodine and thiosulphate, the rose-pink colour of the tri-iodophenol just ceased to be visible.

Solutions were made up containing 0·0010 per cent., 0·0005 per cent., and 0·00025 per cent. of phenol. 250 c.c. of these solutions was taken, caustic soda added, and the titrations carried out in the usual way with iodine and thiosulphate. The first of these solutions showed a very strong rose-pink colour. The second was still very distinctly coloured, whilst the third had just the faintest tinge of rose-pink, just on the limit of visibility of the colour. The caustic soda solutions through which the gas had been passed were made up to a known volume, and an aliquot part then freed from cyanide, distilled, and the distillates made up to 250 c.c. and titrated in the usual way. The end point solution, if coloured, was then diluted to the limit of visibility of the colour, and the amount of phenol thus estimated.

Samples of gas were drawn off from the inlet and outlet of the Livesey washers, the outlet from the Standard washers and also from the inlet to the primary condensers. The tar fog in the gas was estimated at the same time. The following results were obtained:—

Inlet to the Livesey Washers.—Tar fog:* 100 cub. ft. contained 13·1 grms. of tar. *Phenol vapour.* The solution from the washers was made up to 1000 c.c., and 300 c.c. tested for phenol. The end point liquor showed only the faintest trace of pink colour.

Outlet from the Livesey washers (inlet to the Standard washers).—*Tar fog.* 100 cub. ft. contained 1·74 grms. of tar. *Phenol vapour.* No trace of pink in the titrated liquor.

Outlet from the Standard washers.—Tar fog. 100 cub. ft. contained 1·69 grms. of tar. *Phenol vapour.* No trace of pink in the titrated liquor.

Inlet to the primary condensers.—In this case an empty gas washer was introduced between the cotton wool filter and the caustic soda washers, in order to condense the bulk of the moisture separately. A considerable quantity of liquor condensed in this washer, and the phenol in this was estimated separately. The phenol in the caustic soda washers was estimated as before by diluting the liquor to the limit of visibility of the rose-pink colour. The results obtained are contained in Table 10.

Table 10.

Point tested.	Temp.	Grms. phenol per 100 cub. ft. of gas.		
		Condensed liquor.	Caustic soda.	Total.
	°F.			
Condenser inlet	121	0·81	0·06	0·87
Ditto	124	1·15	0·11	1·26
Livesey inlet ..	75			0·015—0·010
Livesey outlet..	71			Less than 0·010
Standard outlet	66			Less than 0·010

These figures are of interest from their bearing on the treatment of effluent from sulphate of ammonia works, as showing that any attempt to prevent the ammonia liquor from taking up phenol by removing the tar from the hot gas would be ineffective, sufficient phenol vapour being present in the gas at the inlet to the primary condensers to account for the phenol dissolved in the condensed liquor from these condensers.

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* In these experiments on the phenols in the gas the "inlet" or "outlet" refers to the "gas inlet" or "gas outlet."

It must be noted in connection with the experiments on the amount of phenol vapour in the gas, that the gas is first passed through a cotton wool filter which becomes gradually coated with tar fog. It is possible that this tar will not be in equilibrium with the gas as regards phenol. The tar fog will have been precipitated at a higher temperature than that existing at the point where the determination is made, and consequently the tar fog on cooling down would tend to take up more phenol from the gas. It is possible that the interchange of the phenol between the gas and the tar may be slower when the tar is floating in the gas than when it is brought into intimate contact with it on the filter. (On the other hand, the amount of tar fog present at the inlet of the primary condenser and Livesey washer is very much greater than at the outlet from the Livesey and standard washers.) From these causes the figures for the phenol vapour in the gas are probably somewhat low. At any rate, the amount of phenol vapour at the inlet to the primary condensers is very much greater than at the inlet to the Livesey washer or the outlet from the standard washers. If we assume that the amount of phenol vapour at the inlet to the washers does actually amount to 0·01 grm. per 100 cub. ft., and that the flow through the washers amounts to 5 galls. per ton of coal carbonised, we see that the gas contains sufficient phenol to give a liquor containing 0·005 grm. of phenol per 100 c.c. The liquor actually contains 0·02 to 0·04 grm. per 100 c.c. The difference is probably partially accounted for by the ammonia in the liquor dissolving phenol from the tar fog passing forward. In the case of the primary condensers, if we assume the flow of condensed liquor as 5 galls. per ton of coal, and the phenol in the gas at 1·0 grm. per 100 cub. ft., this could give a liquor containing 0·4 grm. of phenol per 100 c.c. The liquor actually contains 0·25 grm. of phenol per 100 c.c. A comparison was made of the tar obtained from the Livesey washer with the average tar from the well at the same gas works. The heavy naphthas were determined and also the tar acids. It was found that although there was three times as much heavy naphtha in the tar from the Livesey washer as in the tar from the well, yet the former only contained about three-fifths of the amount of tar acids which the latter contained. It thus seems certain that the tar acids are being largely washed out from the tar fog. If we take into account that, up to the primary condensers, the gas contains sufficient phenol vapour to account for the phenols in the liquor from these condensers, we see that this washing of the tar fog must occur largely in the Livesey washers.

Extraction and examination of the tar acids contained in gas liquor.—A large batch of gas liquor, taken from the well at works "C," was first acidified with sulphuric acid to remove the excess of sulphuretted hydrogen and carbon dioxide. Sufficient caustic soda to neutralise the excess of acid and to drive off the whole of the ammonia was then added, and the whole batch repeatedly boiled down and the sodium sulphate allowed to crystallise until the mother liquor was reduced to small bulk, care being taken that a sufficient excess of caustic soda was present to prevent loss of phenol. The resulting phenate was acidified with sulphuric acid and the phenols extracted. These were then distilled through a four bulb Le Bel column. The mixture distilled as follows:—

Table 11.

Temperature.	Volume.	Remarks.
°C.		
177—180°	18 c.c.	Crystallized.
180—181	33 c.c.	ditto.
181—182	38 c.c.	ditto.
182—184	25 c.c.	ditto.
184—186	18 c.c.	Partially crystallized.
186—193	22 c.c.	Liquid.
193—197	8 c.c.	ditto.
197—280	10 c.c.	Without column.

These fractions were again systematically fractionated The crystalline fractions were drained on the pump and the crystals united, the drainings being added to the liquid fractions.

The following products were thus obtained :—(1) Crystallised phenol; (2) cresols and crystal drainings; (3) high-boiling residue. A further examination of these gave the following figures:—

Table 12.

	Per cent. on original tar acid.	M. pt.	B. pt.	Contains per cent. of phenol.
		°C.	°C.	
(1)	58	30—36	179—184	89
(2)	34		184—201	36
(3)	8			

Thus, the original tar acid washed out by the ammonia liquor contained 65·0 per cent. of pure phenol.

Hence, although the tar contains a much larger amount of cresols than of phenol, yet owing to the more feeble acid nature of the cresols the phenol is preferentially washed out by the ammonia liquor. The amount of pure phenol which is lost in the ammonia liquors, calculated from the above figures, amounts to 0·37 to 0·55 lb. per ton of coal carbonised; whilst the amount of pure phenol recoverable in the tar is only 0·53 lb. per ton of coal carbonised. Thus, about half the pure phenol which is produced in the retorts is lost in the ammonia liquor.

Determination of the correction to be applied to the percentages of phenol in gas liquor due to the fact that the gas liquor contains both phenol and cresols.—The analysis was carried out in the usual way on known solutions of the phenol and cresols extracted from the gas liquor. 1 grm. of the phenol and cresol respectively was dissolved in water and made up to 500 c.c. The analysis of this solution was then carried out as described in the beginning of this paper, the solution not being distilled but directly titrated. The following results were obtained:—*Phenol solution from gas liquor.* 100 c.c. = = 1·604 grm. of iodine = 0·198 grm. of phenols (calc. as phenol). *Cresol solution from gas liquor.* 100 c.c. = 1·426 grm. iodine = 0·176 grm. of phenols (calc. as phenol). If we now take into account the relative volume in which the phenol and cresol fractions were obtained we arrive at the following result:—1 grm. of average tar acid = 7·691 grm. of iodine = 0·950 grm. of phenol (calc. as phenol). We thus see that the results are about 5 per cent. low, due to the presence of cresols in the gas liquor.

Determination of the "oxygen absorption" by the phenols, etc., from gas liquor.—These determinations were carried out by the method used in sewage works analyses. A very dilute solution of the tar acid was prepared, 1 grm. being dissolved to 500 c.c. and 10 c.c. of this further diluted to 500 c.c. This solution thus contained 0·002 grm. of tar acid in 50 c.c. of the solution. The oxidation of 50 c.c. of this solution was carried out by 50 c.c. of a dilute potassium permanganate solution (0·79 grm. per litre) in presence of dilute sulphuric acid. The reaction was stopped at the end of the desired interval by the addition of about 1 c.c. of 10 per cent. potassium iodide solution. The liberated iodine was titrated with a dilute thiosulphate solution. A blank test with water alone was carried out simultaneously. The oxidations were carried out at a constant temperature (23° C.). The following results were obtained:—*Phenol solution ex gas liquor* (3 minutes test). 1 grm. of phenol = 1,401 grms. of oxygen. The above phenol is of course not free from cresol. *Cresol solution ex gas liquor* (3 minutes test). The cresol contains phenol. 1 grm. of cresol = 1,245 grms. of oxygen. *Average tar acid ex gas liquor.* 1 grm. of tar acid = 1,343 grms. of oxygen. The oxygen absorption by very dilute solutions of thiocyanate, thiosulphate, and ferrocyanide was also determined under the conditions of the test. The following were the results obtained:—

Sodium thiocyanate, 1 grm. = 0·582 grm. of oxygen.
Sodium thiosulphate, 1 grm. = 0·336 grm. of oxygen.
Sodium ferrocyanide, 1 grm. = 0·018 grm. of oxygen.

Oxygen absorption of an effluent from a sulphate of ammonia works.—10 c.c. of the filtered effluent was diluted to 500 c.c., and 50 c.c. of this solution was tested. 1000 c.c. effluent = 5·478 grms. of oxygen. This is accounted for as follows:—

TABLE 13.—1000 *c.c. Effluent.*

	Grms. present (Calc. as sodium salt.)	Oxygen required.	Per cent. of total oxygen.
		Grms.	
Tar acids	2·12	2·847	52·0
Sodium thiocyanate ..	3·14	1·827	33·3
Sodium thiosulphate	1·58	0·530	9·7
Sodium ferrocyanide	0·28	0·005	0·1
Other bodies		0·269	4·9
			100·0

The influence of the phenols on the solution of the naphthalene problem remains to be briefly discussed. It is contended that phenols have a very important influence on the deposition of naphthalene from crude gas, which naphthalene in many gas works comes down in a flaky crystalline condition, thus causing blockages in the distributing system, both in the works and the districts supplied. The supposition is that if the tar fog be extracted hot the phenols (and light oils) go forward in the gas[*] (as has been shown in Table 10) and on cooling deposit along with the naphthalene as a solvent thus keeping it in the liquid form. Mention has also been made of the action of ammonia liquor on the phenols in the gas and tar fog, thus removing one of the best naphthalene solvents.[†]

So far as we know, no quantitative estimations on this point have been carried out,[‡] but it is hoped that the method here described and the results obtained will be of value to those engaged in investigating this problem. It was hoped that these figures would show something more definite on this naphthalene question, but in this work the experiments were not carried sufficiently far to warrant any definite statement being made on the subject. The investigation from which these results are drawn not bearing directly on this question, it was impossible to devote further time to the elucidation of this point.

In conclusion, I desire to express my indebtedness to the Directors of Messrs. Hardman and Holden, Ltd., for permission to publish these results. I also wish to cordially thank those gas managers who kindly afforded facilities for the collection of samples, and Mr. H. Mather who carried out many of the analyses here recorded.

DISCUSSION.

Mr. SAMUEL GLOVER said with regard to the proportion of phenols which went to the gas liquor and that which stayed in the tar, where they were of value, that he could not help thinking that the process of condensation, which brought the tar into close contact with the crude gas, would increase the proportion of phenols in the tar. But when there it would be necessary to keep that tar, whether in the form of tar mist or otherwise, from coming into contact with strong ammoniacal liquor, lest the phenols be reabsorbed and reappear in the effluent liquors of the sulphate of ammonia plant. The keeping of the phenols in the tar, where they were of some value, would be assisted by the insertion in the gas works plant of a tar extractor, the function of which was to remove from the crude gas, the suspended globules of tar, which would otherwise get into the washers and scrubbers where the phenols would be absorbed by the ammoniacal liquor. Now if the tar vapour was the vehicle by which the phenols came into contact with the strong liquor, the tar vapours had better be removed from the crude gas before it touched the strong liquor. That there were less phenols found in the liquor from the outlet of the weak liquor finishing washer was due to the fact that the strong ammoniacal liquor in the first washers had already taken out the bulk of it. They also would be glad of a practical process which would remove such phenols as did get carried away by the ammoniacal liquor so that the effluent liquor from ammonia works would not interfere with the bacterial treatment of sewage.

W. IRWIN said as a predecessor of Dr. Skirrow at the Miles Platting Works, he had made experiments 20 years ago on the determination of phenols in treating solutions in contact with tar oils. He used the bromine method and while his results were not so accurate as those of Dr. Skirrow, they were sufficiently accurate to show that in the manufacture of carbolic acid as then conducted, they were losing 20 to 25 per cent. of pure phenol in the neutralised sulphate of soda solution. This result in addition to the saving in caustic soda led him to experiment on and ultimately to substitute carbonic acid for sulphuric acid for neutralising the phenate of soda solution. Dr. Skirrow gave as the reason why there was more phenol than cresol in the ammoniacal liquor that the former was a stronger acid than the latter. Was it not quite as reasonable to assume that, seeing that there is an excess of carbonic acid present, it was due to the fact that phenol is so much more soluble in water than cresol? He should like to ask Dr. Skirrow if he had studied the influence of temperature of carbonisation on the production of phenols and their solutions in the ammoniacal liquor at various points of condensation? Also, if he had compared the influence of temperature on the vapour tension of phenol with that of naphtha of similar boiling point. This might throw some light on the question why there was more deposit at one point than at another.

Mr. RAYMOND ROSS said he had tried the process of phenol estimation. In the Burnley gas liquor there was ·290 per cent. of phenol present, and to that they added ·05 per cent. pure phenol and estimated by the process described in the paper with very accurate results. He estimated the phenol in the waste liquor from the still and found ·115 per cent. and thus showing a loss of 60 per cent. of phenol in the process of manufacture. The lime was fed into the still with hot waste liquor.

Mr. EDWARD ARDERN said he was chiefly interested in the composition of the effluent from ammonium sulphate plants, as he was concerned with its ultimate purification and disposal. The information contained in Table 13 was very interesting as showing the effect on the general composition of the sewage of the admittance of such effluents to the sewers. This effect was more strikingly shown if the amount of oxygen absorbed from permanganate by the waste liquors was expressed in grains per gallon, terms in which the strength of sewage was often given. Taking the figures given in the above table this was found to be equivalent to nearly 400 grains per gallon. (Average oxygen absorption of Manchester sewage 7·5 grains per gallon.) The effect of such waste liquors obviously depended on the relation of its volume to the total flow of sewage. In the case of Manchester the proportion of this liquor was much greater than was usual, owing to the fact that in addition to the recovery of ammonia from the ammoniacal liquor produced at the Corporation gas works, quantities of outside ammoniacal liquors were also dealt with in the city. The total volume of waste liquors from sulphate of ammonium plants entering the sewer was such that the oxygen absorption of the average sewage of Manchester was increased by between 1 and 2 grains per gallon. Thus while no special difficulty in connection with the purification of the sewage was introduced, it would be seen that the presence (in the case of Manchester) of waste liquor from sulphate of ammonia plants considerably increased the amount of oxidisable matters in the sewage, and so long as the Rivers Authority employed the oxygen absorption from permanganate as a standard test of purity of sewage effluents, entailed a consequent increase in the necessary purification works. In connection with the question of the purification of the effluent from sulphate of ammonia plants, it was important to determine how far the oxygen absorption was due to each of the various constituents. Analyses had been made at Davyhulme which agreed fairly closely with the results given by the authors in Table 13. He was astonished to learn that one-half of the total phenols produced from the coal was contained in the ammoniacal liquor and therefore at present lost. Reference to the table quoted would show that over 50 per cent. of the oxygen absorption of the waste liquor from the recovery of ammonia was due to the presence of tar acids. It therefore appeared to him—although he was quite unaware as to how far it was practicable—that attention should be directed to the question of collecting the phenols apart from the ammoniacal liquor, which would not only result in a double yield of phenols, but would considerably reduce the difficulty of dealing with the waste liquor. He might refer to the fact that for some time past Dr. Fowler had been undertaking filtration experiments with crude and diluted waste liquors. These experiments had met with considerable success and were being continued with a view to ascertaining whether it was more economical to deal with the liquor before entering the sewer than when mixed with the sewage at the outfall works.

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[*] cf. Everitt, Gas World, 1906, 227; Colman, J. Gas Lighting 1906, 524.

[†] White and Clary, J. Gas Lighting, 92, 388.

[‡] White and Clary, *loc. cit.*, estimated the phenol in scrubber liquor by shaking out with chloroform and weighing the extract, and stated that these liquors contained about 0·3 per cent. of phenol.

Mr. W. H. Coleman thanked Dr. Skirrow for insisting upon a more rational method of stating the quantity of ammonia in liquor in grammes per 100 c.c. rather than as ounces. In reference to Mr. Ardern's remarks, he did not think that the recovery of ·5 lb. of phenol per ton of coal presented any great possibilities financially. Its value was only about ·9 of a 1d. per ton of coal, or about ·03 of a 1d. per gallon of liquor.

The Chairman said with regard to the Table 10, they would observe that although the tar-fog had been separated from the gas by the cotton-wool filter, the phenol vapour passed forward when the temperature was fairly high. Any separation of the tar therefore at high temperature would not prevent the phenols going forward and getting into the ammoniacal liquor condensed late. The bulk of the liquor condensed in the hydraulic main, which liquor also contained a large amount of phenols. Anything done to the gas after it left the hydraulic main would not greatly influence the total amount of phenol present in the final liquors. The results seemed to show that 0·3 per cent. was about the maximum quantity of phenol which could be absorbed in the condensed liquor, and this figure was fairly regular for liquors obtained from very different materials.

Dr. Skirrow, in reply to Mr. Irwin, said the liquors were not saturated with respect to either phenol or cresol, and therefore the solubility of these bodies in water had no influence on the relative amounts of the two substances taken up. He had not studied the questions of temperature of carbonisation with respect to the problem, the temperatures of carbonisation in each case dealt with being high; and further he had not made any study of the change of vapour pressure with temperature. With regard to the loss of 60 per cent. of the phenols from the liquors in the making of sulphate of ammonia, his experience had been that a much larger percentage of the phenols contained in the gas liquor than that mentioned by Mr. Ross found its way into the waste liquor.

Scottish Section.

Meeting held at Glasgow on Friday, November 29th, 1907.

MR. R. T. THOMSON IN THE CHAIR.

THE TESTING OF SPERM OIL AND SPERMACETI.

BY HARRY DUNLOP.

The examination of sperm oil has received the attention of various authorities on oil analysis, Allen being among the first to point out that this substance was in reality a liquid wax; while other observers have recorded a number of "constants" and "variables" for this oil. Now it is unfortunate that in the compilation of tables of "constants," the method generally adopted in standard books renders it often impossible to obtain, for example, the specific gravity, iodine value, wax alcohols, etc. for one particular sample, which is, in my opinion, more important than the recording of a number of "constants" for different samples between which no relationship may be traced. For this and other reasons, I have found it necessary to obtain and examine a number of specimens of what I believe to be genuine sperm oil, and in the present paper I propose to refer to the more important "constants" and also to several qualitative tests which assist one in forming an opinion as to the genuineness or otherwise of a sample. In Table A are embodied the results of the examination of several samples of Southern and Arctic oil, which were obtained from reliable sources; it also includes a whale blubber oil, which does not call for any special remark. As indicated in Table A, oils 1 and 2 (from two animals) represent the oil after removal of the spermaceti from the "head" and "body" matter respectively. The marked difference shown in the iodine value, saponification value, refraction, etc., is rather peculiar, but oils 1a and 2a must certainly be regarded as abnormal, in fact the oils from the "head" and "body" matter are seldom if ever kept separate after extraction of the spermaceti. Body oil 2b is also abnormal in the amount of unsaponifiable matter, namely 44·3 per cent., being the highest figure yet recorded for this constituent.

Specific gravity.—The limits generally accepted for this "constant" are from about 0·876 to 0·884, and the figures here recorded almost fall within these limits. Too great reliance should not be placed on this test until the absence of mineral oil has been proved, in which case a figure within the limits of 0·875 to 0·882 will generally indicate a pure oil; while oils having specific gravities of 0·883 and upwards, should be carefully tested as to their drying properties, etc.

Wax alcohols, etc.—It is difficult to fix the minimum limit for unsaponifiable matter in sperm oil, a number of figures for apparently genuine oils having been recorded as low as 31·7 per cent., the maximum being about 42·6 per cent. From the examination of a large number of samples, I should say that 36 to 44 would represent the range, although by far the greater number fall between 38 and 42 per cent. In the determination of the unsaponifiable matter, methylated ether should be used in preference to petroleum ether, which gives great trouble by the formation of emulsion layers; a small quantity of potash soap is always dissolved by the former, but it can be easily removed by agitation with dilute caustic potash solution, followed by several washings with water.

Iodine value.—As in the case of fatty oils, sperm oil shows considerable variation in the amount of iodine absorbed, the figures given in Table A ranging from 70·3 to 92·8 per cent., and figures are on record showing almost as great a range. In the case of commercial samples I have examined, the greater number gave iodine values of from 87 to 90 per cent. by the Wijs method, which gives with sperm oil values from 2 to 3 per cent. higher than by the Hübl method.

Some discretion is required when drawing conclusions from a high iodine value, and in all cases it is necessary to take into account the relationship of the iodine value to the specific gravity, saponification value, wax alcohols, etc., and also the tendency of the oil to "gum" at a temperature of 100° C. This latter test, which can be simply carried out by exposing a thin film of the sample on a glass plate to the temperature of the water-bath for 24 hours, gives a very fair indication of the presence of blubber oils; the effect of even 10 per cent. of whale oil or similar oil being quite noticeable after 12 hours' exposure.

Saponification value.—This "constant" is of some importance when taken in conjunction with the specific gravity and percentage of unsaponifiable matter, but as a single test I have found it of little value.

Refractive power.—The relationship which is known to exist between the iodine value and refractive power of many fatty oils does not appear to hold good for sperm oil, although as a general rule a high iodine value is accompanied by a high refraction, but as an independent test the refractive power must take a subsidiary place. It will be observed that there is some relationship between the iodine value and refractive power of the wax alcohols, and the iodine value of the oil; in fact the difference in the amount of iodine absorbed by different oils, must be due to the variable composition of the wax alcohols, and not to the fatty acids.

Refractive power of the unsaponifiable matter.—As the addition of 10 per cent. of ordinary "·865" mineral oil to the wax alcohols will raise the Zeiss reading by about 6 units, a determination of the above will give some indication of this adulterant. The highest reading I have obtained for genuine oils is 47 scale units at 25° C. It is useless to attempt to make a distinction between Southern and Arctic sperm, as the "constants" of the two oils show very clearly. Doubtless, the smell and taste give to the practical man information which a chemical examination is unable to furnish, but I am assured that in the case of oils rendered from the fresh blubber, the distinctive smell of Arctic oil is almost absent, and sample No. 3, Table A, for example, which was rendered on board ship, could not have been distinguished from Southern oil.

Having briefly considered the "constants" of genuine sperm oil, I will now refer to the detection of the commoner adulterants met with in commercial samples.

Taking first mineral oil, a determination and examination of the unsaponifiable matter will give the information desired. However, as a preliminary, it is better to apply Holde's test, which consists in adding water to an alcoholic solution of the saponified oil, when the mineral oil is thrown out of solution, the wax alcohols remaining dissolved in the soap solution. The quantities given by Holde, viz.:—6 to 8 drops of oil and 5 c.c. of $N/2$ alcoholic potash solution, appear to be most satisfactory. In applying Holde's test to sperm oil, to any oil in fact, the water must be added very carefully, as with small quantities of mineral oil present, the turbidity, which appears after the addition of the first few drops, disappears on the further addition of water, but with some practice there is little danger of missing the point where the solution becomes turbid. A series of tests on mixtures of sperm oil with mineral oils of different specific gravity proved that as little as 3·5 per cent. of the latter could be detected.

The separation of the unsaponifiable matter consisting of wax alcohols, etc., and mineral oil, may be attempted by means of acetic anhydride, or simply by applying what may be termed "the solubility in alcohol test" and to which I will refer later. The wax alcohols and other naturally occurring unsaponifiable substances from genuine sperm oil dissolve completely in an equal weight of boiling acetic anhydride, the solution of the acetates remaining clear on cooling to the normal temperature; while mineral oils, although soluble to a large extent in boiling acetic anhydride, separate from the latter on cooling. An apparently simple method of detecting and roughly estimating the mineral oil is thus suggested. Actual trial, however, did not give the results expected, as the following tests will show. Successive weighed quantities of "·885" mineral oil were added to a small flask containing 3 c.c. of acetic anhydride, and the mixture boiled under a reflux condenser after each addition of oil. The first test after the addition of 1·6 grms. of oil remained clear at boiling temperature; while a second test proved that over 3 grms. of the same oil could be dissolved in 3 c.c. of the solvent at the boiling point. In each case, after cooling a few degrees, both solutions became cloudy and finally separated into two layers. A series of tests showed that acetic anhydride at 16° to 20° C. dissolved from 0·5 to 1 per cent. of "·885" mineral oil. It now remained to find whether this solubility would hold good for a solution of wax alcohols in acetic anhydride. With this end in view, 2 grms. of wax alcohols was acetylated by boiling with 3 c.c. of acetic anhydride, and weighed quantities of mineral oil added from time to time, the mixture being boiled and then allowed to cool after each addition of oil. After 0·65 grm. of oil had been added, the solution which appeared clear when hot, became cloudy on cooling, indicating that the solution was saturated; while the further addition of 3 to 4 grms. of oil still gave a clear solution at the boiling point. Calculating from this result, it appears that not less than 24 per cent. of mineral oil in the wax alcohols, or about 9·5 per cent. in the original sample, could be detected by this test.

Solubility in alcohol.—The solubility of the unsaponifiable matter from sperm oil in ethyl alcohol has been proposed as a test for mineral oil, but only within the last few years (Analyst, 1904, 3) has this test been thoroughly investigated. Nash showed that a concentrated solution of the wax alcohols in ethyl alcohol was capable of holding a large quantity of mineral oil in solution, especially when absolute alcohol was employed, thus rendering the test as then applied, quite useless, or worse—misleading. I have repeated the experiments made by Nash, and can confirm his statements as to the solubility of mineral oil; even when alcohol of 0·834 sp. gr. was employed, and a dilute solution of the unsaponifiable matters, the amount of mineral oil dissolved was considerable.

Flashing point.—The flashing point has also been proposed as a test for mineral oil in sperm oil. A number of genuine sperm oils, when tested in Gray's apparatus, flashed at from 410° to 422° F., and experiments with mixtures showed the test to be of considerable value. For example, a mixture of sperm (flashing point 416° F.) with 5 per cent. of "·865" mineral oil, flashed at 361° F., and with 5 per cent. of 0·896 mineral oil, at 392° F.

I should like here to refer to the statement so often made, that sperm oil does not contain glycerol; even the latest published text books referring to sperm oil as consisting entirely of the esters of monohydric alcohols. Assuming this to be correct, the percentage of glycerol yielded by a sample will be an exact measure of the amount of fatty oil present. Now, when examining commercial samples suspected of adulteration with blubber oils, I have, in certain cases, found that the percentage of fatty oil as calculated from the glycerol was greatly in excess of what one would have expected from a consideration of the "constants." As this threw some doubt on the accuracy of the method, I tested a number of genuine sperm oils for glycerol, with the following results, which prove that the above as a general statement is quite erroneous.

Oil.	Wax alcohols. Per cent.	Glycerol. Per cent.
Bottlenose	38·02	2·56
Bottlenose	39·22	2·26
Cachalot "head"	41·16	2·51
Cachalot "head"	42·28	1·53
Cachalot "body"	44·30	1·36

The glycerol was determined by the acetin method after extraction with ether-alcohol mixture. It is therefore dangerous to attempt to calculate the percentage of fatty oil present from the amount of glycerol found, especially when quantities under 2·5 per cent. are obtained. Since writing the above, I find that Fendler (Chem. Zeit., 1905, 29, 555) found 1·32 per cent. of glycerol in a genuine sperm oil.

A more promising method of detecting blubber oils will, I think, be found in the estimation of the brominated glycerides insoluble in a mixture of alcohol and carbon tetrachloride (Procter and Bennett, this J., 1906, 798). The following results were obtained by above method:—

	"Bromides." Per cent.
1. Cachalot "head"	1·13
2. Cachalot "body"	2·00
3. Cachalot "body"	2·30
4. Bottlenose	3·04
5. No. 2 with 10 per cent. whale oil	3·68

These values are in fair agreement with Walker and Warburton's experiments, but as Procter and Bennett have obtained 6·2 to 6·5 per cent. of "bromides" from sperm oil, further investigation with genuine oils would be required before placing any reliance on the method.

Viscosity.—Before the introduction of mineral oils became general, sperm oil was the standard lubricant for all classes of light machinery. At the present day it is almost entirely superseded by mineral oils. No doubt sperm oil shows a better "maintenance of viscosity" at high temperatures than mineral oil of similar specific gravity, as will be seen on reference to Table B, but this fact has possibly been unduly emphasised in the past.

The point here arises as to what can fairly be deduced from a comparison of the curves of such dissimilar oils as lard and sperm. A comparison can be made between sperm and mineral oils with approximately the same rate of flow at an initial temperature; but it appears hardly fair to compare sperm with lard and other fatty oils, since the rate of flow is so widely different at 70° F. This is evident on considering that the possibility of change is so much less in the case of sperm, because a point is reached at a higher temperature where the rate of flow must be practically the same for the two oils.

Spermaceti.—In Table C are embodied the results of an examination of several samples of genuine spermaceti, two of which were prepared in the laboratory from the "head matter" of the Cachalot whale. It will be observed that the iodine values given in above table are considerably higher than those hitherto recorded, sample No. 1 being specially noticeable in this respect. With this sample the high absorption can be accounted for by the presence of a little oil, due to the low temperature and pressure employed in its preparation; but when comparing these values with older published figures, one must make allowance for the higher absorption given by the Wijs over the old Hübl method. The other constants do not call for any special remark.

In testing commercial samples, the melting point, or preferably the solidifying point, in conjunction with the saponification and acid values, will in many cases detect adulteration, but an examination should always include a determination of the iodine value, as well as special tests for paraffin wax and stearic acid. For the detection of the former I have found Holde's test, as in the case of sperm oil, to be quite reliable, as direct experiment on mixtures proved that as little as 3·5 per cent. of paraffin wax could be detected in this way. However, much smaller quantities of the latter adulterant can be detected by separating the wax alcohols, boiling with acetic anhydride, and observing the behaviour of the solution. As in the case of the alcohols from sperm oil, those from genuine spermaceti, when so treated, give a clear solution on cooling to the normal temperature, but if paraffin wax be present, the solution soon turns cloudy, due to separation of the latter. Working in this way it is possible to detect 2·5 per cent. or less of mineral wax in the unsaponifiable matter, or equal to 1·2 to 1·3 per cent. in the original sample.

For the detection of stearic acid I have found the well-known ammonia test reliable, down to about 3 per cent., but with smaller quantities the test appeared somewhat uncertain. A determination of the unsaponifiable matter will, of course, afford a rough means of calculating the amount of mineral wax present in a sample, but where qualitative tests have given negative results, there is little to be gained by carrying out a further examination.

Table A.

Southern and Arctic Sperm Oils from reliable sources.

	Cold test. °C.	Sp. gr. at 15·5 °C.	Wax alcohols, etc. Per cent.	Iodine value. (Wijs.)	Saponification value. Per cent.	Zeiss refractometer at 25° C.	Free acid as oleic acid. Per cent.	Wax alcohols, etc. Iodine value. (Wijs.)	Wax alcohols, etc. Melting point. °C.	Wax alcohols, etc. Zeiss refractometer. 25° C.	Wax alcohols, etc. Zeiss refractometer. 40° C.
1a. Cachalot oil from "head matter"	9·5	·8779	42·28	76·30	14·02	49·7	4·60	60·43	32 –32·5	—	35·0
1b. Cachalot oil from "body matter"	8·5	·8772	42·14	92·85	12·48	54·8	1·42	83·17	24·5–25·5	47·0	39.0
2a. Cachalot oil from "head matter"	7	·880	41·16	70·35	14·44	50·0	1·39	53·7	31·5–32·5	—	35·0
2b. Cachalot oil from "body matter"	7	·8757	44·30	87·90	12·20	54·6	1·07	79·77	23 –24	47·0	—
3. Arctic sperm (bottlenose)	—	·8806	38·02	88·75	12·90	55·2	·73	80·35	23·5–24	46·7	38·7
4. Arctic sperm (bottlenose)	—	·8786	39·22	82·80	12·48	55·3	1·43	69·4	23	46·2	38·2
5. Southern sperm	—	·8791	41·16	84·35	12·97	54·6	1·16	68·5	26·5	45·7	37·7
6. Southern sperm	—	·8798	39·20	84·37	12·90	—	2·53	69·37			
7. Whale (blubber) oil	—	·9241	—	136·30	19·28	70·5	6·28				

Table B.

Viscosities by Redwood's viscometer.

No.	Oil.	Seconds for 50 c.c. 70° F.	90° F.	140° F.	Ratio calculated. 70° F.	90° F.	140° F.
1	Sperm	164	109	56	100	66·4	34·1
2	Sperm	146	102	52	100	69·8	35·6
3	Southern sperm	148	106	54	100	71·6	36·4
4	Arctic sperm	160	—	57	100	—	35·0
5	Sperm	161	110	58	100	68·3	36·0
6	Mineral oil, 0·893	166	99	48	100	59·6	28·9
7	50 per cent. No. 5 and 50 per cent. No. 6	157	102	52	100	64·9	33·1
8	Horse oil	286	180	80	100	62·9	28
9	Lard oil	357	220	90	100	61·6	25·2
10	Tallow oil...........................	382	234	94	100	61·2	24·6
11	Whale oil	250	159	72	100	63·6	28·8

Table C.

Genuine spermaceti.

Spermaceti.	Melting point. °C.	Solidifying point °C.	Iodine value. (Wijs)	Wax alcohols, etc. Per cent.	Fatty acids, per cent.	Melting point of fatty acids. °C.	Free acid (as oleic) per cent.	Saponification value. per cent.	Wax alcohols, etc. Melting point °C.	Wax alcohols, etc. Iodine value.
1. From "head matter," Cachalot. Extracted in laboratory	41 –41·5	41	—	54·22	49·78	32–33	—	12·90	46 –46·5	
2. From "head matter," Cachalot. Extracted in laboratory	41 –42	—	9·33	53·20	—	—	—	12·90	45·5–46	6·35
3. Reliable source (refined)..........	44 –44·5	44	7·21	53·00	50·58	39·5–40	—	12·06	47 –47·5	4·26
4. Reliable source (refined)	45·5–46	45·7	5·32	51·56	—	—	0·10	12·18	47·5–48	3·41
5. Reliable source (refined)	45 –45·5	45	5·50	—	—	—	0·24	12·06	47·5–48	2·98

Journal and Patent Literature.

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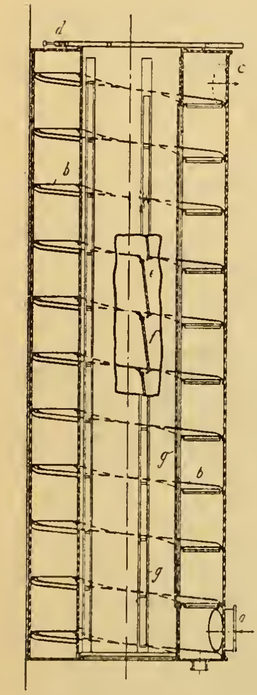
I.—PLANT, APPARATUS, AND MACHINERY.

Patents.

Stills ; Continuous ——. E. Krepper, St. Louis, U.S.A. Eng. Pat. 2800, Feb. 4, 1907.

See U.S. Pat. 843,217 of 1907 ; this J., 1907, 396.—T. F. B.

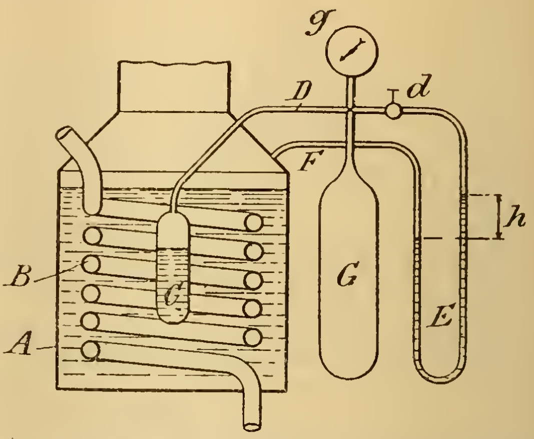
Cooling, washing or enriching of gases or liquids. E. C. R. Marks, London. From Act.-Ges. für Kohlendestillation, Gelsenkirchen-Bulmke, Germany. Eng. Pat 6023, March 12, 1907.



The gas enters the apparatus near the bottom through the pipe, *a*, passes upwards through the spiral chamber formed by the helical plate, *b*, and escapes at the top through the pipe, *c*. The washing liquid enters at the top of the chamber through a number of jets, *d*, flows down over the surface of the spinal plate and escapes at the bottom. In each whorl of the spiral there are as many slots, *e*, as there are inlets, *d*. The washing liquid from any one of the inlets flows round a portion of the upper whorl and then drops through the slot to the next whorl, flows round a portion of this and then again drops on to the whorl beneath, and so on. Each separate supply of liquid therefore flows round the spiral to the bottom without getting mixed with the liquid from the other inlets. As the liquid falls through the slots, it forms a veil or screen of liquid through which the gas flowing upwards must pass, and in order to prevent the liquid from collecting together and falling in a single stream, screens of perforated plates, *f*, are arranged to guide the liquid in its fall and to cause it to spread out. Doors, *g*, are provided to enable the perforated plates to be withdrawn for cleaning.—W. H. C.

Mixtures of liquids [*liquid air, etc.*] ; *Determining and recording the composition, at any time, of boiling* ——. The British Oxygen Co., Ltd., London. From Ges. für Linde's Eismaschinen A.-G., Munich, Germany. Eng. Pat. 19,813, Sept. 4, 1907.

If into a boiling mixture of liquids present in unknown proportions, a vessel be introduced which contains a mixture of the same liquids in known proportions, the temperatures of the two mixtures will be the same, but their saturation pressures will vary according to the proportions in the mixtures. If the two vessels be connected each to one side of a liquid pressure gauge, the variation in the heights of the liquid columns will be at any moment proportional to the composition of the mixtures. The mixture of unknown composition contained in the vessel, A, heated by the coil, B, has the vessel, C, containing the mixture of known proportions, immersed in it. The two vessels are connected to the gauge, E, by the tubes, D, and F, and the difference of level, *h*, indicates the composition of the mixture in A. If the liquids are gaseous at ordinary temperatures, a reservoir, G, having a pressure gauge, *g*, is provided, and a tap is interposed in the pipe, D, at *d*. When in use, the gas in the reservoir, G, condenses as a liquid in C, and the tap, *d*, is then opened.—W. H. C.



Filter elements ; Lining for ——. C. Sellenscheidt, Berlin. Eng. Pat. 20,375, Sept. 12, 1907.

The frames, or plates of filter-presses are covered, or lined with hard rubber, or vulcanite, but have the vulcanite covered with soft rubber at those places which form the joints.—W. H. C.

Filter-press with press-membranes. M. Hankel. Ger. Pat. 174,983, March 16, 1905.

The press is made up of a number of elements the sides of which are hollowed out, so that when the parts are assembled, lens-shaped chambers are formed. Membranes are stretched between the filter elements, and under the pressure of the material being filtered, are forced up against one side of the respective chambers, the other side of which is covered with a filter-cloth. The inlet pipes for the material to be filtered and for the compressing or washing agent are parallel to the axis of the press, and communicate with the chambers by transverse pipes. When the material is fed into the press, it fills the chambers, and the filtrate passes through the filter-cloths and away through suitable channels. The compressing agent is then introduced and enters the chambers behind the membranes, and compresses the press-cakes. The membranes may be of pervious material to allow of compressing and washing the press-cakes at the same time.—A. S.

Carbon dioxide, etc. Eng. Pat. 28,183. *See* XXIII., *under Apparatus.*

II.—FUEL, GAS, AND LIGHT.

New Zealand coals ; Analyses of ——. Report by J. S Maclaurin to the Mines Dept., New Zealand.

Detailed results are given of the analysis of a large number of New Zealand coals, including figures for the calorific power, as determined in a Mahler bomb calorimeter, and of the evaporative power. The semi-anthracite coals from Paparoa are not so rich in fixed carbon as some samples of Welsh anthracite examined for comparison, but are equal to the latter in evaporative power, and contain less sulphur. The bituminous coals are

useful for producing steam or for gas-making, or for household purposes, and yield coke of good quality. Those from Paparoa, Westport, Point Elizabeth, and Brunner, are somewhat better than the samples of Canadian and New South Wales coals with which they were compared. The glance coals do not in all cases yield such compact coherent coke as the bituminous coals, but are good for either steam raising or for household use. The lignites and brown coals are useful for household purposes. The use of the bituminous coals and lignites for the manufacture of producer-gas is also discussed.
—A. S.

Patents.

Fuel and coke ; Production of ——. H. S. Robertson and J. R. Graham, Walthamstow. Eng. Pat. 28,475, Dec. 13, 1906.

A binding agent, of the kind described in Eng. Pat. 20,281 of 1906 (this J., 1907, 1190), with or without the addition of the tarry precipitate therein described, is mixed with lime, pulverulent silica, and a small proportion of saltpetre, and the whole is raised to the boiling point. To this mixture is added anthracite coal, powdered anthracite, coal dust, or the like, in the proportion of about 3½ parts of the mixture to 96½ of the coal, and the product is formed into blocks as usual. These may be converted into coke in any ordinary coking furnace.
—H. B.

Hydrocarbons of high boiling point [*motor fuel*] ; *Process for increasing the explosiveness of* ——. Rütgerswerke-A.-G. Fr. Pat. 380,883, Aug. 17, 1907.

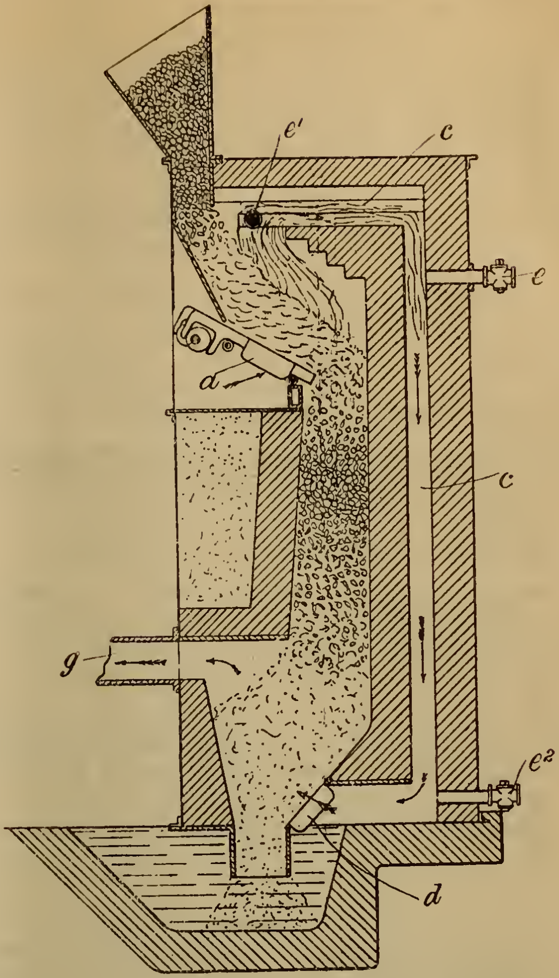
Liquid hydrocarbons of high boiling-point, and ethylic alcohol, are rendered suitable for use in motors working at low compression, by the addition of small quantities of combustible liquids which, at a temperature of 100° C., have a vapour tension of at least 2000 mm. ; *e.g.*, ether, sulphides of carbon, or hydrocarbons of low boiling-point. For example, to a tar-oil fraction, of which over 90 per cent. distils between 160° and 260° C., and of which the flash-point (Pensky) is 51°, there is added 1 per cent. of gasoline or ether.—H. B.

Vertical retorts for the destructive distillation of coal. H. W. Woodall, Wimbourne, and A. McD. Duckham, Upper Parkstone, Dorset. Eng. Pat. 28,580, Dec. 14, 1906.

In operating vertical retorts, having at their lower ends gas-tight hoppers, provided with means for removing the coke periodically without egress of gas or ingress of air, the coke is quenched by means of water or steam in the bottom of the hopper or in the discharging device. By this means the gas absorbed by the coke is expelled before the coke is discharged.—H. B.

Producer gas ; Manufacture of ——. W. J. Crossley and T. Rigby, Manchester. Eng. Pat. 28,181, Dec. 11, 1906.

In the manufacture of producer gas from bituminous fuel, particularly of the caking variety, the fuel is first burned partially on some mechanically operated device, such as the rocking fire-bars, *a*, so as to destroy the bituminous matter and keep the fuel in a free condition. The coked fuel then descends into the producer proper, and the gas produced is drawn off at *g*. The primary air supply, drawn in through the fire-bars, *a*, passes off with the gaseous and tarry products through the channel, *c*, and enters the producer through the fire-bars, *d*. Secondary supplies of air, steam or other gases may be admitted by pipes, *e*, e^1, and e^2. In some cases a rotating valve may be interposed between the producer proper and the upper, coking region ; this valve, which is provided with pockets or the like, to ensure the continuous or intermittent feeding of the coked fuel into the producer, prevents tarry gases being drawn down through the coke and ensures that they will all pass through the channel, *c*.—H. B.



Producer gas generators. W. J. Crossley and T. Rigby, Manchester. Eng. Pat. 28,834, Dec. 18, 1906.

In producers of the type described and illustrated in the preceding abstract, the fire-grate for the primary combustion is adjustably fixed at such an inclination that the burning fuel will slide down it gradually and easily by gravity, the inclination being so adjusted that the volatile matters of the fuel will have been sufficiently expelled before the resulting coke reaches the producer proper.—H. B.

Fuel gas from mineral carbonates and carbonaceous materials ; Apparatus for manufacturing ——. C. H. Rider, St. Louis, Miss., U.S.A. Eng. Pat. 21,078, Sept. 23, 1907.

Three inclined retorts are arranged one above another in a setting of the usual kind, and are provided at each end with air-tight lids ; they are in communication at their lower ends by means of tubular connections. The two lower retorts are filled with limestone, or other mineral carbonate, whilst the uppermost retort contains coarsely-broken charcoal or other carbonaceous material. During the heating of the retorts, carbon dioxide is expelled from the carbonate and passes through the heated carbon in the uppermost retort, becoming converted into the monoxide ; simultaneously small proportions of methane and hydrogen are evolved. The gas obtained contains but little nitrogen. The gas is drawn off from the upper end of the top retort by means of an exhauster.—H. B.

Gas-producer. O. K. Zwingenberger, New York. U.S. Pat. 874,276, Dec. 17, 1907.

The body of the producer is divided into two compartments by a vertical wall which extends from the bottom to near the top. A grate is provided on each side of the wall near the bottom, and the gas outlet is placed on one side of the producer slightly above the level of one of the grates, which has a bridge built upon it near the centre.—W. H. C.

Water-gas ; Generator for ——. F. Dannert, Assignor to J. A. Hutmacher, Berlin. U.S. Pat. 874,309, Dec. 17, 1907.

See Addition of Aug. 10, 1906, to Fr. Pat. 364,210 of 1906 ; this J., 1907, 85.—T. F. B.

Gas producer. W. Towns, Liverpool. U.S. Pat. 874,458, Dec. 24, 1907.

See Eng. Pat. 14,090 of 1905 ; this J., 1905, 1163.—T. F. B.

Blast-furnace and other gases ; Process and apparatus for purifying ——. F. Sepulchre. Fr. Pat. 381,351, Aug. 29, 1907. Under Int. Conv., Jan. 7 and July 2, 1907.

See Eng. Pat. 13,510 of 1907 ; this J., 1907, 1189.—T. F. B.

Metallic incandescence bodies for electric glow lamps ; Method of and means for producing ——. Deutsche Gasglühlicht Akt.-Ges., Berlin. Eng. Pat. 28,775, Dec. 17, 1906. Under Int. Conv., March 27, 1906.

See Fr. Pat. 372,537 of 1906 ; this J., 1907, 521.—T. F. B.

Electric incandescent lamps. The Westinghouse Metal Filament Lamp Co., Ltd., London. Eng. Pat. 18,923, Aug. 22, 1907. Under Int. Conv., Nov. 23, 1906.

A durable conducting connection is made between the metallic filament and leading-in wires of an incandescence electric lamp, by mixing metallic oxides (preferably oxides of the metals of which the filament and wires are composed) with aluminium or other metal suitable for producing an exothermic reaction, applying this mixture to the joint, with or without the addition of a suitable liquid or flux, and finally heating the mass at a point so as to initiate the reaction. The high temperature generated and the alloy produced by the reaction cause the filament and wires to be thoroughly soldered together.—H. B.

Incandescence electric lamp filaments of refractory metals such as tungsten, molybdenum, thorium, etc. ; Manufacture of ——. Siemens und Halske A.-G. Fr. Pat. 380,740, Aug. 10, 1907. Under Int. Conv., Aug. 28 and Sept. 15, 1906, and June 8, 1907.

The refractory metal in fine powder is converted into a plastic mass by means of a small proportion of an agglutinant, such as gelatin, glue, or collodion ; the mass is extruded into fine threads, which are dried, heated gently at first (preferably by means of external heating) *in vacuo* or in an inert atmosphere, and finally raised to a white heat by means of an electric current. When gelatin is employed as the agglutinant, it is dissolved in glacial acetic acid. When collodion is employed, the extruded threads are preferably placed in water or other liquid to wash them and keep them fresh ; when taken from the water they may be given any desired shape. Small quantities of other agglutinants may advantageously be mixed with the collodion.—H. B.

Incandescence bodies of tungsten ; Manufacture of ——. Ges. für Verwertung Chemischer Produkte m.b.H. Fr. Pat. 380,802, Aug. 13, 1907.

Filaments of tungsten which are electrically constant (obtained, for example, by subjecting filaments made of very finely divided tungsten to the temperature at which they are to be used) are rendered constant in lighting power by subjecting them during manufacture to a temperature below the melting-point of tungsten but higher than that at which they will be used.—H. B.

Lamp filaments and current leads ; Conducting connection between ——, *and process for making the same.* The Westinghouse Metal Filament Lamp Co. Fr. Pat. 381,031, Aug. 20, 1907. Under Int. Conv., Nov. 23, 1906.

See Eng. Pat. 18,923 of 1907 ; preceding.—T. F. B.

Cyanogen, etc. Eng. Pat. 2090. *See* VII.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

Normal paraffins from lignite in the cathode-light vacuum ; Fractionation of ——. F. Krafft. Ber., 1907, **40**, 4779—4784.

The author has found that in a vacuum which is high enough for the cathode-light to develop its proper colour, the boiling point of a substance is affected by the height of the column of its own vapour (Ber., 1905, **38**, 248). These observations were made use of in the examination of paraffin from a Saxon lignite. This paraffin softened at the ordinary temperature and was completely fluid at 80° C. It yielded the following fractions :—

Fraction.	I.	II.	III.	IV.	V.
B. pt. in °C. at 0 mm. ; vapour column about 110 mm.	170°	170°—200°	200°—230°	230°—260°	above 260°
Approximate m.pt. in °C.	18°—47°	47°—52·5°	53°—65°	65°—69·5°	70°—86°
Total weight 448·7 grms.	47·2 grms.	87·2 grms.	111·5 grms.	76·1 grms.	126·7 grms.
Weight of fraction, per cent.	10·5 %	19·4 %	24·8 %	16·9 %	28·2 %

After four fractionations, fractions II., III. and IV., were subjected to a fifth fractionation, when the following series of paraffins was obtained, the formulæ of which were confirmed by molecular weight determinations :—

Formula.	Weight in grms.	B. pt. at 0 mm. in °C.	M. pt. °C.	Sp. gr. when fluid.
$C_{19}H_{40}$	2	109	31·8–32	—
$C_{20}H_{42}$	3·5	117·5	36·3–36·6	0·7775
$C_{21}H_{44}$	6·2	125·5	39·9–40·2	0·7778
$C_{22}H_{46}$	9·5	130·5	44·0–44·5	0·7776
$C_{23}H_{48}$	11·5	138	47·2–47·5	0·7799
$C_{24}H_{50}$	16	145·5	50·7–51·3	0·7781
$C_{25}H_{52}$	17·5	152·5	53·8–54	0·7785
$C_{26}H_{54}$	18	160	56·8–57	0·7787
$C_{27}H_{56}$	21	167	about 59·4	0·7789
$C_{28}H_{58}$	15·4	173·5	about 61·6	0·7792
$C_{29}H_{60}$	16·8	179	63·6–64·1	0·7797
$C_{30}H_{62}$	13·8	186	65·6	0·7797
$C_{31}H_{64}$	10·9	193·5	68·4	0·7799
$C_{32}H_{66}$	8·7	201	69·8	0·7798
$C_{33}H_{68}$	9·5	208	71·8	0·7801
$C_{34}H_{70}$	5·8	215	about 73	0·7806
$C_{35}H_{72}$	4·2	222	about 74	0·7813
$C_{36}H_{74}$	3·2	about 230	about 76	0·7819

There were present also two or three homologous paraffins boiling between 250° and 290° C. at 0 mm., but these decomposed slightly on distillation. The residue boiling above 300° C. in the vacuum, weighed about 10 grms. and melted at 85°—93° C. after crystallising from isobutyl alcohol. The number of carbon atoms in this paraffin would appear to be not less than 48 or 50. In the most volatile portions of the paraffin examined, there were small quantities of the homologues $C_{15}H_{32}$, $C_{16}H_{34}$, $C_{17}H_{36}$, $C_{18}H_{38}$. The paraffin therefore contains not less than 35 members of the series C_nH_{2n+2}.—F. Shdn.

Wood distillation in the United States ; Proposed laboratory for ——. Oil, Paint, and Drug Rep., Dec. 23, 1907. [T.R.]

A bill has recently been introduced to Congress providing that the Secretary of Agriculture be authorised to erect, at some convenient place in the Southern States, a building to be used by the Forest Service of the U.S. Department of Agriculture as an experimental wood-distillation laboratory, for the investigation and study of products obtained by the distillation of waste pine wood, and of the methods of obtaining and utilising such products. The cost of erection and equipment of the building is not to exceed $12,000, and the cost of operation and maintenance of the laboratory for a period of three years will not exceed $23,000. A suitable site for the building is to be furnished to the United States free of charge, and the Secretary of Agriculture is authorised to accept such site ; and the sum of $35,000 is to be appropriated out of any money in the treasury not otherwise appropriated.

Patents.

Blast-furnace pitch ; Manufacture of ——. G. Craig, Glasgow. Eng. Pat. 2942, Feb. 6, 1907.

In the manufacture of pitch from blast-furnace tar, the latter is dehydrated by heating, and is then treated in a centrifugal separator or passed through a filter-press, whereby from 7·5—10 per cent. of "clayey" sludge, containing from 50 to 66 per cent. of ash, is removed. The purified tar is subsequently distilled in the usual manner.—A. S.

Apparatus [scrubber] for use in carbonisation. H. Schirp. Fr. Pat. 380,737, Aug. 10, 1907.

The waste gases produced during "carbonisation" are drawn, by means of a fan, from the carbonising chamber first through a dust-collecting chamber, in which they pass alternately above and below a series of vertical partitions, and then through a tank containing a liquid or solid substance for absorbing acid constituents from the gas.—H. B.

Petroleum compounds ; Production of —— *with low flashing points.* S. O. Cowper-Coles, London. Eng. Pat. 27,945, Dec. 7, 1906.

Petroleum is heated in a still in order to freely generate vapour, which is conducted through a series of metal tubes heated to a temperature, *e.g.*, 1700° F., sufficiently high to "break it up," (crack it) the vapour thus obtained being finally condensed. In this manner the flashing point can, it is stated, be reduced from say 120° F. to as low as 16° F.—D. B.

IV.—COLOURING MATTERS AND DYESTUFFS.

Indigo ; Electrolytic reduction of ——. H. Chaumat. Compt. rend., 1907, **145**, 1419—1423.

The author describes a method for the electrolytic reduction of Indigo Blue, which is also applicable generally to insoluble and difficultly reducible substances. The finely pulverised indigo is mixed with powdered graphite and the mixture is disposed around a carbon rod, being held in position by means of a linen bag. The whole is placed in an electrolyte consisting of an aqueous solution of sodium carbonate, and serves as cathode. The anode is placed in a separate compartment.

For every 2 atoms of hydrogen liberated at the cathode, *i.e.*, the quantity necessary for the reduction of 1 molecule of indigo, 2 molecules of caustic soda are formed, which is the quantity required to dissolve the reduced indigo. The graphite and indigo must not be too finely powdered, or the mixture will be impermeable to the liquid.

To obviate the oxidation of the indigo white by the oxygen liberated at the anode, either a diaphragm may be used, or, preferably, sulphides, sulphites or bisulphites of sodium or calcium may be added to the electrolyte. —W. S.

Sodium hydrosulphite ; Reduction of azo dyestuffs by ——. H. Franzen and P. Stieldorf. J. prakt. Chem., 1907, 76, 467—471.

In the reduction of azo dyestuffs by sodium hydrosulphite (compare Grandmougin, this J., 1907, 959), the latter may decompose according to either of the equations :

$$(1)\ Na_2S_2O_4 + 2H_2O = 2NaHSO_3 + H_2$$
$$(2)\ Na_2S_2O_4 + 3H_2O = NaHSO_3 + NaHSO_4 + 2H_2.$$

In order to ascertain which represents the course of the reaction, the authors titrated a given quantity of sodium hydrosulphite with a standard solution of iodine, before and after treatment with certain monoazo dyestuffs, and found that the amount of iodine required in the two cases corresponds with the first equation. This result was confirmed by determining the amount of sulphuric acid obtained when the hydrosulphite solution was boiled with dilute hydrochloric acid in a stream of carbon dioxide before and after treatment with the azo dyestuffs. A small increase was observed after treatment, but the quantity was much less than that required by equation 2. —J. C. C.

Stilbene group ; Colouring matters [dyestuffs] of the ——. *IV. The action of caustic alkalis on p-nitrotoluene and its derivatives.* A. G. Green, A. H. Davies, and R. S. Horsfall. Chem. Soc. Trans., 1907, **91**, 2076—2083.

The authors have studied the action of caustic alkalis on *p*-nitrotoluene and some of its ortho-derivatives. As in the previous investigations (this J., 1898, 146, 837 ; 1904, 1142 ; 1906, 1214), the intermediate products of the reaction were characterised by oxidising them to the stable nitro-compounds by means of air or hypochlorites. It was found that the ultimate products of the reaction are either dibenzyl- or stilbene compounds according to the reactivity of the nitrotoluene derivative employed, the latter depending chiefly on the nature of the ortho-substituent. Thus *p*-nitro-*o*-cyanotoluene yields only the corresponding stilbene compound, whilst the *o*-methyl-, *o*-methoxy-, and *o*-carboxy-derivatives of *p*-nitrotoluene yield dibenzyl compounds, and *p*-nitrotoluene itself, like its *o*-sulphonic acid (compare this J., 1904, 1142), yields either dinitrodibenzyl or dinitrostilbene according to the conditions of the experiment. In general it may be stated that the derivatives of *p*-nitrotoluene which react least easily and give red condensation products, yield mostly dibenzyl compounds, whilst the derivatives which react readily and form violet or blue condensation products yield chiefly stilbene compounds. It is concluded that the alkaline condensation occurs in two stages which may be more or less concurrent, *e.g.*,

$$2CH_3.C_6H_4.NO_2 \rightarrow \begin{array}{l} CH_2.C_6H_4.NO \\ \vert \\ CH_2.C_6H_4.NO \end{array} \rightarrow \begin{array}{l} CH.C_6H_4.NO \\ \Vert \\ CH.C_6H_4.NO \end{array}$$

On oxidation, the product of the first stage yields a dinitrodibenzyl :

$$\begin{array}{l} CH_2.C_6H_4.NO \\ \vert \\ CH_2.C_6H_4.NO \end{array} \rightarrow \begin{array}{l} CH_2.C_6H_4.NO_2 \\ \vert \\ CH_2.C_6H_4.NO_2 \end{array},$$

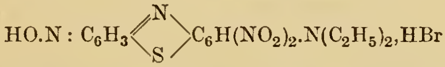
whilst that of the second stage yields a dinitrostilbene :

$$\begin{array}{l} CH.C_6H_4.NO \\ \Vert \\ CH.C_6H_4.NO \end{array} \rightarrow \begin{array}{l} CH.C_6H_4.NO_2 \\ \Vert \\ CH.C_6H_4.NO_2 \end{array}.$$

Substituents which increase the reactivity of the substance would therefore favour the formation of stilbene compounds. Comparative tests showed that whilst the introduction of methyl-, methoxy-, amino-, and carboxy-groups in the ortho-position has but little influence on the reactivity of *p*-nitrotoluene, the more strongly electro-negative groups, such as the sulphophenyl-, cyano-, and nitro-groups exert a powerful effect, that of the nitro-group being the strongest. The stilbene dyestuff yielded by the *o*-carboxy derivative of *p*-nitrotoluene (*p*-nitro-*o*-toluic acid) is similar to Direct Yellow, dyeing unmordanted cotton in bright yellow shades.—A. S.

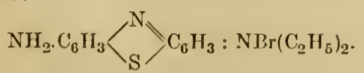
Thiazines. Part II. Derivatives of tetraethylthionine. R. Gnehm and A. Schindler. J. prakt. Chem., 1907, **76**, 471—488. (See this J. 1906, 367; and 1907, 1273.)

Tetraethylthionine, to which the authors give the name, Ethylene Blue, is prepared as follows: A solution of 15 grms. of nitrosodiethylaniline hydrochloride in 3 litres of water is warmed to 78° C. and mixed with a solution of 45 grms. of sodium thiosulphate in 150 c.c. of water. A mixture of 26 c.c. of acetic acid (40 per cent.), 11 c.c. of hydrochloric acid (33 per cent.) and 26 c.c. of water is now added slowly and the temperature raised to 85° C. As soon as a sample gives no green precipitate with ammonia, a solution of 10 grms. of diethylaniline in 10 c.c. of hydrochloric acid, and 10 grms. of a zinc chloride solution (sp. gr. 1·71) are added, and the whole treated gradually with a solution of sodium bichromate (12 grms. in 200 c.c. of water) and boiled for about 1½ hours with gradual addition of 10 grms. of zinc oxide. When the colour of the solution changes from cherry-red through green to blue, a solution of 6 grms. of sodium bichromate in 100 c.c. of water is added, and, finally, 60 c.c. of concentrated hydrochloric acid. On the addition of 150 grms. of common salt, the zinc chloride double salt is obtained as a black blue powder. When an aqueous solution of this is treated with sodium carbonate and a little zinc oxide, the free base is liberated, which on warming with a mixture of nitric acid and sodium nitrite furnishes Ethylene Blue nitrate as a bronzy tar. When the zinc chloride double salt of Ethylene Blue is warmed with a mixture of acetic and nitric acids, a new dyestuff is formed in green crystals, which is considered to be a dinitro*iso*nitrosodiethylaminothionine of the formula (as hydrobromide):



$$HO.N : C_6H_3\left\langle\begin{matrix}N\\S\end{matrix}\right\rangle C_6H(NO_2)_2.N(C_2H_5)_2,HBr$$

the position of the nitro-groups, however, being unknown. This hydrobromide dissolves in water, methyl and ethyl alcohols, and acetic acid with a blue red colour. The solutions are dichroic, and, with the exception of the aqueous solution, are strongly fluorescent. The substance dissolves in sulphuric acid with a Malachite-Green colour which changes to rose-red on dilution. The free base forms brown flocks. On reduction of the nitrate with stannous chloride, leucotriaminodiethylthionine is produced, which is readily oxidised by ferric chloride to the corresponding dyestuff. This gives a greenish-blue solution in water and a green solution with methyl and ethyl alcohols. The solution in sulphuric acid is gray-green becoming bright green on dilution. When Ethylene Blue nitrate is heated with a little nitric acid in glacial acetic acid solution at the ordinary temperature, nitrotetraethylthionine (Ethylene Green) is obtained. This dyestuff gives blue-green solutions with water, methyl, ethyl or amyl alcohols and acetic acid. The dirty blue solution in sulphuric acid changes finally to blue-green on dilution. On reduction with zinc dust and acetic acid, Ethylene Green furnishes aminotetraethylthionine (aminoethylene Blue) which is a blue dyestuff sparingly soluble in water but readily soluble in the organic solvents mentioned above. The solution in sulphuric acid is red-brown changing to violet on dilution. Bromoethylene Blue is obtained from Ethylene Blue by treatment with bromine in glacial acetic acid solution. It is readily soluble in water, alcohol, acetone and acetic acid with a deep blue colour. The solution in sulphuric acid is apple green changing to blue on dilution. When Ethylene Blue nitrate is heated in a closed tube with alcoholic ammonia, diethylthionine is obtained which, as bromide, has the constitution:



$$NH_2.C_6H_3\left\langle\begin{matrix}N\\S\end{matrix}\right\rangle C_6H_3 : NBr(C_2H_5)_2.$$

This is readily soluble in water with a deep blue colour and gives a blue-green solution with methyl or ethyl alcohols, acetone and acetic acid. The solution in sulphuric acid is green, changing to blue on dilution.—J. C. C.

Thiazines. Part III. Derivatives of alkylated benzylanilines. R. Gnehm and A. Schönholzer. J. prakt. Chem., 1907, **76**, 489—508.

The authors describe a number of intermediate products which they have obtained in their experiments carried out with the object of preparing thiazine dyestuffs derived from methyl- and ethyl-benzylaniline. Methylbenzylaniline when treated with sodium nitrite in acid solution yields the corresponding nitroso-derivative, m.pt. 52—53° C., which on reduction furnishes methylbenzyl-*p*-phenylenediamine.

Ethylbenzylanilinesulphonic acid was prepared and its barium and potassium salts examined. The sulphonic acid group was proved to be in the benzyl nucleus. When the potassium salt is fused with caustic potash, ethyl-*p*-hydroxybenzylaniline is formed, which crystallises in plates, m.pt. 62—63° C. The free acid or the potassium salt may be used to prepare the nitroso-derivative which, on reduction, yields the amino-compound; neither of these could be isolated in the pure state. When this amino-compound is treated with sodium thiosulphate and then oxidised with sodium bichromate, a red colour is produced, and, after addition of a solution of ethylbenzylanilinesulphonic acid and a further portion of sodium bichromate, a dyestuff is obtained which is identical with Thiocarmine.

Methylbenzylanilinesulphonic acid, on fusion with caustic potash, yields methyl-*p*-hydroxybenzylaniline, m.pt. 40—41° C., and on treatment with amyl nitrite furnishes a nitroso-derivative from which, however, the corresponding amino-compound could not be isolated on reduction; but the authors succeeded in obtaining dimethyldibenzylthioninedisulphonic acid in a manner similar to that described for the ethyl derivative. Both this dyestuff and Thiocarmine give leuco-compounds on reduction.

Methylbenzylaniline on nitration furnishes methyl-*m*-nitrobenzylaniline crystallising from alcohol in yellow plates, m.pt. 51—52° C.; by reducing this with stannous chloride and subsequent treatment with acetic anhydride, methyl-*m*-acetylaminobenzylaniline is obtained in colourless plates, m.pt. 88° C. Ethyl-*m*-nitrobenzylaniline when treated in the same way yields the corresponding acetylamino-compound, m.pt. 96° C.—J. C. C.

Erythrosine; Determination of organic chlorine and iodine in commercial ——. F. Jean. Rev. Gen. Mat. Col., 1908, **12**, 2—3.

Erythrosine (alkali salt of tetraiodofluorescein) is often mixed with Rose Bengal (alkali salt of tetraiodochlorofluorescein), to suppress its fluorescence and with common salt to increase its solubility. The use of erythrosine for colouring food-stuffs is permitted in Erance, but in America the dyestuff can only be employed when it contains no iodo-chlorine derivative of fluorescein, *i.e.*, no Rose Bengal. The estimation of organic chlorine (and iodine) is therefore important in analysing erythrosine to be exported to America. (1) 0·5 grm. of the dyestuff is incinerated, the residue is taken up with water and filtered to give 100 c.c. of filtrate A. (2) 0·5 grm. of the dyestuff, 0·5 grm. of sodium carbonate, 0·5 grm. of potassium carbonate, and 5 to 6 grms. of magnesia obtained by igniting magnesium nitrate are ground together in a mortar, the mixture is ignited in a platinum crucible at a red heat, the residue taken up with water, and filtered to give 100 c.c. of filtrate B. In 50 c.c. of each filtrate, the amount of iodide is estimated by Pisani's method, using standard silver solution and 1 c.c. of iodide of starch: the amount of silver solution required to decolorise 1 c.c. of iodide of starch solution is allowed for. In the other 50 c.c. of each of the filtrates A and B, the total iodide and chloride are found by titrating with standard silver solution—using potassium bichromate as the indicator. Then, by subtracting the previously determined iodide, the chloride present in each of the two filtrates is arrived at. If the erythrosine contain no organic chlorine, the amounts of chlorine found in both filtrates A and B will be the same; if the figures are not identical, then from the difference between them, the amount of organic chlorine present can be found.—S. H. H.

Polygonum tinctorium; Yield of —— under different conditions. T. Imaseki. *See* XV.

PATENTS.

Vat [thioindigo] dyestuffs; Manufacture of ——. O. Imray, London. From Farbwerke vorm. Meister, Lucius, und Brüning, Höchst a/Main, Germany. Eng. Pat. 29,765, Dec. 31, 1906.

SEE U.S. Pat. 868,295 of 1907; this J., 1907, 1195.—T. F. B.

Red vat dyestuff; Manufacture of a —— and intermediate products. O. Imray, London. From Farbw. vorm. Meister, Lucius, und Brüning, Hoechst a/M., Germany. Eng. Pat. 2592, Feb. 1, 1907.

FROM *o*-nitrometaxylidine ($CH_3 : CH_3 : NO_2 : NH_2 = 6:4:2:1$), by diazotising and reacting with copper-cyanide the nitrometaxylonitrile ($CH_3 : CH_3 : NO_2 : CN$) is obtained, and this upon hydrolysis yields the nitrocarboxylic acid. In the latter compound, the nitro group is reduced by boiling for some hours with sodium sulphide, the amino group is then diazotised, and the diazo solution brought into a solution of potassium xanthate and sodium carbonate. The mixture is stirred for several hours, a mixture of sodium chloracetate and caustic soda lye is then added, and the whole is heated for some hours at 100° C. When cold, it is acidified, whereupon xylylthioglycollic-*o*-carboxylic acid ($CH_3 : CH_3 : S.CH_2.CO_2H : CO_2H = 6:4:2:1$) is precipitated. This may be converted into a red dyestuff, dimethyloxythionaphthenecarboxylic acid, in one of the following ways. (I.) Boiling with nitrobenzene for some hours, when, upon cooling, the dyestuff separates. (II.) When mixed with finely divided sulphur, heated to 250° C., then pulverised and extracted with carbon bisulphide, the residue dissolved in alkaline hydrosulphite and the solution oxidised by blowing in air, the dyestuff is precipitated in a fine state of division. (III.) By heating with a concentrated solution of bisulphite, or a crystallised thiosulphate, for about 3 hours at 180° C., then extracting with water and carbon bisulphide and dissolving in alkaline hydrosulphite, as in II. (IV.) 20 parts of xylylthioglycollic-*o*-carboxylic acid are mixed with 200 parts of caustic soda and 12 parts of water and heated to 180—190° C. for some time, the mass gradually assuming a yellowish tint. When cold, it is dissolved in water and a solution of potassium ferricyanide is added until all the dyestuff has separated out in the form of red flakes. The dyestuff forms a red powder, which dissolves in alkaline hydrosulphite, producing a yellow coloured vat in which cotton and wool are dyed pink, the shade being distinguished by its excellent fastness to washing.—F. M.

Indigo; Manufacture of halogen derivatives of —— and leuco compounds thereof. O. Imray, London. From Soc. Chem. Ind. in Basle, Switzerland. Eng. Pat. 5122, March 2, 1907.

SEE U.S. Pats. 856,687 and 856,776 of 1907; this J., 1907, 818; 819.—T. F. B.

Halogenised vat [thio-indigo] dyestuffs; Manufacture of ——, and derivatives thereof. O. Imray, London. From Soc. Chem. Ind. in Basle, Switzerland. Eng. Pat. 6490, March 18, 1907.

SEE U.S. Pats. 848,354, 848,355, and 848,356 of 1907; this J., 1907, 466, 467.—T. F. B.

Leuco derivatives from gallocyanine; Manufacture of ——. G. B. Ellis, London. From Chem. Fabr. vorm. Sandoz, Basle, Switzerland. Eng. Pat. 6951, March 22, 1907.

SEE Fr. Pat. 375,864 of 1907; this J., 1907, 961.—T. F. B.

Azo colouring matters; Manufacture of ——. H. H. Lake, London. From Chem. Fabr. Griesheim-Elektron, Frankfort, Germany. Eng. Pat. 7057, March 23, 1907.

SEE U.S. Pats. 860,220 and 860,221 of 1907; this J., 1907, 960.—T. F. B.

Azo dyestuffs; Manufacture of yellow ——. A. G. Bloxam, London. From Act.-Ges. f. Anilin-Fabr., Berlin. Eng. Pat. 7146, Mar. 25, 1907.

THIOANILINEDISULPHONIC acid is tetrazotised and combined with phenol in alkaline solution. The resulting dyestuff is ethylated by heating it with alcoholic ethyl bromide in alkaline solution to 60°—70° C. for about 12 hours. The dyestuff thus obtained dyes wool from an acid bath in intensely yellow shades which are fast to milling. The corresponding methylated dyestuff is prepared by using methyl iodide in place of ethyl bromide. Its properties are similar to those of the ethyl derivative. Homologues of phenol may also be employed instead of phenol.—J. C. C.

Sulphurised dyestuffs; Manufacture of ——. A. G. Bloxam, London. From Act. Ges. f. Anilin-Fabr., Berlin. Eng. Pat. 9011, April 18, 1907.

ON heating naphthylaminesulphonic acids, naphtholsulphonic acids and aminonaphtholsulphonic acids to a high temperature with an alkali monosulphide without the addition of sulphur, new sulphide dyestuffs are obtained, which produce shades varying from a reddish dark-brown to a dark olive-brown. Example:—15 parts of the sodium salt of 2:4:8-naphthylaminedisulphonic acid are heated with 90 parts of crystallised sodium sulphide, the temperature being finally raised to about 300° C. The product thus obtained is crushed and may be directly used for producing an olive-brown shade on unmordanted cotton from a dye-bath containing an alkali sulphide. —P. F. C.

p-Nitrodiphenylamine and its derivatives; Process for preparing ——. Act.-Ges. f. Anilinfabr. Fr. Pat. 381,230, Nov. 3, 1906.

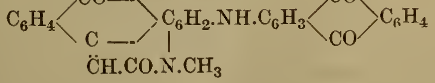
SEE Eng. Pat. 24,091 of 1906; this J., 1907, 959.—T. F. B.

3-*Aminophenyl-5-hydroxy-*1.2-*naphthimidazoledisulphonic acid; Process for making ——.* Act.-Ges. f. Anilinfabr. Fr. Pat. 381,373, Nov. 6, 1906.

SEE Eng. Pat. 24,518 of 1906; this J., 1907, 680.—T. F. B.

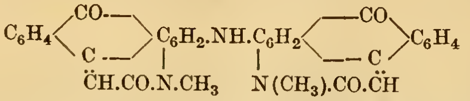
Dyestuffs of the anthracene series; Production of ——, and employment thereof in dyeing and printing. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 13,686, June 13, 1907.

AMINOANTHRAPYRIDONES are condensed with halogen-substituted anthrapyridones or with halogen-substituted anthraquinones, or, secondly, halogen-substituted anthrapyridones may be condensed with aminoanthraquinones, to form (with the exception of the product of condensation of 4-amino-1-anthrapyridone and 4-bromo-1-anthrapyridone) dyestuffs which, on treatment with alkaline reducing agents, furnish vats suitable for dyeing and printing vegetable fibres. The dyestuffs may be converted into sulphonic acids which dye wool from an acid bath, and also (with the exception referred to above) give vats suitable for dyeing and printing. *Example* 1: A mixture of 150 parts of 4-bromo-1-anthrapyridone (obtained by treating 1-acetylmethylamino-4-bromoanthraquinone with alkali), 100 parts of β-aminoanthraquinone, 100 parts of calcium hydroxide, 5 parts of copper chloride, and 2000 parts of naphthalene is boiled for 3 hours. On filtering, the residue is crystallised from aniline and has the formula



$$C_6H_4\left\langle\begin{matrix}CO\text{—} \\ C\text{—}\end{matrix}\right\rangle C_6H_2.NH.C_6H_3\left\langle\begin{matrix}CO \\ CO\end{matrix}\right\rangle C_6H_4 \quad \begin{matrix}\ddot{C}H.CO.N.CH_3\end{matrix}$$

This dyes cotton a very fast red shade from an alkaline hydrosulphite bath. *Example* 2: A mixture of 100 parts of 4-amino-1-anthrapyridone, 100 parts of 4-bromo-1-anthrapyridone, 100 parts of anhydrous sodium acetate, 5 parts of copper chloride, and 2000 parts of naphthalene is boiled for 2 hours. The product which separates in dark violet needles, and has the formula,



$$\begin{array}{c} C_6H_4\left\langle\begin{array}{l} CO—— \\ C—— \end{array}\right\rangle C_6H_2.NH.C_6H_2\left\langle\begin{array}{r} ——CO \\ ——C \end{array}\right\rangle C_6H_4 \\ \ddot{C}H.CO.N.CH_3 \qquad N(CH_3).CO.\ddot{C}H \end{array}$$

gives a bluish-green solution in sulphuric acid changing to red on dilution. The corresponding sulphonic acid dyes wool in violet-blue shades from an acid bath.—J. C. C.

Anthracene compounds; Production of new ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 381,214, Aug. 22, 1907. Under Int. Conv., Nov. 12 and 14, 1906.

See Eng. Pat. 13,686 of 1907; preceding.—T. F. B.

Dyestuff [*from hæmatoxylin*]; *Process for producing a* ——. F. J. Oakes, New York. Eng. Pat. 15,228, July 2, 1907.

See U.S. Pat. 872,250 of 1907; this J., 1907, 1274.—T. F. B.

Azo dye; Red —— *and process of making same.* R. Schule, Frankfort-on-the-Maine, Germany. U.S. Pat. 873,798, Dec. 17, 1907.

The diazo compound of a primary amine is combined with the product of condensation of 1 : 2-diamino-5-hydroxynaphthalene-7-sulphonic acid and *m*-aminobenzaldehyde bisulphite. The monoazo-dyestuff thus obtained is diazotised and combined with a naphtholsulphonic acid, the product being a brown powder dissolving in sulphuric acid with a claret red colour and dyeing unmordanted cotton in red shades fast to washing and acids.—J. C. C.

Thioindoxyl derivatives and process of making same. K. Albrecht, Assignor to Kalle und Co., Biebrich, Germany. U.S. Pat. 874,649, Dec. 24, 1907.

See Eng. Pat. 17,162 of 1906; this J., 1906, 1038.—T. F. B.

Colouring matters for wool [*Sulphide dyestuffs*]; *Process for preparing* ——. Kalle und Co. Fr. Pat. 381,386, July 26, 1907.

See Eng. Pat. 17,610 of 1907; this J., 1907, 1082.—T. F. B.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

Tannic acid; Affinity of silk for ——. P. Heermann. Färber-Zeit., 1908, 19, 4—7.

Silk differs from other textile fibres in its affinity for tannic acid. Thus, vegetable fibres absorb only small amounts of tannic acid, a state of equilibrium being produced which depends on the relative amounts of water, tannic acid and fibre; the tannic acid absorbed by vegetable fibres is readily removed by cold water (see Knecht and Kershaw, this J., 1892, 129; and von Georgevics, this J., 1898, 845): wool absorbs little tannic acid in the cold, and the fibre is rendered hard on treating with hot solutions. Silk, however, behaves somewhat like hide in that it absorbs a large amount of tannin from cold solutions, and as much as 25 per cent. of its weight from a hot solution. The tannin absorbed by silk is not readily removed by water. The absorptions of the following tannins by silk were determined: gambier, gambier substitute, Aleppo gall extract, sumac extract and dividivi extract. Silk was placed in baths heated to 90° C. and containing 100, 300 and 1000 per cent. of the tannin extracts calculated on the weight of the silk; the baths were allowed to cool during 3 or 4 hours and the silk was then washed, wrung, dried, and weighed. In order to estimate the effect of the tannin immersion, silk was also passed through the whole process except the tannin absorption and then weighed. The experiments were carried out with samples of: (1), pure silk which had been degummed; (2), silk, which had been dyed with Prussian blue, by mordanting with basic ferric sulphate and then treating with potassium ferrocyanide and hydrochloric acid; and (3), silk mordanted with tin chloride and fixed with sodium phosphate. The following conclusions are drawn from the results. The experiments with dilute solutions show that most tannin is absorbed by all three samples of silk from the gambier extract; pure silk absorbs almost as much from extract of gall nuts and from sumac extract, but the two prepared samples of silk are only very slightly weighted by these extracts. Divi-divi comes next to gambier in many cases. Gambier substitute exhibits a peculiar behaviour, since tannin is absorbed from it in notable quantity only when concentrated solutions are employed. (See also this J., 1905, 272, 122; 1906, 1089; 1907, 467.)—S. H. H.

Fixation of acid and basic dyestuffs by wool; Influence of acids and bases on the ——. L. Pelet-Jolivet and N. Andersen. Compt. rend., 1907, 145, 1340—1342.

The authors have studied the fixation of Crystal Ponceau and Methylene Blue by wool in acid, alkaline and neutral solution. The wool was immersed in the solution for 5 days at 17° C. The amount of Crystal Ponceau adsorbed in an acid bath increased with increasing quantity of acid; the greatest adsorption took place when hydrochloric acid was used and the least with phosphoric acid, sulphuric acid occupying an intermediate position between the two. In a neutral bath the adsorption was slight and in an alkaline bath almost nothing. Methylene Blue showed exactly the opposite behaviour, the adsorption being greatest in an alkaline bath. These results are regarded as being satisfactorily explained by the colloidal theory of dyeing.—J. C. C.

Patents.

Hydro-extractors. H. Diamanti, Paris and N. Beuf, Beaulieu, France. Eng. Pat. 14,764, June 26, 1907. Under Int. Conv., June 27, 1906.

The machine, which has for its main object the drying of artificial silk, comprises a basket having a biconical wall and a conical bottom. The material to be dried, is distributed on the bottom of the basket by a "pallet" mechanism arranged at the orifice of an axial passage, through which the wet material is supplied to the apparatus. The upper part of the machine is closed by a circular cover, and the passage serving for the discharge of the dried material is tangential to this cover. "At its origin" the discharge passage is provided with an adjustable knife in the form of a ploughshare, which facilitates the removal of the material.—D. B.

Kiers for bleaching and otherwise treating piece goods in the open state. C. L. and H. L. Rothwell-Jackson, Bolton. Eng. Pat. 14,715, June 26, 1907.

The improved kier differs from that described in Eng. Pat. 5409 of 1900 (this J., 1901, 120) in that live steam is not admitted into the kier, the liquor being maintained at the desired temperature by passing it through a suitable heating apparatus which is placed outside the kier between the circulating pump and the top of the kier.—P. F. C.

Souring, chloring, boiling and dyeing folded fabrics; Process and apparatus for ——. H. Thies and W. Mathesius. Fr. Pat. 380,864, Aug. 16, 1907.

This apparatus consists of a telescopic tube, bent at its lower end and widening at the top to form a relatively large hopper. The tube is so suspended at its upper end, that it can be readily moved in any direction. The material to be treated is led into the hopper, travels down the tube, (to which a suitable to-and-fro motion has been imparted), and is finally delivered in regular folds into the dye-vat or other receptacle. In order to ensure the regular folding of the material, the telescopic tube is adjusted from time to time to keep the end of the delivery tube at a constant height above the level of the folded material inside the vat. If desired, the appropriate liquid for the particular treatment can also be run into the hopper at the same time as the fabric.—P. F. C.

Yarn on bobbins or in the form of cops; Apparatus for dyeing ——. H. L'Huillier. Fourth Addition, dated June 27, 1907, to Fr. Pat. 350,981, Jan. 24, 1905 (this J., 1905, 888; 1906, 475; 1907, 92; 1908, 18).

The yarn is directly wound on to a perforated hollow metallic bobbin in which a wooden bobbin has been previously inserted. In order to prevent the wooden bobbin from slipping, it is provided near to one end with a small peg which fits into the cross-piece of a T-shaped incision at the corresponding end of the metallic bobbin. When the winding is completed, the wooden bobbin only is withdrawn, and the "cheese" is mounted on the perforated tube of the dyeing machine, this tube having a less diameter than the perforated tube on which the "cheese" is wound, in order to allow free circulation of the dyeing solution.—P. F. C.

Agers, steam chests, steam boxes and other heated vessels or chambers used in the printing, dyeing or other treatment of woven fabrics or the like; Aniline and other ——. J. P. Liddell, New Mills, Cheshire. Eng. Pat. 28,928, Dec. 19, 1906.

To prevent the escape of steam, heat, or pressure, the chamber is provided with two steam or hot air chests arranged parallel to one another. In order to fill the gap between them, a third steam or hot air chest is arranged so that it can be tilted on its end bearings. This intermediate chest is loaded so that its normal position is at a slight angle from the vertical, and it is then in contact with both the upper and lower steam chests, the surfaces of contact being preferably machined to ensure a fluid-tight joint. A modified arrangement is also claimed in which the intermediate chest is pressed against the other two by springs. The fabric enters the chamber between the upper and the intermediate chests and passes out between the intermediate and lower ones. To prevent condensed moisture from falling on to the fabric, the upper steam chest is provided with a trough, above the line of traverse of the fabric, in which the condensed moisture collects.—P. F. C.

Textile fabrics; Producing impressions fast to water on ——. L. Lilienfeld, Vienna. Eng. Pat. 592, Jan. 9, 1907.

Combinations of nitrocellulose, celluloid, or cellulose acetates with organic acid esters of high boiling point, particularly the esters of phthalic acid, are specially suitable for imparting resistance to water to textile fabrics. Example: 100 parts of nitrocellulose are dissolved with 50 to 150 parts of ethyl phthalate in a suitable solvent and used alone or with other dressing materials. —S. H. H.

Printing textile fabrics. Calico Printers' Assoc., Ltd., Manchester, and R. E. Hindle, Accrington. Eng. Pat. 6434, March 18, 1907.

The invention relates to the causing of variations of pressure in the printing nip between the printing roller and the printing surface, whereby darker or lighter printing effects are produced. This can be performed by making the surface of the printing bowl irregular, *e.g.*, undulating, or by employing an irregular endless band in place of the usual blanket.—S. H. H.

Cotton fabrics; Treatment of —— *in order to produce on them a high gloss, fast to water, soap or acid solutions.* C. Rumpf, Tokio, Japan. Eng. Pat. 5498, March 7, 1907.

The goods after being finished in any of the well known ways of pressing, calendering, or the like, so as to produce as high a lustre as possible, are immersed in or sprinkled with water or washed in a soap solution, whereby the high gloss is "somewhat diminished," leaving a lower, but permanent finish "which will not be in any way affected by the subsequent action of water or soap or acid solutions."—D. B.

Compositions applicable for use in various manufactures [e.g., for finishing textiles]. P. C. D. Castle, Bebington. Eng. Pat. 28,492, Dec. 13, 1906.

See Fr. Pat. 379,476 of 1907; this J., 1907, 1238.—T. F. B.

Finishing sized fabrics; Apparatus for ——. H. J. Haddan, London. From M. Ratignier, Lyons, and H. Pervilhac and Co., Villeurbanne, France. Eng. Pat. 15,886, July 10, 1907.

The stretched and sized fabric is made to pass underneath size-spreaders consisting of brushes, or smooth rubbers or preferably chains of polished non-absorbent material suspended from supports and trailing on the fabric. The brushes are mounted on leather straps which are so driven that the brushes travel in the same direction as the fabric but at a higher speed. A circular or straight oscillatory motion is also imparted to the whole frame on which the straps are mounted. If chains are used as rubbers, it is preferable to suspend them from rods which are connected together in pairs by means of pivots, the other ends of each pair of rods being fastened to rotating crank-discs. —P. F. C.

Waterproof fabrics; Process of making ——. S. Ebizuka, Yokohama, Japan. Eng. Pat. 16,520, July 18, 1907.

The fabric is treated successively with three kinds of paint, each being applied several times until the pores are filled up, so that the subsequent layers of paint do not penetrate the fabric. Each application is followed by drying and rubbing. The paints are prepared in the following manner:—*No.* 1. 1 gall. of linseed oil or other suitable drying oil is mixed with 5 oz. of slaked lime and 1 gall. of water, and the mixture heated until the oil is saponified. The resulting glycerin is then removed, leaving an oil containing an insoluble calcium salt. To 5 gall. of the drying oil 3½ oz. of manganese borate and 2⅔ oz. of litharge are added and the mixture is heated to 300° C. After cooling, the precipitated sediment is removed, and the liquid well mixed with the oil containing the insoluble calcium salt. *No.* 2. 5 gall. of the drying oil are mixed with 3½ oz. of manganese borate, 2⅔ oz. of litharge and 2 lb. 1⅓ oz. of copal and heated to 300° C. After cooling, the precipitated sediment is removed and the liquid mixed with 4 lb. 2⅔ oz. of calcium ricinoleate and 1 lb. 6⅔ oz. of zinc oxide. *No.* 3. 1 gall. of the drying oil is treated with 2 lb. 1⅓ oz. of powdered talc, 4 lb. 2⅔ oz. of starch and mixed with ½ gall. of paint No. 2.—D. B.

Fabric; Waterproof ——. E. Mérou, Paris. U.S. Pat. 874,101, Dec. 17, 1907.

See Eng. Pat. 1383 of 1907; this J., 1907, 1089.—T. F. B.

Waste liquids or trade effluents [from the treatment of textiles]; Machine for straining —— *and recovering the fibres or fibrous substances contained therein.* The Longwood Engineering Co., Ltd., and W. D. Walsh, Huddersfield. Eng. Pat. 6562, March 19, 1907.

The machine consists of a tank provided with a false, perforated, curved bottom terminating at one side in a knife edge or sharp lip extending outwards and downwards. The false bottom is concentric with a shaft extending longitudinally of the machine. The shaft carries arms and discs having brushes adjustably secured thereto, and, as it revolves, the brushes successively wipe over the perforated bottom. In passing clear of the knife edge, the bristles which are slightly bent while in contact with the perforated plate, regain their normal condition and cause the fibres carried thereby to be thrown over the extending lip into a receptacle.—D. B.

VI.—COLOURING WOOD, PAPER, LEATHER, &c.

Patents.

Printing wall paper and the like; Machines for ——. M. Kroenert, G.m.b.H., Altona, Germany. Eng. Pat. 17,335, July 29, 1907. Under Int. Conv., Aug. 3, 1906.

The pattern roller and colour cloth are adjusted by means of a hand lever, which is connected through gearing arrangements with the carriages of the colour-applying device and of the pattern roller. The gearings are so adjusted that when the hand lever is operated, the pattern roller and the colour cloth are displaced in the ratio of 1 to 2.—P. F. C.

Dyeing skins ; Machine for ——. Billaud, Fillias and Co. Fr. Pat. 381,192, Aug. 9, 1907.

The machine is for the brush dyeing of skins (*e.g.*, rabbit skins), and consists essentially of a long trough and a device for feeding the dye-liquor to a long cylindrical brush. The skin is placed on a table moving horizontally beneath the brush, the latter being rotated in the opposite direction to the motion of the table, and by its contact, distributing the dye-liquor over the skin. The uniformity of this distribution is further ensured by passing the skin beneath a second similar cylindrical brush.—H. G. B.

VII.—ACIDS, ALKALIS, AND SALTS, AND NON-METALLIC ELEMENTS.

Ferric chloride ; Influence of hydrochloric acid on the hydrolysis of ——. G. Malfitano and L. Michel. Compt. rend., 1907, **145**, 1275—1277.

By studying the increase, with time, of the electrical conductivity of solutions of ferric chloride, containing varying quantities of hydrochloric acid, the authors have found that the amount of acid necessary to prevent hydrolysis varies slightly with the concentration of the ferric chloride and increases considerably with the temperature. A quantity of acid which would entirely prevent hydrolysis, if added before this begins, may be insufficient to restore the hydrolysed solution to its original state, or even to prevent further decomposition, if added during hydrolysis and small quantities of acid, though preventing hydrolysis at first, may favour it later. The authors explain these facts by supposing that the colloid formed from the direct products of hydrolysis, consists of complex ions, which resist the action of hydrochloric acid. (Compare this J., 1904, 1242.)—F. Sodn.

Chromium sulphate ; A new ——. P. Nicolardot. Compt. rend., 1907, **145**, 1338—1340.

When a solution containing 100 grms. of the violet chromium sulphate in a litre, is boiled with barium carbonate, an uncrystallisable "varnish" separates from the filtrate, which is represented by the formula, $Cr_2O_3,2.5SO_3,7.5H_2O$. This sulphate is readily soluble in water giving a green solution which is not precipitated by barium chloride or sodium phosphate. When caustic soda or potash is added in amount sufficient to neutralise the sulphuric acid, another chromium sulphate is obtained, in which the ratio of Cr_2O_3 to SO_3 is equal to unity. This gives a solution which is of a brighter green than the sulphate mentioned above.—J. C. C.

Ammonium sulphate. Statistics of production. Bradbury and Hirsch. [T.R.]

The production of ammonia, calculated into sulphate of ammonia (including that used in the manufacture of ammonia-soda and for other chemical purposes) from all sources in the United Kingdom during 1907 is estimated at 316,000 tons, distributed as shown in the following table, the figures for the two preceding years being added for comparison :—

	1905.	1906.	1907.
	Tons.	Tons.	Tons.
Gas works	156,000	157,000	162,000
Iron works	20,000	21,000	22,000
Shale works	46,000	48,500	51,000
Coke and carbonising works and producer gas	46,500	62,500	81,000
	268,500	289,000	316,000

Of this production England is estimated to have contributed 206,500 tons, Scotland, 107,000 tons, and Ireland, 2,500 tons.

Sulphuric acid in Canada. Oil, Paint, and Drug Rep., Dec. 30, 1907. [T.R.]

The largest amount of sulphuric acid consumed in the Province of Ontario is used in the refining of petroleum. In the purification of the distillates, ordinary sulphuric acid of 66° B. is generally used, fuming sulphuric acid being employed in rare cases for varieties of oil difficult to purify. Sulphuric acid is largely used in the manufacture of superphosphates, especially at Smith's Falls. An increasing demand for sulphuric acid is found in the nitroglycerin, dynamite, and dualin industry. Dynamite works in Ontario consume about one-half ton of concentrated sulphuric acid per day. Sulphuric acid is also used in Ontario in the manufacture of acetic acid from calcium acetate. This industry consumes over a ton of sulphuric acid per day.

Patents.

Hydrated carbonate of magnesium and its production. G. Sisson, Newcastle-on-Tyne. Eng. Pat. 24,134, Oct. 30, 1906.

Calcined dolomite is slaked with water and treated with sea-water until the whole of the lime is replaced by magnesia. The resulting slurry of magnesium hydroxide is treated with carbon dioxide (from the calcination of the dolomite), until the magnesium is converted into bicarbonate, and is then mixed with a further quantity of the magnesium hydroxide slurry, in order to obtain the magnesium in the form of hydrated carbonate.—A. S.

Pyrites cinder and other metallic sulphides low in sulphur ; Treating or utilising ——. J. H. Thwaites, Peterborough. Eng. Pat. 27,515, Dec. 3, 1906.

Pyrites cinder or other similar sulphides low in sulphur and containing zinc, are finely powdered and lixiviated, the liquid being used over and over again, with requisite additions of water or of wash-liquors, and after precipitation of the dissolved copper by means of scrap iron. When the solution is sufficiently concentrated in salts of zinc and iron, it is evaporated, most of the sulphate of iron is recovered by crystallisation, and the remainder of the iron is precipitated by means of hydrated zinc oxide or alkali hydroxides or carbonates, leaving a nearly pure solution of zinc salts.—A. S.

Cyanogen ; Extraction of —— *from gases.* R. Lessing, London. Eng. Pat. 2090, Jan. 28, 1907.

The gas, after careful extraction of tarry matters, but previous to the extraction of ammonia, is scrubbed with suspensions, in water or ammoniacal liquor, of ferrous oxide, or a ferrous salt, the acid radical of which does not form a "fixed" ammonium salt. Practically all the cyanogen is absorbed, forming a blackish sludge very suitable for the manufacture of ferrocyanides. The scrubbing liquid may be prepared by precipitating a solution of ferrous sulphate or chloride with ammoniacal gases, or the cyanogen sludge from a previous operation may be treated with milk of lime, which yields calcium ferrocyanide and a suitable ferrous residue. The precipitate is thoroughly washed, access of air being avoided, and well agitated with the suspending liquid, a mixture containing about 0·5 to 0·6 lb. of iron per gallon giving satisfactory results.—F. Sodn.

Litharge ; Manufacture of ——. W. A. Humphrey, Enfield Highway, Middlesex. Eng. Pat. 2144, Jan. 28, 1907.

Molten litharge as discharged, for example, from a cupellation or refining furnace, is granulated by subjecting it to the action of a blast of air, steam or the like, which is projected against it from an adjustable nozzle. The granulated litharge is forced by the air- or steam- blast against a cooled plate.—A. S.

Chlorine compounds of lime ; Manufacture of ——. G. W. Johnson, London. From Chem. Fabr. Griesheim-Elektron, Frankfort, Germany. Eng. Pat. 8476, April 11, 1907.

See Fr. Pat. 376,848 of 1907 ; this J., 1907, 1047. —T. F. B.

Aluminium acetate: Process for manufacturing insoluble ——. Chem. Werke F. Friedlaender, G.m.b.H., Berlin. Eng. Pat. 8576, April 12, 1907. Under Int. Conv., April 17, 1906.

See Fr. Pat. 379,547 of 1907; this J., 1907, 1254.—T.F.B.

Compounds of oxygen [*Nitric acid, sulphuric acid, etc.*]; *Process and device for making* —— *from the elements at a high temperature.* O. Bender, Neu-Babelsberg, Germany. Eng. Pat. 8653, April 15, 1907.

See Fr. Pat. 377,442 of 1907; this J., 1907, 1090.—T. F. B.

Nitric acid or nitric oxide from atmospheric air; Process for the production of ——. H. Pauling, Assignor to Salpetersäure-Ind.-Ges., Gelsenkirchen, Germany. U.S. Pat. 873,891, Dec. 17, 1907.

See Fr. Pat. 365,070 of 1906; this J., 1906, 928.—T. F. B.

Sulphurous acid; Separating —— *from combustion gases.* J. Babé, Honfleur, France, and H. Pape, Hamburg, Germany. Eng. Pat. 19,973, Sept. 6, 1907. Under Int. Conv., Sept. 10, 1906.

Sulphur dioxide is separated from furnace gases by absorption in water at a temperature below 0° C., the proportion of water being limited to that sufficient to absorb the gas and give a saturated solution, the freezing point of which lies below 0° C. The gases, cooled and thoroughly washed, are conducted through a special cooling chamber, kept below 0° C., in which the water vapour present condenses and absorbs the sulphur dioxide. Any extra water required is added in a finely-divided form, such as steam or spray, but a solution of a suitable salt, such as a 5 per cent. solution of common salt, substituted for the water, reduces the chance of freezing from undue dilution.—F. Sodn.

Hydrosulphites; Manufacture of stable ——. Farbw. vorm. Meister, Lucius und Brüning, Hoechst a/Main, Germany. Eng. Pat. 20,580, Sept. 16, 1907. Under Int. Conv., Sept. 26, 1906.

Stable solid hydrosulphites are obtained by evaporating a solution of the hydrosulphite *in vacuo* at a temperature below the dehydration point of the crystallised salt. Sodium hydrosulphite solution is, for example, evaporated *in vacuo* at a temperature not substantially exceeding 48° C. The evaporation is not carried to complete dryness. —A. S.

Metallic compounds; Purification of ——. C. van Brunt, Schenectady, Assignor to General Electric Co. New York. U.S. Pat. 873,809, Dec. 17, 1907.

See Eng. Pat. 18,489 of 1906; this J., 1907, 1042.—T. F. B.

Liquefaction of atmospheric and other gases. Soc. l'Air Liquide, Paris. Eng. Pat. 29,733, Dec. 31, 1906. Under Int. Conv., Jan. 4, 1906.

See Fr. Pat. 370,850 of 1906; this J., 1907, 247.—T. F. B.

Air or other gases; Purification of ——. Soc. l'Air Liquide, and J. Babin, Paris. Eng. Pat. 11,710, May 18, 1907. Under Int. Conv., May 26, 1906.

See Fr. Pat. 375,887 of 1906; this J., 1907, 919.—T. F. B.

Sulphur; Preparation of sublimed ——. A. Walter, Naples, Italy. U.S. Pat. 873,812, Dec. 17, 1907.

For the preparation of sublimed sulphur, a retort, cooling chamber, and collecting chamber are arranged in circuit. The retort is connected with a boiler by an inlet connection and communicates, by an outlet connection, with a suction pipe, by means of which the gas and vapours are withdrawn from the retort by an injector and pass to the cooling chamber, and thence to the collector, on the bottom of which the powdered sulphur is deposited, the gases passing out of the collector and back again to the injector.—F. Sodn.

Hydrogen from water-gas; Method of producing ——. A. Frank, Charlottenburg, Germany. U.S. Pat. 873,853, Dec. 17, 1907.

See Fr. Pat. 371,814 of 1906; this J., 1907, 408.—T. F. B.

Mixtures of liquids, etc. Eng. Pat. 19,813. *See* I.

VIII.—GLASS, POTTERY, AND ENAMELS.

Seger cones; Softening temperatures and testing of ——. Rothe. Tonind. Zeit., 1907, 1366—1368.

The softening points in question were determined in an iridium-tube furnace, in an atmosphere of nitrogen. The cones tested were those manufactured in the Royal Porcelain Factory at Charlottenburg, and of these only such were chosen as showed externally no signs of injury (cracks, rifts, etc.). Great care was taken to get truly average results, and to this end about 200 trials were made. Each test lasted about 90 minutes. In determining the temperatures, the Le Chatelier and a thermo-couple of iridium and iridium-ruthenium were employed, as well as an optical pyrometer. The couples were protected by magnesia tubes. The cones were attached to a Marquard porcelain tile, and they were smaller than those employed in ordinary testing. It was found that the rate of heating, at least twenty minutes before the softening point, should not exceed 5° C. per minute. The cones tested, ranged between the numbers 4—20 and represented a range of temperature from 1200° to 1530° C. At still higher temperatures, the variations (between estimated and observed softening points) were found to be greater, and no detailed experiments were proceeded with. The results are summarised in the following table:—

Cone:	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Estimated temperature	1210	1230	1250	1270	1290	1310	1330	1350	1370	1390	1410	1430	1450	1470	1490	1510	1530
Observed temperature.	1225	1225	1260	1285	1305	1335	1345	1360	1375	1395	1410	1435	1460	1480	1510	1525	1530

Patent.

Ceramic pastes; Machine for drying ——. E. Sommerschuh and P. Spengler. Fr. Pat. 381,187, Aug. 7, 1907.

See Eng. Pat. 18,147 of 1907; this J., 1907, 1092.—T.F.B.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Patents.

Materials for roofing, dampcourses, and the like; Manufacture of ——. H. F. Cates, Streatham Common. From O. Schreiber, Leipzig-Plagwitz, Germany. Eng. Pat. 7739, April 2, 1907.

See Fr. Pat. 374,830 of 1907; this J., 1907, 873.—T. F. B.

Wood; Manufacture of a substitute for —— *particularly applicable in the manufacture of turnery ware.* F. Schnell, Gutenstein, G. W. Mayer, Wiener Neustadt, and E. Hartwich, Vienna. Eng. Pat. 8161, April 8, 1907.

See Addition of April 10, 1907, to Fr. Pat. 379,609 of 1906; this J., 1907, 1281.—T. F. B.

Artificial stone; Process for making ——, *and the stone.* H. O. Duerr, Wilmington, Del. U.S. Pat. 873,849, Dec. 17, 1907.

Finely-divided silica, or silicious material, which may previously have been roasted, is ground with lime. The mixture is "hydrated" and mixed with coarser silicious material and with cement. Sufficient water to render the mass plastic is then added, the whole is moulded and subjected to the action of steam under pressure.—A. G. L.

Cement or cementitious material from slag; Manufacture of ——. Collos Portland Cement Co., Ltd., London. From H. Colloseus, Berlin. Eng. Pat. 15,765, July 9, 1907.

Molten blast-furnace slag, in a finely-divided condition, is treated with aqueous solutions of hydroxides of metals other than calcium, the aqueous solution also being in a finely-divided, or "atomised" state. The hydroxides used are those of potassium, sodium, barium, strontium, magnesium and aluminium, as well as of iron and chromium. For hydraulic work, especially, a small proportion of ferric hydroxide should be mixed with the other hydroxide used. For slags containing 45—52 per cent. of calcium oxide, 28—32 of silica, and 12—16 of alumina, so much of a 5 per cent. solution of hydroxide is used as will leave 0·8—1·2 per cent. of the hydroxide in the slag. More acid slags, containing 42—46 per cent. of lime, 32—35 of silica, and 8—12 of alumina are treated with a 5—10 per cent. solution of hydroxide in quantity sufficient to leave 1·5—2·5 per cent. of the hydroxide in the slag.

(See Eng. Pats. 3619, 13,886 and 14,329 (apparatus) of 1905; also Fr. Pat. 356,276; this J., 1905, 971, 1307; 1906, 316, 320.)—A. G. L.

Cement; Process for making ——. H. G. Barnhurst and J. W. Fuller, jun. Fr. Pat. 381,134, July 8, 1907.

See U.S. Pat. 861,699 of 1907; this J., 1907, 1010.—T.F.B.

X.—METALLURGY.

Iron; Solubility of graphite in ——. G. Charpy. Compt. rend., 1907, **145**, 1277—1279.

The solubility of graphite in pure iron was determined by four different methods. (*a*). Swedish iron was melted with an excess of wood charcoal and allowed to cool slowly, thus giving a grey cast iron containing 3·75 per cent. of total carbon (3·34 per cent. of graphite). Portions of this were then heated at various temperatures during several hours, cooled in water, and analysed. They were found to contain the following percentages of combined carbon:—When cooled from 750° C., 0·31 per cent.; 850°, 0·85; 1000°, 1·08; 1050°, 1·36; 1080°, 1·44; 1100°, 1·40; and from 1150° C., 2·47 per cent. (*b*). The metal was prepared as in (*a*), but cooled rapidly in a metal mould to give a white cast iron, containing 2·82 per cent. of carbon (all combined). This, heated to 1150°, cooled slowly to 1000° C., and then quenched in cold water, showed 0·92 per cent. of dissolved carbon. (*c*). The crucible containing the molten metal, prepared as in (*a*), was placed in a furnace at 1000° C. for 3 hours, and then plunged into cold water. This metal was found to contain 0·95 per cent. of dissolved carbon. (*d*). Carburisation was effected by cementation at 1000° C., in wood charcoal. Two experiments gave 1·10 and 0·89 per cent. (mean 0·99) of dissolved carbon respectively. By all four methods the solubility of carbon in pure iron is found therefore to be about 1 per cent. at 1000° C., and it decreases with falling temperature.—F. Sodn.

Steel; Gas occluded in ——. G. Belloc. Compt. rend., 1907, **145**, 1280—1283.

The volume of gas evolved at different temperatures on heating a sample of steel, containing 0·12 per cent. of carbon, is found to be intimately connected with the critical points of iron. Evolution of gas commences at 150°—400° C. and this at first consists almost exclusively of carbon dioxide, but above 400° C., hydrogen and carbon monoxide constitute the main portion, their relative proportions varying with the conditions. At about 550° C., carbon dioxide is replaced by nitrogen, but this gas appears in relatively small quantities. The proportion of gas remains small until the commencement of transformation of α-ferrite into β-ferrite, which is marked by a copious evolution. There is again a diminution as the transformation proceeds and a further increase with the change from β-ferrite to γ-ferrite. The volume appears to increase with temperature in the region of γ-ferrite, and a total volume of gas, 11—12 times the volume of the steel may be extracted up to 1200° C. The transformation of the carbon of cementation into temper carbon, for the above steel, has no marked influence on the evolution. The gas appears to be very irregularly distributed in a bar of steel, the proportion being greater in the middle layers than at the surface or centre. With reference to the state of the gas in the solid metal, it is noted that there is no indication of the existence of a dissociation pressure.—F. Sodn.

Gases contained in metals [iron]; Extraction of ——. O. Boudouard. Compt. rend., 1907, **145**, 1283—1284.

The author has measured the gas evolved from various forms of commercial iron and the results show that it is very difficult to extract all the contained gas, especially when the metal is not in a state of fine division. In the experiments recorded below, the samples were exposed to the air for a fortnight between two consecutive heatings.

	Mass. grms.	Surface. sq. cm.	C.c. of gas per 1 c.c. of metal during heatings at 1100° C.		
			1.	2.	3.
Wire					
0·5 mm. ...	34·0	280·5	5·7	1·3	0·72
1 „ ...	40·0	213·3	5·7	0·82	0·53
2 „ ...	40·5	108·8	4·9	2·0	1·3
Bar					
1 cm (1) ...	38·6	22·0	0·8	0·54	0·51
(2) ...	38·7	22·0	0·56		
Sheet					
1 mm. (1) .	41·0	80·0	4·8	1·4	0·91
(2) .	41·5	80·0	5·3		
Filings of 1 cm. bar .	46·0	very great	16·1	3·56	0·08

Composition of the gas:—

	Mass. grms.	Total gas evolved (c.c.).			
		Carbon dioxide.	Hydrogen	Carbon monoxide.	Nitrogen
Wire					
0·5 mm.	34·0	6.22	11·89	12·70	2·89
1 „	40·0	7·01	7·83	20·23	1·36
Sheet	82·5	5·08	17·40	53·46	2.81
Filings	46·0	5·16	29·17	66·45	5·22

These quantities, calculated into percentages by weight, are of about the same order as those of sulphur and phosphorus usually present. The whole of the nitrogen appears to have been extracted.—F. Sodn.

Ferrosilicon; Chemical behaviour of high-percentage ——. J. Haas. Chem.-Zeit., 1908, **32**, 8.

The author has shown previously (Stahl u. Eisen, 1904, 1315) that 50 per cent. ferrosilicon dissolves rapidly and completely in a concentrated solution of copper-ammonium fluoride, with separation of metallic copper in a spongy condition. There is a vigorous evolution of gas, probably due to the formation of hydrofluosilicic acid. It is suggested that this reaction may be of service in the analysis of high percentage ferrosilicons.—A. S.

Manganese ; Phosphorus compounds of ——. S. Shemtschushny and N. Jefremow. J. Russ. Phys.-Chem. Ges., 1907, **39**, 777—787. Chem. Zentr., 1908, **1**, 14.

A series of alloys of manganese and phosphorus were prepared by fusing the elements together in a sand crucible under a layer of molten barium chloride, and were examined microscopically, and their cooling curve determined. The latter consists of four distinct branches, viz., *a b*, from 1260° to 964° C. (0—9·5 atoms of phosphorus per cent.) ; *b c*, from 964° to 1390° C. (9·5—28·6 atoms of phosphorus per cent.) ; *c d*, from 1390° to 1095° C. (28·6—40·5 atoms of phosphorus per cent.) ; and *d e*, from 1095° to 1180° C. (40·5—46·9 atoms of phosphorus per cent.). Of these, *a b*, *b c*, and *d e* represent respectively the solubility curves of manganese and of the compounds, Mn_5P_2 and MnP. The compound, Mn_5P_2 is very stable and can be heated above its melting point without appreciable decomposition. The compound, MnP, forms mixed crystals containing from 50 to 56 atoms of manganese per cent. The results described were confirmed by the examination of the micro-structure of the alloys. —A. S.

Manganese ; Alloys of —— *with copper and nickel.* S. Shemtschushny, G. Urasow and A. Rykowskow. J. Russ. Phys.-Chem. Ges., 1907, **39**, 787—802. Chem. Zentr., 1908, **1**, 14—15.

The authors examined the alloys of manganese with copper and with nickel, and in both cases, the form of the cooling curves and the micro-structure of the alloys indicate that the two pairs of metals form a continuous series of mixed crystals. The different result obtained by Wologdine (this J., 1907, 471) in the case of manganese-copper alloys is attributed to the use of alloys containing an appreciable quantity of carbon. In the case of the manganese-nickel alloys containing from 36 to 51·5 atoms of nickel per cent., a second arrest-point was observed, which may be due to the decomposition of the solid solution, which is produced at first, with formation of the compound, MnNi.—A. S.

Mercury in its ores ; Volumetric determination of ——. J. A. Muller. Bull. Soc. Chim., 1907, **1**, 1169—1173.

The principle of the method consists in precipitating the mercury from a solution, to which potassium iodide and sodium hydroxide have been added, with excess of formaldehyde, dissolving the precipitate in standard iodine solution and then determining the excess of the latter. The author's experiments show that the best results are obtained under the following conditions :—(1) *Minerals containing neither gold nor platinum.*—A quantity of the powdered mineral containing about 1 grm. of mercury is decomposed by heating gently with *aqua regia*, and then evaporated to dryness at about 50° C. (or better, *in vacuo* over potassium carbonate, at the ordinary temperature). The residue is taken up with hot water, treated with about 50 c.c. of a 20 per cent. potassium iodide solution, then with sodium carbonate until no further precipitate is formed, and then with sufficient sodium hydroxide to render the solution alkaline. The solution is filtered, the precipitate being first washed with a little warm water, then extracted with a small quantity of a solution containing potassium iodide and sodium hydroxide (this solution being passed through the filter 7—8 times), and finally washed again with enough hot water to make up the volume of the whole filtrate to 100 c.c. To an aliquot part of this solution are added sodium hydroxide and formaldehyde in such quantities that, for about 0·1 grm. of mercury, 20 c.c. of 20 per cent. sodium hydroxide and 20 c.c. of 35 per cent. formaldehyde solution are used. The mixture is allowed to stand in a stoppered flask for 20 hours at about 25° C., the supernatant liquor is decanted from the precipitated mercury, and the latter is washed four times with alcohol, a small quantity of air being passed through the flask after the first and second washings to remove any trace of formaldehyde, care being taken, however, not to dry the precipitate. The precipitate is then treated with standard iodine solution containing excess of potassium iodide. The flask is stoppered, placed in a dark cupboard, and frequently shaken until the mercury has nearly all dissolved (it is best to effect this solution in an atmosphere of carbon dioxide). The solution is then decanted, and the residue is treated with a further small quantity of iodine solution. If, on standing, the decanted solutions and washings deposit a trace of mercury, this must be separated and dissolved as before. The excess of iodine is then titrated with thiosulphate. (2) *Minerals containing gold or platinum.*—The mercury should be volatilised in the form of mercuric chloride, the latter being collected in a Peligot tube containing water. After rinsing out the delivery tube, air should be passed through the mercuric chloride solution to remove excess of chlorine. The mercury may then be determined in the aqueous solution thus obtained.—L. E.

Amalgams : the hydrargyrides of the alkali and alkaline-earth metals. G. McPhail Smith. Amer. Chem. J., 1907, **38**, 671—683.

The author studied the action of air, water, and aqueous ammonia on solutions of the hydrargyrides of sodium, potassium, rubidium, and cæsium in mercury ; and also the condition of equilibrium attained when each of the amalgams in the three pairs—sodium and potassium, sodium and rubidium, and sodium and cæsium, were subjected to the action of the corresponding one of three equivalent solutions containing molecular proportions of sodium chloride and of potassium, rubidium, or cæsium chloride. It was found that the mercury compounds are increasingly stable in the order : lithium, potassium, rubidium, cæsium, and sodium. On exposure to a limited quantity of air, in closed vessels, the amalgams of the alkali metals are oxidised to different extents, and on the addition of water, oxygen is copiously evolved, with the simultaneous formation of hydrogen peroxide, in the cases of the oxidised amalgams of potassium, rubidium, and cæsium, but in the case of sodium-amalgam, neither hydrogen peroxide nor oxygen is formed. The stability of the amalgams of the alkaline-earth metals increases in the order : calcium, strontium, barium.—A. S.

Alloys ; Electro-potential and nature of metallic ——. N. Puschin. J. Russ. Phys.-Chem. Ges., 1907, **39**, 528—566. Chem. Zentr., 1907, **2**, 2026—2029. (See this J., 1907, 826, 1141.)

Aluminium-bronze group of alloys.—(1) *Aluminium-copper alloys.*—The alloys poor in copper are white. Those rich in copper are very hard. Determinations of the potentials of the alloys in a solution of calcium hydroxide indicated the existence of the compound, AlCu, but the existence of the other compounds, Al_2Cu and $AlCu_3$, mentioned by Le Chatelier, could not be detected. The compound, AlCu, is brittle, and is very easily oxidised. (2) *Aluminium-silver alloys.*—These are similar, in general, to the aluminium-copper alloys. Those containing up to 66 atoms of silver per cent. are very easily oxidised. The alloys rich in silver are remarkably hard. Potential measurements revealed the existence of the compound, AlAg, but not of the compounds, $AlAg_2$ and $AlAg_3$, discovered by Behrens and by Petrenko (this J., 1905, 928). (3) *Antimony-bismuth alloys.*—The formation of a continuous series of mixed crystals is confirmed. (4) *Lead-tin alloys.*—Potential measurements indicate that a solid solution containing up to 20 atoms of tin per cent. is formed. (Compare this J., 1904, 255, 791, 1093.) *Alloys of the hydrogen phosphide type.*—(1) *Antimony-zinc alloys.*—The potential-curve of the alloys reveals the existence of the compounds, Sb_2Zn_3 and SbZn (this J., 1905, 137 ; 1906, 268) analogous to the compounds, PH_3 and PH_2, but no evidence of the compound, Sb_2Zn, mentioned by Herschkowitsch was obtained. (2) *Arsenic-tin alloys.*—Addition of arsenic increases considerably the hardness of tin, and the resulting alloys are brittle, especially those containing from 40 to 50 atoms of arsenic per cent. Alloys of this composition also exhibit a remarkable tendency to become crystalline. Potential-measurements in $N/1$ sulphuric acid and in $N/1$ potassium hydroxide solutions, revealed the existence, in the first case, of the compounds, AsSn and As_2Sn_3, and in the second, the latter compound only. Thus, in certain circumstances, the existence of some solid phases may be overlooked by the potential-method, this being especially the case if two solid phases, having equal solution-tensions, exist side by side. (3) *Antimony-tin alloys.*—Potential-measurements in three different electrolytes indicated the existence of the compounds, SbSn and Sb_2Sn_3. (4) *Antimony-silver alloys.*—The potential-curve reveals the existence of the compounds, $SbAg_2$ and $SbAg_3$, and of solid solutions of $SbAg_2$ in antimony, $SbAg_3$ in $SbAg_2$, and silver in $SbAg_3$. (5) *Antimony-nickel alloys.*—The compounds, SbNi and $SbNi_3$, were indicated on the potential-curve, but there was no evidence of the existence of the compounds, Sb_2Ni_5, Sb_5Ni_4, and $SbNi_4$, mentioned by Lossew (this J., 1906, 430).—A. S.

Metals; Action of oxygen on ——. E. Jordis and W. Rosenhaupt. Z. angew. Chem., 1908, 21, 50—66.

The authors submitted copper, zinc, and tin, and some alloys of the two last-named metals with copper, to the action of oxygen and of air in a closed tube from which the air had previously been exhausted, and after definite periods at different temperatures, measured the volume of oxygen absorbed. The alloys examined had compositions corresponding to the formulæ:—Cu_9Zn, $Cu_{13}Zn_3$, $Cu_{13}Zn_5$, Cu_9Zn_5, and $Cu_{13}Sn_3$. The oxygen and air were used in two conditions, viz., (1) saturated with aqueous vapour, and (2) dried by means of calcium chloride and concentrated sulphuric acid. The results are given in tables and curve-diagrams, and lead the authors to the following conclusions:—None of the metals or alloys examined is attacked by oxygen at the ordinary temperature. Noticeable oxidation takes place only above 60° C. in the case of copper, above 100° C. with tin, and above 180° C. with zinc. Below 200° C., the moist oxygen acts less rapidly on copper and zinc than the dried gas, but above 200° C., and also below that temperature in the case of tin, the moist gas acts more energetically than the dried gas. At 145° C. and above, air has a greater action than oxygen on copper, probably owing to the production of oxides of nitrogen and hydrogen peroxide. The determining factor in the degree of action of oxygen on metals is not the reaction: $2Me + O_2 = 2MeO$, but the character and properties of the surface layer of the metal produced in the first instance.—A. S.

Alloys; Action of nitric acid on some ——. C. Montemartini and E. Colonna. L'Ind. Chimica, 1907, 7, 293—298. Chem. Zentr., 1908, 1, 13.

The authors subjected alloys of zinc with 10 per cent. of another metal to the action of nitric acid of different concentrations, and determined the amount of ammonia produced. In the following table are given the quantities of ammonia (in grms.) produced by 1 grm. of the different alloys when acted upon by the acid at 7°—10° C.

Volume and strength of the nitric acid.	Zn + Mg.	Zn + Al.	Zn + Cd.	Zn + Bi.	Zn + Sn.	Zn + Cu.	Zn + Ag.
2500 c.c. of 0·25 %	0·00541	0·00253	0·00246	0·02142	0·03726	0·03078	0·00597
1000 c.c. „ 1·00 „	0·01149	0·00758	0·00517	0·02360	0·02322	0·02820	0·00444
120 c.c. „ 10·00 „	0·01795	0·02737	0·00889	0·02711	0·01100	0·01740	0·00233
70 c.c. „ 27·50 „	0·01659	0·00641	0·00978	0·01854	0·02787	0·01633	0·00181
45 c.c. „ 45·00 „	0·02656	0·00132	0·01181	0·00984	0·03299	0·01119	traces
40 c.c. „ 60·00 „	0·00885	—	0·00619	traces	0·01899	0·00163	—
30 c.c. „ 70·60 „	—	—	—	—	0·00598	—	—

In the experiments with 27·5 per cent. nitric acid, hydrogen was tested for in each case, but was never detected. (See also Stansbie, this J., 1906, 1071.)—A. S.

Mercury statistics for 1907. Oil and Col. Tr. J., Jan. 11, 1907. [T.R.]

Mr. A. S. Pickering gives the following figures relating to the mercury trade in the United Kingdom:—

	Imports.	Exports.	Highest.	Lowest.
	Bottles.	Bottles.	£ s. d.	£ s. d.
1907	39,448	29,465	8 5 0	6 15 0
1906	38,823	27,712	7 7 6	6 17 0
1905	34,034	21,330	7 15 0	7 1 0
1904	33,218	27,277	8 5 0	7 14 0
1903	34,886	18,846	8 15 0	8 5 0
1902	33,192	19,519	8 17 6	8 14 6
1901	35,341	26,863	9 2 6	8 17 6
1900	32,725	25,869	9 12 6	9 2 6
1899	51,696	32,239	9 12 6	7 15 0
1898	54,563	34,014	7 15 0	6 16 0

Estimated consumption, United Kingdom, 13,000 bottles per annum. The prices given are per bottle (of 75 lb.).

Antimony production of the United States in 1906. Bd. of Trade J., Jan. 2, 1907. [T.R.]

The U.S. Geological Survey report that by far the greatest amount of antimony produced from domestic ores is that contained in antimonial lead. For 1906 a production of 10,546 tons (of 2,000 lb.) of antimonial lead, containing 1,362 tons of antimony, was reported by the refineries of the country. It is estimated that about one-fourth of this was produced from foreign ores, so that the production from domestic ores was about 1,021 tons. This quantity was about half that produced in any one of the preceding five years, and was less than the trade requirements, so that antimony was melted with lead to supply the demand.

Steel rail specifications. Eng. and Min. J., Dec. 28, 1907. [T.R.]

The new specifications adopted by the Carnegie Steel Company, on Nov. 1, to govern contracts for steel rails, cover composition as follows:—

Sections.	Range, per cent.		Limit, per cent.	
	Carbon.	Manganese.	Phosphorus.	Silicon.
50 to 60 lb. ..	0·35 to 0·45	0·70 to 1·0	0·10	0·20
61 to 70 lb. ..	0·35 to 0·45	0·70 to 1·0	0·10	0·20
71 to 80 lb. ..	0·40 to 0.50	0·75 to 1.05	0·10	0·20
81 to 90 lb. ..	0·43 to 0·53	0·80 to 1·10	0·10	0·20
91 to 100 lb. ..	0·45 to 0·55	0·84 to 1·14	0·10	0·20

The number of passes and speed of train shall be so regulated that, on leaving the rolls at the final pass, the temperature of rails of sections 75 lb. per yard and heavier will not exceed that which requires a shrinkage allowance at the hot saws of 6 $\frac{7}{16}$ in. for a 33-ft. 75-lb. rail, with an increase of $\frac{1}{16}$ in. for each increase of 5 lb. in the weight of the section. No artificial means of cooling the steel shall be used after the rails leave the rolls, nor shall they be held before sawing for the purpose of reducing their temperature.

Mineral and metal production of the United States in 1907. Eng. and Min. J., Jan. 4, 1908. [T.R.]

In the accompanying table is summarised the production of the more important minerals and metals in the United States in 1907 so far as it has been possible to collect the statistics. The figures for copper, lead and spelter are based on reports received directly from the producers. The other statistics are based chiefly on the reports of producers, State mine inspectors, and special correspondents. The statistics for the production of gold and silver in the United States are the preliminary estimates of the Director of the Mint.

Product.	Customary Measure.	1906.			1907.			Changes in quantity.
		Quantity.	Value.		Quantity.	Value.		
			Total.	Per Unit.		Total.	Per Unit.	
Non-metallic—								
			$	$		$	$	
Coal, bituminous .	Short ton.	341,629,113	400,550,951	1.17	383,480,070	441,949,931	1.15	I. 41,850,957
Coal, anthracite ..	Short ton.	72,209,566	166,307,002	2.30	85,063,264	159,942,986	1.88	I. 12,853,698
Garnet...........	Short ton.	5,404	179,548	33.22	6,500	216,125	33.25	I. 1,096
Iron ore	Long ton.	49,217,489	102,372,377	2.08	52,418,755	110,079,385	2.10	I. 3,201,266
Limestone flux ...	Long ton.	14,552,000	9,604,320	0.66	14,925,000	10,447,500	0.70	I. 373,000
Petroleum.........	Barrel.	131,771,505	80,277,279	0.609	165,877,906	118,408,409	0.71	I. 34,106,401
Phosphate rock ..	Long ton.	2,052,742	12,342,741	6.01	1,917,000	13,419,000	7.00	D. 135,742
Manufactured—								
Bromine	Pound.	1,229,000	184,350	0.15	1,062,000	138,060	0.13	D. 167,000
Coke	Short ton.	32,690,362	86,887,392	2.66	40,090,670	106,757,970	2.69	I. 7,400,308
Copper sulphate ..	Pound.	50,925,932	3,157,408	0.062	40,138,117	2,733,405	0.068	D. 10,787,815
Ferrous sulphate..	Short ton.	22,839	228,390	10.00	26,212	262,120	10.00	I. 4 373
Graphite, artificial	Pound.	4,868,000	312,764	0.064	6,924,000	483,717	0.0698	I. 2,056,000
Lead, sublimed white	Short ton.	7,988	798,880	100.00	8,700	1,026,600	118.00	I. 712
Zinc oxide*	Short ton.	77,800	6,257,361	80.43	83,280	7,516,360	90.25	I. 5,480
Metallic—								
Aluminium	Pound.	14,350,000	5,166,000	0.36	25,000,000	11,250,000	0.45	I. 10,650,000
Copper	Pound.	917,620,000	180,000,339	0.1960	895,104,000	184,937,437	0.20661	D. 22,516,000
Gold	Oz. fine.	4,648,385	96,101,400	20.67	4,335,560	89,616,017	20.67	D. 312,825
Iron, pig..........	Long ton.	25,307,191	486,151,139	19.21	25,975,944	592,251,523	22.80	I. 668,953
Lead	Short ton.	345,529	39,093,151	113.14	359,058	38,239,677	106.50	I. 13,529
Mercury	Flasks.	25,309	1,035,138	40.90	19,900	805,950	40.50	D. 5,409
Silver.............	Oz. fine.	56,183,500	37,525,521	0.66791	56,925,911	37,187,990	0.65327	I. 742,411
Zinc	Short ton.	225,494	27,961,256	124.00	246,688	29,415,077	119.24	I. 21,194

* Includes zinc-lead pigment.

Patents.

Steel, or steel alloys ; Treatment of metals, such as —— in order to vary, improve or accentuate the qualities or character thereof. W. F. L. Frith, London. From C. J. Grist, Johannesburg, S. Africa. Eng. Pat. 27,914, Dec. 7, 1906.

Steel or steel alloys are hardened by heating them in a closed vessel, containing liquid or gaseous mercury, to a temperature corresponding with one of the recalescence points of the metal (preferably the lowest), and whilst at this temperature, passing an electric current through the metal for a short time. This treatment is usually carried out after the steel has been chilled and tempered as usual. A "good," *i.e.*, well-manufactured, close and homogeneous steel requires from 200 to 500 volts ; a "bad" steel with a high percentage of carbon, 50 to 200 volts ; and a "bad" steel with little carbon, 100 volts or less. The current used for small pieces varies from 15 to 25 ampères. (See Eng. Pats. 13,352 of 1900 and 23,939 of 1901 ; this J., 1901, 1218 ; 1903, 34.) —A. G. L.

Steel ; Process of making ——. H. O. Chute, Cleveland, Ohio. U.S. Pat. 874,391, Dec. 24, 1907.

A superheated pig iron rich in silicon and phosphorus is produced, together with a sulphurous slag, by smelting iron from a basic charge containing phosphorus and manganese under suitable thermal conditions. The molten pig iron so produced is then brought into contact with ferric oxide, silicon being eliminated with the production of a silicate slag containing manganese. In the subsequent elimination of phosphorus and carbon, a basic phosphoric slag is produced. A silicious non-bessemer ore is then smelted with both of these slags, the superheated pig iron obtained being afterwards treated, as above, for the elimination of silicon, phosphorus and carbon.—C. A. W.

Aluminium and alloys containing aluminium ; Soldering of ——. Küpper's Metallwerke, G.m.b.H., Bonn, Germany. Eng. Pat. 13,696, June 13, 1907. Under Int. Conv., June 13, 1906.

The surfaces of the aluminium or alloy of aluminium to be soldered are first thoroughly cleaned, and coated with a flux consisting of ammonium stearate. This flux is made by melting stearic acid and gradually adding to it 30—40 per cent. of its weight of an aqueous solution of ammonia. Each surface is next separately coated with a solder consisting of 90 per cent. of tin and 10 of copper, after which the two surfaces are soldered together with the same solder, or with any other ordinary solder. The solder and flux may also be powdered, mixed together and then applied to each of the two surfaces to be joined, and the proportions of the copper and tin in the solder may be varied somewhat.—A. G. L.

Ore roasting process. A. R. Wilfley, Denver, U.S.A. Eng. Pat. 15,419, July 4, 1907.

See U.S. Pat. 859,420 of 1907 ; this J., 1907, 1013.—T. F. B.

Minerals ; Process of roasting ——. A. R. Wilfley. Fr. Pat. 381,143, July 12, 1907.

See U.S. Pat. 859,420 of 1907 ; this J., 1907, 1013.—T. F. B.

Metallic alloy and its process of manufacture. P. I. Juppont and J. Teil, Toulouse, France. Eng. Pat. 16,352, July 16, 1907. Under Int. Conv., July 16, 1906.

See Fr. Pat. 368,371 of 1906 ; this J., 1907, 52.—T. F. B.

Magnetic ore separator. G. W. Lundberg, Ijernas, and A. G. Holmberg, Krylbo, Sweden. Eng. Pat. 16,675, July 20, 1907.

Ore and gangue, mixed with water, are introduced into a horizontal channel, in the upper part of which runs a belt. A little above this belt are placed, at intervals, groups of electro-magnets. Just before the first electro-magnet, and between every pair of groups, a hollow is formed in the channel, in which the ore and gangue are stirred up with the water by means of pipes delivering water: at these points, also, other pipes wash the belt free from adhering mineral matter. A second series of hollows is formed just below each group of electro-magnets. These hollows are provided with an overflow outlet delivering into a waste-conduit, into which a series of water-pipes placed in the hollows, washes the gangue which is not attracted to the belt. The ore which has successively been attracted to the belt at each group of electro-magnets finally leaves the channel by an outlet at the further end. —A. G. L.

Muffle or furnace for annealing. A. Smallwood, Assignor to The Incandescent Heat Co., Ltd., London. U.S. Pat. 874,039, Dec. 17, 1907.

See Eng. Pat. 18,877 of 1905; this J., 1906, 1049.—T. F. B.

Furnace; Cupola ——. M. Zippler, Allegheny, Pa. U.S. Pat. 874,476, Dec. 24, 1907.

The cupola furnace is of the ordinary type except that the lining near the base is formed with a fireclay portion projecting inwards. Below this projection, air flues are provided, and these are connected outside, through metal flue boxes, with compound tuyères which are led into the furnace through the projecting part.—C. A. W.

Nickel and copper in sulphide ores and mattes; Process of rendering —— soluble in water. W. S. Gates and H. H. Dow, Midland, Mich., Assignors to Ontario Nickel Co., Worthington, Canada. U.S. Pat. 874,496, Dec. 24, 1907.

The ores are roasted, either alone or with some chloride, and then treated with a haloid solution containing a free halogen, such as bromine. The process may be varied by a preliminary lixiviation with water after roasting, and subsequent treatment with the halogen solution.—C. A. W

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(*A.*)—ELECTRO-CHEMISTRY.

Ozone; Formation of —— by the action of the silent discharge at low temperatures. E. Briner and E. Durand. Compt. rend., 1907, **145**, 1272—1274. (Compare this J., 1907, 416 and 929.)

With an ozoniser plunged in a mixture of solid carbon dioxide and ether (–78° C.), a concentration of 11 per cent. of ozone, as indicated by the manometer, has been obtained by the authors, using pure oxygen. The yield was 12 grms. per kilowatt-hour. At –194° C. (in liquid air) the ozone is seen to trickle down the walls of the apparatus as a deep blue viscous liquid, the vapour tension of which is so low at this temperature, that all the oxygen is converted into ozone. Experiments at varying pressures show that the maximum yield, 55 grms. per kilowatt-hour, is given at 100 mm. (*loc. cit.*). Using air, instead of oxygen, a yield of only 20 grms. per kw.-hour. is realised: the ozone is practically free from oxides of nitrogen. A much smaller yield of ozone results, if the discharge be in the form of arc or spark, 0·79 grm. per kw.-hour being obtained with the spark at –194° C., and even this is probably due to the silent discharge which accompanies the spark. It is noted that the silent discharge gives rise to very little heat, since it has no appreciable effect on the rate of evaporation of liquid air. There is no danger of pure ozone exploding, if every trace of organic matter be removed from the ozoniser by washing with chromic acid mixture. —F. Sodn.

Indigo: Electrolytic reduction of ——. H. Chaumat. *See* IV.

Patents.

Boron carbide; Massive ——, and process of making same [electrically]. S. A. Tucker, Assignor to E. A. Sperry, New York. U.S. Pat. 869,114, Oct. 22, 1907.

Carbon is mixed with a boron compound in excess, such as boron oxide, and subjected to a reacting temperature in an electric resistance furnace, under conditions which eliminate foreign bodies from the carbide produced. The pressure, produced by the escaping gases, is controlled within the furnace during the reaction, and there is produced practically pure boron carbide, with a composition, B_6C, the mass after cooling having a metal-like fracture and a specific gravity approximately 2·7. By subjecting the material to a non-uniform temperature, various forms of carbide, possessing different physical characteristics, may be obtained, and may be separated from each other; thus, by slowly cooling the outer layers, and by allowing contraction to open up caverns within the mass, large crystals, free from a tendency to fracture, may be obtained. The slow cooling may be produced automatically by current-regulating mechanism.—B. N.

Furnace; Electric ——. G. Holmgren, Westeras, Sweden U.S. Pat. 873,861, Dec. 17, 1907.

A stationary iron core is provided with several poles, so as to form a number of magnetic circuits, and two concentric melting chambers, acting as the secondary, enclose the core, radial channels between the poles connecting together the chambers. A multipole rotary magnet, with a less number of poles than the stationary iron core, is revolved, by means of a vertical shaft, below the core.—B. N.

Cell; Electrolytic ——. A. E. Gibbs, Wyandotte, Mich. U.S. Pat. 874,064, Dec. 17, 1907.

A permeable diaphragm is surrounded by a metallic jacket forming the cathode, the latter having hollow projections extending within the wall of the diaphragm. The inner ends of the projections form outlet channels for the products of electrolysis.—B. N.

Electric incandescent lamps. Eng. Pat. 18,923. *See* II.

Incandescence electric lamp filaments, etc. Fr. Pat. 380,740. *See* II.

Incandescence bodies, etc. Fr. Pat. 380,802. *See* II.

(*B.*)—ELECTRO-METALLURGY.

Patents.

Printing plates; Process for preparing —— by means of electrolytic etching. H. Strecker-Aufermann, Munich, Germany. Eng. Pat. 28,319, Dec. 12, 1906.

See Fr. Pat. 372,294 of 1906; this J., 1907, 536.—T. F. B.

Iron; Electro-deposition of ——. S. O. Cowper-Coles, London. Eng. Pat. 28,897a, Dec. 18, 1906.

The roasted ore is mixed with coke, so as to form a filter-bed through which a solvent for iron oxide, such as a solution of sulphuric acid, is passed. An electric current may be passed through the ore, in order to aid the solution of the iron oxide. The liquid, after passing through the filter-bed, is caused to circulate through a tank containing insoluble anodes, arranged around a revolving mandrel forming the cathode.—B. N.

Steel; Process of producing ——. G. O. Seward, East Orange, N.J., and F. von Kugelgen, Holcombs Rock, Va., Assignors to Virginia Laboratory Co., New York. U.S. Pat. 874,628, Dec. 24, 1907.

The process consists in fusing iron, as an electrode, in contact with a refining slag. Meanwhile air may be blown into the furnace for the purpose of oxidising a part of the impurities.—C. A. W.

Smelting-furnace ; Electric ——. W. R. Parks, Assignor to S. S. Parks, Chicago, Ill. U.S. Pat. 873,890, Dec. 17, 1907.

The negative electrode is provided in its upper surface with a circular gutter, arranged concentrically with the axis of the positive tubular electrode. A series of drains are arranged at points equidistant from the centre of the gutter, and lead from the latter downwards, the lower openings of the drains converging towards the axis of the negative electrode.—B. N.

Furnace ; Ore-reducing ——. J. McLoughlin, Rye, N.Y. U.S. Pat. 874,527, Dec. 24, 1907.

The furnace is intended for the continuous reduction of ores containing a vaporisable metal, such as zinc, and consists of an elongated upright body provided with a hopper and screw at the upper end for feeding the ore downwards, and an adjustable outlet at the bottom for the removal of solid products. Fume apertures are provided: below these, and set in the furnace wall, metal electrodes, for the production of an electric arc, are fixed.—C. A. W.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

Arachis (peanut) oil ; Detection of —— in solid fats by Renard's test. W. B. Smith. J. Amer. Chem. Soc., 1907, 29, 1756—1757.

In applying Tolman's modification of Renard's test to solid fats containing cottonseed oil, the author invariably obtained a precipitate even in the absence of arachis oil, although this precipitate was frequently gelatinous and not crystalline like that of "arachidic acid." The following table shows the comparative results obtained with the solid fatty acids (separated by the lead-ether method) of other fats :—

Fat.	Solid fatty acids.	Fatty acids crystallising from 90 per cent. alcohol.	Beginning of crystallisation.	Iodine value of crystals.	M. pt. of crystals.
	Per cent.	Per cent.	°C.		°C.
Arachis oil	13·73	4·24	37	0·7	71·5
Lard	39·30	5·93	20	7·4	54·3
Lard + 10 per cent. of arachis oil	37·35	1·62	19	4·2	55·0
Oleostearine	36·31	15·18	25	4·9	61·5

On recrystallising the crystals from the lard and lard containing arachis oil, the melting points of the new crystals were found to be 55° C. and 77° C. respectively. Hence in the case of cottonseed oil or other oils containing a large proportion of solid fats, it will be necessary to recrystallise the "arachidic acid" until the crystals show a melting point above that of stearic acid in order to identify "arachidic acid" when present.—C. A. M.

Stearic acid ; Solubility of —— in ethyl alcohol at zero. W. H. Emerson. J. Amer. Chem. Soc., 1907, 29, 1750—1756.

The results obtained in the authors' determinations of the solubility of stearic acid recrystallised 8 times from alcohol until the m. pt. remained constant at 69·1° to 69·4° C. (corr.) may be summarised as follows :—

Sp. gr. of alcohol at 0°C.	Approximate strength of alcohol by vol.	Amount of stearic acid dissolved in 100 c.c. at 0°C.
	Per cent.	grms.
0·82650	95·7	0·1246
0·82715	95·5	0·1223
0·82871	95·1	0·1139
0·83126	94·5	0·1035
0·83183	94·3	0·0996

Hehner and Mitchell (*Analyst*, 21, 316) found the solubility of pure stearic acid in (purified methylated) alcohol of 94·4 per cent. strength to be 0·15 grm. in 100 c.c., whilst Kreis and Hafner obtained the value 0·1249 grm. in 100 c.c. of 95 per cent. alcohol. From other experiments the authors conclude that for use in Hehner and Mitchell's method of determining stearic acid, the solubility may be regarded as practically constant when the amount of stearic acid exceeds about 0·7 grm. with 100 c.c. of alcohol or about 0·5 grm. with 50 c.c. of alcohol of 94 to 95 per cent. strength. Below these amounts there was found to be a steady increase in the solubility. For the determination of small amounts of stearic acid they therefore recommend an addition of a weighed quantity of the pure acid sufficient to bring the total to about 0·7 grm. for 100 c.c. of alcohol (or 0·5 grm. for 50 c.c.). Supersaturation of the "saturated" solution may be guarded against by evaporating part of the liquid and comparing the result with the solubilities in the table given above. Evaporation of the stearic acid with alcohol on the steam-bath was found to increase the apparent solubility, possibly through the formation of an ester. Thus by evaporating 1·272 grms. of the acid with 50 c.c. of 94·3 per cent. alcohol, the solubility of the residue in alcohol of that strength was increased by 1·54 per cent. of the acid used.—C. A. M.

XIII.—PIGMENTS, PAINTS ; RESINS, VARNISHES ; INDIA-RUBBER, &c.

(*A.*)—PIGMENTS, PAINTS.

Patents.

Paint ; Process for manufacture of ——. F. R. Tiller, O. L. Benzinger, and R. A. Meyer. Fr. Pat. 381,195, Aug. 12, 1907.

A paint, having when dry a bright metallic lustre, is produced by mixing finely-pulverised mica (20 to 30 parts) with a 4 per cent. collodion solution (300 to 400 parts) and diluting the mixture with ether (200 to 300 parts). Bronze paints, and others of a similar nature are obtained by adding the necessary colouring matter.—G. W. McD.

Paints ; Use of barium sulphite in the manufacture of ——. M. Rosazza. Fr. Pat. 381,059, Aug. 21, 1907.

Barium sulphite is used as a substitute for lead compounds in the composition of paints.—G. W. McD.

Lampblack ; Method and apparatus for the manufacture of —— from hydrocarbons. A. Wegelin A.-G. für Russfabrikation und Chem. Ind. Fr. Pat. 380,983, Aug. 19, 1907.

The apparatus consists of a cylinder and piston, the latter being driven by any convenient motive power. Both ends of the cylinder are provided with a pipe and stop-valve for supplying a hydrocarbon gas. At the lower portion of each end of the cylinder is another pipe and stop-valve leading to a chamber of much smaller capacity than the cylinder and furnished with an electric sparking apparatus. Each of these smaller chambers communicates by a pipe and valve with a receiver for the lampblack formed. When the piston moves forward, it compresses the hydrocarbon gas into the small chamber, and, when the end of the stroke is reached, the charge in the sparking chamber is exploded by means of a rod geared up to the main piston rod. As the stroke reverses, the gas is compressed at the opposite end of the cylinder and exploded in a similar manner. An automatic arrangement is also provided for opening the valve between the sparking chamber and the receiver for the lampblack. The rapid expansion of the compressed gas carries the deposited lampblack into the receiver.—G. W. McD.

(*C.*)—INDIA-RUBBER, &c.

India-rubber ; Action of nitrogen trioxide on ——. O. Gottlob. Z. angew. Chem., 1907, 20, 2213—2221. (See also this J., 1907, 422, 538.)

Conflicting formulæ have been assigned by Weber, Harries, and Alexander to the yellow nitrosite of caoutchouc. Under the direction of Harries, the author has subjected the matter to an extended investigation, and arrives at the following conclusions. Crude or purified rubber under the action of mixtures of nitrogen trioxide and peroxide yields bodies of varying composition, but these are all more or less impure and are converted by purification or further chemical treatment into Harries' "nitrosite *c*" (this J., 1903, 103), which is a chemical individual of the formula, $C_{10}H_{15}N_3O_7$, and decomposition-point 158°—161° C. In order to obtain this body in the pure state, it is necessary to follow Harries' method closely. It is desirable to generate the nitrous gases from arsenic and nitric acid of sp. gr. 1·3—1·4.—W. A. C.

Rubber statistics, 1907. S. Figgis & Co. Jan. 2, 1908. [T.R.]

The total production of rubber in 1907 amounted to about 69,000 tons, against 65,000 tons in 1906. England imported 22,964 tons, and America, 16,020 tons. The shipments of Para rubber amounted to 30,360 tons, and of Peruvian, 7160 tons; of this quantity, Europe received 20,940 tons. The supply of plantation rubber from the East has increased to over 1000 tons (in 1906 it was 510 tons): the area planted is about 350,000 acres, or 50 per cent. more than in 1906. Brazil exported about 41,500 tons in 1907, against 38,000 tons in 1906. The total production of West African rubber amounted to 17,000 tons, about the same as in 1906. East African rubber showed an increased supply.

Patents.

Vulcanised rubber; Process for the regeneration of ——. J. C. L. Guerry. Fr. Pat. 380,998, Oct. 25, 1906.

The combined sulphur is removed by heating the vulcanised rubber to 180° C. with primary or secondary aromatic amines. The mass after cooling is dissolved in benzene, the solution filtered from insoluble impurities, and the caoutchouc precipitated by alcohol, the reagents remaining in solution. The amines can be partially replaced by aromatic hydrocarbons soluble in alcohol and benzene, and of high boiling point, such as naphthalene and anthracene. The sulphur not in chemical combination can be removed by previous treatment with caustic alkalis. The product obtained by this process is stated to be susceptible to re-vulcanisation.—H. G. B.

Fibrous tissue [Rubber substitute]; Manufacture of an elastic ——. G. Hoffmann, Bradford. Eng. Pat. 845, Jan. 12, 1907.

On boiling certain connective tissues of animals with water, alkali or acid (preferably with dilute tannic acid), the gelatin is removed, and the residue resembles india-rubber. It may be used as a substitute for that substance, *e.g.*, in the manufacture of cores for golf or other balls. —S. H. H.

[*Rubber substitute*] *Composition of matter.* A. G. Inrig, Bexley Heath, Kent. Eng. Pat. 9094, April 19. 1907.

A substitute for india-rubber is prepared by treating the "gelable" parts of animals with "potash or soda" to effect a thorough cleansing, and then mixing the material with 20—60 per cent. of oil with the addition of 50 per cent. of water, and heating for about one hour at 200° F. 1 per cent. of sodium stannate and 1 per cent. of potassium bichromate are now added, and the whole heated to 212° F. for 5—10 minutes, when the material may be poured into moulds, and allowed to cool and set. It may be considerably toughened by incorporating 5—10 per cent. of sulphur, and heating for about one hour at 260° F. under hydraulic pressure. —H. G. B.

Resilient substances; Manufacture of ——. Z. Olsson, Stockholm. Eng. Pat. 22,640, Oct. 14, 1907. Under Int. Conv., May 16, 1907.

The process relates to the manufacture of a light and porous matter of great elasticity, suitable as a substitute for air in filling the tyres of automobiles. Tyres filled with such a material are not rendered unfit for use by a puncture. The material is produced by introducing one or more gas-generating substances into a liquid mass of gelatinous or elastic character, or by introducing into such a liquid mass one or more chemical substances which produce gases when in contact with the moist mass. A mixture of chalk and tartaric acid is particularly recommended. The product is forced by pressure into the mounted tyres.—H. G. B.

XIV.—TANNING, LEATHER, GLUE, SIZE.

Patents.

Leather; Composition for stuffing ——. W. G. Roach, Cincinnati, and A. C. Roach, Newport, U.S.A. Eng. Pat. 29,368a, Dec. 24, 1906.

The leather is suspended in a bath of 12½ lb. of carnauba wax, 6¼ lb. of beeswax, 6¼ lb. of vaseline, and 100 lb. of stearic acid, at a temperature of 85—90° C., until the hide has been thoroughly penetrated by the composition. The degree of stiffness can be modified by varying the proportion of carnauba wax, and for harness leather, the amount of vaseline may be increased to 25 lb. The process is stated to be specially adapted for waterproofing, lubricating, and stiffening chrome leather intended for shoe soles, harness, belting, upholstering, etc.—H. G. B

Leather; Russia ——, *and a method of manufacture thereof.* J. W. and W. C. Dunn, London. Eng. Pat. 13,475, June 11, 1907.

Russia leather possessing the characteristic smell, but with the appearance of "bright grain" Morocco leather, is produced as follows. The Russia leather hides are degreased, shaved to the required thickness, re-tanned with sumac or other suitable material. and dyed. They are then placed between "crust" Russia hides for a sufficient time to restore the "scent," and are finally finished off in a similar manner to goatskins for Moroccos. —H. G. B.

Leather; Manufacture of ——. J. Inouye, Osaka, and T. Dogura, Yoshino, Japan. Eng. Pat. 16,887, July 23, 1907.

See Fr. Pat. 380,411 of 1907; this J., 1908, 28.—T. F. B.

Skins; Machine for treating [washing, depilating] ——. W. R. Smith and Buffalo Leather Co. Fr. Pat. 381,084, Aug. 22, 1907.

The machine is intended for washing dirt from skins or other articles by means of a moving liquid, or for treating skins or other articles with a chemical solution, *e.g.*, a sodium sulphide solution for depilation. It consists essentially of a vat, of circular or flattened elliptical section, fitted with two paddle-wheels which cause a circulation of the liquor. Perforated pipes are fixed at the bottom of the vat near the paddles, to inject air under pressure for maintaining the skins in suspension and for keeping them from turning over.—H. G. B.

Leather substitute or artificial leather; Process for the manufacture of a ——. Plunder und Pollak. Fr. Pat. 380,941, July 15, 1907.

The process consists in treating leather parings with an adhesive preparation made as follows. Equal parts of oleic acid and colophony are melted together, and two parts of this mixture are added to a solution of one part of casein, in five parts of water. This mixture is made into a paste with the leather, and the paste pressed into plates and dried. The product so obtained can be cut or compressed, and is capable of many applications as a leather substitute.—H. G. B.

Glue from mineral-dressed leather; Process for extracting ——. A. R. Weiss, jun., Hilchenbach, Germany. Eng. Pat. 19,019, Aug. 23, 1907.

The process relates to the production of glue from chrome-tanned or other mineral-dressed leathers by first treating the leathers with the hydroxides of alkali, alkaline-earth, or other light metals at temperatures varying between 100° and 125° C., and afterwards boiling down with water in the usual way. The salts of these metals, particularly the phosphates (*e.g.*, bones) can also be used for the same purpose, or the leathers may be treated first with hydroxides and then with the salts.—H. G. B.

XV.—MANURES, &c.

Nitric acid ; Determination of —— in soils by means of "*nitron*" (1.4-*diphenyl*-3,5*endanilodihydrotriazole*). J. Litzendorff. Z. angew. Chem., 1907, **20**, 2209—2213.

The nitron method (this J., 1905, 291, 458, 638) lends itself very well to the determination of nitric acid in soils which contain at least 2—3 mgrms. of nitrogen (as nitrate) per 100 grms. In the case of poorer soils, or of extracts sterilised by heat treatment, the evaporated extracts tend to contain an excessive proportion of some substance which inhibits the crystallisation of nitron nitrate. This difficulty, however, can be met to some extent by the use of hydrogen peroxide, which destroys the body in question. —W. A. C.

Sodium nitrate ; Behaviour of —— in the soil of swamp lands. G. Daikuhara and T. Imaseki. Bull. Imp. Centr. Agric. Exp. Stat., Japan, 1907, **1**, 7—36.

Laboratory experiments showed that, when sodium nitrate is applied to paddy (swamp land) soil, it is partially reduced first to nitrite and then, in succession, to ammonia and free nitrogen ; the loss in the form of free nitrogen varies according to the species of denitrifying organisms and the amount of soluble organic compounds originally present in the soil. This loss is greatly increased if much organic matter in a form easily available for microbes, *e.g.*, glycerin, sodium acetate, starch, fresh oil-cake or straw, be applied together with the nitrate. Nitrate cannot therefore be regarded as a favourable fertiliser for plants grown on swamp lands, since not only is there a considerable loss due to the system of irrigation practised, but there is a greater loss of nitrogen by denitrification, and more of the poisonous nitrites are formed, than in dry land. If nitrate be used, organic materials should not be applied along with it, or at least, should only be used in a well rotted condition, when they will not exert such a favourable influence on denitrification.—A. S.

Magnesium sulphate ; Manuring with ——. G. Daikuhara. Bull. Imp. Centr. Agric. Exp. Stat., Japan, 1907, **1**, 81—86.

In the case of soils where the amount of lime exceeds to any great extent that of magnesia, manuring with magnesium compounds is necessary. The cheapest and most effective salt for this purpose is the crystallised sulphate, applied annually in small quantities as a top dressing. In the case of the loamy humus soil with which the author's experiments were made, 10 parts of crystallised magnesium sulphate were equivalent to 100 parts of finely-powdered magnesite when mixed in with the soil and applied before sowing, whilst as a top dressing, 1 part of the sulphate was equivalent to 100 parts of magnesite. —A. S.

Bone-dust ; Some observations on manuring with ——. S. Uchiyama. Bull. Imp. Centr. Agric. Exp. Stat., Japan, 1907, **1**, 105—119.

From the results of sand cultures of barley, it was found that magnesite acts in a similar manner to limestone in reducing the availability of bone-dust as a fertiliser. With a ratio of lime to magnesia of 2 : 1, the yield is depressed more than with equal proportions of the two bases. The most favourable yield was obtained with calcium sulphate in place of limestone. The phosphoric acid of bone phosphate is not so easily available in presence of sodium nitrate as in presence of ammonium sulphate. The yield was poorest when part of the potassium sulphate in the general fertiliser was replaced by potassium carbonate, but it was not possible to distinguish how far this was due to the use in this experiment of sodium nitrate in place of ammonium nitrate, and how far to the alkalinity of the potassium carbonate. In experiments with a sandy soil, it was found that the yield of barley with bone-dust and sodium nitrate as fertilisers is not markedly different whether potash is applied in the form of potassium sulphate, potassium carbonate, or wood ashes. Laboratory experiments with potassium carbonate and bone-dust and bone-ash, with and without addition of chloroform, showed that phosphoric acid is brought into solution from bone-dust both by bacterial action and by chemical interaction of the bone-dust and the potassium carbonate, the effect due to the latter cause being much greater than that due to bacterial action. Both actions are much less pronounced with bone-ash than with bone-dust.—A. S.

Soils containing less than 0·02 per cent. of sulphuric anhydride ; Effect of special manuring with sulphates on ——. C. Daikuhara. Bull. Imp. Centr. Agric. Exp. Stat., Japan, 1907, **1**, 135—143.

The author grew experimental cultures of barley in order to ascertain the effect of special manuring with sulphates on the three soils described in the following table :—

	Nature of soil.	CaO. per cent.	MgO. per cent.	P_2O_5. per cent.	SO_3. per cent.
I	Sandy loam	0·153	0·092	0·025	0·016
II	Clayey.	0·028	0·118	0·022	0·013
III	Clayey.	0·093	0·035	0·017	0·010

The results showed that in all three cases, the proportion of sulphuric anhydride present in the soils was sufficient for the requirements of the barley plants. In the case of soil II., which was a stiff clay very poor in potash, and of an acid reaction, probably due to acid silicates, addition of limestone had little effect on the unmanured soil, but with the soil treated with the general manure used in the experiments, limestone caused an increase in the yield of barley corns from 1·25 to 38·63 grms. ; this large increase can be partly explained as due to neutralisation of the acidity of the soil by the limestone.—A. S

Sulphocyanides ; Application of —— as fertilisers. R. Perotti. Staz. sperim. agrar. ital., 1906, **39**, 193. Biedermann's Zentralbl., 1907, **36**, 804—805.

Ammonium sulphocyanide prevents the germination of seeds, but if it be applied to the soil some time before sowing the seeds, this injurious effect is prevented. The conversion of the sulphocyanide into assimilable compounds proceeds with relative rapidity, and under these conditions, the sulphocyanide acts as an efficient nitrogenous fertiliser.—A. S.

Astragalus lotoides ; Cultivation of ——. T. Imaseki. Bull. Imp. Centr. Agric. Exp. Stat., Japan, 1907, **1**, 121—123.

In many districts of Japan, the seeds of a leguminous plant, known as " Genge " (*Astragalus lotoides*) are sown in September or October between the rice plants in paddy (swamp land) fields. In the following spring, after it attains the flowering stage, the plant is incorporated in the field as green manure. As the accumulation of nitrogen by this plant is effected by means of the symbiotic growth with its root bacteria, the author tried the effect of inoculating the seeds, before sowing, with pure cultures of the bacteria. In all cases the inoculated seeds gave higher yields both of the whole plants and of the different portions (stems and leaves, roots) of the plants than did the original seed. The nitrogen content of different portions of the *genge* plant in the air-dry condition was found to be : stems, 1·86 ; leaves, 3·54 ; and roots, 2·71 per cent.—A. S.

Polygonum tinctorium ; Yield of —— under different conditions. T. Imaseki. Bull. Imp. Centr. Agric. Exp. Stat., Japan, 1907, **1**, 125—128.

THE author made experimental cultures in a loamy humus soil and an alluvial sandy loam in order to ascertain the effect of varying the ratio of lime to magnesia on the yield of *Polygonum tinctorium*, which is utilised to a considerable extent in Japan for the production of indigo. The detailed results are given in tables and show that when lime is applied in the form of calcium carbonate or air-slaked lime, better results are obtained when the ratio $CaO : MgO = 2 : 1$ or $1 : 1$ than when it is $3 : 1$. When lime is applied in the form of calcium sulphate, good results are also obtained when the ratio $CaO : MgO = 3 : 1$, since in this case the availability of the fertiliser depends upon its small solubility in water and not upon the acidity of the rootlets.—A. S.

XVI.—SUGAR STARCH, GUM, &c.

Dextrose ; Distinguishing —— from maltose, lactose, and sucrose by means of Barfoed's acid cupric acetate solution. F. C. Hinkel and H. C. Sherman. J. Amer. Chem. Soc., 1907, **29**, 1744—1747.

SINCE it was proposed to detect dextrose in sugar solutions by means of Barfoed's solution and then use the filtrate for the detection of maltose or lactose, it is important to know (1), the minimum amount of dextrose that can be detected, and (2), the maximum amount that will be quite destroyed, since presence of undestroyed dextrose would clearly make any reduction tests for maltose or lactose in the filtrate, useless. The reagent used in the authors' experiments consisted of 45 grms. of crystallised cupric acetate and 1·2 c.c. of 50 per cent. acetic acid per litre. The sugar solution to be tested was added to 5 c.c. of this Barfoed reagent, and the test-tube immersed for 3½ minutes in boiling water, then examined for cuprous oxide, allowed to stand for 5 to 10 minutes at the ordinary temperature, and again examined. To obtain uniform results it was found necessary to use test-tubes of nearly the same diameter and thickness of glass. Under the conditions described, quantities of 0·0002 to 0·0005 grm. of dextrose gave a slight but perceptible reduction, whilst no reduction was produced by 0·02 grm. of maltose or lactose or 0·03 grm. of sucrose. Quantities of dextrose of 0·0004 grm. to 0·002 grm. could thus be detected in the presence of the disaccharides, but to insure complete destruction of the dextrose, the amount could not be allowed to exceed 0·002 grm. to 5 c.c. of the reagent. The disaccharides caused reduction when their amount was too great, or when the solution was too acid, or the heating too prolonged. As it is difficult to obtain a definite degree of acidity in the cupric acetate solution, the reagent should, in every case, be tested upon known solutions of sugars under uniform conditions of working —C. A. M.

Starch ; Determination of —— in commercial products. E. Parow and F. Neumann. Z. Spiritusind., 1907, **30**, 561—562.

OF the methods proposed for the determination of starch perhaps the best is that which consists in dissolving the starch by means of malt extract, completing the saccharification by hydrochloric acid and determining the dextrose by Fehling's solution. The method, however, is tedious and is open to large errors unless considerable skill is applied to it ; further the theoretical factor, 0·9, for calculating from dextrose to starch gives results which are too low, so that the authors are in the habit of using a factor of their own, 0·95. They have consequently worked out a simpler method for commercial use, by which the dextrose is determined polarimetrically, a modification of Gschwendner's method (this J., 1906, 870) :—10 grms. of the sample are introduced into a 100 c.c. flask and are mixed with 50 c.c. of acid brine. The flask is fitted with a reflux tube and placed in a water bath which is already boiling vigorously. The flask is shaken three times during the first 15 minutes, and this suffices for starches, but for cereals further shaking is necessary at intervals. After treatment at the boiling temperature for exactly 1 hour, 10 c.c. of basic lead acetate are added, and the liquid is cooled and diluted to the mark. A small quantity of bone charcoal previously purified by hydrochloric acid is added, and after 15 minutes, the liquid is filtered and polarised in the 200 mm. tube. The acid brine is prepared by dissolving 200 grms. of salt in 800 c.c. of water, adding 220 c.c. of hydrochloric acid (sp. gr. 1·125) and filtering. This method is quite empirical, since the starch is not entirely converted into dextrose ; the determinations are therefore all performed in triplicate, and the results must be concordant. The calculation of the results is based on factors established by determinations made by the diastase-acid method mentioned above ; these factors vary for the different kinds of starch, and the following have been deduced from a large number of concordant determinations :

Kind of starch.	Polarisation factor for dry starch.	
	Soleil-Ventzke scale.	Circular degrees.
Potato	2·872	8·288
Maize	2·938	8·478
Rice	2·944	8·497
Wheat	2·918	8·420

—J. F. B.

XVII.—BREWING, WINES, SPIRITS, &c.

Starchy raw materials of distilleries ; Presence of diastase in ——, and their conversion into alcohol without malt. K. Windisch and W. Jetter. Z. Spiritusind,. 1907, **30**, 541—542, 552—555.

IN certain small distilleries in South Germany, spirit is made entirely from raw rye ; no malt is used but the starch is saccharified only by the diastase which is present in the raw grain. The process is as follows :—30 kilos. of rye grist are added all at once to 54 litres of water at a temperature of 64° C. The mash is covered up and steeped for half an hour, by which time the temperature will have fallen to 44° C. Sixty litres of boiling water are then added so as to raise the temperature again to 65°—66° C. After standing for a further period of 2 hours, cold water is stirred in until the temperature falls to 31° C. At this stage, ¾ lb. of pressed yeast, worked up with water, is added, the mash is cooled by a coil to 19° C. and discharged into the fermentation tun. Fermentation is started at 16° C. and proceeds for five days. The authors have investigated this process not only with rye but with wheat, barley and other cereals, as well as with potatoes and artichokes, so as to ascertain the extent of the existence of diastase in such raw materials. They have compared the yields of alcohol obtained by mashing the raw grain, both grist and meal, alone and with malt, also by mashing the steamed material with malt. Rye was the only grain which contained sufficient diastase to produce as much alcohol without malt as with malt. The fineness of grinding had no influence on the saccharification, but steaming before saccharifying with malt rather reduced the yield. Wheat contains a considerable quantity of diastase, but not sufficient to give the full yield of alcohol without the addition of malt ; the size of the grist has an appreciable influence on the saccharification. Wheat starch is completely saccharified by malt without previous gelatinisation. Similar results to those obtained with wheat were afforded in a lower degree by raw barley and in a still lower degree by raw oats; buckwheat is equivalent to wheat. Maize behaves differently; it contains only a little diastase, and the raw starch is far less readily saccharified by malt than the steamed material; the same applies to raw rice and millet. Potatoes contain only traces of diastase, and the raw starch is only partially saccharified by malt. In the case of artichokes, the whole of the inulin is saccharified whether with malt or without, and with either raw or steamed material.—J. F. B.

Green malt; Bacterial disease of ——. H. Schnegg. Z. ges. Brauw., 1907, **30**, 576—579, 588—591, 600—602, 608—612, 623—625, and 630—634.

In moist seasons, green malt exhibits a disease, in consequence of which the rootlets die off at an early stage and the number of "sinkers" is increased. The disease is caused by bacteria, which have their seat in the embryo of the barley and thence spread over the rootlets, penetrating the peripheral cells and so causing death. In nutrient solutions containing sugar, the bacteria induce fermentation and formation of acid, whilst in the barley corn they secrete enzymes which exert a solvent action on the cell walls of the endosperm. By the addition of disinfectants to the steep water, the organisms can be rendered harmless, but not without damage to the germinative properties of the barley. Substances such as lime, chloride of lime, and sodium carbonate, which increase the germinative power of barley, do, however, produce a diminution in the harmful action of the bacteria. It may be that the bacteria are not to be regarded as disease organisms, but that their function is to promote the modification of the barley. When kilned, the diseased green malt exhibits all the qualities of a good malt.—T. H. P.

Hops: Air-dried or kilned ——. Allg. Brauer- u. Hopfenz., 1907, No. 230. Z. ges. Brauw., 1907, **30**, 592—593.

It is pointed out that hops possess a considerably higher brewing value when air-dried than when subjected to kiln-drying, which latter causes not only a diminution in the weight of the hops but also partial loss of their most valuable constituents. This deterioration is, of course, intensified if, as often happens, the hops are subjected to a high temperature for 7—8 hours. In thin layers, hops will dry in the air in two or three days if the weather is favourable, and will retain their colour perfectly.—T. H. P.

Wort refrigerator; Advantages of the closed, countercurrent —— over the cooler-back and open refrigerator system. J. Liebmann. Woch. für Brau., 1907, **24**, 696—697, 718—720.

The Baudelot refrigerator, such as is generally used in America, or any open cascade refrigerator must always constitute a weak point as regards infection of the wort, whatever precautions be taken, and sources of infection can generally be detected at the joints and the ends of the pipes. Another objection is that, when working with the cooler-back, the sediment is rejected and considerable quantities of wort are thus wasted. After full investigation the author has discarded both cooler-back and open refrigerator and uses only a closed refrigerator. In working this system, special arrangements have to be provided for aërating the wort. The author has devised for this purpose an iron box, fitted to the discharge from the hop-copper and easily dismounted for daily cleaning. The air pipe, leading into the box, ends in perforated branches so that as the wort is drawn through the box by the pump, it is thoroughly aërated. The admission of the filtered air requires the most exact regulation, the size of the air-cock being established by experiment. If too little air be supplied, troubles are experienced in the form of slow fermentation, and bad attenuation and clarification; if too much air be admitted, the beer will be deficient in hop-aroma and body and will have an insipid taste. The next point in working the closed system, without the cooler-back, is to remove the wort as quickly as possible from the hops, and the best way is to provide sufficient cooling surface to cool the wort from boiling temperature to 7·5° C. in one passage at a fairly high speed. But if the refrigerator be too small for this, the wort must be collected and passed through a second time. In this connection it is to be noted that the temperature of the wort in the collecting cistern after the first passage must not be below 62° C., because when wort is kept for any length of time at temperatures between 37° and 56° C., it rapidly darkens in colour and acquires an alliaceous flavour. The author's refrigerator consists of one set of 16 batteries and contains 827 sq. ft. of $\frac{5}{8}$ in. copper tubing. This cools 300 barrels of wort, direct from the copper, to 7·5° C. in 90 minutes. When the refrigerating surface is increased to 1255 sq. ft., it is expected that the same work will be done in less than an hour. No attempt is made to separate the sediment, and the wort goes straight to the pitching tun, in which it is cooled by a cold water coil to 2° C. and mixed with yeast. Both the yeast mixture and the cold wort are aërated with filtered air. By this system, infection of the wort is impossible, and the beer remains stable. Boiling water is passed through the refrigerator before and after use; every other day it is steamed for 30 minutes, and every fortnight it is cleaned by boiling a solution of sodium carbonate in it; it has not been taken to pieces for four years, and thus no manual labour is required for keeping it clean.—J. F. B.

Yeast; Poisonous action of cereals on ——. F. Hayduck. Woch. für Brau., 1907, **24**, 673—679, 685—692, 706—714, 746—755.

A full investigation has been made of the poisonous action exerted by the meals of certain cereals on yeast, to which reference was made by Lange (this J., 1907, 1104). Rye, wheat and barley contain substances which are poisonous to bottom-fermentation beer yeast; wheat flour and aqueous extracts prepared from it under certain conditions are also poisonous to top-fermentation distillery and pressed yeasts. So far, no poisonous action has been detected in the case of maize, and oats only show it at a certain stage of germination. The poisonous action is only exhibited in the presence of fermentable sugar and in the absence of certain salts; it manifests itself in the form of decreased fermentative power and the dying off of the cells. The poisonous substance is an albuminoid, not dissolved by alcohol and ether but soluble in glycerol; it is dissolved by water in the presence of peptonising enzymes and by dilute acids. Profound proteolysis by tryptase, acids or alkalis destroys it completely. It is only partially destroyed by the operations of malting, curing and mashing. Heating at 100° C. destroys the poison of rye but not that of wheat; the latter is also unaffected by boiling with alcohol. The poisonous substance may be precipitated from an acid aqueous wheat extract by neutralisation with alkali. The poisonous action of wheat flour is completely inhibited by calcium and sodium carbonates. Other calcium salts and the salts of barium and zinc, in small quantities, restrain it considerably; a similar action is also exerted by larger quantities of the chlorides, sulphates and phosphates of potassium and ammonium; magnesium salts occupy a position between these two groups. Bottom-fermentation yeast is not fortified against the poison by favourable nutrition. In saccharine yeast-water media the poisonous action is not inhibited unless the calcium salts exceed a certain limit. Yeast debilitated by age or warm storage is more susceptible to the poison than fresh yeast. The comparative resistance of top-fermentation yeasts as against bottom-fermentation yeasts is not explained by their different mode of life; bottom yeasts when cultivated by the "Lufthefe" system employed for pressed yeasts do not become more resistant to the poison. The greater susceptibility of the bottom yeasts is therefore a racial character. When bottom-fermentation beer yeast has been poisoned by a saccharine aqueous extract of wheat, the extract is deprived of any further poisonous action.
—J. F. B.

Bottled beer; Flora of ——. *V. Bacillus flavus. VI. Bacillus cerevisiae.* F. Fuhrmann. Zentralbl. Bakt. Abth. 2, 1907, **19**, 117; Z. ges. Brauw., 1907, **30**, 614—615. (Compare this J., 1906, 861.)

Bacillus flavus forms egg-shaped rods, 1—1·2 μ long and 0·6 μ wide. When grown on nutrient gelatin, it forms on the surface sharply defined, bright yellow colonies, which are quite circular and only slightly raised, the submerged colonies being spherical and dirty yellow and without projections. The organism is extremely motile, each cell being provided with three or four long, slender flagellæ. The bacillus is facultative anaerobic and its temperature optimum lies at about 25° C. It can utilise asparagine, ammonium lactate, tartrate and chloride and potassium nitrate as sources of nitrogen, provided that carbon in the form of dextrose, sucrose, lactose or glycerol is also present.

Bacillus cerevisiae forms rounded rods, 1—1·5 μ in length and 0·6 μ in breadth and, in many of its biological and morphological characters, resembles the *B. coli* group. It is a facultative anaerobe and is not a typical beer organism but rather a water bacterium, probably originating in the water employed for washing the bottles. Its temperature optimum is 30—33° C. and it is motile, each cell being provided with 5—8 long flagellæ. In mineral nutrient solutions it can make use of asparagine, ammonium tartrate, lactate or chloride or potassium nitrate as a source of nitrogen, and dextrose, sucrose, lactose or glycerol as its source of carbon; in this and in its forms of growth it differs essentially from *B. coli.*
—T. H. P.

Acetylmethylcarbinol; Formation of —— *during the acetous fermentation of wine.* J. Pastureau. J. Pharm. Chim., 1908, **27**, 10—12.

Acetylmethylcarbinol has been previously recorded as occurring in certain commercial vinegars (this J., 1905, 745). It is now found to be a constant and normal product formed in the course of the acetous fermentation of wines, probably through the action of oxidising bacteria on the isobutylglycol present. Red wines of ordinary quality, which before treatment were shown to be free from acetylmethylcarbinol, were found to yield from 0·3 to 0·5 grm. per litre after undergoing acetous fermentation, even when merely submitted to the action of *Mycoderma vini* as well as to the successive influence of *M. vini* and *M. aceti.*—J. O. B.

Tartaric acid in cider; Detection of ——. G. A. Le Roy. Compt. rend., 1907, **145**, 1285.

The cider or analogous liquid is approximately neutralised and precipitated by an excess of basic lead acetate. The precipitate is washed with cold water and then decomposed by sulphuretted hydrogen. After filtration and evaporation, the liquid, now free from sulphuretted hydrogen, is neutralised with sodium bicarbonate and evaporated to dryness on the water-bath. The residue is moistened with a 1 per cent. solution of resorcinol in concentrated sulphuric acid and heated, when an intense violet-red coloration indicates the presence of tartaric acid or a tartrate. Under the same conditions citric acid gives no colour, and malic and lactic acids give yellow colorations.—F. Sodn.

Starch; Determination of —— *in commercial products.* E. Parow and F. Neumann. *See* XVI.

Denatured alcohol; Report of U.S. Commissioner of Internal Revenue on ——. Oil, Paint, and Drug Rep., Dec. 23, 1907. [T.R.]

So far, little if any loss of revenue has resulted from the use of industrial untaxed alcohol, and the quantity of tax-paid alcohol withdrawn from the warehouse during the last fiscal year was in excess of similar withdrawals during any like period since 1894. The expenses incident to the administration of the new law have been unexpectedly light There had been appropriated for the purpose the sum of $250,000, but the actual disbursements have been only $43,266. These included salaries and the expenses of inspectors, deputy collectors, storekeepers, gaugers, office force, laboratory supplies, etc. Few attempts at fraud have been attempted in connection with the manufacture and distribution of the untaxed spirits. There were withdrawn from bond for denaturation during six months ended June 30th, 3,084,950 galls. of taxable spirits, and there were produced 1,397,861 galls. of completely denatured alcohol, of which 1,355,763 galls. were distributed between manufacturers, wholesalers, retailers, and to persons other than registered dealers. Of specially denatured alcohol, for use of manufacturers only, there were shipped from warehouse during the last six months of the fiscal year, 375,277 wine galls. Therefore 1,731,040 galls. were sent into consumption during the six months ended June 30. Of this quantity, manufacturers received in addition to the 375,277 gallons of specially denatured spirits, a quantity of completely denatured alcohol estimated to have been 777,391, or in all about 1,152,668 gallons.

Patent.

Non-alcoholic beverages from fermented liquors; Process for making ——. H. Linzel and C. Bischoff, Berlin. U.S. Pat. 874,216, Dec. 17, 1907.

See Eng. Pat. 17,651 of 1904; this J., 1905, 810.—T. F. B.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, AND DISINFECTANTS.

(*A.*)—FOODS.

Milk; The proteolytic enzymes of ——. A. J. J. Vandevelde. Bull. Soc. Chim. Belg., 1907, **21**, 434—458.

The results of the experiments described prove that a proteolytic enzyme capable of digesting casein, albumin, etc., actually exists in fresh cows' milk. It is able to dissolve about two-thirds of the milk proteins; this action appears to be limited and to come to an end after a certain length of time. The age of the cow has no influence on the activity of the enzyme nor has the period of lactation. The author finds that a 3 per cent. solution of iodoform in acetone is the most useful antiseptic to use in studying the proteolytic action of milk enzymes. The addition of 3·3 c.c. to 25 c.c. of milk completely sterilises the latter without interfering with the action of the enzyme.—W. P. S.

Gliadin [in flour]; Polariscopic method of determining ——. G. W. Shaw. J. Amer. Chem. Soc., 1907, **29**, 1747—1750.

Details are given of an experimental study of Snyder's method of determining gliadin (this J., 1904, 387). In 45 comparative determinations in which the amount of gliadin was also determined by the Gunning-Kjeldahl method, the average differences with soft and hard wheats and flour were −0·02 to +0·04 per cent., and only in three cases did the difference exceed 0·05 per cent. To obtain a solution suitable for rapid filtration, it was found necessary to avoid excessive shaking of the mixture of material and alcohol. In the author's experience it was also found essential to make two determinations by means of the polariscope, first upon the original solution and afterwards upon the filtrate after separation of the proteins by the addition of mercuric nitrate solution, a correction to give the true proportion of gliadin thus being obtained This correction was especially necessary in the case of wheat meals, in which the average difference between the two readings was 1·05 on the sugar scale (0·21 per cent. on the gliadin scale). In the case of flours, however, the difference did not exceed 0·04 per cent.

on the gliadin scale, and for such samples the correction might be neglected unless very great accuracy were required.—C. A. M.

Meat and meat extracts; Further studies on the application of Folin's creatine and creatinine method to ——. A. D. Emmett and H. S. Grindley. J. Biol. Chem., 1907, 3, 491—516.

In view of the statement by Hehner (this J., 1907, 709) that the low results obtained by some investigators in the determination of creatine in meat extracts by Folin's method is due to the use of an insufficiency of picric acid, the authors have made a number of experiments in order to determine the conditions under which trustworthy results may be obtained. As the result of their work they find that an increase in the quantity of picric acid, according to Hehner's suggestion, does not cause a difference in the so-called original creatinine determinations, but that it does generally produce an appreciable difference when the creatinine from creatine is also present, and, further, that the quantity of picric acid (1·2 per cent. solution) recommended for use in the case of meat extracts, meat, and urine should be left at 15 c.c. for the original creatinine determinations, and be increased to 30 c.c. for the creatinine derived from the creatine. The use of a small or large quantity of 10 per cent. alkali solution made almost no difference in the determination of the original creatinine, 5 c.c. yielding slightly lower results than 10 or 15 c.c.; for the creatinine from creatine, 10 c.c. of alkali gave better results than 5 c.c. and equally as good results as 15 c.c. The following is an outline of the method as now used by the authors:—Ten grms. of the meat extract are dissolved in water and diluted to a volume of 500 c.c. Aliquot portions of this solution are transferred to 500 c.c. flasks, 15 c.c. of 1·2 per cent. picric acid solution and 10 c.c. of 10 per cent. sodium hydroxide solution are added to each, the mixtures are shaken, and diluted to the mark after standing for 5 minutes. The depth of colour of the solutions is then compared with that of $N/2$ potassium bichromate solution in a layer 8 mm. in depth. Ten mgrms. of pure creatinine when treated with picric acid and alkali and diluted to 500 c.c. give a reading of 8·1 mm. when compared with 8 mm. of the bichromate solution. For the determination of both creatinine and creatine, 10 c.c. of the solution are placed in a 100 c.c. flask, 10 c.c. of $N/1$ hydrochloric acid are added, and the mixture is heated in an autoclave for 30 minutes at a temperature of 117°—119° C. After cooling, the solution is diluted to 100 c.c. Aliquot portions of this solution are then transferred to 500 c.c. flasks, treated with picric acid and alkali, and the colorations produced compared as described above. The quantity of creatinine multiplied by the factor 1·16 gives the creatine. The authors find about 0·45 per cent. of combined creatine and creatinine in meat and from 1·4 to 6·5 per cent. in meat extracts.—W. P. S.

Tea leaves; Chemical composition of —— at various stages of development. S. Sawamura. Bull. Imp. Centr. Agric. Exp. Stat., Japan, 1907, 1, 145—147.

Variously developed leaves of young twigs bearing four leaves, the top one of which was in a folded condition, were picked and analysed. The detailed results are given in a table, and show that during development of the tea leaves, the proportions of water, crude protein, and theïne decrease, whilst those of ether extract, crude fibre, and tannin increase. The amount of soluble constituents apparently does not vary regularly with the stage of development of the leaves.—A. S.

Black tea; Aroma of ——. T. Katayama. Bull. Imp. Centr. Agric. Exp. Stat., Japan, 1907, 1, 145—152.

Tea leaves which have been previously treated with different antiseptics, still develop, on standing, the characteristic aroma, which cannot, therefore, be due to micro-organisms. If, however, the leaves be treated with cyanogen gas for 5 hours, or heated above 60° C. for 1 hour, the aroma is subsequently no longer developed. The substance or substances to which the aroma is due can be removed from the tea leaves by repeated extraction with alcohol or ether. The author is of the opinion that the aroma is produced by enzymic action. The leaves were found to contain oxydase and peroxydase, but these are not destroyed by heating at 65° C., and cannot therefore be the cause of the aroma. The view that enzymes are concerned in the production of the aroma, was confirmed by the following experiment of Sawamura. Two solutions were prepared by extracting: (1), 156 grms. of fresh tea leaves with absolute alcohol; and (2), 147 grms. with 20 per cent. alcohol. Solution (1) was evaporated to dryness and the residue dissolved in water, and the solution was mixed with the precipitate obtained by adding ether-alcohol to solution (2). In the mixture the characteristic aroma of black tea was produced.—A. S.

Erythrosine; Determination of organic chlorine and iodine in commercial ——. F. Jean. *See* IV.

Patents.

Cereals and cereal products; Process of and apparatus for bleaching and ageing ——. J. M. Williams, Guthrie, U.S.A. Eng. Pat. 6636, March 19, 1907. Under Int. Conv., May 18, 1906.

See Fr. Pat. 375,832 of 1907; this J., 1907, 986.—T. F. B.

Butter; Process of making a vegetable —— capable of being spread. P. Kolesch. Fr. Pat. 381,197, Aug. 13, 1907.

See Eng. Pat. 18,499 of 1907; this J., 1907, 1251.—T. F.B.

(*B.*)—SANITATION; WATER PURIFICATION.

Patents.

Sewage purification and the destruction of pathogenic organisms. P. Parsons, Blackburn, Lancs. Eng. Pat. 25, Jan. 1, 1907.

The sewage is conducted through a settling chamber into a fermentation tank provided with a stirring apparatus. The sewage remains in this tank for about three days, being agitated at intervals, and the liquid portion is then pumped on to bacteria beds. These are three in number and are situated one above the other in a chamber placed above the fermentation tank. The beds are composed of clinker on which is placed a deep layer of loamy earth, the whole being supported on concrete floors. The sewage is sprayed over the surface of the upper bed, and means are provided for collecting the liquid at the bottom of the bed and conducting it to the spraying device in the next lower bed. As the effluent passes from the lower bed through a pipe to be discharged into a river, it is subjected to the action of ozonised air, the latter being forced into the inlet of the pipe through which the effluent passes. Four sets of the plant may be provided, so that the sewage from a town may be treated continuously.—W. P. S.

Water still. C. K. Mills, London. From The Sanitary Water-still Co., New York. Eng. Pat. 4991, Mar. 1, 1907.

The still consists of two parts; the upper part comprises a water-supply reservoir and condenser, whilst the lower part is the boiler. Both parts are cylindrical in shape. The top of the lower part is dome-shaped and projects into the water reservoir, a central pipe extending from the top of the dome to above the surface of the water in the reservoir. An annular channel is fitted round the internal wall of the lower part of the apparatus, the inner wall of this channel ending concentrically within the lower edge of the dome so as to form a narrow circular slit. The channel serves as a collecting trough for the water condensing on the walls of the dome; the inner wall of the channel is formed in two parts with an air space between, so as to protect the condensed water from the full heat of the steam in the boiler. Water is admitted from the upper reservoir to the boiler by means of a tap and feed cup. As the water boils, it is aerated by a device consisting of a hollow cup-like base surmounted by a central pipe; this device is placed in the boiler and the steam generated under the cup is forced through an injector-jet fitted in the central pipe. The jet of steam draws in air from the feed cup through a lateral pipe, and, whilst the steam is condensed in the dome, the air passes up the pipe above the dome, carrying with it volatile impurities. The air escapes through small orifices in a cap placed on the top of the pipe. An overflow outlet is provided on the condensed water channel.—W. P. S.

(*C.*)—DISINFECTANTS.

Emulsions. S. U. Pickering. Chem. Soc. Trans., 1907, **91**, 2001—2021.

On churning up paraffin oil with a solution of soft soap, an emulsion is formed, which, on allowing the mixture to stand, gradually rises to the surface. It usually contains 65—82 per cent. of the oil by volume, and is as viscid as thick cream. By adding paraffin, in small portions, to such an emulsion, and churning after each addition, emulsions consisting of 99 per cent. of paraffin oil and 1 per cent. of a 1 per cent. solution of soap can be obtained; these are practically solid, but are still true emulsions of oil in water, since they will mix perfectly with water to form weaker emulsions, whereas addition of paraffin oil in bulk, without churning, eventually causes de-emulsification of the whole. The formation of an emulsion is not much affected by the character of the oil or the extent of the churning, or, within certain limits, by the proportion of soap. In a stable emulsion the proportion of oil decreases somewhat from the top downwards, but frequently the existence of layers of approximately uniform composition can be detected. Solutions of organic substances other than soap, *e.g.*, glue, flour, milk, starch, albumin, saponin, etc., will also emulsify paraffin oil. The oil globules in an emulsion are probably prevented from coalescing by being enveloped in a pellicle consisting of particles of solid much more minute than the globules themselves. In the case of liquid emulsifiers, these solid particles are derived from the solution, which in all cases contains a substance with but little affinity for water, and insoluble in paraffin oil. "Emulsions prepared with liquid emulsifiers often become spontaneously de-emulsified, and this occurs at once if the emulsifier is destroyed; for example, if an acid or any sodium salt be added to an emulsion containing soap." "Electrolytes, as such, apparently have no de-emulsifying action." Any precipitated substance in a sufficiently fine state of division, and which is wetted more easily by water than by paraffin oil will act as an emulsifier, and the emulsions thus produced apparently do not become de-emulsified spontaneously. In some cases it is possible, under a microscope, to see the solid particles composing the film which envelops the oil globules. The basic sulphates of calcium and iron, prepared by adding lime or lime-water to the normal sulphates, form excellent emulsifiers. Emulsions made with basic copper sulphate contain the elements of Bordeaux mixture and act as a fungicide as well as an insecticide. If 1·6 grms. of copper sulphate be taken per 100 c.c. (the quantity used in "normal" Bordeaux mixture made with milk of lime; see this J., 1907, 1291), 3·5 c.c. of "Solar Distillate" (sp. gr. 0·858) will yield with the basic sulphate an emulsion which neither sinks nor rises. In the case of Bordeaux mixture made with lime-water (*loc. cit.*), only 0·7 grm. of copper sulphate is used to every 100 c.c., and an emulsion which will neither sink nor rise, is obtained with 1·4 c.c. of "Solar Distillate." The emulsions, unlike soap emulsions, can be mixed with caustic soda to make a detergent "winter wash." If fungicidal properties are not required, the emulsions may be prepared with the cheaper ferrous sulphate in place of copper sulphate, and these possess certain advantages over those prepared with the copper salt. Moreover, since ferrous hydroxide is itself an emulsifier, the precipitation of the basic sulphate by means of lime-water can be dispensed with, and sufficient caustic soda may be added to the normal sulphate to precipitate the hydroxide and leave about 2 per cent. in excess, as is required in a "winter wash." The emulsifying power of precipitated substances is destroyed as soon as they have been dried, or have by any other means been deprived of their fine-grained structure. Solids which are not sufficiently fine-grained to act as emulsifiers will, in many cases, when present in considerable proportions, form quasi-emulsions, in which the particles of paraffin oil are merely entangled with the particles of solid, and may easily be separated from them, *e.g.*, by dilution with water. Among the substances which form quasi-emulsions are lime, silica, alumina, plaster of Paris, lead arsenate paste, and various precipitated hydroxides and basic salts. Some of the quasi-emulsions can be used for spraying purposes.—A. S.

XIX.—PAPER, PASTEBOARD, &c.

Patents.

Celluloid and similar substances; Apparatus for utilising the waste of ——. E. Garbin, Genoa, Italy. U.S. Pat. 874,181, Dec. 17, 1907.

See Eng. Pat. 10,319 of 1905; this J., 1905, 1028.—T. F. B.

Plastic transparent imputrescible substance of great resistance; Preparation of a ——. E. Crumière. First Addition, dated Aug. 3, 1907, to Fr. Pat. 369,635, Sept. 3, 1906 (this J., 1907, 112).

A cuprammonium solution of cellulose is allowed to evaporate to dryness. The adherent mass thus obtained is freed from copper compounds by the action of dilute acid, then rapidly washed and finally dried.—P. F. C.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

Sparteine; An isomeride of ——: *isosparteine.* C. Moureu and A. Valeur. Compt. rend., 1907, **145**, 1343—1345.

iso-Sparteine hydriodide (this J., 1907, 1292; 1908, 37) when treated with sodium carbonate yields the free base which is a colourless oil boiling at 177·5—179° C. at 16·5 mm. It is insoluble in water but readily soluble in the ordinary organic solvents. It has a rotation of $\alpha_D =$ −25·01; sp. gr. at 17°/4° C., 1·02793, and index of refraction $n_D = 1·53319$ at 17° C. *iso*-Sparteine resembles sparteine in its reactions, and the authors have prepared a number of its salts.—J. C. C.

Mistletoe [*Viscum album*]; *Volatile alkaloid in* ——. M. Leprince. Compt. rend., 1907, **145**, 940—941.

In addition to viscachoutin, viscic acid, a glucoside, and a resinoid substance, the dried plant of *Viscum album* contains a liquid volatile base, $C_8H_{11}N$, with an odour resembling that of nicotine or of coniine. It forms a crystalline sulphate, a very deliquescent crystalline hydrochloride, and a more stable platinochloride $(C_8H_{11}N,HCl)_2PtCl_4$, in yellowish, shining, micaceous scales, darkening at 230° C. and melting, with decomposition, at about 250° C. The base is extracted from the dry plant by means of 95 per cent. alcohol, acidified with 1 per cent. of hydrochloric acid. After distilling off the solvent, the residual extract is made alkaline with sodium carbonate and distilled. The alkaline distillate is saturated with sulphuric acid, evaporated *in vacuo*, and the sulphate of the alkaloid crystallised in the usual manner.—J. O. B.

Racemic inositol; Occurrence of —— in mistletoe berries. G. Tanret. Compt. rend., 1907, **145**, 1196—1198.

Racemic inositol, which has not been previously recorded as a natural plant constituent, occurs in fresh mistletoe berries (*Viscum album*) to the extent of 0·4 per cent. It is accompanied by 1·2 per cent. of ordinary, inactive inositol, which has previously been obtained from walnut leaves in much smaller quantity, *viz.*, 0·3 per cent. from the dry material. This is also the first recorded instance of the occurrence of a racemic sugar in a living organism. —J. O. B.

Quercitol; Occurrence of ——. E. O. von Lippmann. Ber., 1907, **40**, 4936—4937.

A quantity of a crystalline substance was found between the bark and the wood of a recently felled oak that had grown in a clearing near Kissingen. This was dissolved in water, and the solution decolorised and concentrated. Colourless crystals of pure quercitol separated, which melted at 232° C., and had $[\alpha]_D = +27°$ at 20° C. in aqueous solution.—F. Shdn.

Essential oil of nutmeg; Constituents of ——. F. B. Power and A. H. Salway. Chem. Soc. Trans., 1907, **91**, 2037—2058.

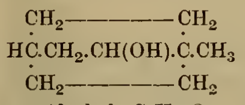
The oil used by the authors was specially distilled from unlimed nutmegs of good quality. The yield of oil was 6·94 per cent. This oil was a nearly colourless, limpid liquid, having the sp. gr. 0·8690 at 15°/15° C., an optical rotation of +38°4′ in a 100 mm. tube, and was soluble in three times its volume of 90 per cent. alcohol. A heavier oil, obtained by rectifying the normal oil, thus removing a large proportion of the terpenes, was also examined. This was a pale yellow liquid, with the following constants:—sp. gr., 1·102 at 20°/20° C.; $a_D = +1°17'$ in a 100 mm. tube; saponification value, 6·10. The authors find that the essential oil of nutmeg contains the following substances. Eugenol and *iso*eugenol, about 0·2 per cent.; *d*-pinene and *d*-camphene, about 80 per cent.; dipentene, about 8 per cent.; and *d*-linalool, *d*-borneol, *i*-terpineol, and geraniol, about 6 per cent. There were also present a new alcohol in very small amount, which yielded on oxidation a diketone, $C_8H_{14}O_2$, giving a dioxime melting at 140° C.; a trace of an aldehyde resembling citral, but yielding a β-naphthocinchoninic acid derivative melting at 248° C.; safrole, about 0·6 per cent.; myristicin, $C_{11}H_{12}O_3$, about 4 per cent.; myristic acid, about 0·3 per cent.; formic, acetic, butyric, and octoic acids, and a new monocarboxylic acid, $C_{13}H_{18}O_3$, all in the form of esters, and in relatively small amount. The acid, $C_{13}H_{18}O_3$, crystallises from dilute acetic acid in hexagonal prisms, melting at 84—85° C. The authors conclude that the portion of oil of nutmeg regarded as "myristicol," is really a mixture of alcohols, of which terpineol appears to be the predominating constituent.—F. Shdn.

Santene. O. Aschan. Ber., 1907, **40**, 4918—4923.

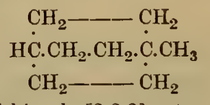
The oil of Siberian pine-needles was fractionated, and santene, C_9H_{14}, was found in the first fractions. The presence of santene was proved by means of the nitrosyl chloride reaction in oils from the needles of the German pine (*Pinus picea*), and the German fir (*Abies excelsa*). The constants of santene from Siberian oil and of its derivatives agreed with those observed by Müller for santene obtained from East Indian sandalwood oil (this J., 1900, 848). Under the action of glacial acetic acid and dilute sulphuric acid, santene unites with a molecule of acetic acid to form santenol acetate, $C_9H_{15}O.C_2H_3O$, which boils at 215°—219° C., and at 88°—89° C. at 8 mm. It is optically inactive and has $n_D = 1{\cdot}45929$ at 19° C., and the sp. gr. 0·9871 at 20°/4° C. On saponification it yields santenol, $C_9H_{16}O$, which boils for the most part at 195°—196° C., about one-third boiling between 196° and 198° C. Santenol after distillation sets to a solid melting at 80°—81° C. After several crystallisations from light petroleum, it forms large, clear tablets or prisms, melting at 97°—98° C. The phenylurethane derivative forms long, fine needles melting at 61°—62° C. When oxidised with chromic acid, santenol gives a ketone, which melted at 58°—59° C. after fractionation, and gave a semicarbazone melting at 225°—226° C. (See this J., 1907, 1292.)—F. Shdn.

Essential oils; Constituents of ——. (Further derivatives of santene, and preparation of bicyclo-[2.2.2]-octane.) F. W. Semmler and K. Bartelt. Ber., 1907, **40**, 4844—4849.

The authors have made a further examination of the diketone obtained by the oxidation of santene by ozone (see this J., 1907, 1292), and have converted it into a substance with a bicyclic structure by condensation. When the diketone is boiled with sodium ethoxide in alcoholic solution, a ketone, $C_9H_{12}O$, is produced, which boils at 100°—105° C. at 9 mm., has the sp. gr. 1·01 at 20° C., and $n_D = 1{\cdot}50387$. It forms a semicarbazone, m. pt. 205° C. If the diketone be reduced in alcohol with sodium, an alcohol, $C_9H_{16}O$, is produced, which is described as 1-methyl-bicyclo-[2.2.2]-octanol-7. This boils at 98°—100° C. at 9 mm., has the sp. gr. 1·001 at 20° C., and $n_D = 1{\cdot}49668$. As it is stable towards permanganate, it must be bicyclic, and derived from the monocyclic diketone by condensation. The alcohol was converted by means of phosphorus pentachloride into the chloride, $C_9H_{15}Cl$, which boiled at 82°—84° C. at 9 mm., had the sp. gr. 1·019 at 20° C., and $n_D = 1{\cdot}49097$. On reduction with sodium in alcohol, the chloride passes into the corresponding hydrocarbon, C_9H_{16}, or 1-methyl-bicyclo-[2.2.2.]-octane. This hydrocarbon boils at 149°—151° C., has the sp. gr. 0·875 at 20° C., and $n_D = 1{\cdot}46900$. The ketone, $C_9H_{14}O$, (1-methyl-bicyclo-[2.2.2]-octanone-7) was produced by oxidising the alcohol, $C_9H_{16}O$, with chromic acid. This ketone boils at 91°—94° C. at 9 mm., has the sp. gr. 1·002 at 20° C., and $n_D = 1{\cdot}48950$. It forms a semicarbazone melting at 214° C., and an oxime boiling at 132°—135° C. at 10 mm.



Alcohol, $C_9H_{16}O$



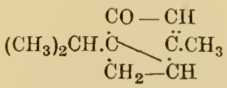
Methyl-bicyclo-[2.2.2]-octane.

—F. Shdn.

Essential oils; Consituents of ——. Constitution of umbellulone. F. W. Semmler. Ber., 1907, **40**, 5017—5023.

After the synthesis of bicyclo-[2.2.2]-octane (see preceding abstract), the author has looked for the occurrence of such compounds amongst the constituents of essential oils. According to one of the formulæ put forward by Tutin (this J., 1906, 776; 1907, 432), umbellulone has a ring bridged by two carbon atoms. Contrary to expectations, the physical constants of umbellulone and the author's octanone differ widely from each other. The author considers that the structure of umbellulone closely resembles that of tanacetone. In umbellulone the keto grouping is in the menthone position, whilst in tanacetone it is in the carvone position. Moreover, umbellulone contains one double bond near to the keto grouping. Umbellulone, obtained by the author from the oil of *Umbellularia californica*, had the following constants:—boiling point, 93°—98° C. at 10 mm., sp. gr. 0·958 at 20° C., $n_D = 1{\cdot}4895$, $a_D = -31°\ 30'$ in a 100 mm. tube. The observed molecular refraction was 45·19, whilst that calculated for the ketone $C_{10}H_{14}O|^{=}$ was 43·72. This increment points to a substance of the tanacetone type. Dihydro-umbellulol, $C_{10}H_{18}O$, obtained by reducing the ketone with sodium, boiled at 91°—93° C. at 10 mm., had the sp. gr. 0·931 at 20° C., $n_D = 1{\cdot}47348$, and $a_D =$

−27° 30′ in a 100 mm. tube. This on oxidation with chromic acid gave β-dihydro-umbellulone, $C_{10}H_{16}O$, which boils at 83°—87° C. at 10 mm., has the sp. gr. 0·928 at 20° C., $n_D = 1{\cdot}45862$, and $a_D = -30° 30'$ in a 100 mm. tube. The oxymethylene and benzylidene compounds of the ketone, $C_{10}H_{16}O$, were prepared in order to prove that a CH_2-grouping is next to the keto grouping. The ketone was treated with sodium and isoamyl formate. The oxymethylene compound, $C_{10}H_{14}O : CH.OH$, thus formed, boils at 105°—107° C. at 10 mm., has the sp. gr. 1·001 at 18° C., and $n_D = 1{\cdot}49097$. The observed molecular refraction is 52·13, whilst that calculated for $C_{11}H_{16}O_2|^{=}$ is 49·84. With ferric chloride it gives a violet-red coloration, and when oxidised with permanganate, passes into homotanacetonedicarboxylic acid, $C_{10}H_{16}O_4$, melting at 146° C. The benzylidene compound of the ketone, $C_{10}H_{14}O : CHC_6H_5$, was produced by acting upon the ketone with sodium and benzaldehyde. This boils at 185°—188° C. at 9 mm., has the sp. gr. 1·030 at 20° C., and $n_D = 1{\cdot}574$. The observed molecular refraction was 76·89, whilst that calculated for $C_{17}H_{20}O|^{=}_{4}$ was 72·65. The benzylidene compound set to a solid melting at 81°—82° C. When oxidised by means of permanganate, the benzylidene compound forms a mixture of benzoic and homotanacetonedicarboxylic acids, which were separated by means of the methyl esters. The neutral ester of homotanacetonedicarboxylic acid, $C_8H_{14}(COOCH_3)_2$ boils at 148°—153° C. at 10 mm.; the free acid, $C_8H_{14}(COOH)_2$, melts at 146°—147° C. when crystallised from water, and is dextro-rotatory. The corresponding acid prepared from *d*-tanacetone is lævo-rotatory and melts at 146°—147° C. When the two optical isomerides were crystallised together from water, short needles were obtained melting at 179° C. The following formula is suggested for umbellulone.



The following constituents of essential oils have a constitution of the tanacetone type:—tanacetone, thujyl alcohol, umbellulone, sabinol, and sabinene.—F. Shdn.

Curcuma [*turmeric*] *oil.* H. Rupe. Ber., 1907, **40**, 4909—4910.

Curcuma oil when distilled gives a low-boiling fraction which, as Schimmel and Co. have shown, is identical with phellandrene, but no other constant-boiling fraction. When boiled with dilute sodium hydroxide solution, a compound containing oxygen, b.p. 156° C. under 12 mm. pressure, is obtained as well as a phenolic substance. This compound is not an alcohol, ketone, aldehyde or acid and is probably not identical with the turmerol described by Jackson and Menke. When boiled with stronger alkali, it yields a ketone, $C_{13}H_{18}O$, boiling at 119—120° under 8 mm. pressure, which is optically active and characterised by a crystalline semicarbazone, m.p. 119·5—120·5°, and a liquid oxime, b.p. 159° C. at 11 mm.; it affords well-crystallised condensation products with aromatic aldehydes. On oxidation with permanganate, terephthalic acid and *p*-methylacetophenone are formed. Milder oxidation gives rise to an acid, $C_{12}H_{16}O_2$, m.p. 33—34° and an oxyacid, $C_{12}H_{16}O_3$, m.p. 150°: the former acid is converted by permanganate into a dicarboxylic acid, $C_{12}H_{14}O_4$, m.p. 228°.—E. F. A.

Eucalyptol (*cineol*); *Determination of* ——. Schimmel's Rep., Oct. 1907, 45—50.

The methods for the determination of cineol based upon the formation of addition-compounds with hydrobromic acid and phosphoric acid respectively, are stated to be inaccurate. A new method is proposed based on the formation of an addition-compound of resorcinol and cineol, which is soluble in a large excess of a concentrated solution of resorcinol. 10 c.c. of the oil containing cineol are treated with about 70 c.c. of a 50 per cent. aqueous solution of resorcinol in a 100 c.c. flask having a graduated neck. After shaking well for 5 minutes, resorcinol solution is added so as to bring the unabsorbed portion of the oil into the neck of the flask, where its volume is read. This when deducted from 10 gives the volume of cineol in 10 c.c. of the original oil. Oils very rich in cineol should be diluted with an equal volume of oil of turpentine before carrying out the test. The resorcinol can be recovered from the resorcinol-cineol solution, by distilling off the cineol by means of steam, and evaporating the residue.—A. S.

Cineol [*eucalyptol*] *in eucalyptus and cajuput oils; Determination of* ——. C. T. Bennett. Chem. and Drugg., 1908, 72, 55.

The author has tried the resorcinol method recently proposed for the determination of cineol (see preceding abstract), and states that when applied to eucalyptus and cajuput oils, it gives too high results. Indeed in some experiments (see following table) quoted by Schimmel and Co., "taking the specific gravity into account, it would appear that the results by phosphoric acid are nearer the truth than those by the resorcinol method."

Eucalyptus oil.	Sp. gr.	Cineol by resorcinol method.	Cineol by phosphoric-acid method.
1	0·9185	71%	51 and 60%
2	0·9142	81%	40 and 51%

The author has found that with oils containing not less than 50 per cent. of cineol, the phosphoric acid gives "very fair results," but the unabsorbed portion of the oil should be removed from the addition-compound by pressing, since on washing with petroleum ether, there is "some tendency to decomposition."—A. S.

Pinene; New method of hydration of ——. P. Barbier and V. Grignard. Compt. rend., 1907, **145**, 1425—1427.

The authors describe a method of effecting the hydration of pinene at a low temperature. 1 kilo. of *l*-pinene is dissolved in 1 kilo. of glacial acetic acid, and 100 grms. of a 50 per cent. aqueous solution of benzenemonosulphonic acid are added. On shaking the mixture its temperature gradually rises to 65° C., when the liquid becomes homogeneous. After standing for 12 hours, it is treated with water to separate the acetic acid, washed, dried, and submitted to distillation under reduced pressure. The portion distilling over up to 85° C. at 15 mm. consists chiefly of unaltered pinene. The higher-boiling portion is saponified by means of alcoholic potash and the resulting oil distilled under a pressure of 13 mm. The chief fraction consists of terpineol (yield 52 per cent. of the pinene taken). By the action of a 50 per cent. solution of benzenemonosulphonic acid alone on pinene, a small quantity of terpineol was also obtained, whilst from the aqueous solution, terpine hydrate was extracted.—W. S.

p-Iodoguaiacol (*guaiadol*). E. Mameli and G. Pinna. Arch. Farmacol. sperim., 1907, 6, 193—238. Chem. Zentr., 1907, 2, 2044—2045.

The authors prepared *p*-iodoguaiacol from *p*-aminoguaiacol by the aid of Sandmeyer's reaction. The *p*-aminoguaiacol was obtained by treating guaiacol with diazobenzene chloride in alkaline solution, and reducing the resulting benzeneazoguaiacol with phenylhydrazine. 14 grms. of the *p*-aminoguaiacol were diazotised at −3 to −6° C., and the diazo solution was treated, after 12 hours, with 30 c.c. of dilute sulphuric acid, and then a saturated solution of potassium iodide was added gradually, with stirring, followed, after vigorous agitation, by a concentrated solution of sodium hypophosphite and 25 grms. of copper sulphate. On distilling with steam, *p*-iodoguaiacol passed over as a reddish-yellow oil, which solidified on cooling. If the oil does not solidify, it is dissolved in dilute alkali and reprecipitated by carbon dioxide. A yield of 60 per cent. is obtained. After recrystallisation from petroleum ether, it forms colourless cubical or prismatic crystals having an odour resembling that of clove oil, and a sharp, "burning" taste. It has the sp. gr. 1·5, melts at 43° C., and decomposes at about 180° C. It is insoluble in cold, and slightly soluble in hot water, but dissolves readily in most organic solvents. —A. S.

Tartrates; Decomposition of calcium and barium —— by alkali chlorides. H. Cantoni and Jolkowsky. Bull. Soc. Chim., 1907, 1, 1181—1189.

The solubility of calcium (or barium) tartrate in water (see this J., 1905, 812) is not the only factor which determines the amount of dissolved calcium salt when a solution of calcium chloride is precipitated with an alkali tartrate, since the alkali chloride, which is also produced, decomposes a portion of the tartrate. To determine the effect of this reaction, the authors have examined the action of potassium, ammonium, and sodium chloride solutions on calcium and barium tartrates. In each case, 100 c.c. of the alkali chloride solution and a quantity of the tartrate were stirred together continuously in a special apparatus at a constant temperature, and series of experiments were made in which temperature, time of contact, and concentration of the chloride respectively, were varied. The results showed that calcium tartrate undergoes decomposition to a greater extent than does barium tartrate, and that the amount of decomposition is greatest with ammonium chloride and least with potassium chloride (the difference between the three chlorides, in this respect, is not, however, very great). The amount of decomposition increases with temperature; thus, at 16° C., 100 c.c. of 7 per cent. ammonium chloride solution decompose 0·1670 grm. of calcium tartrate, and 0·1050 grm. of barium tartrate, whereas, at 85° C., the amounts dissolved are 0·6699 and 0·2360 grms. respectively. With regard to the time required to produce a state of equilibrium, it was found that the reaction is nearly complete in four hours (sooner in the case of potassium chloride). The experiments with varying concentrations of the alkali chlorides showed that the amount of tartrate decomposed increases with the concentration. A comparison of the results of these experiments with those obtained in studying the solubilities of the tartrates in water showed that much more of these salts dissolve in alkali chloride solution than in pure water. The experiments indicate that in precipitating calcium chloride solution with 10 per cent. potassium tartrate solution, the amount of calcium tartrate that passes into solution will be about four times as much as that dissolved by water under the same conditions. The authors consider that a thorough knowledge of the action of various alkali salts on metallic salts of tartaric, malic, and succinic acids is required in order to solve the problem of the separation of these acids.—L. E.

Patents.

1-*Phenyl*-2.3-*dimethyl*-4-*dimethylaminopyrazolone; Production of* ——. E. Scheitlin, Altstetten, Switzerland. Eng. Pat. 13,383, June 10, 1907. Under Int. Conv., Feb. 13, 1907.

By the action of dimethyl sulphate on 1-phenyl-2.3-dimethyl-4-sulphaminopyrazolone at 110°—115° C., an almost quantitative yield of 1-phenyl-2.3-dimethyl-4-dimethylaminopyrazolone is obtained.—A. S.

Hydrazine; Manufacture of ——. F. Raschig. Ludwigshafen-on-the-Rhine, Germany. Eng. Pat. 22,957, Oct. 17, 1907. Under Int. Conv., Nov. 22, 1906.

When a hypochlorite is treated with an excess of ammonia in the cold, and the resulting mixture is heated, the monochloramine (NH_2Cl) first formed reacts with ammonia, and hydrazine is produced. For example, 1 litre of sodium hypochlorite solution, containing about 70 grms. of active chlorine, is added to 1 litre of 20 per cent. ammonia solution, the temperature being kept below 15° C. The mixture is then, without delay, heated to boiling. By boiling away the excess of ammonia, acidifying with sulphuric acid, and evaporating to crystallisation, the hydrazine is isolated as the difficultly soluble sulphate. A yield, about 25 per cent. of that calculated, is obtained. (See also this J., 1907, 1108.)—F. Sodn.

Methylenecitryloxytoluic acid. R. Berendes and J. Callsen, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 874,824, Dec. 24, 1907.

See Addition of June 1, 1907, to Fr. Pat. 368,133 of 1906; this J., 1907, 1215.—T. F. B.

Xanthine bases; Oxyalkyl derivative of the ——. R. Berendes and F. Herwig, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 874,825, Dec. 24, 1907.

See Fr. Pat. 377,382 of 1907; this J., 1907, 1028.—T.F.B.

Oxalates; Process for making —— from the corresponding formates by heating in a rarefied atmosphere. Elektrochemische Werke. Fr. Pat. 381,245, Aug. 24, 1907. Under Int. Conv., Oct. 13, 1906.

See Eng. Pat. 19,943 of 1907; this J., 1907, 1253.—T.F.B.

Dichloroethylene from symmetrical tetrachloroethane; Process for producing ——. Cons. f. Elektrochem. Ind. Fr. Pat. 381,430, Aug. 31, 1907.

See Eng. Pat. 19,576 of 1907; this J., 1908, 35.—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Patents.

Photographs on metal, glass, porcelain, etc.; Process of producing ——. A. Hans, Friedenau, Germany. U.S. Pat. 874,005, Dec. 17, 1907.

See Fr. Pat. 373,652 of 1907; this J., 1907, 717.—T. F. B.

Photometer. H. Bryhni. Fr. Pat. 381,397, Aug. 27, 1907. Under Int. Conv., Sept. 5, 1906.

See Eng. Pat. 19,768 of 1907; this J., 1907, 1255.—T. F. B.

XXII.—EXPLOSIVES, MATCHES, &c.

Patents.

Nitrate explosives; Manufacture of ——. A. Ermel, Herstal, Belgium. Eng. Pat. 10,526, May 6, 1907.

See Fr. Pat. 377,509 of 1907; this J., 1907, 1067.— T. F. B.

Nitroglycerin; Manufacture of explosive oils containing ——. H. J. Haddan, London. From J. F. Lehmann, Munich, Germany. Eng. Pat. 21,117, Sept. 23, 1907.

Glycerine (100 parts) is mixed with water (17 to 20 parts) or hydrochloric acid (20 parts). A stream of hydrochloric acid gas is passed through the liquid for several hours at 100° C. An equal weight of glycerine is then added, and the whole heated to 110° C. for 24 hours, with a reflux condenser. The traces of hydrochloric acid are finally removed by heating to 150°—160° C. By this process of condensation, a product is obtained containing mono- and dichlorhydrin, di- and triglycerin, and the chlorhydrins of these two bodies. On nitration of this mixture, an explosive material is obtained, which freezes at a much lower temperature than nitroglycerin.—G. W. McD.

Gunpowder; Manufacture of ——. C. W. Volney, Keyport, N.J. U.S. Pat. 874,264, Dec. 17, 1907.

Alcohol and ether are removed from nitrocellulose powder by subjecting it, in a closed vessel, to air heated to 35° C. at normal pressure, and alternately subjecting the powder to air heated to the same temperature, with the pressure reduced to about 70 mm., such steps being each continued for about the period of one hour.
—G. W. McD.

[*Explosive*] *Materials; Art of treating* ——. C. W. Volney, Keyport, N.J. U.S. Pat. 874,265, Dec. 17, 1907.

Nitrocellulose powder is finished by the process of removing from the powder, in the pressed form, the volatile solvents. The powder is placed in a closed vessel, and dried and heated air or other gas introduced into the latter. A certain portion of the air is then removed from the vessel in order to reduce the pressure, the temperature being kept constant at 35°—40° C. These processes are repeated alternately, the pressure in the closed vessel fluctuating about 10 per cent.—G. W. McD.

Nitrocellulose; Electrolytic apparatus for the manufacture of ——. G. C. de Briailles, Paris. U.S. Pat. 874,564, Dec. 24, 1907.

See Fr. Pat. 364,349 of 1906; this J., 1906, 911.—T. F. B.

Powder; Improved ——, *and method for preparing the same.* J. Luciani. Fr. Pat. 380,963, Oct. 24, 1906.

For the purpose of reducing muzzle flame, diminishing the sound, and reducing pressure in the gun, certain bodies are claimed as additions to the ordinary components for propellant explosives. Carnauba wax (2 to 7 per cent.), sodium bicarbonate (2 per cent.), and beeswax (1 per cent.) are added in the mixing machine and incorporated with the ordinary paste. The paste is then rolled out into sheets of any desired thickness. The beeswax is said to prevent the explosive becoming brittle on drying.
—G. W. McD.

Safety explosives; Method for the manufacture of aromatic nitro-compounds from solvent naphtha, and their use in the preparation of ——. C. Distler, E. Blecher and C. Lopez. Fr. Pat. 380,996, Aug. 19, 1907.

The substance for nitration consists of solvent naphtha (b. p. 120°—180° C.), obtained from coal tar distillation, and purified by treatment with alkalis and sulphuric acid. The acid mixture is composed of 65 volumes of nitric acid (sp. gr. 1·5) and 13·5 volumes of sulphuric acid (sp. gr. 1·84). Naphtha (30 litres) is poured into the acid mixture (60 litres) with continuous agitation, and the temperature is kept below 25° C. Sixty litres of fresh acid are then added, and the whole raised to 80° C., for some time, and then cooled. The spent acid is now drawn off, and the nitrated oily material is again treated with a further quantity of 60 litres of mixed acid and 40 litres of sulphuric acid at 80° C. After the removal of the acids, the nitro-compound is purified by repeated washing with water, and is then mixed with such oxidising bodies as ammonium nitrate, ammonium perchlorate, picric acid, etc. An example of such a composition is given as: ammonium nitrate (88 parts), and nitro-derivative of solvent naphtha (12 parts).—G. W. McD.

XXIII.—ANALYTICAL CHEMISTRY.

APPARATUS.

Patent.

Carbon dioxide gas contained in the combustion gases of boiler flues and the like; Apparatus for automatically indicating and recording the percentage of ——. E. P. Ward, Belfast. Eng. Pat. 28,183, Dec. 11, 1906.

This specification describes an apparatus for gas analysis, of the type in which the alternate falling and rising of a reservoir, containing a sealing liquid and connected by flexible tubing to a gas-sample vessel of known capacity, alternately causes a measured volume of the gas to be drawn into the latter vessel and driven therefrom into an absorption vessel containing caustic potash solution. In this apparatus the recording beam is operated by the weight of the caustic potash solution driven out of the absorption vessel; the greater the proportion of carbon dioxide in the gas, the smaller is the quantity of solution displaced by the gas, and *vice versa.* Numerous details of construction are given.—H. B.

INORGANIC—QUANTITATIVE.

Magnesium; Volumetric determination of ——. F. Repiton. Monit. Scient., 1907, 22, 33—35.

The sample in which magnesium is to be determined is evaporated with excess of nitric acid, the residue is dissolved in nitric acid, filtered, and, if phosphates be present, these are removed by treating the solution with molybdic acid solution. The molybdate precipitate is filtered off, the filtrate is neutralised with ammonia, evaporated to dryness, and the residue redissolved in nitric acid. The solution is transferred to a graduated flask, 2 per cent. of citric acid or an equivalent weight of ammonium citrate are added, and also a known quantity of standard ammonium phosphate solution; after the addition of a quantity of 10 per cent. ammonia equal to one-third of the total volume of the solution, the mixture is placed aside for 24 hours, when the whole is diluted to the mark with $N/10$ ammonia and filtered. The excess of ammonium phosphate is then determined in an aliquot portion of the filtrate by the uranium acetate method. The addition of citric acid prevents the formation of the salt, $Mg_3(PO_4)_2$. It is also important to know approximately the quantity of magnesia present so as to avoid using excess of ammonium salts, as $Mg(NH_4)_4(PO_4)_2$, is liable to form in the presence of such excess.—W. P. S.

Nickel; Detection and determination of ——, *in presence of considerable quantities of cobalt, iron, and manganese.* E. Pozzi-Escot. Compt. rend., 1907, **145**, 1334—1335.

Nickel may be estimated in minerals containing large amounts of cobalt, iron and manganese as follows:—If metals of the alkaline-earths are present, they are removed from the solution by ammonium sulphate. To the concentrated filtrate is added a large excess of a saturated solution of ammonium molybdate, and some ammonium chloride, and the whole is heated to 80—90° C. for some minutes; it is then stirred for an hour until cold or, if possible, the cooling is effected by ice. The whole of the nickel is thus precipitated as a double molybdate of nickel and ammonium (this J., 1907, 1030) together with most of the iron. The precipitate is filtered off, washed with a saturated solution of ammonium chloride, boiled with water, and ammonium chloride and ammonia added in order to precipitate the iron. The nickel contained in the filtrate from this may be estimated colorimetrically, or the solution may be boiled with excess of caustic potash to expel ammonia, and the nickel precipitated as hydrated sesquioxide with bromine. The oxide is then dissolved in an acid, and the nickel determined electrolytically.—J. C. C.

Ferrosilicon ; Chemical behaviour of high-percentage ——. J. Haas. *See* X.

Mercury in its ores ; Volumetric determination of —— J. A. Muller. *See* X.

Nitric acid ; Determination of —— in soils by means of "nitron." J. Litzendorff. *See* XV.

ORGANIC—QUALITATIVE.

Peanut (arachis) oil ; Detection of —— in solid fats by Renard's test. W. B. Smith. *See* XII.

Dextrose ; Distinguishing —— from maltose, lactose, and sucrose by means of Barfoed's acid cupric acetate solution. F. C. Hinkel and H. C. Sherman. *See* XVI.

Tartaric acid in cider ; Detection of ——. G. A. Le Roy. *See* XVII.

ORGANIC—QUANTITATIVE.

Erythrosine ; Determination of organic chlorine and iodine in commercial ——. F. Jean. *See* IV.

Stearic acid ; Solubility of —— in ethyl alcohol. W. H. Emerson. *See* XII.

Starch ; Determination of —— in commercial products. E. Parow and F. Neumann. *See* XVI.

Gliadin [in flour] ; Polariscopic method of determining —— G. W. Shaw. *See* XVIII*A*.

Meats and meat extracts ; Further studies on the application of Folin's creatine and creatinine method to ——. A. D. Emmett and H. S. Grindley. *See* XVIII*A*.

Eucalyptol (cineol) ; Determination of ——. *See* XX.

Cineol [eucalyptol] in eucalyptus and cajuput oils ; Determination of ——. C. T. Bennett. *See* XX.

XXIV.—SCIENTIFIC & TECHNICAL NOTES.

Membranes of collodion, gold beaters' skin, parchment paper, and porcelain ; Permeability of ——. S. L. Bigelow. J. Amer. Chem. Soc., 1907, **29**, 1675—1692.

The experiments described in detail deal with the effects of forcing a pure liquid through one and the same or through different membranes at varying pressures and temperatures so as to obtain comparable numerical values. The apparatus employed consisted of a vertical glass tube, to the lower end of which was fixed a brass holder having an opening 15 mm. in diameter closed by a flat membrane of the given material held in position by means of a metal ring and screws. At right angles above the holder there was a calibrated capillary tube provided with mm. scales for measuring the volumes of liquid passing through the membranes, and some distance above this there was a stopcock in the vertical tube. The pressure was obtained and regulated by means of two mercury bulbs 10 cm. in diameter, the lower fixed in place and the other movable. In using the apparatus, the membrane holder and vertical tube were filled with water to above the stopcock, and the capillary tube nearly to the end of the scale towards the pressure bulbs, and the pressure applied by opening a stopcock in the capillary tube between the bulbs and the scale. The number of cubic mm. which would pass through one square cm. of membrane in one minute was adopted as the unit of permeability (M). By means of this apparatus it was found that thin collodion membranes immersed in water gave practically the same permeability results in successive experiments ; and that their permeability was not materially altered under the relatively high pressure of 840 mm. of mercury. Gold beaters' skin showed a lower degree of permeability than collodion membranes of two or three times its thickness, whilst parchment paper altered continuously under constant temperature and pressure, becoming less and less permeable. The general conclusions arrived at were that Poiseuille's law for the passage of liquids through capillary tubes applied also to the passage of water through the four membranes ; and that the rate at which liquids pass through molecular interstices was capable of expression " by the same laws which formulate the passage of liquids through capillary tubes."—C. A. M.

Turbid liquids ; Flocculation of —— by salts. A. D. Hall and C. G. T. Morison. J. Agric. Sci., 1907, 2, 244—256.

Certain substances, *e.g.* clays, assume a natant condition when suspended in water, remaining in suspension sometimes for days ; this condition is discharged and the particles settle out when mere traces of soluble salts are added. The authors' experiments were carried out with a levigated kaolin, the particles of which were less than 0·002 mm. in diameter and would remain natant for more than 24 hours. These particles when suspended in water were observed to possess an energetic Brownian motion which instantly ceased when a trace of flocculating salt was added. Up to a certain point, the flocculation, as measured by the rapidity of settlement, is proportional to the amount of salt added; beyond this limit all solutions flocculate alike. The reaction between the flocculated substance and the flocculant depends on the relative quantities of each and not (within limits) on the concentration of either ; thick suspensions, however, settle more readily than dilute ones. The process of flocculation does not appear to be accompanied by any removal of the salt from solution (adsorption) nor by any removal of the base of the salt, leaving the solution acid. The conductivity of the mixture after flocculation is not appreciably lower than the conductivities of the components. Free acids are the most powerful flocculators, though aluminium salts are nearly as strong ; then come the salts of the bivalent elements and then those of the univalent elements ; potassium salts are twice as effective as the corresponding sodium salts. The acid of the salt exerts an influence as well as the base, in the following order : hydrochloric, nitric, sulphuric, acetic, oxalic, and tartaric ; citric acid and phenol do not flocculate at all. Hydroxides and salts with an alkaline reaction act in the reverse direction, as de-flocculators ; calcium and barium hydroxides, however, have a slight flocculating action. The flocculated substance may be restored to the natant condition by washing away the flocculating salt and shaking up the substance with pure water. Besides kaolin and similar clays, natrolite was the only substance tested which could be brought into the natant condition without assistance. All the other minerals, as well as precipitated silica and alumina, could only be suspended on the addition of traces of free alkali. No theory has yet been put forward which explains all the facts, but the size of the particles (less than 0·004 mm.) is the first condition for suspension. Further, kaolin and natrolite are compound silicates containing an alkali metal, and it is reasonable to suppose that the natant condition depends on the presence of traces of free alkali, entering the liquid by partial hydrolysis (or by intentional addition).

Flocculation by acids or salts might then be the result of the neutralisation, substitution or suppression of the hydrolysed alkaline portion of the substance.—J. F. B.

Plant juices obtained by successive extractions; Constancy in composition of ——. G. André. Comptes rend., 1907, **145**, 1349—1352.

The author has previously shown that the content of dry extract of the juice of plant tissues often decreases as the pressure employed in expressing the juice is increased, whereas the composition of the dry extract (ash- and nitrogen-contents) is practically independent of the pressure. He has now investigated the effect of variations in pressure on the composition of the liquor obtained by treating expressed pulp residue with water and subsequently expressing the mixture. Leaves of *Valerianella olitoria* (corn-salad), and carrot roots, were employed. The pulps were first subjected to a pressure of 25 kilos. per sq. cm., then treated with water for 24—48 hours, and expressed under increasing pressures of 3, 12·5, and 25 kilos. per sq. cm., the liquors obtained at these respective pressures being collected separately; this process of extraction and expression was repeated two or three times. Examination of the various liquors thus obtained, showed, that with the individual aqueous extracts (as with the plant juice itself), the content of dry extract generally decreased with increasing pressure, while the composition of the dry extract remained practically constant. It was also found that, in the case of the carrot roots, the percentage of ash in the dry extract increased with the successive extractions. A considerable proportion of the nitrogenous and saline matter was not extracted by the above-described treatment. A further experiment, in which carrot pulp was heated with water on a boiling water-bath for 100 hours, showed that, under these conditions, practically all the potash passed into solution, and that the nitrogen and phosphoric acid were left in the residual pulp.—L. E.

New Books.

Treatise on Chemistry. By H. E. Roscoe, F.R.S., and C. Schorlemmer, F.R.S. Volume II. The Metals. New edition completely revised by Sir H. E. Roscoe and Dr. A. Harden. Macmillan and Co., Limited, St. Martin's Street, London, also Bombay, Calcutta and Melbourne. 1907. Price 30s. net. The Macmillan Company, New York, Boston, Chicago, Atlanta, and San Francisco. The Macmillan Company of Canada, Ltd., Toronto.

Large 8vo volume, containing 1404 pages of subject-matter and the alphabetical index. The text is illustrated with 259 engravings. The matter is classified and grouped according to the following scheme. I. Determination of the atomic weights of the metals. II. Molecular weights of the metals. III. Valency of the elements. IV. Classification of the elements. V. Crystalline form of metals. VI. Colloidal solutions of metals. VII. Alloys and amalgams. VIII. Constitution of salts, acids, and bases. IX. Metallic oxides, hydroxides and salts. X. Solubility, fusibility, and volatility of salts. XI. Chemical change. XII. Spectrum analysis. XIII. Crystallography. XIV. Systematic description of the metals and their derivatives, including XV., the radioactive metals. In this work "due attention has been paid to the more important technical processes connected with metallurgy, and no pains have been spared to assist the description of such processes by drawings of the most modern forms of apparatus and plant." It is also pointed out that though "the last edition of this work appeared," ten years ago, nevertheless "all the more important points connected with discoveries" in the intervening period, have been carefully included in the present volume. "The subject of crystallography, which formerly appeared in the first volume, has now been included in the second."

Chemie der höheren Pilze. Eine Monographie von Dr. Julius Zellner, Professor der Chemie an der Staatsgewerbeschule in Bielitz. Wilhelm Engelmann's Verlag, Leipzig. 1907. Price M.9.

8vo volume, containing 241 pages of subject-matter, three pages of appendix, and alphabetical indexes of botanical names and subject-matter. The following are the subjects treated of, as classified by the author:—I. Mineral constituents. II. Hydrocarbons. III. Fats. IV. Lecithins. V. Cholesterol and the bodies of the ergosterol group. VI. Alcohols. VII. Monobasic acids. VIII. Dibasic and polybasic acids. IX. Amino-acids. X. Bodies of the urea- and purine-group. XI. Bases. XII. Carbohydrates and related substances. XIII. Tannins. XIV. Colouring matters. XV. Resins and terpenes. XVI. Proteins. XVII. Ferments. XVIII. Toxins. XIX. Milky juice of fungi. XX. Nutritive value of fungi. XXI. Chemical composition of some of the best investigated varieties of fungi.

Technologie der Fette und Oele. Handbuch der Gewinnung und Verarbeitung der Fette, Oele, und Wachsarten des Pflanzen- und Tierreichs. Unter Mitwirkung von G. Lutz, O. Heller, Felix Kassler, und anderen Fachmännern, herausgegeben von Gustav Hefter, Zweiter Band. Gewinnung der Fette und Oele. Julius Springer's Verlag, Monbijouplatz 3, Berlin N. 24. 1908. Price M.28. Bound in half leather, M. 31.

Large 8vo volume, containing 904 pages of subject-matter, with 155 illustrations, and 19 tables, followed by alphabetical indexes of names and subjects. Among the tables, is a map of those portions of the countries bordering on the Mediterranean, wherein the olive tree abounds. The subject-matter of this work is classified and arranged according to the following scheme:—I. Vegetable Oils. a. Drying oils. b. Semi-drying oils. c. Non-drying oils. II. Vegetable Fats. III. Animal Oils. a. Fish oils and oils of amphibious animals. b. Animal oils. IV. Animal Fats. V. Vegetable Waxes. VI. Animal Waxes. a. Liquid animal waxes. b. Solid animal waxes.

Year-Book of Pharmacy. Comprising Abstracts of Papers relating to Pharmacy, Materia medica, and Chemistry, contributed to British and Foreign Journals, from July 1, 1906, to June 30, 1907, with the Transactions of the British Pharmaceutical Conference at the Forty-fourth Annual Meeting, held in Manchester, July, 1907. J. O. Braithwaite, E. Saville Peck, and Edmund White. J. and A. Churchill, 7, Great Marlborough Street, London. 1907. Price 10s. 6d.

The Electric Accumulator. Vol. 11. January to December, 1907. E. Brettell-Vaughan. Printing and Publishing Co., 15, Queen Street, Cheapside, London, E.C. 1907. Price 4s. 6d.

A collection of the issues of this Journal for the year 1907, bound as a single volume, but paged consecutively, and with a table of contents, alphabetically arranged, and paged.

Der Kautschuk, seine Gewinnung unter Beruecksichtigung des Plantagenbaues, seine Verarbeitung und Regeneration. Fritz Frank. Sonder-Abdruck aus den Verhandlungen des Vereins zur Beförderung des Gewerbfleisses. Leonard Simion Nf.'s Verlag, Berlin, 1907.

This monograph contains 262 pages of subject matter with 26 illustrations, and furnishes a complete and illustrated account of the cultivation and utilisation of the india-rubber tree; also the production and consumption of india-rubber, the variation of costs and prices; also methods of and machinery for working up the raw material, as well as for regenerating caoutchouc from waste material, residues, etc. Finally, a paragraph at the close, is devoted to the chemical composition and probable constitution of caoutchouc, with a bibliographic table.

Bulletin of the Imperial Institute. Vol. V., No. 3, 1907. Price 1s.

This number of the Bulletin contains reports on recent investigations made in the Scientific and Technical Department of the Imperial Institute regarding economic products from British East Africa; Para rubber from the Federated Malay States; rubbers from the Gold Coast; peat from the Falkland Islands and iron ore from Parapara, New Zealand; as well as general notices regarding economic products and their development.

Patent List.

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to Inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

Applications.

97. Thwaites and Cranford. Kilns. Jan. 2.

224. Lake. Apparatus for removing solid matter from gases. Jan. 3.

501. Fairbrother (Sauerbrey Maschinenfabr. A.-G.). Vaporisers for mineral-containing liquids. Jan. 8.

615. Magnée and Demeure. Furnaces.* Jan. 10.

Complete Specifications Accepted.

418 (1907). Mewes. Refrigerating, condensing, or heating apparatus. Jan. 15.

800 (1907). Collins. *See under* II.

5131 (1907). Lake (Maschinenbauanstalt, Eisengiesserei und Dampfkesselfabr. H. Paucksch). Drying machines. Jan. 8.

5342 (1907). Onslow. Gas-heated furnaces. Jan. 8.

7648 (1907). Trottier. Apparatus for classifying solid materials. Jan. 15.

8253 (1907). Koeber and Koeber. Strainers for filter-presses. Jan. 15.

14,093 (1907). Warren. Rotary kilns. Jan. 15.

II.—FUEL, GAS, AND LIGHT.

Applications.

138. Sheldon. Distilling and coking coal. [U.S. Appl., Jan. 2, 1907.]* Jan. 2.

144. Smithdale. Manufacture of gas. Jan. 2.

252. Johnston. Gas producers. Jan. 4.

254. Sepulchre. *See under* X.

314. Driscoll and others. Compound for treating fuel. Jan. 6.

361. Limberg. Coke furnaces. [Addition to No. 14,992 of 1907.]* Jan. 6.

572. Williams. Gas purifying contrivance.* Jan. 9.

710. British Cyanides Co., and Rossiter. Purification of coal gas. Jan. 11.

Complete Specifications Accepted.

800 (1907). Collins. Manufacture of retorts for gas and other furnaces. Jan. 15.

3270 (1907). Jones. Coke ovens. Jan. 15.

10,062 (1907). Burnett. Extracting the liquid from washed coal. Jan. 15.

16,867 (1907). Sussmann. Manufacture of incandescent mantles. Jan. 15.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

Applications.

342. Gehre. Nitrifying schist oil and similar oils.* Jan. 6.

517. Henderson. Apparatus for recovering gases and the lighter distillates from mineral oil stills. Jan. 9.

Complete Specification Accepted.

21,060 (1907). McMullen. Refining crude petroleum and other hydrocarbons by distillation. Jan. 15.

IV.—COLOURING MATTERS AND DYESTUFFS.

Applications.

90. Johnson (Badische Anilin und Soda Fabrik). Manufacture of intermediate products and colouring matters containing sulphur. [Addition to No. 26,053 of 1907.] Jan. 1.

344. Basler Chem. Fabr. Manufacture of a red vat dyestuff. [Ger. Appl., Jan. 16, 1907.]* Jan. 6.

486. Newton (Bayer und Co.). Manufacture of anthracene derivatives. Jan. 8.

553. Newton (Bayer und Co.). Manufacture of leuco derivatives of the gallocyanine series. Jan. 9.

Complete Specification Accepted.

10,326 (1907). Imray (Soc. Chem. Ind. in Basle). Manufacture of halogen derivatives of indigo. Jan. 15.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

Applications.

202. Venter. Removing soda lye from fabrics saturated with it. [Addition to No. 15,352 of 1907.]* Jan. 3.

228. Garscadden and Gillies. Skein or hank dyeing machine. Jan. 4.

444. Bailey. Machines for scouring textile fabrics. Jan. 8.

527. Green. Renovating silk. Jan. 9.

Complete Specifications Accepted.

83 (1907). Ribaucourt. Dry-scouring fabrics in an extended condition. Jan. 8.

233 (1907). Boyeux. Dressing textiles. Jan. 15.

737 (1907). Seaman. Sizes for treating yarns. Jan. 15.

764 and 765 (1907). Calico Printers' Assoc., and Fourneaux. Printing or dyeing textile fibres. Jan. 15.

16,512 (1907). Boullier. Production of artificial silk. Jan. 15.

19,840 (1907). Levinstein, and Levinstein, Ltd. Dyeing union goods. Jan. 15.

VI.—COLOURING WOOD, PAPER, LEATHER, &c.

Complete Specification Accepted.

10,729 (1907). Newton (Bayer und Co.). Dyeing paper pulp. Jan. 8.

VII.—ACIDS, ALKALIS, AND SALTS.

Applications.

137. Harvey and Simpson. Production of nitrogen compounds, particularly nitric acid. Jan. 2.

139. Raschig. Manufacture of hydrazine. [Addition to No. 22,957 of 1907. Ger. Appl., June 6, 1907.]* Jan. 2.

272. Rüber. Simultaneous production of an alkali salt, a phosphorus-containing manure, and carbonic acid.* Jan. 4.

273. Sadtler and Sadtler. Making alkali hydroxides.* Jan. 4.

575. De Stucklé. Sulphide of zinc or the like.* Jan. 9.

654. Naumann. Producing sal ammoniac by the decomposition of common salt with ammonium sulphate.* Jan. 10.

726. Jacob. *See under* X.

Complete Specifications Accepted.

220 (1907). Sauer. Producing gas mixtures containing large quantities of carbonic acid. Jan. 8.

16,850 (1907). Swayze. Decomposing felspar. Jan. 15.

VIII.—GLASS, POTTERY, AND ENAMELS.

Application.

702. Von Seemen. Manufacture of products for ceramic or abrasive uses by means of bauxite or other aluminous earths. [Ger. Appl., Jan. 11, 1907.]* Jan. 11.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Applications.

14. Everett. Separating the constituents of asphalt, etc. Jan. 1.

69. Caspar. Manufacture of fireproof, pulverulent, basic compounds which become ductile on addition of water, and are adapted to be burnt hard. [Ger. Appl., Jan. 5, 1907.]* Jan. 1.

289. Payne. Imitation marble and granite.* Jan. 4.

336. Webster and Brider. Artificial marble. Jan. 6.

467. Bougleux. Treatment of puzzolane and other volcanic earths.* Jan. 8.

Complete Specifications Accepted.

27,619 (1906). Collins. Manufacture of refractory articles. Jan. 15.

547 (1907). Kuntze. Self-glazing fireproof clay. Jan. 15.

7832 (1907). Heuer. Production of plastic wall coverings. Jan. 15.

X.—METALLURGY.

Applications.

92. Plathner and Dorn. Coating metals. [Addition to No. 15,535 of 1906.]* Jan. 1.

254. Sepulchre. Purifying blast-furnace and other gases.* Jan. 4.

433. Herrenschmidt. Manufacture of aluminium. [Fr. Appl., Jan. 10, 1907.]* Jan. 7.

490. Rudge-Whitworth, Ltd., and Heathcote. Treatment of iron or steel to prevent oxidation or rust. Jan. 8.

491. Cowper-Coles. Coating iron and steel with metal. Jan. 8.

701. Sulman. Separation of zinc from ores or compounds. Jan. 11.

Complete Specifications Accepted.

25,304 (1906). Rauch. Alloy of iron. Jan. 15.

516 (1907). Hart and Wickham. Eliminating chromium and silica from iron ore. Jan. 15.

1615 (1907). Twynam. Concentration of argillaceous ores. Jan. 8.

18,051 (1907). Foust. Ore concentrating jigs. Jan. 15.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

Applications.

401. Edison. Electrolytes for alkaline storage batteries. [U.S. Appl., May 10, 1907.]* Jan. 7.

726. Jacob. Electrochemical manufacture of acetates, especially sodium acetate. Jan. 11.

COMPLETE SPECIFICATION ACCEPTED.

5751 (1907). Mackenzie (Bolle und Co.). Electric melting furnace. Jan. 15.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

COMPLETE SPECIFICATIONS ACCEPTED.

13,136 (1907). Lórincz Festékgyár betéti Társaság, and others. Paints. Jan. 15.

23,328 (1907). Grognot. Manufacture of resinous products analogous to natural resins. Jan. 15.

XIV.—TANNING, LEATHER, GLUE, SIZE, &c.

APPLICATION.

287. Seyewetz and Meunier. Tanning or manufacturing leather. [Fr. Appl., Feb. 25, 1907.]* Jan. 4.

COMPLETE SPECIFICATION ACCEPTED.

296 (1907). Lake (Turner Tanning Machine Co.). Apparatus for treating hides or skins. Jan. 8.

XV.—MANURES, &c.

APPLICATION.

272. Rüber. *See under* VII.

XVI.—SUGAR, STARCH, GUM, &c.

APPLICATIONS.

214. Hoff. Manufacture of sugar from starch substances.* Jan. 3.

569. Greenwood. Manufacture of gum tragasol. Jan. 9.

XVII.—BREWING, WINES, SPIRITS, &c.

APPLICATION.

348. Waterkeyn. Manufacture of alcohol from grain. Jan. 6.

COMPLETE SPECIFICATION ACCEPTED.

8848 (1907). Guillaume. Rectification of alcohol or other product similarly treated. Jan. 15.

XVIII.—FOODS; SANITATION, WATER PURIFICATION; AND DISINFECTANTS.

(*A.*)—FOODS.

APPLICATIONS.

38. Williams, and Almo Food Co. Cooked cereal food. Jan. 1.

43. Stanton and Hill. Manufacture of coffee essence. Jan. 1.

COMPLETE SPECIFICATION ACCEPTED.

13,660 (1906). Bertels. Preparation of a food mixture. Jan. 8.

(*B.*)—SANITATION; WATER PURIFICATION.

COMPLETE SPECIFICATIONS ACCEPTED.

28,047 (1906). Hird. Treating sewage sludge or other organic waste or refuse. Jan. 15.

8899 (1907). Girerd. Purification of waste water and sewage. Jan. 15.

XIX.—PAPER, PASTEBOARD, &c.

APPLICATIONS.

402. Leek. Oxidised enamel or paint for coating strawboard, pulpboards, etc. Jan. 7.

426. Metzger. Marbling paper, pasteboard, etc.* Jan. 7.

COMPLETE SPECIFICATIONS ACCEPTED.

10,729 (1907). Newton (Bayer und Co.). *See under* VI.

24,001 (1907). Bock. Machines for making paper. Jan. 8.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

APPLICATIONS.

139. Raschig. *See under* VII.

413. Dubosc. Preparation of camphol ethers and their application to the preparation of nitrocellulose solutions and celluloid. [Fr. Appl., Jan. 8, 1907.]* Jan. 7.

COMPLETE SPECIFICATIONS ACCEPTED.

6109 (1907). Kuzel. Peptisation of colloidal elements. Jan. 15.

7097 (1907). Ritsert. Converting the products of combustion of belladonna, stramonium, etc., into suitable form for medical use. Jan. 15.

10,784 (1907). Ellis (Chem. Fabr. vorm. Sandoz). Manufacture of camphene and by-products. Jan. 8.

24,662 (1907). Read Holliday and Sons, and Silberrad. Manufacture of mellitic acid. Jan. 8.

XXII.—EXPLOSIVES, MATCHES, &c.

APPLICATIONS.

238. Lichtenstein. Matches. Jan. 4.

351. Haddan (Lehmann). Manufacture of cartridges and explosive charges containing ammonium nitrate.* Jan. 6.

403. South African Maganite Explosives Synd., and Bloxam. Manufacture of explosives. Jan. 7.

Complete Specification Accepted.

3199 (1907). Himalaya. Manufacture of explosives. Jan. 15.

XXIII.—GENERAL ANALYTICAL CHEMISTRY.

Complete Specification Accepted.

23,996 (1907). Féry. Calorimeters. Jan. 15.

Journal of the Society of Chemical Industry.

No. 3, Vol. XXVII. FEBRUARY 15, 1908. No. 3, Vol. XXVII.

Official Notices.

APPOINTMENT OF HON. TREASURER.

Mr. Thomas Tyrer, Stirling Chemical Works, Stratford, London, E., has been appointed Hon. Treasurer of the Society. Subscriptions may now be sent to him.

ANNUAL INDEX, 1907.

The Index is issued with this number of the Journal.

DRAFT BY-LAWS.

AS FINALLY SETTLED BY THE COUNCIL.

Take Notice that in pursuance of the provisions of Clause 37 of the Charter a General Meeting of the Society will be held at the House of the Society of Arts, John Street, Adelphi, London, on Friday, the 13th day of March, 1908, at 3.30 o'clock in the afternoon, for the purpose of considering and adopting the draft By-laws, which, after due consideration of the observations received from members in response to the invitation in that behalf, have been finally settled by the Council, and a print of such finally settled By-laws was sent to each Member of the Society in the January 31st number of the Journal.

By order of the Council.

Charles G. Cresswell,
Secretary.

Birmingham and Midland Section.

Meeting held at Birmingham on Thursday, November 28th, 1907.

MR. HARRY SILVESTER IN THE CHAIR.

THE VALUATION OF FIRECLAYS.

BY E. P. PAGE AND W. J. REES.

The chemical and physical properties of the naturally and artificially formed silicates have received, and are at the present time receiving considerable attention both by mineralogists and technical investigators, the first mentioned dealing with the various questions from the geophysical standpoint, and the latter having more regard to the formation of slags, glazes, &c., in industrial operations. In both cases the research has more particular reference to the reactions taking place in the liquid or viscous states. The clayworker studies the question, we may say, from three standpoints, as follows:—

1. The production of silicate compounds fusible at temperatures from 900° to 1500° C., as glazes.
2. The production of partially fusible bodies, as porcelain (*i.e.*, bodies which "mature" at certain definite temperatures).
3. The production of bodies as infusible as possible, for the building of ovens and furnaces for use in the various industries whose processes necessitate the use of high temperatures.

In the first case mentioned, the mixture of the various compounds is heated until it is in a liquid state, and there is opportunity for interaction of the constitutents.

In the second case, only a partial reaction is permissible, and heat is applied just sufficiently to bring about this reaction.

In the third case, the less reaction there is between the constituents the better. This last instance is the only one with which we are immediately concerned, and the purport of this paper is to indicate some of the factors which have to be taken into account when considering the utility of a fireclay.

As a preliminary, we may say that clay workers think of temperatures in the Seger cone scale, and not particularly in thermometric degrees. The cone scale is used in this paper, though we give the approximate temperature at which the cone is supposed to melt. A recent test of these cones shows that, although there are differences of 10° C. in some cases between the theoretical and actual melting points of cones, yet a series of any one number are fairly accurate in themselves. Further, that a clay cannot be considered as "refractory" which is not equal in fire-resisting properties to cone 26 (about 1650° C.). The rule adopted by the Association of Firebrick Manufacturers in Germany is as follows:—"The limit of refractoriness of a material is to be considered as exceeded when the material, or one of its constituents, uniformly distributed in fragments, begins to melt or separate by liquation; not only the surface of the piece tested, but also the face of the fracture must be taken into consideration when judging." There is no such standard in this country, neither does there seem to be any recognition of the potentialities in the manufacture of refractory articles. Some people have a fancy for the productions of a certain district or a particular mine, others consider one clay is as good as another, and consider the price of purchase only. The appearance counts for much with some, and finally the chemical analysis is considered a criterion by which to judge.

The following data are necessary for a complete examination:—Chemical analysis; mineralogical analysis; mechanical analysis; specific gravity of the fired wares; porosity; limit of refractoriness; behaviour of the clay when fired at intervals from cone 1 to cone 10. With this information at hand, one may form a fair idea as to the value of refractory materials for different purposes. It must be borne in mind, however, that no single clay will make articles to suit every purpose. Success can only be obtained by the building up or synthesis of bodies from materials often widely differing from each other.

Chemical analysis.—It is not necessary to go into the details of the methods of analysis, but rather to indicate some considerations as to the use of the ultimate chemical analysis in affording data for estimating the value of a clay for any given purpose. It is, of course, of value as indicating the presence or absence of any deleterious substances. A large proportion of fluxing impurities such as iron oxides, lime, titanium, alkalis, &c., will naturally seriously discount the value of a fireclay. The usual method of using the ultimate analysis is to consider only the ratio of total fluxes to silica. Richter, Bischof, and Seger have all, many years ago, shown this to be very unsatisfactory, as it left the alumina contents of the clay entirely out of consideration. They showed that the primary ratio to be taken into consideration is that of silica : alumina, and that it is the ratio of total fluxes to this ratio which is important. Richter, in 1868, pointed out that the extent to which any fluxing constituent lowered the fusing point was directly proportional to its molecular weight. On this principle, both Bischof and Seger deduced formulæ for calculating the refractoriness from the ultimate analysis. A formula of this kind is as follows:—

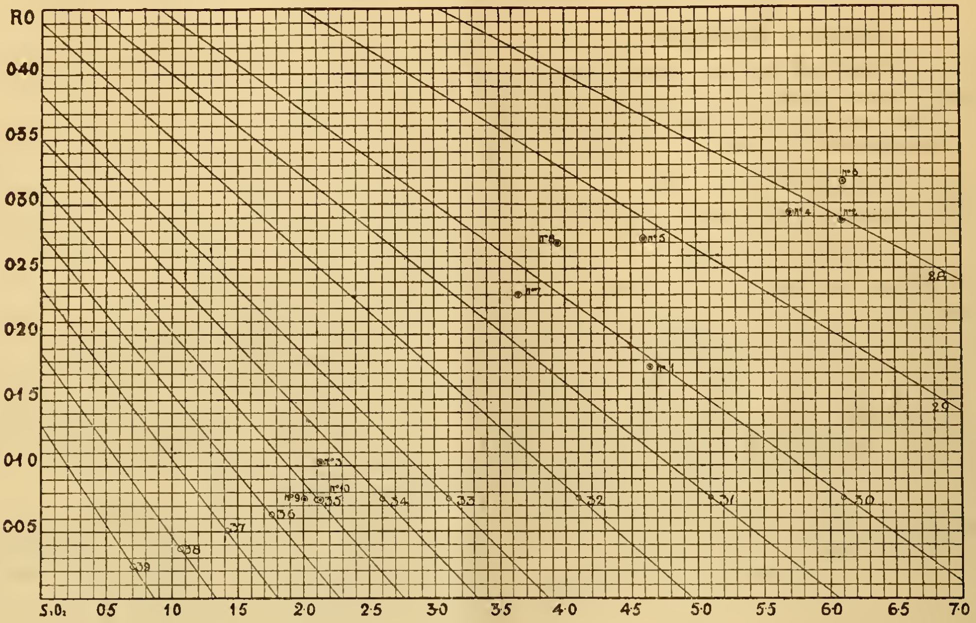
$$\frac{(\text{Percentage of alumina})^2 \times \text{Mol. wt. of alumina.}}{(\text{Mol. wt. of silica})^2 \times (\text{Percentage of silica}) \times \text{F.}}$$

where F is the sum of the percentages of the fluxes divided by their respective molecular weights.

Ludwig has gone still further in this direction, using the general law applying to dilute solutions (first enunciated by Richter as previously referred to), that equimolecular quantities of different substances dissolved in equal amounts of the same solvent, lower the melting point in the same degree. Ludwig, assuming the clay as the solvent and the fluxes as the dissolved substance, calculated the molecular formula of a clay from its ultimate analysis, making the alumina equivalent equal to unity and adding together the equivalents of the various fluxes, thus obtaining a formula such as Al_2O_3, $2{\cdot}125SiO_2$, $0{\cdot}0755RO$ In this expression there are only two variables, silica and flux (RO). This molecular formula

CHART SHOWING LUDWIG'S METHOD.

CLAYS FROM TABLE Nº1 INDICATED BY ⊙ AND Nº, CONES BY ○ AND Nº.



is then plotted on a chart, the silica as the abscissa and ten times the equivalent of the fluxes as the ordinate. The melting point zones on the chart were obtained by calculating the molecular formulæ for Seger cones 28 to 39, and plotting them as before. The origin was then assumed to be pure alumina, and the equivalent amount of flux which it was necessary to add to an equivalent of alumina in order to lower its melting point to that of any given cone was determined by experiment. This amount of flux was then marked on the ordinate, and a line drawn from that point to the abscissa, passing through the given cone point on the chart. Richter's law strictly speaking, applies to dilute solutions only, hence this formula and chart are more applicable to clays with but a small amount of flux, and do not apply to common brick clays and glazes. The method is certainly, at the present time, the most useful way of applying the results of the ultimate analysis, though the examination of a number of fireclays shows it to be not altogether reliable (See clay No. 2 in table of analysis). The point where these formulæ break down, to some extent, is in their failure to bring into consideration the mechanical constitution of the clay. For instance, the exact state of the presence of the silica in the clay is very important. If it is in a fine amorphous state, it may lead to fluxing, whilst if it is in comparatively coarse particles it renders the clay more refractory. From the above considerations it is obvious that the ultimate chemical analysis is insufficient, and though, of course, very much better than no test at all, is at times totally misleading.

No.	Percentage Composition.						Formula, Al_2O_3=Unity.						Sum of formula.	Melting point.	
	SiO_2.	Al_2O_3.	Fe_2O_3	CaO.	MgO.	K_2O.	SiO_2.	Al_2O_3.	Fe_2O_3	CaO.	MgO.	K_2O.		Cone.	Chart.
1	70·70	25·80	2·36	·31	—	·89	4·656	1	·1166	·0219	—	·0347	Al_2O_3, 4·656 SiO_2, ·176 RO	29—30	30—31
2	73·84	20·54	4·43	·08	—	1·40	6·112	1	·2745	·0069	—	·0069	Al_2O_3, 6·112 SiO_2, ·288 RO	19—20	28
3	53·99	43·21	2·43	·11	·28	·37	2·124	1	·0717	·0045	·0165	·0092	Al_2O_3, 2·124 SiO_2, ·102 RO	33—34	34—35
4	73·07	21·74	3·50	·41	·26	1·0	5·71	1	·2053	·0343	·003	·050	Al_2O_3, 5·71 SiO_2, ·293 RO	31—32	28—29
5	68·60	26·10	3·75	·45	·29	·796	4·45	1	·047	·008	·007	·008	Al_2O_3, 4·51 SiO_2, ·273 RO	32—33	29—30
6	74·43	20·61	3·15	·43	·18	1·2	6·13	1	·193	·0396	·0198	·0644	Al_2O_3, 6·13 SiO_2, ·317 RO	31—32	27—28
7	64·90	30·25	3·05	·47	·69	·49	3·65	1		·2	30		Al_2O_3, 3·65 SiO_2, ·230 RO	32	30—31
8	67·50	27·95	2·55	1·22	1·25	·25	3·95	1		·2	70		Al_2O_3, 3·95 SiO_2, ·270 RO	29	29—30
9	45·68	38·54	·90	·08	·38	·66	2·015	1	·0298	·0037	·0254	·0186	Al_2O_3, 2·015 SiO_2, ·0775 RO	35	35
10	47·69	38·15	·077	·21	TiO_3 ·12	1·26	2·125	1	·0257	·0100	TiO_3 ·0040	·0358	Al_2O_3, 2·125 SiO_2, ·0775 RO	35	35

"Rational" analysis.

	Clay No.									
	1	2	3	4	5	6	7	8	9	10
Clay substance— $Al_2O_3.2SiO_2.2H_2O$	62·42	53·83	94·03	51·31	62·07	48·27	—	—	96·55	—
Felspar— $K_2O.Al_2O_3.6SiO_2$	4·81	1·30	5·97	4·92	1·52	4·62	—	—	1·15	—
Quartz sand— SiO_2	32·77	44·87	—	44·10	36·41	47·11	—	—	2·30	—

Mineralogical analysis.—Fireclays and shales consist of varying amounts of quartz, silica (sand), silicate of alumina (clay substance), and felspathic matter in the shape of sand, and in many cases mica. Seger worked out a method for the separation and determination of these three main constituents by treatment with sulphuric acid and caustic soda to remove the clay substance; the residue is then treated for the determination of alumina, iron, and alkalis, and from the figures obtained the mineralogical composition is calculated. To arrive at comparable results, standard solutions should of course be used. Seger did not claim that the method was strictly scientific, but it is most useful, and gives good practical information. The assumption that the felspar present is orthoclase does not always hold good, neither can one say that it is always insoluble in sulphuric acid. Hydrated silica may also be present, and would be included in the figures as clay substance, but, in spite of these facts, as already stated, clay workers find the information of much use, and in considering refractory clays it enables them to anticipate to some extent the probable behaviour of the clays at high temperatures. This will be seen if we consider the phenomena of fusion. The first step in the destruction of a clay is the softening of the most fusible constituent, usually the felspar, this fused constituent then reacts with the others and leads to the formation of more fusible compounds, until finally the whole mass loses its shape. It is a point as to the order in which this fluxing action continues after the fusion of the most fusible constituent. Assuming, for the moment, that in a given clay the felspar is the most fusible, it is not quite certain whether the clay substance or the silica is first attacked. It will largely depend, first on the purity, and then on the size of the particles.

Mechanical analysis.—From the last statement it will be seen that the nature of a clay, whether of a fine or coarse structure, has some bearing on its behaviour under working conditions. The clay is first broken down by boiling, and an examination of the coarser particles is made microscopically. To obtain definite information and measurements of the grains, recourse must be had to elutriation. This can be done approximately with the Schultz apparatus, or more accurately with the Schoene or centrifugal apparatus. (For description of this latter apparatus see Bull. 64, Bureau of Soils, Dept. of Agriculture, Washington, U.S.A., 1900.)

The results of such an examination with the Schoene apparatus are set out below:—

	A.	B.
	Per cent.	Per cent.
Coarse sand, grains over 0·333 mm.	0·68	0·39
Fine ,, ,, from 0·333 to 0·040 mm.	3·41	26·95
Silt from 0·040 to 0·025 mm.	3·81	14·13
Rock dust from 0·025 to 0·010 mm.	10·92	20·17
Clay substance from 0·010 to 0·000 mm. ..	81·51	38·55
	100·33	100·19

A is a fat, plastic, refractory fireclay. B is a lean, short clay.

Specific gravity and porosity.—These factors are of use as indicating the structure of the manufactured article, and have more particular application to special productions, such as crucibles, &c. A porosity determination is generally considered the most useful. At the present time two methods of expression are used. In one, the degree of porosity is expressed as the percentage of water absorbed by a given weight of dry brick. In the other and most rational method, the expression of porosity refers the volume of pore space to the volume of the brick. The term specific gravity is also used ambiguously, it is used as expressing the specific gravity of the clay, as determined by grinding to powder and using the ordinary method for insoluble powders, and it is also used to express the volume weight of the whole piece. This question is well treated in Jackson's "Ceramic Calculations."*

Limit of refractoriness.—A definition of what is meant by the limit of refractoriness was given in the first part of this paper. It now remains to speak of the methods and value of the determination. One of the first methods used was an indirect one; it consisted in mixing pure quartz sand with the clay to be tested, and determining the proportion of sand necessary in order that the test piece should run down to a liquid at the same temperature as a standard clay. This was not satisfactory. Bischof then adopted standard clays as a means of comparison, but as the standard clays were not available to others, Seger adopted mixtures of silica and alumina, &c., forming the mixture into "cones" or small pyramids. The most modern method is to expose the clay to the high temperatures obtainable in the electric furnace, and we believe this is the method adopted at the National Physical Laboratory; it is claimed that it gives a much more accurate result than the use of the Deville furnace and Seger cones as standards. This may be, but as far as we are aware, no direct comparison has been made between the two methods. As pointed out, one does not necessarily want to know the limit of refractoriness in thermometric degrees. There are influences other than temperature to be taken into account when considering the probable behaviour of clays in actual practice. Furnace gases, dust, and the time factor enter into question; therefore, a comparison with standard mixtures of comparative purity, for the same interval of time, the same furnace atmosphere and temperature, which is obtained by the use of a combustion furnace, such as the Deville, is of greater value than the knowledge that the limit of refractoriness is so many degrees Centigrade.

It was mentioned that the minimum of refractoriness was cone 26, and the maximum it is worth while noting is about cone 36, which is the figure for pure kaolinite, quartz being nearly as high. Fireclays having a refractoriness equal to cone 35 are very scarce, and consequently somewhat high in price.

Behaviour in fire.—The value of this factor is in the information it affords as to contraction and expansion at various temperatures. This information is more particularly useful to the manufacturer.

In conclusion, we may say our intention was not to treat the points exhaustively, but rather to indicate some of the necessary data which must be available before an opinion can be formed as to merits or demerits of various clays, and finally we wish to express our thanks to Messrs. E. J. & J. Pearson, Ltd., and to Messrs. Chance Bros. & Co., Ltd., for permission to use the information given.

DISCUSSION.

The CHAIRMAN said that only that week a case of considerable loss had come under his notice, whereby a quantity of finished iron was spoiled through the use of an inferior firebrick, which was unable to withstand the temperature to which it was exposed. Any method, therefore, which afforded a ready means of testing the refractory properties of fire-resisting materials and determining their suitability or otherwise for various purposes, should be of technical interest and value.

With reference to the presence of spots of iron oxide in fireclay goods, which frequently caused a failure at high temperatures, he asked the authors if in their experience the weathering of the clay got rid of the iron, and improved its refractory qualities.

Professor T. TURNER said that testing of fireclay was of great importance in the Midland district, but hitherto there had been no uniform and recognised method adopted in this country for the testing of fireclay. In recent years, however, and particularly since the establishment of the Pottery School in North Staffordshire, a number of important investigations had been carried out by English workers. The Schöne apparatus for the mechanical analysis of clays had been introduced into the North Staffordshire Pottery School with very satisfactory results. Reference might also be made to a method of recording the size and physical properties of moulding sands which had recently been described by Prof. Ries. In this system, a series of tests and standards was adopted, including fineness, permeability, porosity, refractoriness, binding properties, chemical analysis, and duration of use. These properties were then diagrammatically represented on a card, so that any other sand could be at once compared with one which had been already tested.* Possibly some such method might be found applicable in the clay industry. In connection with sizing by means of sieves attention was drawn to the work of a Standardizing Committee of the Institute of Mining and Metallurgy, as a result of which wire meshes of accurate gauge and of definitely progressive sizes would very shortly be obtainable; and for scientific purposes such screens should replace the unsatisfactory wire gauze now in general use. The interesting series of shrinkage tests exhibited by the authors had, no doubt, a direct bearing on the irregular results which were obtained at high temperatures with the old Wedgwood pyrometer.

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* Longmans, Green and Co.

Mr. L. **Archbutt** asked whether the authors could give any information as to the composition of firebricks best able to resist the fluxing action of coal ash; also whether the time factor was not of considerable importance in the use of Seger cones, and the best method of using these cones as temperature indicators, in controlling pyrometers for example.

Mr. H. L. **Heathcote** said he would like to know more about the chemical and physical properties associated with the absence of cracking in articles made from fireclay.

Mr. E. A. **Lewis** asked if the "weathering" of fireclay had anything to do with its properties.

Mr. **Collis** said that he also had heard that weathering was of importance.

Mr. **Whitely** referred to the usefulness of the microscopical work on the structure of fireclay bodies by J. W. Mellor.

Mr. E. P. **Page** said, in reply to Prof. Turner, that silica might be considered a high temperature flux, and the other fluxing compounds present might be considered low temperature fluxes.

The action of flying ash was a serious problem with the use of rotary cement kilns, the linings of which were subject to the action of ash and of the cement. A thin coating of "diamantin" or of "carborundum" had been recommended; some works used a brick with as little "free" silica as possible, whilst bricks with a fair amount of silica (65 to 70 per cent.) were considered by others to be satisfactory.

Weathering of clay brought it into a condition much more easy to work, and saved much wear and tear of grinding mills. First-class bricks were being made from unweathered clay by proper methods of working up the clay.

London Section.

Meeting held at Burlington House on Monday, January 6th, 1908.

DR. J. LEWKOWITSCH IN THE CHAIR.

THE DETERMINATION OF SMALL QUANTITIES OF BISMUTH.

BY HERBERT W. ROWELL.

The accurate determination of small quantities of bismuth in copper, lead, and several alloys used in electrical and chemical work and in the raw materials from which they are made, has of late developed further importance to many connected with these industries, but experience has shown that concordant results are not obtained by the usual methods of analysis, and the discrepancies are a source of much inconvenience. In illustration, the following are results found by various chemists on the same samples of base bullion, with the expectation of agreeing within 0·005 per cent.:—

Chemist:	A	B	C	D	E	F
Sample	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
No. 1	0·155	—	0·002	0·125	—	—
„ 2	0·080	0·054	0·008	—	—	—
„ 3	0·095	—	0·003	—	0·083	0·062
„ 4	0·110	0·062	—	—	0·090	—

It is usual to separate bismuth as a basic salt and weigh as the tri-oxide, basic chloride, or metallic bismuth, but as the conditions for completely precipitating these basic salts are not easily secured without at the same time including other metals, the results vary widely on either side of the truth.

Stone (this J., 1887, 416) points out that excess of potassium iodide added to a dilute sulphuric acid solution of bismuth produces a yellow colour, the intensity of which is directly proportional to the amount of bismuth present, and the figures at the end of this paper further show that it is possible to estimate small amounts with great delicacy even in the presence of many other elements. Unfortunately, the methods of arriving at a solution containing all the bismuth free from other metals present many difficulties, upon which no light has been thrown, and which are generally unnoticed. The notes following are the result of much practical work and point out some usual sources of error with means of avoiding them.

Bismuth is precipitated as sulphide from dilute hydrochloric and sulphuric acid solutions by hydrogen sulphide; the precipitate is soluble in strong hydrochloric acid and in nitric acid and other oxidising agents, and is slightly soluble in ammonia and ammonium sulphide, but is precipitated by and insoluble in excess of dilute sodium or potassium sulphide solution, and by these means may be separated from all usually occurring metals except lead, copper and silver. The silver may be precipitated from moderately acid solutions by hydrochloric acid or sodium chloride, and will leave all bismuth in the filtrate. It is often stated that bismuth is carried down when precipitating large quantities of lead from the solution as sulphate. This, however, is not so if the solution contains a sufficient quantity of nitric acid, and the lead is precipitated gradually from the boiling solution to prevent occlusion. To obviate this supposed loss, Low and others attempt to precipitate the bismuth as basic chloride from a nitric acid solution of refined lead, by adding dilute ammonia till free acid is neutralised and the liquid remains faintly opalescent, and then adding 1 c.c. of dilute hydrochloric acid. The neutralisation is difficult to perform to this degree of nicety, and when the acid is added it is seized by the local lead and bismuth, which it converts into insoluble basic chlorides, and the main portion of the bismuth is either precipitated as hydroxide or basic nitrate, or, as more often happens, remains in solution. When it is necessary to evaporate a solution of lead, bismuth, &c., to fuming with sulphuric acid, the residue should be well boiled with a liberal quantity of dilute sulphuric acid, as the lead sulphate retains a large proportion of a form of bismuth sulphate which is not easily soluble. Bismuth salts are not volatile at the temperature of boiling sulphuric acid, and the loss, recorded by Brearley and Ibbotson, in the presence of antimony must have been mechanical. Ulgreen separated large quantities of lead from bismuth by depositing the latter on a strip of pure lead immersed in the acetic solution, but a small quantity of bismuth is not all deposited after 24 hours, and there is still the strip of lead to be got rid of.

In the absence of lead, any silver and copper may be separated from a sulphuric, nitric, or acetic acid solution by precipitating them with an excess of potassium iodide, boiling, cooling, and shaking to collect the fine precipitate and filtering, or the bismuth may be separated as oxychloride as directed below, after removing the silver as chloride. The separation of bismuth from copper as a double cyanide with potassium is uncertain in the case of small amounts. The separation from copper, adopted by Rose, and followed by the majority of chemists, is to add excess of ammonia and ammonium carbonate to the nitric acid solution, boil, filter, and weigh the precipitate as tri-oxide after ignition, or, in the presence of hydrochloric or sulphuric acids, to reduce the precipitate to metal with potassium cyanide, using elaborate precautions, and weigh. Extensive experiments have, however, proved that all of the bismuth may be thrown down if the excess of ammonia and ammonium carbonate is small, or if the solution be both boiled and allowed to stand warm for some considerable time, or if either iron, aluminium, or a large quantity of bismuth be present; otherwise small amounts are not completely precipitated. The reduction in bulk of solution, or the addition of large quantities of ammonium chloride, brings down more bismuth, and sometimes all. Rose and others note a loss of bismuth by the method, and Laughier goes so far as to suggest that lead may be precipitated as carbonate in this way, leaving all the bismuth in solution, but the almost entire solubility when only small quantities are present seems never to have been generally realised and seeing that 0·001 per cent. in a copper for electrical purposes is a matter for consideration, the method is dangerous to many interests.

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* Proc. Amer. Foundrymen's Assoc., 1906, p. 63.

In the solution from which oxychloride of bismuth is to be precipitated, sufficient hydrochloric acid must be present to satisfy all other elements, or these elements will absorb the hydrochloric acid subsequently added to form oxychloride of bismuth; the method of precipitation is to be followed as described below. The basic chloride is not precipitated from tartaric acid solutions, although Rhead and Sexton suggest this method as a separation from antimony. The methods for separating bismuth as oxalate, double acetates, phosphate, or formate have not proved successful with small quantities.

The iodide method.—As it is not necessary in this method to obtain the bismuth as a pure salt, practically all the sources of trouble in separation are dismissed. The object is to first obtain a solution free from large quantities of lead, copper, tin, antimony, gold, and silver, then to precipitate the bismuth as oxychloride, together with possible traces of these metals, arsenic, or tellurium, and to apply the colorimetric method to the solution of this precipitate in sulphuric acid. *Ores, mattes, &c.*, are dissolved in hydrochloric and nitric acids, and silica removed as usual, and the filtrates treated as described under copper or lead, with the exception that hydrochloric acid must be removed by evaporating with sulphuric acid to precipitate any lead. Samples containing large amounts of tin, antimony, or arsenic may be fused with a mixture of equal parts of sodium carbonate and sulphur, and the melt dissolved in water and boiled, when all the bismuth is found in the black residue on filtering, and may be dissolved in nitric acid. 10 grms. of *copper* are dissolved in 60 c.c. of nitric acid (1 : 1), the solution is diluted with 150 c.c. of water, and a saturated solution of sodium carbonate added till a slight permanent precipitate forms, 1 c.c. is added in excess, which brings down all the bismuth and some copper, and the whole is boiled for 5 minutes and allowed to settle. The precipitate is filtered off, washed once, and dissolved through the paper back into the original beaker with hydrochloric acid, and the bismuth is precipitated as basic chloride and, if necessary, re-precipitated to separate the remaining copper as directed below. 10 grms. of refined *lead, base bullion*, &c., are dissolved in 80 c.c. of water and 20 c.c. of nitric acid (sp. gr. 1·42), boiled to precipitate most of the tin and antimony, and a small excess of sodium chloride solution (1 : 200) added to precipitate the silver. The lead is precipitated by adding 60 c.c. of boiling sulphuric acid (1 : 20) drop by drop to the boiling solution, with constant stirring, and then 30 c.c. of sulphuric acid (1 : 3) in excess. The liquid is cooled and allowed to stand an hour, filtered, and the precipitate washed several times by decantation with sulphuric acid (1 : 20). 5 c.c. of strong hydrochloric acid are added to the filtrate, and a slight excess of ammonia, then drops of hydrochloric acid (1 : 5) till a drop of methyl orange in the solution indicates that it is just acid, when it is boiled for a minute and allowed to stand in a warm place for an hour. The precipitate is collected on a filter and washed twice, and the acidity of the filtrate re-adjusted to see if it is free from bismuth, or it is tested with potassium iodide. The filter and precipitate are now pulped with 10 c.c. of sulphuric acid (1 : 3), 30 c.c. of water added, and the solution is boiled, cooled thoroughly to separate any lead sulphate and, filtered through a Hirsch's or similar funnel on the filter pump, and the paper pulp carefully washed with sulphuric acid (1 : 20). All, or a suitable fraction of the filtrate containing possibly antimony, arsenic, tellurium, iron, and traces of lead, copper, or silver, and not more than 2 or 3 mgrms. of bismuth, is placed in one of a pair of 10-inch Nessler tubes, and 5 c.c. of sulphuric acid (1 : 3) with some water in the other, and both are shaken up after the addition of 5 c.c. of potassium iodide (20 per cent.) and 10 drops of sulphurous acid (1 saturated solution to 2 water). The blank tube is titrated with a standard solution of bismuth (made by dissolving 0·1 grm. of pure metal in 10 c.c. of strong nitric acid and making up to 1000 c.c. with water), till the colour of about 120 c.c. matches that of an equal volume of the test solution.

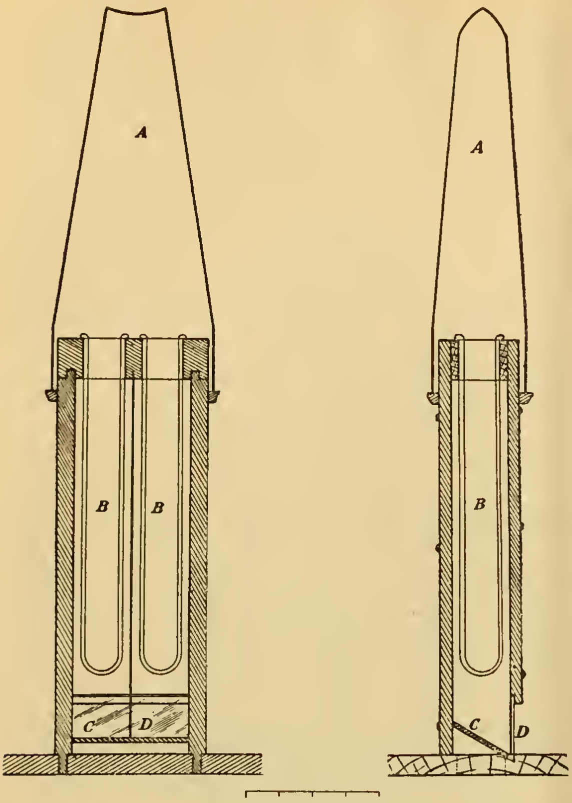
Arsenic, antimonic, and nitrous acids and ferric salts, or excessive quantities of sulphuric or nitric acids, sulphates, or nitrates throw out iodine, which is removed by prolonged boiling, or more easily by sulphurous acid. A hot solution of bismuth iodide is a little darker than when cold, and in the presence of tellurium, boiling permanently and slightly darkens the colour. A large excess of sulphurous acid produces an iodine colour, which is removed by the addition of more potassium iodide. Alkalis in excess, ammonium acetate, hydrochloric acid, and chlorides bleach the colour, but the addition of more sulphuric acid or potassium iodide restores it. Experiments show that any precipitates of copper or silver iodides or metallic tellurium may be filtered off without losing any bismuth, but that lead iodide carries a large proportion of the bismuth with it. Two mgrms. of lead, copper, or silver may be present in the Nessler tube without giving a precipitate or darkening the colour, but a careful watch must be kept on this, as a very slight precipitate considerably darkens the tint.

Two operators using the apparatus shown below, clearly and correctly distinguished between the following quantities of bismuth, which were unknown to them, and also between various other intermediate quantities in 125 c.c. of solution:—None and 0·00001 grm.; 0·00020 grm. and 0·000225 grm.; 0·0010 grm. and 0·00105 grm.; 0·0020 grm. and 0·0021 grm.; 0·0030 grm., and 0·0031 grm. 0·00001 grm. represents 1 part in 12½ millions, and these figures show that this colour test is at least twice as delicate as Nessler's test for ammonia, and that the limit of error is within 5 per cent. of the bismuth present, which means that a result of 0·001 per cent. is correct to within 0·00005 per cent., or a result of 0·10 per cent. is within 0·005 per cent. of the truth.

The following figures were obtained on testing the same sample of base bullion on several occasions, and represent many other similar comparative tests:—

50-grm. lots, gravimetric method.	Colour method.
Per cent.	Per cent.
0·057	0·095
0·073	0·092
0·090	0·095
0·084	0·097
	0·095

The precipitates obtained gravimetrically were dissolved, and portions tested colorimetrically, and proved to be almost pure bismuth oxychloride, while the remainders of the solutions from the colour method were purified, and the bismuth weighed as oxychloride, and these precipitates again dissolved and tested by the colour method. The results in both cases agreed closely with the original results; this was taken as proof that the high results found by the colour method were due to bismuth only, and that the large number of operations in the usual gravimetric separation involves loss of bismuth.



Inches.

A.—Metal shade.
B.—Glass tubes to contain liquids for comparison.
C.—White ground glass reflector.
D.—Transparent ground glass.

The apparatus is a simple form of colorimeter where all light is cut off except the small amount diffused through the ground glass at the bottom of the front side, and reflected through the length of the tubes to the eye by the slip of ground white glass. The light metal shade is made to fit one or both eyes closely, at the discretion of the operator, and can be removed to manipulate the tubes. A thin metal partition separates the tubes, all is painted dead black, and the light which enters is diffused to prevent, as much as possible, reflection on the polished sides of the tubes. The apparatus is applicable to the colorimetric determination of copper, iron, ammonia, and titanium as well as of bismuth.

Discussion.

Mr. A. C. Chapman said that the fact that such divergent numbers as those instanced by the author were obtained, was proof of the need for some accurate method for estimating small quantities of bismuth in the presence of large quantities of other metals. Bismuth was one of the most difficult metals to estimate in complex alloys, and those who had attempted to separate lead from appreciable quantities of bismuth by means of sulphuric acid, could confirm the author's statement as to the difficulty of obtaining accurate results. The iodide method, referred to by the author, was proposed a good many years ago, but so far as he (Mr. Chapman) knew it had not previously been applied to the estimation of very small quantities, and Mr. Rowell had done good service in showing the degree of sensitiveness of the method and its applicability to the estimation of very small quantities. The author had referred to the fact that bismuth could not be precipitated as oxychloride in the presence of tartaric acid. This was doubtless due to the fact that bismuth formed stable soluble double tartrates with the alkali metals. Some time ago he (Mr. Chapman) proposed a method for the estimation of tartaric acid based on its precipitation as basic bismuth tartrate. He had at the time tried to apply this to the estimation of small quantities of bismuth, but had found that impossible owing to the necessity of having the bismuth in excess. Had the author had much experience of the method in which bismuth was precipitated as phosphate ? It was an old method, but had recently been subjected to a good deal of critical study, and it had been established that the results were very satisfactory. The solubility of bismuth phosphate was exceedingly slight, both in nitric and in phosphoric acids, and it was possible to separate comparatively small quantities of bismuth from large quantities of other metals.

Mr. Arnold Philip said the estimation of small quantities of bismuth in alloys by an iodide colorimetric method had been in use for many years. The particular variant of this method which he had used in the past had been the co-precipitation of lead bismuth iodides, the re-solution and re-crystallisation of the precipitates thus obtained, and the comparison of the colour of the resulting crystals with others containing known quantities of bismuth. The results obtained were only roughly quantitative, although the accuracy was distinctly better than that of the unsatisfactory examples quoted by the author. The author's own process had undoubtedly solved what had hitherto been a difficult problem.

Mr. T. C. Cloud said he had read a paper on May 31, 1904, before the Society on the determination of very small quantities of bismuth in copper, in which he dealt with very much smaller quantities than those mentioned in the paper at present before them. Fifty years ago, Abel and Field showed that so small a quantity as 0·000015 grain of bismuth could be easily detected. The method used was to precipitate the solution, to which a small quantity of lead had been added, with sufficient potassium iodide to just precipitate the lead iodide. The iodide was filtered off, dissolved in very dilute hydrochloric acid by boiling, and then crystallised by cooling. The crystals showed distinctly the small quantity of bismuth he had indicated. As a quantitative test, however, it was not reliable, because of the difficulty in getting the crystals down under exactly the same conditions in two different experiments, and the difference in physical constitution caused a difference in the colour. But if the operation were performed without crystallising, as he had indicated in the paper referred to, there was no difficulty in determining 0·0001 of a grain of bismuth with certainty.

Mr. Rowell said he had tried the phosphate method, but found the one now described more convenient. Abel's method was not satisfactory because the colour of the crystals was greatly influenced by the physical conditions of the experiment. The quantities given in his paper were correct to 0·005 per cent. He had estimated in lead a quantity equal to 0·00028 per cent., which was correct to 0·00005 per cent., due to the fact that 50 grms. of sample were taken. He usually operated on 2 grms. of the sample, although starting with 10, to reduce the proportion of loss that was inevitable in the method. It was only a question of the amount of sample one could conveniently take as to how accurate the method would prove.

NIAM FAT.

BY DR. J. LEWKOWITSCH.

ERRATUM.

In the Journal for Dec. 31st, 1907, page 1266, column 1, line 11 ; *for* 41·19 *read* 31·19.

Manchester Section.

Meeting held at Manchester on Friday, January 10th, 1908.

MR. R. H. CLAYTON IN THE CHAIR.

NEW REACTIONS FOR THE CHARACTERISATION OF MERCERISED COTTON.

BY JULIUS HÜBNER, M.SC.TECH., F.I.C.

Although the mercerisation of cotton has been carried out on a very large technical scale for many years, it is well known that at present no reliable method exists for ascertaining whether a particular sample of cotton has been mercerised or not. The value of such a method for technical and commercial purposes should be considerable, and would be enhanced if the method of testing were capable of affording an indication of the degree of mercerisation to which a particular sample of cotton had been subjected, and of showing whether the operation had been properly and regularly conducted. Fibres which have been thoroughly mercerised exhibit very distinct microscopic characteristics (Hübner and Pope, this Journal, 1904, **23**, pp. 404, *seq.*). It is, however, found to be exceedingly difficult in many instances to say with certainty whether fibres have been mercerised if such fibres are taken from fabrics which have been mercerised on an industrial scale. Those who have practical experience in mercerising will readily understand why this must be the case. In many instances the individual fibres have been only incompletely penetrated by the caustic soda solution, and frequently some of the fibres have not been mercerised at all. The strength of the caustic soda solution used has also a very considerable influence upon the microscopic appearance of the fibres.

Among other causes which tend to make the method of microscopic examination difficult in practice should further be mentioned the application of certain finishing operations, such as the Schreiner finish, after mercerisation.

Mercerised cotton exhibits increased affinity for the substantive cotton colours, and a considerable contraction of the fibres takes place during the treatment with caustic soda. Hübner and Pope (*loc. cit.*) have shown that maximum absorption of colour and the highest shrinkage of the fibres result from treating the cotton with caustic soda solution of from 50° to 60° Tw. They have also pointed out that the colour absorption and shrinkage are not directly proportional to the strength of the caustic soda solution. Since this date, Schaposchnikoff and Minajeff (Zeits. f. Farben- und Textil Ind., 1905, **4**, 81—84) have further investigated the dyeing property of mercerised cotton, and have found that cotton treated with strong caustic soda, without tension, is capable of absorbing about 40 per cent. more of the substantive cotton colours and of the sulphur colours than is ordinary non-mercerised cotton.

During the course of an investigation of the proportion of iodine absorbed from solution by textile fibres and other materials (Chem. Soc. Trans., 1907, **91** and **92**, 1057—1073), the author made a number of observations which seemed to indicate the possibility of devising a reliable method for ascertaining, not only whether a sample of cotton had been mercerised or not, but also the approximate degree of completeness with which the mercerising process had been applied. These observations were followed up with a successful result, and are detailed in the present paper. The author has observed that mercerised and non-mercerised cotton behave quite differently towards a solution of iodine in aqueous potassium iodide, and the first part of the present investigation deals with this new fact.

A 1/10 normal solution of iodine in potassium iodide and water is conveniently used for showing the distinction. On immersing ordinary bleached cotton and cotton which has been mercerised in the stretched and unstretched condition in this solution, both the mercerised samples become coloured very deeply brown, whilst the non-mercerised sample assumes a lighter brown colour; the difference in behaviour becomes much more apparent when the samples are rapidly dried after immersion. It seemed of interest to ascertain whether this treatment with iodine merely produced a difference of depth of shade on the different kinds of cotton, or whether different colorations actually result from the treatment. For this purpose, hanks were immersed in solutions of iodine of varying concentration, and *N*/200 iodine solution was first applied. The different hanks were immersed in this for 48 hours, they were then squeezed and compared with each other.

(1) Non-mercerised cotton, boiled, washed, unbleached:—a light yellowish brown shade.

(2) Non-mercerised cotton, boiled, washed, bleached:—the brown shade is the same depth as that of (1), but somewhat duller.

(3) Cotton mercerised without tension, unbleached:—very much darker in colour than either (1) or (2); the shade is of a dull chocolate which on exposure to air soon changes to a greyish chocolate.

(4) Cotton mercerised without tension, bleached:—the colour is of the same depth as that of (3) but a little brighter and more brownish in shade.

(5) Cotton mercerised under tension, unbleached:—the colour is somewhat lighter than either (3) or (4), but much darker than either (1) or (2). The shade is a little duller than that of (3) or (4).

(6) Cotton mercerised under tension, bleached:—lighter in colour and more of a brownish shade than (5). Compared with (2), it is however much darker and more of a dull brownish shade.

Parallel experiments carried out with *N*/100 iodine solution gave the following results:—

(1) and (2) appear a light brown, (2) being more of a yellowish and somewhat duller shade. (3) and (4) are both a very dark, dull chocolate, which appears practically black before the water is squeezed out of the hanks. (5) is somewhat duller than (3) and (4), whilst (6) is brighter than (5) and more of a reddish brown shade. It is, however, much redder and much heavier than either (1) or (2).

In another series a *N*/400 iodine solution was employed, which produced the following colorations:—

(1) is a very faint brownish yellow; (2) is somewhat duller than (1), but about the same depth of shade; (3) and (4) are much darker in colour than (1) and (2), and more of an olive green shade, and (5) and (6) appear the same shade as (3) and (4), but a little lighter.

The observations recorded above, therefore, prove that the absorption of iodine from solution in potassium iodide and water by mercerised cotton differs very materially from that of the ordinary non-mercerised cotton. A distinct change of shade is noticed in every instance if the cotton has been bleached. It should be pointed out here that the bleaching of the cotton was conducted with special care, so as to avoid the possibility of the formation of oxycellulose. The samples were, after bleaching, tested both with Fehling's solution and by dyeing with Methylene Blue, and found to be free from oxycellulose.

Cross and Bevan (Cellulose, London, 1895, p. 7) state that "the hydrates of cellulose generally react with iodine in aqueous solution, giving indigo-blue coloration." The author has treated mercerised cotton with a solution of iodine in water but found that practically no coloration of the mercerised cotton was produced.

If cotton hanks which have been mercerised with caustic soda of different strengths are immersed in a *N*/100 iodine solution along with untreated cotton, it will be noticed that at the moment of immersion a beautiful gradation of colour, increasing in strength with the increase in strength of the soda solution used in mercerising, is produced. After an immersion of about 5 minutes' duration, there is little difference in the depth of coloration between the non-treated cotton and the one treated with caustic soda of 10° Tw., whilst the one treated at 20° Tw. is distinctly more strongly coloured than the 10°, the 22° stronger than the 20°, the 24°

stronger than the 22°, the 26° much stronger than the 24°, the 28° stronger than the 26°, the 30° is much stronger than the 28°, the 40° much stronger than the 30°, the 45° stronger than the 40°, the 50° much stronger than the 45°, whilst the 60° and the 70° are if anything rather weaker than the 50°. Hanks which have been steeped in this iodine solution for 4 hours show, after exposure to the air, that the non-treated cotton soon becomes practically white. and that the samples which have been treated with the different strengths of soda still exhibiting the characteristic gradation of colour pointed out above.

The following experiments were undertaken with a view to ascertain whether the amounts of iodine absorbed differ with the various kinds of cotton immersed. The amount of natural moisture contained in the air-dry samples of cotton yarn, which had been kept for two weeks in a fairly warm, dry room, was ascertained in the usual manner with the following results :—

	Moisture,
	Per cent.
Ordinary cotton, unbleached	6·12
do. bleached	5·88
Cotton mercerised without tension, unbleached	8·535
do. bleached	8·36
Cotton mercerised under tension, unbleached	7·65
do. bleached	7·45

50 grms. (dry weight) of each cotton was immersed in 500 c.c. of a $N/100$ solution of iodine for 48 hours. The partly exhausted solutions were titrated in the usual way and the following results obtained :—

	Iodine absorbed.
	Grm.
Ordinary cotton, unbleached	0·1500
do. bleached	0·1448
Cotton mercerised without tension, unbleached	0·2311
do. bleached	0·2108
Cotton mercerised under tension, unbleached	0·2083
do. bleached	0·1778

It is thus proved that mercerised cotton exhibits greater affinity for iodine than does ordinary non-mercerised cotton, and that, as is the case when dyeing with the substantive cotton colours, cotton mercerised under tension absorbs less than cotton which has been allowed to shrink during the treatment. In every case the bleached cotton absorbs less iodine than the same cotton in the unbleached state.

It is of interest to compare the iodine absorption values found in these experiments with the values obtained by Schaposchnikoff and Minajeff (*loc. cit.*) for the absorption of substantive cotton colours. These observers state that the ratio of colour absorption between non-mercerised and mercerised cotton is approximately as 100 : 140.

The iodine absorption figures compare as follows :—

Cotton.	Mercerised		
	Ordinary.	Without tension.	Under tension.
Unbleached	100	154	138·8
Bleached	100	145·6	122·8

As will be seen, the values agree remarkably well with those found by Schaposchnikoff and Minajeff.

The characteristic manner in which mercerised cotton is coloured by solutions of iodine in aqueous potassium iodide solution has been pointed out above. It is known that ordinary cotton loses the absorbed iodine quickly and completely by washing with water, but it has not been stated before that mercerised cotton behaves differently from ordinary cotton in this respect. This is clearly seen if non-mercerised and mercerised cotton hanks are immersed for a few minutes in a $N/10$ solution of iodine. On very careful observation of the effect produced by washing with water, it is to be noticed that after two or three applications of water the typical brown coloration of both the mercerised and the non-mercerised cotton turn to a more chocolate shade ; at this stage the ordinary cotton becomes rapidly decolorised whilst the mercerised cotton turns a dark navy blue colour, which, however, on repeated washing fades very rapidly into white.

C. G. Schwalbe (Ber., **40**, 4523) states that strongly hydrated celluloses are coloured blackish-blue by zinc chloride iodine solution and by solutions of iodine in potassium iodide and water, and that " zinc chloride iodine solution and, with less success, iodine potassium iodide solution may be used for the detection of hydration in cellulose." The author has found that, as stated above, the cotton, on immersion in the iodine potassium iodide solution, becomes coloured a blackish-brown, and that the blackish-blue coloration of the mercerised cotton only appears after repeated washing with water.

It was further found, when the quantity of iodine and of potassium iodide in the solution is increased considerably, that the blue coloration produced on the mercerised cotton by washing becomes more stable, whilst it is still possible to wash out the iodine completely from the non-mercerised cotton.

A solution of 20 grms. of iodine dissolved in 100 c.c. of a saturated solution of potassium iodide in water was found to be suited for the characterisation of mercerised cotton. If samples of mercerised cotton are immersed in this solution together with non-mercerised ones, for a few seconds, it will be seen that after a few washings with water the ordinary cotton becomes a very light chocolate colour, whilst the mercerised sample remains black. After a few more applications of water, the non-mercerised cotton becomes white, but the mercerised sample remains a blueish-black colour, which only fades very slowly on prolonged washing.

Further experiments were made in which the cotton samples, after immersion in the iodine solution described above, were washed with an aqueous solution containing about 2 per cent. of potassium iodide in place of water ; in these cases, the iodine is removed from both samples more slowly than by washing with water, and the black-brown colour of the samples does not change into blueish-black. After prolonged washing with this solution, the non-mercerised cotton becomes ultimately white with a brownish tint, whilst the mercerised cotton remains a brownish-black.

Further washing with the potassium iodide solution has practically no effect on the shade of the mercerised cotton. On adding water to the samples, thus practically removing the iodide, the colour of the mercerised cotton changes immediately into a blueish-black, whilst the ordinary cotton becomes quite white.

For the characterisation of mercerised cotton by this method, a solution containing more iodine, *i.e.*, 30 grms. of iodine in 100 c.c. of saturated solution of potassium iodide in water, may be employed with advantage. If samples of cotton which have been mercerised with soda solutions of different strengths are immersed in the reagent described, and afterwards washed with water, or, better still, with a 2 per cent. aqueous solution of potassium iodide, the black-brown coloration is seen to wash out the more slowly the stronger the soda solution with which the material has been treated. It may be also pointed out here that the rate at which the colorations wash out is not directly proportional to the strengths of the caustic soda used in the mercerisation, and it was found that the coloration of the cotton mercerised with soda of 70° Tw. washes out more quickly than that of the samples treated with soda of 50° and of 60° Tw., observations which fully agree with Hübner and Pope's (*loc. cit.*) statement concerning the dyeing properties and the amount of shrinkage of the fibres produced by the different strengths of soda.

For the purpose of examining a pattern of either cloth or yarn with a view to ascertaining the strength of caustic soda with which it has been mercerised, a range of patterns mercerised with different strengths of soda should be prepared for the purpose of comparison. If coloured samples are to be examined, it is necessary either to discharge the colour by means of any of the well-known agents or the standard patterns must be dyed to approximately the same shade with dyestuffs similar to those which have been used in producing the pattern under examination. The patterns are then immersed in the iodine solution for a few seconds and washed. With careful observation the degree of mercerisation can be ascertained with fair accuracy. I shall deal further with this question in discussing the application of another reagent for the same purpose.

It has already been stated that the difference in depth of shade produced on mercerised and non-mercerised cotton by immersion in a solution of iodine in potassium iodide and water becomes still more apparent if the samples are dried. On exposing hanks which have been immersed in the solution described above, to the action of the atmosphere, without drying them previously, the iodine fades rapidly and completely from the non-mercerised hank after it becomes dry, whilst the dark brown colour of the mercerised hank fades very slowly. Thus hanks of mercerised cotton treated in this manner, which have been exposed for more than 13 weeks, are still very strongly coloured.

Hanks of cotton yarn mercerised with caustic soda of different strengths, were immersed side by side with non-mercerised yarn in the reagent, and afterwards slightly washed and exposed to the atmosphere. It was found that the non-mercerised hank became soon decolorised; the hanks treated with soda of 10° and of 20° Tw. faded somewhat more slowly, 23° still more slowly, 26° much more slowly, 28° much more slowly than 26°, 30° much more slowly than 28°. After about 7 weeks' exposure the 30° hank is still of a light brown colour, the 40° one darker than the 30°, the 50° darker than the 40°, the 60° slightly darker than the 50°. The 70° hank is somewhat lighter than the one treated at 60°, which is still, after this long exposure, of a very dark brown colour. The fading of the range of patterns may be accelerated by washing either with water or with potassium iodide solution until the non-mercerised hank becomes practically white. The blue colorations of the samples which have been washed with water fade much more rapidly than the brown coloration of those which have been washed with the potassium iodide solution. The marked increase in the length of time required to bring about the fading of the coloration of hanks which have been treated with soda of 26°, 28° and 30° Tw., and the decrease of that treated at 70° Tw., again fully agrees with Hübner and Pope's observations referred to above.

Hanks coloured with iodine in the manner described, which have been sealed up air-tight in bottles after immersion, show no fading of the colour whatsoever, although exposed to the action of the light for two months. The fading, therefore, seems to need the action of the air.

In all the experiments described it was found that cotton mercerised without tension reacts more powerfully than that mercerised under tension.

In the microscopical examination of paper-making fibres, a solution of zinc chloride and iodine is largely employed. (Herzberg, Papierprüfung, Berlin, 1902, p. 65.) With this solution cotton fibres are coloured claret-red, whilst wood cellulose fibres are coloured dark blue. Lange (Bericht des V. Internationalen Kongresses für angewandte Chemie, Berlin, 1903, 2, p. 909) proposes the use of a similar solution for the characterisation of mercerised cotton. A solution also closely resembling this is recommended in the Journal Soc. Dyers and Col. (1906, 22, 250). Samples of the fabric to be examined are immersed in the solution together with non-mercerised cotton and afterwards washed. The blackish-blue colour of the non-mercerised cotton is much more quickly removed by washing than that of the mercerised sample. The blue colour of the mercerised cotton washes out, however, fairly quickly; it is much less stable than that produced by the strong iodine potassium iodide reagent described above, and therefore naturally much less reliable, especially if the sample under examination has been incompletely mercerised.

It has not been observed before that solutions of zinc chloride containing very small quantities of iodine produce a marked coloration on mercerised and on ordinary cotton fibres, and further, that the colour reaction is influenced by the strength of the zinc chloride solution used. This may be shown by the use of a standard solution prepared by dissolving 1120 grms. of zinc chloride in 480 c.c. of water and by gradually diluting this solution and adding to each 20 c.c. of the different dilutions, 4 drops of the following iodine solution, corresponding to approximately 0·00195 grm. of free iodine:—1 grm. of iodine, 20 grms. of potassium iodide, 100 c.c. of water. This iodine solution has been used in all the tests described in this investigation. If the amount of iodine above noted is added to 20 c.c. of water, and if mercerised and non-mercerised cotton are immersed in this solution, it will be noticed that the samples are very faintly yellowish tinted only; the two samples behave practically identically. In the following solutions which contain zinc chloride, the amount of zinc chloride is given in grms. in 300 c.c. of solution.

20 grms.—The action of the small amount of zinc chloride is distinctly noticeable. The samples are of a light brownish colour, the mercerised slightly darker than the non-mercerised.

40 grms.—The action is much stronger than the above, and the mercerised cotton is considerably darker than the non-mercerised.

60 and 80 grms.—The shade of the samples is a bright brown, the difference between the two samples is about the same as with 40 grms.

100 grms.—The shade of the samples changes more into a chocolate brown, and the mercerised cotton is much darker than the non-mercerised.

120, 140, 160, 180, 200 grms.—The shade of chocolate becomes gradually more and more blueish as the zinc chloride solution becomes stronger; the shade of the mercerised cotton becomes gradually darker and darker, whilst that of the non-mercerised cotton alters but little in strength, and if anything becomes lighter.

220, 240, 260 grms.—The shade changes into still more blueish-chocolate.

280 grms.—At this strength the mercerised cotton changes to a very dark reddish navy blue shade, whilst the non-mercerised sample is only very faintly tinted reddish. The difference in depth of shade with this concentration of the zinc chloride solution is more pronounced than at any other.

300, 320, 340, 360, 380 grms.—The shade of the mercerised cotton becomes gradually more greenish until 380 grms. is reached, when it is of a bright greenish-blue. The difference between the mercerised and the non-mercerised cotton becomes gradually less pronounced as the strength of the solution increases from 280 to 380 grms., and the shade of the non-mercerised samples increases gradually in strength.

400 grms.—This solution only penetrates very slowly, and the samples become but very faintly tinted.

If the patterns are allowed to remain in the different solutions it will be noticed after 24 hours' immersion that those steeped in the solutions of from 0 to 200 grms. have all become colourless. At from 220 to 280 grms., the non-mercerised cotton is colourless, whilst the shade of the mercerised samples ranges from a reddish-violet at 220 grms. to a blueish-violet at 280 grms. At 300 grms. the ordinary cotton is slightly coloured, whilst the mercerised sample is a dark blue shade. At 320 grms. both ordinary and mercerised cotton are deeper and bluer in shade than at 300 grms. With 340 grms., both samples become very dark blue in colour, and the mercerised slightly deeper than the non-mercerised. At 360 and 380 grms., the difference between the two samples becomes again more distinct, the mercerised cotton being lighter and the shade of both being more of a greenish-blue. At 400 grms. the mercerised cotton is faintly greenish-blue tinted, and the non-mercerised one colourless.

During this long exposure the iodine slowly disappears from the solution; a similar result is obtained if the patterns, after immersion in the zinc chloride iodine solutions, are steeped in zinc chloride solutions of strengths identical with those from which the respective patterns have been taken. The non-mercerised and the weakly mercerised samples are always much more quickly decolourised than those which have been mercerised with strong soda solutions.

On heating the zinc chloride iodine solution which gives the most distinct reaction, and then immersing the samples of mercerised and non-mercerised cotton, no colouration is produced; on cooling, however, the dark navy blue colouration of the mercerised cotton at once appears.

Experiments, similar to those described, were made in which a still smaller amount of iodine was used (2 drops of iodine solution to 20 c.c. of the reagent, corresponding to about 0·000974 grm. of iodine). The reaction proceeds much more slowly, the maximum strength of coloration appearing after from 20 to 30 minutes immersion. As in the above experiments, the solution containing 280 grms. of zinc chloride in 300 c.c. of solution gives the most distinct result; with this the mercerised cotton turns a dark reddish-blue, whilst the non-mercerised remains practically white.

From the manner in which the coloration of the two cottons changes with the strength of the zinc chloride solution, it must be clear that to get satisfactory results the zinc chloride solution must be carefully prepared to the strength given; for the same reason, it is also of importance to employ an iodine solution of approximately the strength stated.

It has already been pointed out that it is possible, with a certain degree of accuracy, to ascertain by means of the iodine potassium iodide solution the strength of caustic soda solution which has been employed in the mercerisation of cotton goods. The zinc chloride iodine solution given above is, however, still better suited for this purpose. By means of this solution, the depth of colouration of the samples can be very readily compared, whilst comparison by washing the samples, as is necessary when using the other solution, is, without doubt, less convenient and more difficult.

In the following experiments, in which cotton samples are immersed which have been mercerised with different strengths of caustic soda, the amount of iodine added to 100 c.c. of the zinc chloride solution is given in drops of the iodine potassium iodide solution described above.

(1) *With* 20 *drops.*

Cotton mercerised with caustic soda of —°Tw.

0°—Slightly reddish tinted.

10°—Little stronger tinted than 0, shade a faint reddish chocolate.

20°—Considerably darker than 10—shade more of a blueish chocolate.

23°—Darker than 20 and shade still more blueish.

26°—Much darker than 23—shade a blueish chocolate.

30°—A very dark reddish navy blue—shade very much darker than 26.

40°, 50°, 60°, and 70°—All black.

(2) *With* 10 *drops.*

0°—Remains white.

10°—Very faintly brownish tinted.

20°—Quite distinct from 10, the shade being stronger and more of a chocolate.

23°—Still more blueish and a little stronger than 20.

26°—Much darker and bluer than 23.

30°—Much darker than 26—shade a reddish blue.

40°—Much darker than 30.

50°, 60°, 70°—Darker than 40.

(3) *With* 5 *drops.*

0°, 10°, 20°, 23°, 26°—Colourless.

30°—Just faintly tinted blueish.

40°—Very light blue.

50°—Much stronger blue than 40.

60°—Practically the same as 50, but if anything a trifle lighter.

70°—Lighter than either 50 or 60.

The foregoing experiments clearly demonstrate that solutions (1) and (2) may be employed for the purpose of deciding whether cotton has been treated with soda solutions of from 10 to 30° Tw. strength, whilst solution (3) will produce distinct colorations if soda of from 30 to 60° Tw. has been employed.

The fading of the blue colorations produced by the reagent may be applied as a further means of deciding the strength of the soda used in treating the sample in question. If the samples are removed from the zinc chloride iodine solution and exposed to the action of the air, the colours fade in the inverse ratio of their strength; this is particularly striking when solution (1), or a solution containing even more iodine, is used, the non-mercerised sample and the weakly mercerised ones becoming rapidly white. The fading proceeds much more slowly if the samples are allowed to remain in the zinc chloride iodine solution, or if they are placed in a fresh solution of zinc chloride without iodine.

If the reaction is applied to cloth, it is advisable to first wet out the samples thoroughly, and to squeeze them well between filter paper before immersion into the reagent. Discharging of the colour of the sample is only necessary if its shade is too dark to show the blue colouration distinctly, or if the degree of mercerisation has to be determined. The test is not interfered with by previously discharging the colour. If, in testing coloured patterns, any suspicion exists that the pattern has only been weakly mercerised, part of the pattern should be immersed in zinc chloride solution of standard strength without iodine; in this manner very faint colour changes may be readily detected. Colours, in the production of which tannic acid has been employed, should be stripped, as otherwise the reaction proceeds very slowly. It is hardly necessary to point out here that goods containing starch cannot be used in the reaction until the starch has been completely removed.

It has already been stated that cotton which has been mercerised without tension shows a higher reactivity than that mercerised under tension; this applies, naturally, also to the reactions given above. There is obviously no reason to suppose that caustic soda of mercerising strength is employed intentionally in the industries for mercerising cotton goods without tension; the fact stated above is therefore, of little importance as far as these tests are concerned. It is, in my opinion, of no great importance to those concerned whether cotton goods have been mercerised at say 50°, or 55°, or 60° Tw., it being well known that cotton which has been treated properly with solutions of these strengths becomes thoroughly mercerised. It is, however, of immense importance to ascertain with absolute certainty whether soda solutions have been used of such strengths that the typical effect of mercerisation has not been obtained.

It was of interest to ascertain whether cotton treated with mercerising agents, other than caustic soda, could be distinguished by means of the typical zinc chloride iodine solution. Cotton which has been mercerised with either sulphuric, nitric, or syrupy phosphoric acid, or with saturated zinc chloride solution, saturated solution of sodium sulphide, or saturated solution of barium mercuric iodide, gives the characteristic blue reaction. Cotton treated with hydrochloric acid, saturated potassium mercuric iodide, or potassium iodide solution behaves similar to ordinary cotton, in that the blue colouration is not produced. It is known, however (Hübner and Pope, *loc. cit.*), that the action of these reagents, although considerably weaker, is similar to that of caustic soda. Cotton hanks treated with these agents were therefore immersed in zinc chloride iodine solutions, together with non-mercerised cotton, containing larger quantities of zinc chloride than the one described.

Grms. of zinc chloride in 300 c.c. of solution.

Cotton treated with hydrochloric acid.

300 and 320.—Treated cotton a trifle redder in shade than non-mercerised.

340. Treated cotton distinctly more strongly coloured than ordinary cotton, but not so strongly as mercerised cotton.

360. Treated cotton more strongly coloured than the non-mercerised, bluer in shade than at 340, and nearly as strong as mercerised cotton.

380. The cotton treated with hydrochloric acid goes as quickly blue as the mercerised sample, whilst the non-mercerised cotton colours much more slowly.

Cotton treated with saturated solution of potassium mercuric iodide.

300 and 320.—Same as non mercerised sample.
340. Treated cotton a little more greenish-blue than the non-mercerised sample.
360. Treated cotton colours much more quickly than non-mercerised cotton.
380. The treated sample turns as quickly blue as the mercerised cotton.

Cotton treated with saturated solution of potassium iodide.

300 to 360. Same as cotton treated with potassium mercuric iodide.
380. The sample treated with potassium iodide colours nearly as quickly blue as the mercerised cotton, and certainly much more quickly than non-mercerised cotton.

It is, therefore, shown that all these cottons treated with higher strengths of zinc chloride show a greater reactivity than does non-mercerised cotton, in that the coloration appears much more rapidly. The difference in depth of shade is certainly much more distinct with the cotton samples which have been treated with either hydrochloric acid or with potassium mercuric iodide, as compared with those which have been treated with potassium iodide solution. This affords further proof of the correctness of the shrinkage figures given in Hübner and Pope's paper, and the behaviour of cotton treated with these agents towards the substantive cotton colours.

Knecht (J. Soc. Dyers and Col., 1905, 21, 189), has pointed out that cotton treated with human saliva shows increased affinity for substantive cotton colours. Cotton treated in this manner gives a distinct reaction with the zinc chloride iodine reagent described; the colouration is similar to that given by cotton which has been treated with a weak solution of caustic soda.

Hanks of cotton were immersed in a nearly saturated solution of caustic potash in absolute alcohol for one hour, one hank being then washed with absolute alcohol and the other with water until free from potash. Both samples gave the characteristic blue colouration with the zinc chloride iodine solution.

Solutions other than zinc chloride, with the addition of minute quantities of iodine dissolved in potassium iodide and water.

Sulphuric acid (sp. gr. 1.84) was mixed with water in the proportions given below, and to 20 c.c. of each of the acid solutions, potassium iodide iodine solution was added, equal to approximately 0·000973 grm. of iodine. Hanks of non-mercerised and of mercerised cotton were immersed in the different solutions, and the following observations made.

Acid solution. Water c.c.	Acid solution. Sulphuric acid c.c.	
100	0	Practically no coloration.
95	5	The coloration becomes more distinct; the non-mercerised cotton shows a brownish tint and the mercerised sample is distinctly yellowish coloured.
90	10	Both samples are now more strongly tinted than in the last solution; the mercerised is a little stronger in shade than the non-mercerised cotton.
85 to 75	15 to 25	The reddish-brown shade of the cotton increases gradually with the increase in the strength of the acid solution used, and the difference in depth of shade between the two samples becomes gradually more apparent.
70	30	On immersion of the hanks it is immediately noticed that the mercerised cotton is rapidly coloured a reddish-brown shade, whilst the non-mercerised sample colours much more slowly. The shade of the samples is somewhat redder and brighter than the brown coloration produced on cotton by immersion in a much stronger solution of iodine in aqueous potassium iodide.
65	35	The colouration of both samples changes towards a chocolate brown.
60	40	The shade of the mercerised cotton changes still more towards chocolate, whilst that of the non-mercerised sample changes less.
55	45	The mercerised hank, immediately on immersion, becomes a heavy brownish-violet colour, whilst the non-mercerised cotton assumes a much lighter chocolate shade. It is of interest to note that the mercerised hank, after having been in contact with this particular strength of acid for a short time begins to wriggle very strongly, but the non-mercerised cotton seems hardly acted upon by the acid.
50	50	Both hanks turn rapidly reddish blue in shade and then soon become black. Both hanks wriggle very strongly in this solution.

The fact that the coloration produced by the small quantity of iodine in the two last sulphuric acid solutions on mercerised cotton appears so rapidly and so very strongly made it of interest to add still less iodine to the sulphuric acid solution which produces the most distinct reaction (45 c.c. sulphuric acid + 55 c.c. water). If 1 drop of the iodine potassium iodide solution given above is added to 200 c.c. of the sulphuric acid solution, the samples of mercerised cotton immediately turn a dark navy blue shade on immersion, whilst non-mercerised cotton is but faintly tinted. After 5 hours' immersion, the non-mercerised cotton has become a light dull blue.

If this solution is used as a reagent for the characterisation of mercerised cotton, great care must be exercised in avoiding excess of iodine in the solution. A very slight increase in the amount of iodine added will tend to produce the blue coloration, not only on the mercerised, but also on the non-mercerised cotton. The blue coloration of the mercerised cotton appears more rapidly with the sulphuric acid iodine reagent than it does with the zinc chloride iodine solution, but the former has the distinct drawback that, as pointed out above, the difference in the depth of coloration between the non-mercerised and the mercerised samples becomes less distinct if they are allowed to remain in the reagent for some time.

Phosphoric acid.—Syrupy phosphoric acid was mixed with water in the proportions given below, and to 20 c.c. of each of the acid solutions potassium iodide iodine solution was added, containing approximately 0·000973 grm. of free iodine. The following observations were made on immersing mercerised and non-mercerised cotton in these solutions:—

C.c. phosphoric acid in 100 c.c. of solution.	
5 and 10.	No coloration is noticed.
15, 20, 25.	A slight increase in the depth of the yellow coloration is seen.
30 and 35.	The yellow changes to a more reddish tint, but there is practically no difference in the depth of colour of the mercerised as compared with the non-mercerised cotton.

40 to 100.	The brown coloration increases gradually in strength and becomes redder in tone, until the solution contains 80 parts of acid in 100 parts. At this strength the shade changes more to chocolate.
100.	Gives the most distinct reaction; the mercerised cotton is of a very deep chocolate colour, whilst the non-mercerised sample is very much lighter in colour.

The colour of the acid iodine solution up to 45 acid in 100 parts of solution is a very light yellowish tint, similar to that of water to which a very small amount of iodine solution has been added. This yellow tint gradually becomes more reddish with increasing strength of the acid solution. At the concentration of 55 acid in 100 parts of solution, however, the light yellow tint of the solution changes to a deep golden yellow. If a still smaller amount of iodine is used in conjunction with the syrupy phosphoric acid, the difference in the strength of the coloration of mercerised as compared with non-mercerised cotton becomes still more apparent, and the shade produced is more blueish-chocolate in character.

Nitric acid.—The proportion of nitric acid (sp. gr. 1·42) to water and of the amount of iodine added to each solution is given as in the last set of experiments.

5.	No reaction.
10.	Very slight brownish coloration.
15 to 25.	The colour of the samples increases gradually in strength, and the difference in the depth of coloration between mercerised and non-mercerised cotton becomes more distinct.
30.	The mercerised cotton is coloured a very heavy reddish brown, whilst the ordinary cotton is of a light brown colour.
Above 30.	The iodine is precipitated from solution.

Hydrochloric acid.—The different amounts of hydrochloric acid (sp. gr. 1·21) are given in parts in 100 of solution; the quantity of iodine added to each strength of acid is the same as in the former sets of trials.

0 to 15.	No action.
20.	Both samples tinted brownish.
25 and 30.	The brownish colour of the two samples increases gradually in strength.
35 to 70.	The strength of the coloration increases with the strength of the acid solution, and the brown becomes more reddish in shade. At 70, the mercerised cotton is coloured a heavy reddish brown, whilst the non-mercerised sample is of a very light brown colour.
75 to 100.	The strength of the coloration of both samples increases gradually, and the shade changes to a chocolate brown. At 100, the mercerised cotton is very heavily coloured.

After an immersion of 48 hours in the different solutions, all the samples of non-mercerised cotton become white. The coloration of the mercerised samples which have been immersed in the solutions containing up to 75 parts of acid in 100 parts also become discharged, whilst those in the solutions containing above 75 acid still remain distinctly coloured.

Aluminium chloride.—In the following experiments 4 drops of the potassium iodide iodine solution were added to 20 c.c. of each of the different strengths of the aluminium chloride solution. Observations were taken after 30 minutes' immersion of the mercerised and non-mercerised cotton samples.

Grms. of aluminium chloride in 100 c.c. of solution.

(1)	66·7	The non-mercerised cotton becomes of a reddish, and the mercerised cotton of a blueish-chocolate shade of about the same intensity.
(2)	60·0	The shade of the non-mercerised cotton is a little redder and that of the mercerised sample a little bluer than (1). The shade of the latter is slightly deeper than that of the former.
(3)	53·0	The non-mercerised cotton is lighter, but of the same shade as (2); the mercerised sample is bluer than sample (2), the shade becoming a greyish chocolate. The colour of the mercerised sample is at this strength of solution distinctly stronger than that of the non-mercerised.
(4)	46·7	The shade of the non-mercerised cotton is the same as that of (2) and (3) but much lighter, whilst the coloration of the mercerised sample tends still more towards a grey. The difference in the strength of the coloration of the two samples is still more apparent than in (3).
(5)	40·0	The non-mercerised cotton is only very slightly tinted, and the colour of the mercerised cotton becomes a dark reddish grey.
(6)	33·0	The non-mercerised cotton is hardly tinted; the shade of the mercerised sample is somewhat bluer and weaker than that of (5).
(7)	26·7.	The non-mercerised sample remains practically colourless, whilst the mercerised cotton assumes a still lighter blueish grey tint than in (6).
(8)	20·0.	The non-mercerised cotton remains practically colourless, and the mercerised sample becomes of a greenish-grey tint, still lighter than that of (7).

The brown coloration of the ordinary cotton produced by aluminium chloride solutions in conjunction with iodine increases gradually in strength with the strength of the solution, but the shade of colour does not alter materially. The strength of the coloration of the mercerised cotton increases with the strength of the solution until 100 c.c. of solution contain 46 7 grms. of aluminium chloride; above this strength, no further increase in the strength of the coloration is produced. The shade of colour assumed by the mercerised cotton changes gradually from a greenish-grey tint (with the weakest solution) to a more and more reddish-grey, and then gradually into a blueish-chocolate. The reaction, on the whole, proceeds more slowly than the zinc chloride iodine reaction.

After 2 hours immersion.—(5) The non-mercerised cotton becomes colourless and the mercerised sample of a medium grey colour. (4) The non-mercerised sample becomes brownish in tint and the mercerised cotton assumes a very dark greyish chocolate shade.

After 4 hours' immersion.—(4) The non-mercerised cotton becomes colourless, whilst the mercerised sample remains of a very dark greyish-chocolate colour and nearly black.

After three days' immersion.—(4) The shade of the mercerised cotton remains practically unchanged.

From the foregoing experiments it will be seen that the colour reactions produced on mercerised cotton by means of aluminium chloride solutions in conjunction with very small amounts of iodine may be quite well applied to the characterisation of mercerised cotton. For this purpose the following reagent can be conveniently used. From 15 to 20 drops of the iodine potassium iodide solution given above are added to 100 c.c. of solution containing 46·7 grms. of aluminium chloride. Mercerised cotton steeped in this solution becomes of a very dark brownish chocolate shade after 1 hour's immersion, whilst non-mercerised cotton remains practically white.

The action on mercerised and non-mercerised cotton of minute quantities of iodine in aqueous potassium iodide solution in conjunction with other salts, such as magnesium, calcium, and strontium chlorides, potassium iodide, sodium acetate, organic compounds, etc., has also been examined and is at present still under investigation.

The author finds that some of the reactions set forth in the present paper are of value in the characterisation of the different types of artificial silks; this investigation is still in progress and will also be extended to other textile- and paper-making fibres. He hopes to lay the results of these investigations before the Society at an early date.

The author desires to acknowledge the valuable services rendered by his assistant, Mr. Sidney H. Higgins, M.Sc., in connection with the large amount of experimental work involved.

Discussion.

The Chairman considered that the tests brought forward would be of considerable help to merchants and would in many instances save considerable trouble and expense. He wished to know whether the results shewing the different colorations with the different degrees of mercerisation agreed with the facts obtained in practice by using different strengths of caustic soda in the mercerising process?

Mr. J. H. Lester agreed with Mr. Hübner that microscopical examination was of little or no value for determining the degree of mercerisation of cotton, but he wished to know whether cotton which had been mercerised with low strengths of soda shewed any distinct microscopic characteristics. Did the time of mercerisation influence the reactions shewn by the author? It would be also of interest to know whether the stripping agents employed in discharging coloured patterns would in any way interfere with the reactions brought forward.

Dr. F. H. Bowman said that the author had stated that mercerised cotton absorbed more of his test solution than unmercerised; and that cotton mercerised under tension absorbed less colour than that treated without tension. He (Dr. Bowman) had always understood that mercerised cotton could be dyed with a smaller amount of colour and at less cost than ordinary cotton, and this was one of Mercer's claims. In his opinion microscopical examination was a good means of distinguishing mercerised cotton only when it was fully mercerised and could not be relied on except then. His own experiments indicated that mercerised cotton absorbed more dye.

Mr. W. F. A. Ermen said the author had pointed out that great care should be used in preparing such a solution of zinc chloride as would give the most distinct colour reaction with mercerised cotton. He also understood that the amount of iodine added had to be carefully adjusted so as to avoid tinting of the unmercerised samples. He should like to know whether a sample which had been immersed in a wrongly made up solution once could be rendered colourless and used a second time in a solution of a different strength, or whether the re-action would not take place a second time?

Dr. B. W. Gerland asked whether the reaction was influenced by using different kinds of cotton in the process of mercerisation.

Prof. W. J. Pope observed that he could substantiate all that had been said in testimony of the simplicity and efficiency of the Hübner test for mercerised cotton. The test was one which was greatly needed in the Manchester trade and, in the hands of the chemist, would give practically all the information needed as to the manner in which a particular piece had been mercerised. He deprecated, however, the suggestion that the test might be applied by the merchant himself, and thought that, if such a procedure became customary, trouble and disputes would infallibly result.

Mr. R. B. Brown said that the author had pointed out the analogy between iodine- and colour-absorption by mercerised cotton; might not the colour absorption be used to ascertain the degree of mercerisation? Was there any relation between the extent of fading of the iodine colorations produced on mercerised and unmercerised cotton, and that of colouring matters? Had the zinc chloride iodine reagent been used on both bleached and unbleached cotton, and if so was there any marked difference in the result?

Mr. R. E. Crowther asked whether it were possible to apply the reaction successfully to mercerised cotton which had been dyed with Aniline Black and subsequently discharged with potassium permanganate. The author had shewn patterns indicating by colour-difference the amounts of iodine absorbed by mercerised as compared with ordinary cotton; would it not be possible to ascertain volumetrically the respective amounts of iodine which had been absorbed by the cotton mercerised with different strengths of caustic soda?

Mr. J. H. Gilbertson said that he had tried Mr. Hübner's solutions of potassium iodide and iodine, and of zinc chloride and iodine, on samples of cloth mercerised and dyed with Aniline Black by various methods, such as the prussiate-, the vanadium-, the copper-, and the one-bath black. He found, on stripping the blacks by means of potassium permanganate and oxalic acid, and then treating the patterns with the two reagents, that they gave excellent results in defining between mercerised and non-mercerised cotton.

He did not suppose that it was Mr. Hübner's intention to recommend his reagents for the purpose of defining the strengths of the caustic soda used in mercerising cloth if soda of say from 50° to 70° Tw. has been used. With soda of these strengths, the amount of tension or stretch obtained in the various types of mercerising machines varied considerably. This would, therefore, show differences with the reagents, although the same strength of caustic soda might have been used in every case. He also found that the reactions might be used with equally good results independent of whether the cotton had been mercerised and bleached or mercerised only. In his opinion, the reagents would also prove to be of great value to the dyer in determining whether the uneven dyeing of yarn or cloth was due to the dyeing itself or to uneven impregnation in the process of mercerising.

Mr. L. E. Vlies said it was well known that large amounts of sodium sulphide were used in the dyeing of sulphur colours on cotton, and that this agent was capable of mercerising cotton; he therefore wished to know whether samples which had been dyed in that manner would not show the reactions explained by the author without the cotton having been actually mercerised with caustic soda?

Mr. Hübner, in reply to the Chairman, said that the depths of the colorations obtained with the zinc chloride iodine reagent agreed entirely with the results obtained in practice when caustic soda solutions of different strengths were used in the process of mercerising. In reply to Mr. Lester, cotton which had been mercerised with caustic soda of low strengths would hardly exhibit distinct microscopic characteristics, because it had been shown by Pope and himself that at such strengths the untwisting and the swelling of the fibres was very incomplete. The time of mercerisation could only influence the reactions if the process had been carried out so rapidly that complete penetration of the cloth by the soda had not been accomplished. That would practically amount to incomplete mercerisation, which would, and that quite rightly, be indicated by the two reagents. A great number of dyed and printed samples had been discharged by means of the different discharging agents, but so far it had not been observed that these treatments interfered with the indications of the tests. The idea that a certain shade could be produced on mercerised cotton with a smaller amount of colour than on non-mercerised cotton was quite wrong. Mercerised cotton exhibited greater affinity for the substantive cotton colours, and as a result of this the dyebath in which mercerised cotton has been treated became better exhausted than was the case with non-mercerised cotton. He quite agreed with Dr. Bowman's remarks that microscopic examination would give reliable results only if the cotton has been very completely mercerised; but difficulties were introduced, even then, if certain finishes, such as the Schreiner finish, had been applied to the cloth after mercerising.

In reply to Mr. Ermen, he had pointed out in the paper in what manner the strength of the zinc chloride solution, and of the amount of iodine added to it, influenced the reaction. It was quite easy for the chemist to adjust his reagent properly; the iodine solution should be added immediately before using the reagent, and if known samples of mercerised and of non-mercerised cotton were immersed in the reagent, it would at once be seen whether the solution would give the desired result. Samples which had been immersed in a wrongly made up solution might be rendered colourless by washing with water and might then be again immersed in a fresh zinc chloride iodine solution; the reaction was not interfered with by the washing of the sample. Replying to Dr. Gerland, he had used the reagents on different kinds of cotton, but had not observed that the reactions were influenced thereby. In reply to Mr. Brown, he observed that colour absorption could not be applied with anything like the same success for the purpose of ascertaining the degree of mercerisation as could the zinc chloride iodine reagent. Cotton which had been mercerised under tension absorbed more colour than non-mercerised cotton, but it absorbed much less than that which had been treated without tension. Although a certain gradation in colour would be produced, if, say, a substantive cotton colour were used for dyeing the samples which have been mercerised with different strengths of caustic soda, it must not be forgotten that the non-mercerised cotton would also be coloured, and that, therefore, the differences in depth of shade would be only slight. With the zinc chloride iodine reagent, the non-mercerised cotton remained, however, practically white, whilst the thoroughly mercerised sample turned a very dark navy blue shade, nearly black, so that the range of colorations produced by the different strengths of soda between the two extremes, was, therefore, a very wide one. It would be hardly possible to establish any relation between the extent of fading of the iodine from mercerised and non-mercerised cotton as compared with the fading of organic colouring matters. There was practically no difference in the results produced by the reactions where applied on either bleached or unbleached cloth. The Aniline Black question had already been answered by Mr. Gilbertson. He did not think that there was much likelihood of success in trying to ascertain, by volumetric methods, how much iodine had been absorbed by the various samples which had been mercerised with different strengths of caustic soda. The amounts of iodine absorbed, as he had shown in the paper, were very small, whilst, as he had also pointed out, the different shades which were produced by immersion in a solution of iodine in aqueous potassium iodide not only differed in depth but actually changed from a light yellowish-brown, at the lower strengths, to a dark chocolate-brown, at the higher strengths of soda. In reply to Mr. Vlies he said that the reagents had been tried on cotton which had been treated with sodium sulphide solutions. Sodium sulphide produced the effect of mercerisation only if a very concentrated solution was used. Cotton which had been treated with solutions of sodium sulphide, up to 50 per cent. in strength, were not coloured blue with the zinc chloride iodine reagent.

Mr. W. H. Pennington said that he had conducted experiments on an industrial scale with a view to ascertain the relative amount of colour absorbed by mercerised and non-mercerised cotton. He fully agreed with Mr. Hübner's remarks. The results of all his experiments, in which tons of cotton had been dyed comparatively, bore out that more colour was actually absorbed by mercerised than by non-mercerised cotton, and that the dyebath from the former was always better exhausted than that from the latter.

Journal and Patent Literature.

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I.—PLANT, APPARATUS, AND MACHINERY.

Patents.

[*Inflammable*] *Liquids; Storing and handling ——, and apparatus therefor.* F. Clauss and L. Lewisson, Berlin. Eng. Pat. 28,698, Dec. 15, 1906.

An inflammable liquid is filled into, or discharged from, the store tank by causing it to displace, or be displaced by, a "neutral" liquid. Two vessels may be used which are alternately filled with the inflammable and with the "neutral" liquid, or the inflammable liquid may be contained in an underground tank at some distance above which another tank is provided to contain the "neutral" liquid which is the specifically heavier of the two. The bottom of the lower tank can be put into communication with either the top or the bottom of the upper tank by a pipe and a three-way tap, and the top of the lower tank is provided with a feed or discharge pipe.—W. H. C.

Drying liquids; Apparatus for ——. J. Kunick, Berlin. Eng. Pat. 1692, Jan. 22, 1907.

The working of an apparatus in which liquid is evaporated in a thin film on the surface of internally heated cylinders, rotated in contact, is improved by enclosing the cylinders in a jacket and connecting the latter to a powerful exhauster. A current of rarefied air which may be heated or cooled as desired is thus caused to pass over the surface of the cylinders and greatly facilitates the evaporation.—W. H. C.

Drying machines. H. H. Lake, London. From Maschinenbauanstalt, Eisengiesserei und Dampfkesselfabr. H. Paucksch, A.-G., Landsberg, Germany. Eng. Pat. 5131, March 2, 1907.

See Fr. Pat. 375,063 of 1907; this J., 1907, 860.—T. F. B.

Drying apparatus. G. W. McMullen, Picton, Ontario, Canada. U.S. Pat. 875,368, Dec. 31, 1907.

The apparatus consists of a chamber having insulating top and side walls. A number of horizontal, water-cooled condensers are disposed upon the floor of the chamber, baffle-plates are arranged to extend across the chamber above the condensers, with heating coils above the baffle-plates and vapour-generating troughs supplied with steam above the heating coils. The materials to be dried are supported on shelves in the upper portion of the chamber.—W. H. C.

Dryer. J. Weintz, Cleveland, Ohio. U.S. Pat. 875,874, Jan. 7, 1908.

A stationary horizontal cylinder has at each end hollow movable heads connected together within the cylinder by a number of horizontal pipes arranged in a ring concentric with the wall of the cylinder. The heads are rotated from without, and a series of elevators are mounted on the pipes so as to be rotated with them in the annular space between the shell of the cylinder and the ring of pipes. Steam is supplied to the hollow heads and passes through the pipes, and the cylinder is provided with inlet and discharge openings.—W. H. C.

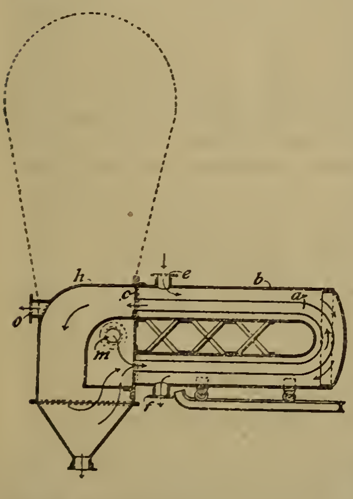
Rectifying mixtures of liquids. R. Ilges, Cöln-Bayenthal, Germany. Eng. Pat. 17,056, July 25, 1907.

The claim is for a rectifying column formed of superimposed compartments or segments, each of which has a number of "staggered" rows of tubes which pass through it from side to side. The spaces between the tubes are filled with balls of the same diameter as the tubes, which latter are placed two or three diameters apart and are "staggered" vertically, so that only the tubes of every fifth row are directly in a vertical line. The segments may be used as deplegmators or rectifiers: in the first case cooling water is circulated through the tubes and passes from row to row by outside overflow shelves; in the second case hot vapour is passed through the tubes from boxes or steam-chests at each side, which are so arranged that alternate tubes or pairs of tubes are connected at the sides of the segment. A rectifying segment may be used as an evaporator to generate the vapour to be rectified.—W. H. C.

Evaporator. E. Zaremba, Chicago, Ill. U.S. Pat. 870,211, Nov. 5, 1907.

The evaporator, which is specially intended for corrosive liquids, consists of a vessel lined with insulating and refractory material. It may either be an open tank, or may be enclosed, if it is desired to conduct the evaporation under reduced pressure. Two electrodes, preferably formed of graphite, are suspended in the liquid from insulated and varnished copper rods which extend across the vessel above the level of the liquid. The rods are connected to the terminals of an electric generator and on passing the current, the liquid acts as a resistance and becomes heated, causing its evaporation. If a heating effect only is desired, an alternating current is used, but if electrolysis of the liquid is also desired, a direct current is employed.—W. H. C.

Heating device with horizontal tubes for heating, evaporating, and dissolving vessels. O. Peters. Ger. Pat. 186,532, May 10, 1905.



The apparatus (see figure) consists essentially of the liquor-space, *h*, the heating coil, *a*, and the steam (vapour) chamber, *b*. The liquid to be heated or evaporated enters at *m*, and leaves at *o*; the steam enters at *e*, and the condensed water is run off at *f*. Between the chamber, *h*, and the heating chamber, is a partition, *c*, in which are fixed the two ends of a siphon having one or more bends. The directions in which the liquid and the steam travel are indicated by the arrows. The hood marked in with dotted lines is used when the apparatus is employed as an evaporator.—A. S.

Vacuum-producing apparatus. C. A. Parsons, Newcastle on Tyne. U.S. Pat. 874,986, Dec. 31, 1907.

See Fr. Pat. 355,181, 1905; this J., 1905, 1162.—T. F. B.

Mixing apparatus. C. Mastian and A. Delfosse, Pont d'Ardres, Assignors to Soc. des Raffinerie et Sucrerie Say, Paris. U.S. Pat. 875,444, Dec. 31, 1907.

See Fr. Pat. 369,319 of 1906; this J., 1907, 108.—T. F. B.

Gas regenerative furnaces. F. Siemens. First addition dated Aug. 17, 1907, to Fr. Pat. 339,323, Jan. 2, 1904. (See Eng. Pat. 5866 of 1903; this J., 1904, 317).

The gas from the producers placed at only one, or on both sides of the furnace, passes either directly to one side of the hearth or else is conducted through a flue or channel which passes above the crown or beneath the sole of the furnace to the gas-inlet on the other side of the hearth. By this arrangement the cooling of the gas which is due to its long travel from the regenerators to the hearth when the direction of flow is reversed, is compensated for by the heat radiated from the crown, or sole, of the furnace.—W. H. C.

II.—FUEL, GAS, AND LIGHT.

Patents.

Coal and other minerals; Apparatus for washing ——. J. Shaw, Kirby Moorside. Eng. Pat. 7111, March 25, 1907.

The coal is fed into the lower end of an inclined trough and meets a current of water introduced at the upper end. The specifically heavier impurities are carried to the discharge at the upper end of the trough by the action of a bottom plate provided with fixed dams or riffles and by a horizontal frame situated above the bottom plate and also provided with dams or riffles. Both the bottom plate and the frame receive a reciprocating movement, but in opposite directions, and further, the dams on the frame are hinged so that they can be raised just before and during the downward movement of the frame and lowered just before and during its upward movement. The coal is washed over a fixed dam at the lower end of the trough on to a discharge trough from which any heavy bodies that may have been washed down with the coal are returned to the main trough by means of cross bars or scrapers carried on endless chains working over rollers or drums in an upward direction.—W. H. C.

Drying peat, or other similar materials. W. T. Griffin and B. W. Tucker. Fr. Pat. 381,272, Aug. 26, 1907.

The peat is caused to pass through a series of jacketed tubes in which screw conveyors are arranged. The tubes of each row are alternately inclined in opposite directions and are connected by boxes at alternate ends so that the material passes through all the tubes of each row in succession. Steam is injected into the tubes through the hollow, perforated shafts of the screw conveyors and passes from the other end of the tubes, through the jackets to the outlet.—W. H. C.

Briquettes and cork bricks; Process of manufacture of ——. H. Schurz and G. Bülling. Fr. Pat. 381,250, Aug. 24, 1907.

The waste liquors from cellulose manufactures are used as the agglomerant in making briquettes from coal dust and floating carbonaceous dust from locomotives, and for bricks of crushed or powdered cork.—W. C. H.

Coke ovens. A. O. Jones, Whitley Bay, Northumberland. Eng. Pat. 17,137, July 26, 1907.

Each oven is provided with two passages to conduct air from the regenerators to the heating flues and two passages to conduct the waste gas to the regenerators. These passages are closed and opened in opposite pairs by sliding dampers which are all connected by cranks to a rod which passes longitudinally beneath the battery of ovens, so that the position of all the dampers can be simultaneously reversed.—W. H. C.

Coke oven. A. O. Jones, New Brancepeth. U.S. Pat. 875,436, Dec. 31, 1907.

See Eng. Pat. 11,660 of 1906; this J., 1906, 1139.—T. F. B.

Coke oven; Regenerative ——. E. Coppée, Brussels. U.S. Pat. 875,896, Jan. 7, 1908.

See Fr. Pat. 359,888 of 1905; this J., 1906, 468.—T. F. B.

Coke-ovens; Process of rendering inoffensive the gases and vapours discharged from regenerative by-product ——, *between the periods of manufacture of coke.* G. Lessing. Fr. Pat. 381,186, Aug. 6, 1907. Under Int. Conv., Aug. 12, 1906.

The gases and vapours, produced between the periods of manufacture of coke in regenerative by-product coke-ovens, which pass up the ascension pipes, are prevented by a valve from entering the main receiver, but are drawn, together with air, which enters the apparatus through the cleaning valve at the top of the ascension pipes, into a special receiver or condensing apparatus, the cleaning valves being kept open during these intervals. Any explosion of the air and gases drawn into the special receiver and condensing apparatus, is avoided by the extinction of the flame in the apparatus.—W. C. H.

Gas for power purposes; Process of producing ——. F. W. Barker and T. L. White, New York. Eng. Pat. 29,396, Dec. 24, 1906. Under Int. Conv., Sept. 12, 1906.

See U.S. Pat. 839,798 of 1906; this J., 1907, 248.—T. F. B.

Coal gases and analogous gases; Treatment of —— *in recovering tar and ammonia therefrom.* W. Feld, Hönningen on Rhine, Germany. Eng. Pat. 29,752, Dec. 31, 1906.

See U.S. Pat. 851,349 of 1907; this J., 1907, 602.—T. F. B.

Electric conductors of refractory metal, applicable especially for use as incandescing bodies in electric lamps; Manufacture of ——. British Thomson-Houston Co., London. From General Electric Co., Schenectady, U.S.A. Eng. Pat. 21,504, Sept. 28, 1906.

See Fr. Pat. 379,394 of 1907; this J., 1907, 1232.—T. F. B.

Filaments for electric incandescent lamps; Machine and apparatus for manufacturing ——. F. M. F. Cazin, Hoboken, N.J. U.S. Pat. 874,938, Dec. 31, 1907.

The apparatus comprises a vessel from which the air can be exhausted, and a number of receptacles provided with concentrically arranged squirting orifices, through which "fillets or glowers" consisting of a core and cover, can be squirted into the vessel. The receptacles serve to hold semi-plastic material, and means are provided for maintaining such material in a semi-plastic liquid condition, and for squirting it out of the orifices. Means are also provided for forming the fillets squirted into the exhaustible vessel into any desired final shape in the vessel.—W. C. H.

Metallic filaments; Process of bringing —— *to incandescence in a reducing or inert atmosphere.* Allgem. Elektricitäts Ges. Fr. Pat. 381,515, Sept. 4, 1907. Under Int. Conv., Sept. 6, 1906.

This patent covers the use of water-gas, freed from carbon dioxide and oxygen before use, if necessary, by means of suitable absorbents, as a reducing or inert atmosphere, in which metallic filaments can be brought to incandescence.—W. C. H.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

Oils of the aromatic and aliphatic series; Action of dimethyl sulphate upon ——. T. W. Harrison and F. M. Perkin. Analyst, 1908, **33**, 2—11.

From an experimental study of Valenta's method of separating aromatic oils from aliphatic oils by means of dimethyl sulphate (this J., 1906, 366), the authors find that aromatic oils are soluble in the reagent in all proportions, but that mineral oils are not insoluble. Thus 8·5 per cent. of Russian petroleum was dissolved by its own volume of dimethyl sulphate, and by repeated extraction with fresh quantities of the reagent, as much as 80 per cent. could be dissolved. Hence the conclusion is arrived at that Valenta's method does not yield quantitative results in the determination of aromatic oil in admixture with mineral oil. It is useful, however, as a qualitative test; for on shaking such a mixture with dimethyl sulphate, the bulk of the aromatic oil is dissolved, and, as a rule, only a small proportion of the mineral oil. Then by saponifying the dimethyl sulphate layer with alcoholic potassium hydroxide solution, and extracting the diluted solution with ether, the aromatic oil may be separated nearly free from mineral oil, and its nature determined by further tests. (See also Graefe, this J., 1903, 575.)—C. A. M.

Acetone; Quantitative determination of ——. G. Heikel. Chem.-Zeit., 1908, **32**, 75—76.

The methods of Messinger (this J., 1889, 138; see also this J., 1891, 166) and of Denigés (this J., 1899, 179, 523) give accurate and concordant results with pure acetone, but neither will do so in the case of crude products such as are obtained in wood distillation and in the manufacture of acetone. By employing the two methods together, however, the author states it is possible to obtain useful information as to the nature of such crude products. In the manufacture of acetone there are obtained besides pure acetone (over 99 per cent. strength):—(1). So-called "ketone," consisting chiefly of methyl-ethyl ketone, b.-pt. 65°—75° C., sp. gr. 0·811—0·815 at 15° C. (2). Light acetone oil, b. pt. 75°—130° C., sp. gr. 0·82—0·83. Heavy acetone oil, b. pt. 130°—250° C., sp. gr. 0·88—0·89. The percentage of acetone in these products as determined by the two methods mentioned was as follows:—

	A. Messinger.	B. Denigés.	Ratio of B : A
"Ketone"	89·9	63·5	0·706
Light oil	57·2	32·6	0·570
Heavy oil	39·5	25·4	0·643

The mercury-acetone precipitate,

$$3[(HgSO_4)_2 3HgO], 4CO(CH_3)_2,$$

obtained in Denigés' method is white in the case of pure acetone, yellowish-white with "ketone," brownish-yellow with light oil, and nearly brown with heavy oil. Examples are given in which the ratio, B : A (see table) and the colour of the mercury precipitate are utilised in ascertaining the nature of various crude products of acetone manufacture.—A. S.

Patents.

Coal-tar pitch; Method of producing ——. J. F. Lovejoy, Assignor to A. Stein, New York. U.S. Pat. 875,196, Dec. 31, 1907.

Coal-tar is mixed with a considerable proportion of water and is then distilled until the resulting pitch has a melting-point of about 155° F. The tar is mechanically agitated and has steam blown through it during the distillation.—W. H. C.

Wood distillation; Apparatus for ——. G. B. Frankforter, Minneapolis, Minn. U.S. Pat. 875,342, Dec. 31, 1907.

The wood contained in crates, or baskets, enters the retort through a chamber forming an air-lock, and is moved forward by an endless chain from which the crates are suspended. The retort is a long, inclined chamber, the middle portion of the floor being convex with a depression forming a gutter at each side, from which pipes pass through the bottom to a main pipe below. The retort is heated by a furnace placed at the lower end, which is intensely heated, the temperature decreasing towards the upper end. The residue in the crates is discharged from the lower end of the retort into a cooling chamber which also forms an air-lock.—W. H. C.

Wurtzilite; Treatment of ——. M. Stine. Fr. Pat. 381,459, Sept. 2, 1907.

See U.S. Pat. 864,836 of 1907; this J., 1907, 1099.—T.F.B.

IV.—COLOURING MATTERS AND DYESTUFFS.

Indigo crop of India. Comm. Intell. Dept., Calcutta. [T.R.]

In the Final Memorandum on the indigo crop for 1907—1908, it is estimated that 371,300 acres have been planted, a decrease of 11·8 per cent. over 1906—1907. In Bengal, the yield last season amounted to 1000 tons, against 865 tons in 1905-6. In Madras the yield was about 840 tons, in the United Provinces 280 tons, and in the Punjab 450 tons. The exports by sea amounted to 34,825 cwt. in 1906-7, against 31,186 cwt. in 1905-6.

Hydroxyanthraquinones; Methyl ethers of some ——. A. G. Perkin. Chem. Soc. Trans., 1907, 91, 2066—2075.

The suggestion of Böck (this J., 1903, 88) that the non-tinctorial substances isolated from Chay root (*Oldenlandia umbellata*) by Perkin and Hummel (this J., 1894, 244, 346) do not possess the constitution assigned to them, but probably contain reduced anthraquinone nuclei, the compounds in question have been re-examined, and as a result this surmise is shown to be incorrect. *Anthragallol dimethyl ether* (*A*), m. pt. 209° C., when treated with alcoholic potassium acetate, gives a crystalline salt, $C_{16}H_{11}O_5K$. The ease with which the dimethyl ether can be methylated to the trimethyl ether of anthragallol, indicates that it contains a methoxy-group in the ortho position to the carbinol group. *Anthragallol dimethyl ether* (*B*), yields the same trimethyl ether as the dimethyl ether (A), but does not give a precipitate with alcoholic potassium acetate. The melting point of the dimethyl ether (B) and of its acetyl derivative are found to be 230°—232° and 176°—178° C. respectively instead of 225°—227° and 175° C. as previously stated. Experiments are described which show that in the compound (A) the methoxy-groups occupy the positions 1 : 3, and in (B) the positions 1 : 2. *Anthragallol dimethyl ether* (*C*). The amount of this substance previously isolated was so small, that a re-examination of it was not possible. Its melting point, 212°—213° C. does not agree with that of Böck's synthetic anthragallol dimethyl ether (m. pt. 159°—160° C.) and it is possibly not a distinct compound. *Alizarin a-methyl ether* forms a garnet-red potassium salt crystallising in prismatic needles, and on methylation is readily converted into alizarin dimethyl ether. *Hystazarin monomethyl ether* yields on methylation a dimethyl ether, which forms pale yellow needles, m. pt. 235°—236° C., sparingly soluble in alcohol.

Oesterle (this J., 1907, 920) has suggested that the monomethyl ether of a trihydroxymethylanthraquinone (m. pt. 216°), obtained by him from the wood of *Morinda citrifolia* is probably identical with the compound, m. pt. 200° C., isolated by Perkin and Hummel (this J., 1894 353; 1895, 27) from the root bark of *Ventilago madraspatana.* A re-examination of this compound showed that it has the melting point previously stated, and hence Oesterle's conjecture is incorrect.—A. S.

Amines; Action of halogens on aromatic ——, *and its application in the synthesis of certain dyestuffs.* A. Ostrogovich and T. Silbermann. Bul. Soc. de Stiinte din Bucuresci, 1907, **16**, 120—126. Chem. Zentr., 1908, **1**, 266.

By heating aniline with iodine, bromine, or chlorine at 140°—180° C., dyestuffs of the induline class are formed, whilst a mixture of *p*-toluidine, aniline, and iodine under similar conditions, yields *p*-rosaniline hydriodide (see this J., 1907, 604). In a similar manner, by subjecting a mixture of aniline hydrochloride and *a*-naphthylamine to the action of iodine in presence of some free aniline, a substance resembling rosinduline is produced.—A. S.

Aniline oxidations with halogen acids. A. Ostrogovich and T. Silbermann. Bul. Soc. de Stiinte din Bucuresci, 1907, **16**, 127—133. Chem. Zentr., 1908, **1**, 266.

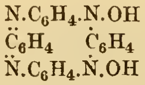
In presence of mineral acids aniline is oxidised to Aniline Black by either chloric, bromic, or iodic acid. In presence of acetic acid, on the other hand, aniline is only slightly acted upon by chloric acid, whilst by bromic acid it is converted into dianilinoquinoneanil, and by iodic acid into azophenine. For the preparation of dianilinoquinoneanil, 20 grms. of aniline are dissolved in 125 c.c. of glacial acetic acid and 150 c.c. of water, then a solution of 12·5 grms. of potassium bromate in 350 c.c. of water is added, and the whole heated for two hours on the water-bath. The compound crystallises from acetone and benzene in brownish-red needles melting at 202—203° C. It is easily soluble in acetone and benzene and slightly soluble in ether. Dianilinoquinone is formed as a by-product in the process. On melting dianilinoquinoneanil with aniline hydrochloride and aniline, a blue induline dyestuff is produced, insoluble in water and soluble in alcohol, whilst if *p*-phenylenediamine be used in place of aniline, a bluish-violet induline dyestuff, soluble in water, is obtained. *p*-Phenylenediamine and *o*- and *p*-aminophenol behave similarly to aniline when oxidised by potassium bromate in acetic acid solution. On adding a solution of 2·5 grms. of potassium iodate in 25 c.c. of water to a solution of 8 grms. of aniline in 50 c.c. of glacial acetic acid and 50 c.c. of water, aniline iodate separates in white scales which explode at 112° C. If the mixture be warmed on the water-bath, the aniline iodate dissolves, Azophenine is formed and gradually separates. Azophenine crystallises from toluene in garnet-red leaflets melting at 236—237° C.—A. S.

Induline formation. A. Ostrogovich and T. Silbermann. Bul. Soc. de Stiinte din Bucuresci, 1907, **16**, 133—141. Chem. Zentr., 1908, **1**, 266—267.

When Aniline Black is heated with excess of aniline salt to about 180° C., it is converted quantitatively into indulines. From this fact and from others, the authors draw the conclusion that the formation of indulines by the oxidation of aniline in presence of mineral acids is due to the intermediate formation of Aniline Black. (See also preceding abstract).—A. S.

Aniline Black; Constitution of ——. F. Marsden. J. Soc. Dyers and Col., 1908, **24**, 9—10.

The results of a few trials are given, which had for their object the estimation of the amount of oxygen required for the production of Aniline Black in bulk. Known quantities of chromic acid were added, in the cold, to weighed quantities of aniline, in neutral or acid solution, and the reaction allowed to proceed until the quinone smell was noticed. The quantities of aniline, chromic acid and chromium oxide remaining were then estimated. The results of five trials are tabulated, and these show that the amount of oxygen used per grm.-molecule of aniline, varied between 29·8 and 35·1 grms. Willstätter and Moore (this J., 1907, 755) have proposed the formula $(C_6H_4\frac{1}{2}N)_x$ for Aniline Black, and an analysis of the black prepared by the author gives figures which agree well with the formula, $(C_{12}H_9N_2O)$. Without offering any experimental evidence as to the manner in which the oxygen is combined, the author proposes the formula $(C_{12}H_9N_2O)_x$, $x=4$ or higher even number, indicating his idea of the manner of linking by a simplified graphic formula :—



$$\begin{array}{l} N.C_6H_4.N.OH \\ \ddot{C}_6H_4 \quad \dot{C}_6H_4 \\ \ddot{N}.C_6H_4.\dot{N}.OH \end{array}$$

—F. M.

Patents

Indigo ; Chlorinated derivatives of ——. O. Imray, London. From Soc. of Chem. Ind., Basle, Switzerland. Eng. Pat. 9546, April 24, 1907.

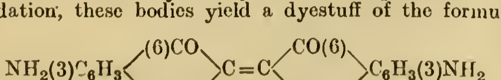
The chlorination is carried out by passing chlorine into a well-cooled mixture of 20 parts of finely-divided indigo in 200 parts of nitrobenzene. When the gain in weight amounts to 14 parts, the mass is cooled to the ordinary temperature and left to stand for 18—20 hours. The chlorinated product separates in the form of crystals, which are filtered off, washed and dried. In composition it agrees closely with the formula, $C_{16}H_9O_2N_2Cl$, and forms a crystalline, bright blue powder, soluble in strong sulphuric acid and in aniline and nitrobenzene when these are warm, but not very readily when cold. Cotton is dyed in the vat in pure blue tints, which are brighter than those obtained with indigo, and of better fastness to washing and chlorine. By the use of larger quantities of chlorine, acting for a longer time, other chlorination derivatives are produced.—F. M.

Vat dyestuff derived from indirubin and process of making same. G. Engi, Assignor to Soc. Chem. Ind. in Basle, Switzerland. U.S. Pat. 876,158, Jan. 7, 1908.

See Addition of March 23, 1907, to Fr. Pat. 372,627 of 1906 ; this J., 1907, 1135.—T. F. B.

Vat dyestuff ; Brown ——. A. Schmidt, Assignor to Farbw. vorm. Meister, Lucius und Brüning, Hochst-on-the-Maine, Germany. U.S. Pat. 872,085, Nov. 26, 1907.

By heating *m*-aminophenylthioglycollic-*o*-carboxylic acid or its acidyl derivatives with alkali hydroxides, the leuco compounds, *m*-aminooxythionaphthene carboxylic acid or *m*-aminooxythionaphthene are produced. On oxidation, these bodies yield a dyestuff of the formula,



This product is insoluble in water, alkalis, and dilute acids, but soluble in concentrated sulphuric acid with a blue coloration. With alkaline hydrosulphite solution a yellowish-brown vat is produced, which dyes wool and cotton in brown shades.—S. H. H.

Vat dyestuff ; Green-black ——. A. Schmidt, Assignor to Farbw. vorm. Meister, Lucius, und Brüning, Hochst-on-the-Maine, Germany. U.S. Pat. 872,086, Nov. 26, 1907.

By using *p*-aminophenylthioglycollic-*o*-carboxylic acid or its acidyl derivatives in place of the corresponding meta compounds, in the process described in the preceding abstract, a dyestuff is obtained analogous to the one there described, but having the amino groups in the para positions with respect to the sulphur. This dyestuff dissolves in concentrated sulphuric acid with a greenish-blue coloration, and with alkaline hydrosulphite solution it coloration, and with alkaline hydrosulphite solution it yields a yellowish-green vat from which wool and cotton are dyed in greenish-black tints.—S. H. H.

Dyestuffs of the anthracene series ; Process for preparing green to blue ——. Farbwerke vorm. Meister, Lucius und Brüning. Ger. Pat. 181,879, March 21, 1903. Addition to Ger. Pat. 172,464, March 1, 1903 (this J., 1907, 313).

Polyhydroxyanthraquinones, which have at least two hydroxyl groups in the *para*-position to one another, or their leuco-derivatives, are condensed with alkali salts of the sulphonic or carboxylic acids of aromatic amines, in presence of stannous oxide or stannous acetate. —T. F. B.

Tetra - alkyldiaminodibenzyltetrahydroxyanthraquinones ; Process for preparing ——. Farbwerke vorm. Meister, Lucius und Brüning. Ger. Pat. 184,807, May 26, 1906.

Anthrachrysone is condensed with formaldehyde in alkaline solution, and the product is heated with a dialkylaniline.—T. F. B.

Alkylated p-diaminoanthrarufins ; Process for preparing ——. Farbwerke vorm. Meister, Lucius und Brüning, Ger. Pat. 185,546, April 1, 1906.

4.8-Dihalogenated anthrarufins are treated with mono-alkylamines in presence of catalytic agents, such as metallic copper. The products are converted into dyestuffs by sulphonation.—T. F. B.

Anthraquinone series ; Process for preparing derivatives of the —— *containing nitrogen.* Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 184,808, May 26, 1906.

The products of condensation of anthrachrysone and formaldehyde in alkaline solution (see this J., 1907, 960) are heated with primary amines of the benzene series. —T. F. B.

Dyestuff ; Anthracene ——. J. Deinet, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 874,743, Dec. 24, 1907.

The new dyestuff is obtained by treating a solution of anthraquinone in sulphuric acid with copper. It is a black paste giving a dull-violet vat with alkaline hydrosulphite from which cotton is dyed brown.—J. C. C.

Dyestuff ; Anthracene ——. J. Deinet, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 874,744, Dec. 24, 1907.

By treating a solution of *a*-methylaminoanthraquinone in sulphuric acid with aluminium a dyestuff is obtained, which is a greenish-black paste giving a reddish vat with alkaline hydrosulphite from which cotton is dyed olive-green.—J. C. C.

Azo dyestuff ; Greenish-black ——. W. König, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 874,967, Dec. 31, 1907.

Claim is made for the dyestuffs obtained by combining, in alkaline solution, sulphonic acids of 1-naphthylamine compounds with alkylated 1-amino-7-naphthol. Thus 1-naphthylamine-5-sulphonic acid diazotised and combined with 1-benzylamino-7-naphthol yields a dyestuff, the sodium salt of which dissolves in water with a grayish-blue colour, and dyes wool in greenish-black shades from an acid bath. Upon reduction it yields 1-naphthylamine-5-sulphonic acid and 1-benzylamino-7-hydroxy-8-naphthylamine.—F. M.

Azodyestuff; Violet-black ——. W. König, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 874,968, Dec. 31, 1907.

Claim is made for the dyestuffs obtained by combining, in alkaline solution, sulphonic acids of 1-naphthylamine compounds with 1-amino-7-naphthol. Thus 1-naphthylamine-4-sulphonic acid diazotised and combined with 1-amino-7-naphthol yields a dyestuff, the sodium salt of which dissolves in water with a violet colour, and dyes wool from an acid bath in violet-black shades. Upon reduction, it yields 1-naphthylamine-4-sulphonic acid and 1·8-naphthylenediamine-7-naphthol.—F. M.

Anthraquinone derivative. P. Thomaschewski, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 875,390, Dec. 31, 1907.

See Eng. Pat. 13,686 of 1907; this J., 1908, 71.—T. F. B.

Anthracene dyestuff and process of making same. M. H. Isler, Mannheim, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 876,190, Jan. 7, 1908.

See Fr. Pat. 379,414 of 1907; this J., 1907, 1235.—T. F. B.

Dyestuffs capable of being chromed on the fibre; Production of ——. Badische Anilin und Soda Fabrik. Fr. Pat. 381,107, Aug. 23, 1907. Under Int. Conv., April 15, 1907.

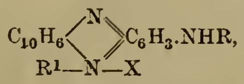
The sparingly soluble dyestuff obtained by the combination of one molecule of *oo*-tetrazophenol-*p*-sulphonic acid and two molecules of β-naphthol is rendered more soluble by treating its alkali salts with the oxides, hydroxides, carbonates or other salts of the metals of the magnesium group (except glucinum). The same effect may be obtained by preparing the dyestuff in presence of these salts.—J. C. C.

Dyestuff for preparation of lakes; Process for making a red monoazo ——. Wülfing, Dahl und Co. A.-G. Fr. Pat. 381,204, Aug. 16, 1907. Under Int. Conv., Nov. 17, 1906.

2-Naphthylamine-1-sulphonic acid is diazotised and combined with β-naphthol in presence of Turkey-red oil. It is claimed that the use of the latter renders the dyestuff particularly suitable for the preparation of lakes.—J. C. C.

Dyestuffs of the safranine series; Process for preparing ——. F. Kehrmann. Ger. Pat. 183,117, May 5, 1905.

Isorosindulines of the general composition,



where R and R^1 are fatty or aromatic radicals, and X is an acidic radical, are treated with amines. The products dye red to greenish blue shades on tannin-mordanted cotton, or they can be converted into acid wool dyestuffs by sulphonation.—T. F. B.

[Gallocyanine] dyestuffs; Process for preparing blue to greenish-blue ——. Farbwerke vorm. L. Durand, Huguenin et Cie. Ger. Pat. 182,783, Nov. 17, 1905. Addition to Ger Pat. 178,841, Feb. 12, 1905 (see this J., 1907, 681).

In the condensation of gallocyanines with carboxylic acids of aromatic amines, a certain amount of leuco-compound is formed, and not utilised. This is prevented either by oxidising the leuco-compound as it forms, or by adding some easily reducible substance to the mixture, *e.g.*, picric acid or an aromatic polynitrosulphonic acid. —T. F. B.

Lakes from azo dyestuffs, etc. Fr. Pat. 381,205. *See* XIIIA.

Azo lakes. Fr. Pat. 381,206. *See* XIIIA.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

Banana fibres. Bull. Imp. Inst., 1907, 5, 228—231.

The samples of fibres gathered in British East Africa were well prepared and of good quality and comparable with the best fibres used for rope making. Analysis of seven samples showed 10 per cent. of moisture, 2—4·8 per cent. of ash and 71—74 per cent. of cellulose. The loss on boiling with dilute alkali (α- and β- hydrolysis) varied from 10 to 25 per cent. and in this respect the fibres are inferior to those of *Musa Ensete* though somewhat superior to the *M. ulugurensis* fibre.—E. F. A.

"*Tuor*" *fibre.* Bull. Imp. Inst., 1907, 5, 233.

The fibre was pale yellow in colour and of a fair lustre. The plant yielding it was identified as *Sansevieria guineensis.* The length of staple was 3 feet and analysis showed: moisture, 8·8; ash, 1·2; α-hydrolysis (loss), 12·4; β-hydrolysis (loss), 16·1; loss on acid purification, 4·5; cellulose, 69·9 per cent. (See also this J., 1907, 757.)—E. F. A.

Cotton fibre; Effect of different reagents on the ——. W. Minajeff. Z. Farben-Ind., 1908, 7, 1—3, 17—21.

It has been stated that in mercerised and well-bleached cotton the cuticula is absent, but the author's observations do not support this contention. The cuticula contains, as incrustants, fat, wax, colouring matter, and a substance called cutin, which is insoluble in sulphuric acid, so that processes in which alkaline agents are used, such as boiling and mercerising, as also bleaching, will affect it, so far, at least, as these waxy and fatty bodies are concerned. In some cases it is difficult to distinguish the cuticula under the microscope, the different mechanical and chemical treatments increasing the difficulties of distinction. The author studied the actions of some reagents on the cotton fibre under the microscope and arrived at the following conclusions. The cuticula of the raw cotton fibre resists treatment with concentrated cuprammonium solution, fairly strong sulphuric acid (but not the concentrated acid), and concentrated alkaline liquors both during boiling and during mercerising: the cuticula of the bleached fibre has the same properties as those of the unbleached fibre although not so strongly marked. The fibre walls are soluble in concentrated cuprammonium solution and swell strongly when treated with more dilute solutions. They are dissolved by concentrated sulphuric acid, being changed to a substance of the nature of amyloid; they swell in weaker solutions, but show no change under the microscope when left for a long time in a 10 per cent. solution of the acid. They are changed during mercerising in a manner which is well known. The fibre walls suffer important changes during the process of oxidation (production of oxycellulose); they become weakened and brittle and in this state are not dissolved by cuprammonium solution. The inner protoplasmic covering of the fibre behaves somewhat similar to the cuticula. Sketches of the differently treated fibres are given. (See also Lange, this J., 1898, 917; and Hübner and Pope, this J., 1904, 404.)—S. H. H.

Ferrocyanides of sodium and potassium; New applications of the —— [in calico printing]. Sealed Note No. 1431, dated Dec. 10, 1903. A. Dondain and G. Corhumel. Bull. Soc. Ind. Mulhouse, 1907, **77**, 372—375.

1. When diazo salts are printed upon tissues prepared with alkaline solutions of β-naphthol, it frequently occurs that, in the operations of washing and soaping, the "whites" become stained owing to undecomposed diazo salts present in the tissues combining with the β-naphthol in the unprinted parts. In the case of tissues upon which diazotised *p*-nitraniline has been printed, a passage through a bath of sodium sulphite (5 grms. per litre) suffices to destroy the diazo compound, but such treatment is useless for tissues which have been printed with diazotised α-naphthylamine. For these the authors recommend a passage at full width, of half a minute's duration, through a bath of sodium ferrocyanide (5 grms. per litre) at a temperature of 60° C. When basic dyestuffs are printed along with the Naphthylamine Claret, the alkaline ferrocyanide is added to the tartar emetic bath though which the tissues are passed after steaming.

2. In the Prud'homme Aniline Black reserve style, basic dyestuffs are now printed chiefly in admixture with zinc compounds, instead of as hitherto with albumin and sodium acetate etc., on tissues padded with ferrocyanide-Aniline Black mixtures. On steaming, the Black is produced in the unprinted parts, while in the printed parts the dyestuffs become imperfectly fixed, probably as double ferrocyanides of the dyestuff base and zinc. In the subsequent chroming of the tissues, a portion of the dyestuff is washed away or is more or less fixed by the "whites" or associated discharge colours. To prevent this, the tissues, instead of being chromed, are passed through a bath of sodium ferrocyanide (5—10 grms. per litre) at a temperature of 60° C. As, however, the ordinary Aniline Black needs to be chromed to render it intense in shade and less liable to turn green on exposure, the substitution of this treatment for the chroming operation, involves the use of a padding mixture, such as one in which half the usual amount of aniline hydrochloride is replaced by rather more than this proportion of Oehler's "Ungreenable Aniline Salt," which will give a black of intense shade without chroming.

3. With the ordinary stannous chloride mixtures white reserves on Paranitraniline Red and Naphthylamine Claret are obtained with some difficulty, prolonged soaping and severe clearing being required, after the souring operation. J. Brunner observed that the addition of sodium ferrocyanide to the printing mixture facilitates the operations. Based on this discovery, the authors have put into use a printing mixture composed of: (*a*), sodium ferrocyanide (500 grms.) dissolved in British gum solution (2 kilos.); and (*b*), stannous chloride (3500 grms.), citric acid (500 grms.) and acetin (500 grms.) dissolved in British gum solution (3 kilos.), the two portions, (*a*) and (*b*), being separately prepared and then mixed together. After printing this mixture on the tissues prepared with β-naphthol, and developing, the goods are soured, washed, soaped for 5 minutes at a temperature of 60° C., and cleared with bleaching powder solution at ½° B. The "whites" thus obtained upon the red are as pure as those obtained upon the claret grounds. —E. B.

Report on the preceding article (*Sealed note No.* 1431). H. Schmid. Bull. Soc. Ind. Mulhouse, 1907, **77**, 380—381.

1. A passage of tissues printed in Naphthylamine Claret through a dilute bath of an alkali ferrocyanide has the effect, as Dondain and Corhumel claim, of preventing the "whites" from becoming stained. 2. It is possible that coloured reserves under the ferrocyanide-Aniline Black may in some instances be deeper and brighter when a treatment of the tissues with an alkali ferrocyanide is substituted for the usual one with alkali chromate or bichromate, although the advantage gained in this way must be more or less counterbalanced by the necessitated employment in the production of the Black of a more costly homologue of aniline in place of the latter. As a matter of fact, however, in the author's trials no improvement in the fixation of the basic dyestuffs was observed. 3. Stannous ferrocyanide was first applied in 1902 and, therefore, before the date of the sealed note No. 1431, as a substitute for stannous chloride in the production of discharges. Its suggested use in reserving insoluble azo dyestuffs is consequently but a slight innovation.—E. B.

Hydrosulphite-anthraquinone discharge mixture; Note on the ——. C. Sunder. Bull. Soc. Ind. Mulhouse, 1907 **77**, 382—384.

A mixture containing per kilo. 125 grms. of "Rongalite C" (sodium sulphoxylate-formaldehyde) and 7 grms. of anthraquinone, in the form of a finely-ground paste, gives on tissues dyed in α-Naphthylamine Claret a clearer discharge than does a mixture containing the same proportion of "Rongalite C," along with 0·65 grm. of Induline Scarlet per kilo. The use of mixtures containing anthraquinone is especially advantageous in the production of coloured discharges with such basic dyestuffs as are unable to withstand the severe treatment with bleaching powder solution necessary to clear the white and coloured discharges obtained with mixtures containing Induline Scarlet. It is essential that the anthraquinone should be finely ground. When the paste is sufficiently fine, the white-discharge mixture has a milky appearance. The efficiency of the discharge also depends upon the composition of the Claret, in the production of which no oil preparations must be employed in the alkaline β-naphthol solution, and calcium acetate must not be added to the diazo salt solution. The most successful results are obtained when the Claret shows a bright, full shade; one of a dull, flat shade does not discharge readily. The white discharge effected with the aid of anthraquinone does not, after the steaming operation, easily alter on exposure to air; after soaping, it is quite permanent. That obtained with Induline Scarlet, on the other hand, rapidly becomes soiled, owing to the re-oxidation of the dyestuff, during the time which elapses between the steaming and soaping operations. Treatment of the tissues with acid before soaping, which has been recommended, is unnecessary in the case of the discharges produced with anthraquinone.—E. B.

Hydrosulphite-anthraquinone discharge mixture for Naphthylamine Claret; Note on the ——. Report on C. Sunder's Communication. H. Schmid. Bull. Soc. Ind., Mulhouse, 1907, **77**, 384—386. (See preceding abstract.)

The principal catalytic agents employed in practice in conjunction with sodium sulphoxylate-formaldehyde for the purpose of producing discharge-patterns on tissues dyed in α-Naphthylamine Claret are Induline Scarlet, Patent Blue V, and anthraquinone. The first of these has been the longest used in this connection, and in regard to the proportion required, is the most effective of the three. When supplied in admixture with sulphoxylates, it is known under the names of "Rongalite C special" and "Hydrosulphite NF special," etc. It is, however, frequently preferred to apply the dyestuff in the bath of diazotised α-naphthylamine in developing the Claret, in order that the same discharge mixtures may be used for both Paranitraniline Red and α-Naphthylamine Claret. This method has the advantage of avoiding all danger of regeneration of the dyestuff in the discharged parts of the patterns by oxidation in the air. It is specially to be recommended for coloured discharges. The addition of the Scarlet to the developing bath, although the quantity employed is very minute, has a favourable influence upon the shade of the Claret, which it deepens and brightens slightly. The second compound, Patent Blue V, in the presence of glycerin and a little free formaldehyde, acts very effectively. The oxidation of the trace of dyestuff left in the reduced state in the printed parts after steaming and soaping, etc., is not, in the case of the white discharge, a drawback, as it gives this a faint blue tinge which is not objectionable. In regard to anthraquinone, the compound which has been most recently introduced into calico printing for the purpose of assisting the production of discharges (see this J., 1907, 196 and 467), the author, in general, confirms Sunder's statements concerning the great advantages gained by its use.—E. B.

Formaldehyde-sodium hydrosulphite; [Non-existence of] the so-called ——. E. von Meyer. *See* VII.

Errata.

This J., Jan. 15, 1908, page 19, col. 1, line 28 from top: *After* "temperatures" *insert* "at or somewhat."

Also, page 19, col. 1, line 29 from top: *Delete* semicolon *and* "it dissolves it."

Patents.

Dry scouring of fabrics in an extended condition. E. Ribaucourt, Roubaix, France. Eng. Pat. 83, Jan. 1, 1907.

In Eng. Pat. 29,764 of 1906 (this J., 1907, 820) there is described a machine wherein the extended fabric first travels through a dry-scouring liquid and then over a tube in which a partial vacuum is maintained. The suction tube is now placed in the scouring liquid and in this way the liquid is sucked through the fabric. The liquid may be afterwards returned to the scouring vat.—S. H. H.

Silk; Boiling-off of ——. Schmid Frères. Fr. Pat. 381,492, Nov. 10, 1906.

The vessel containing the boiling-off liquor is made of wood or other poor conductor of electricity. Two electrodes are arranged at some distance apart, so that they will not come into contact with the material, and so that a current of electricity may be passed through the soap liquor and the lather. It is claimed that with the aid of the current, the time required for boiling-off is much shortened and that the strength and brilliancy of the fibre is better than with soap unaided. To increase the conductivity of the soap liquor, small quantities of sodium acetate or phosphate may be added and to improve the strength and elasticity of the fibre, a little formaldehyde may be added as well. With skeins, a form of apparatus may be employed permitting of the boiling-off and drying being performed in one operation.—F. M.

Degumming flax and other textile fibres by hydrocarbons; Method of ——. Syndicat des Procédés Rousseau. Fr. Pat. 381,153, July 19, 1907.

Raw flax, hemp, etc., is subjected to ammoniacal fermentation and then boiled (100 parts) with a mixture of 2 parts of sodium carbonate, 1 part of sodium bisulphite and 4 parts of soap, with which is incorporated the hydrocarbon. After washing and drying, the fibre is entirely degummed and very pliable. The soap used is Marseilles soap intimately mixed with one-sixth to one-tenth of its weight of petroleum benzine. If glycerin and amyl acetate are added in the washing process, the fibre acquires considerable brilliancy.—J. C. C.

Chromic oxide on animal or vegetable fibres; Process for precipitating ——. H. Lange and R. Escales. Ger. Pat. 186,692, Jan. 18, 1905.

Fibres are impregnated with solutions of the tetrathiocyanodiammonio-derivative of chromic acid, in presence of alkalis, acids, or acid salts. The substance is prepared by heating ammonium thiocyanate with ammonium bichromate; it is decomposed by heat, chromic oxide being one of the products.—T. F. B.

Dyeing, bleaching and finishing; Wood rollers for use in ——. G. Evans and Sons, Ltd., and G. H. Evans, Manchester. Eng. Pat. 16,715, July 22, 1907.

The ends of wooden rollers suffer very much in use, and claim is here made for a metal cap, to fit over the end of the roller. The cap is fastened by means of split or bifurcated nails, which when driven through it into the wood are forced to spread, the cap thus being held firmly in position.—F. M.

Dyeing machinery. J. Sulzbach, New York. U.S. Pat. 871,376, Nov. 19, 1907.

The invention relates to the even distribution of dye on threads, fabric or yarn, to the even and effective removal of surplus dye solution, and to the production of multicoloured variegated, and shaded dyeings. The dye solution is contained in a series of bottles, which are mounted on a rotatory carrier. Sponges or some other similar porous material are placed in the necks of these bottles, and as the bottle carrier revolves, the sponges become saturated with the dye solutions. The material is caused to pass in contact with the sponges and in this way becomes impregnated with the dye solutions in certain parts. The surplus dye solution is removed by a series of cylindrical wipers which work concurrently with the dye distributors. If variegated effects are desired, the bottles contain solutions of different dyestuffs, whereas to produce shaded dyeings, solutions of different concentrations of the same dyestuff are employed. Separate wipers are used for each colour and for each of the varying concentrations of colour used in the distributing bottles. After the wiping operation, the material passes into a steam chest and then over a drying cylinder.—S. H. H.

Dyeing apparatus [for yarn]. F. N. Patterson, Lexington, N.C. U.S. Pat. 875,553, Dec. 31, 1907.

The yarn is wound on a hollow cone with perforated sides and is held in place by an expansible jacket and by a "binder" which extends across the top of the cone. The cone is mounted in a closed box. The dye-liquor enters by a pipe which projects through the bottom of the box and communicates with the perforated sides of the cone, so that the dye-liquor passes into the interior of the cone, then out through the yarn, and finally leaves the box through an outlet pipe.—A. S.

Vegetable fibres dyed with substantive dyestuffs; Ulterior treatment of ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 381,279, Aug. 26, 1907. Under Int. Conv., March 5, 1907.

The fastness of vegetable fibres dyed with substantive dyestuffs is increased by treatment with salts of magnesium and stannates. The dyed fibre may be treated for some hours in a 15 per cent. solution of magnesium sulphate, wrung out, and introduced at once into a solution containing 10—15 c.c. of caustic soda (34° B.) and 1 to 1·5 grms. of sodium stannate per litre.—T. F. B.

Cotton fabrics with effects in wool; Process for producing multicoloured ——. L. Cassella und Co. Fr. Pat. 381,495, Nov. 10, 1906.

See Eng. Pat. 25,971, 1906; this J., 1907, 1136.—T. F. B.

Dyeing yarn and tissues, and printing warps and tissues, under the influence of vacuum and of atmospheric pressure; Apparatus for ——. O. Albert. Fr. Pat. 381,120, June 6, 1907.

The apparatus consists of a tank divided into compartments and covered by a metal wire screen, above which is a web of permeable material. Any patterns or designs to be imprinted on the material are placed on this web. The level of liquid in the tank is kept constant by means of a pipe which communicates with a reservoir, the supply of dye-liquor, etc., to which is regulated by a float-valve. The material to be dyed or printed is passed slowly over the web of pervious material or over the patterns thereon, and the dyeing or printing is effected by the aid of a vacuum, a hood connected to a suitable suction apparatus being caused to pass above the surface of the material and draw up the dye-liquor, etc., through the web of pervious material. Any excess of liquor is removed from the upper surface of the dyed material by means of an endless band which passes over it.—A. S.

Discharge effects on a-Naphthylamine Claret; Production of white or coloured ——. C. Sünder. Ger. Pat. 186,050, April 6, 1906.

Anthraquinone is added to the hydrosulphite discharge paste for *a*-Naphthylamine Claret. (See this J., 1907, 196.)—T. F. B.

VII.—ACIDS, ALKALIS, AND SALTS, AND NON-METALLIC ELEMENTS.

Acetic acid; Use of —— *free of excise duty in Canada.* Board of Trade J., Jan. 16, 1908. [T.R.]

The "Canada Gazette" for 21st November last contains an Order-in-Council, dated 29th November, 1907, which provides, that acetic acid when used as a raw material in the manufacture of chromium acetate may be free of excise duty in the Dominion of Canada when it contains not more than 56 per cent. of real acetic acid by weight, and that it may be supplied to manufacturers of chromium acetate under such regulations as may be prescribed by the Department of Inland Revenue.

Catalytic reactions; Heterogeneous ——. *IV. Kinetics of contact sulphuric acid.* M. Bodenstein and C. G. Fink. Z. physik. Chem., 1907, **60**, 1—45.

The gases, sulphur dioxide and oxygen, were carefully dried over conc. sulphuric acid, mixed in the desired proportion, and introduced into a hard glass cylindrical tube (vol. about 100 c.c.) which contained the catalyzer. The latter consisted of a compact roll of platinum gauze and filled the tube as completely as possible, thus avoiding a "dead space" in the reaction vessel. The rate of the reaction was followed by measuring the decrease of pressure at constant volume. The temperature was varied between 155° and 248° C., but most of the measurements were made at 248° C. In order to detect any variation in activity (poisoning) of the platinum catalyzer during the measurements, the experiments were made in series, the first and third being with the same reacting mixture. Except when the relative amount of oxygen present was small, the rate was found to be independent of its concentration, proportional to that of sulphur dioxide, and inversely proportional to the square root of the concentration of sulphur trioxide. The variation in the activity of the platinum did not cause any change in this law. A very satisfactory explanation is furnished by the theory that the velocity of the reaction on the immediate surface of the platinum is very great, that this surface is protected by a layer of absorbed sulphur trioxide, through which the gases must diffuse, and that therefore the velocity of the reaction ordinarily depends only on the rate at which the more slowly diffusing gas (SO_2) passes through this layer of sulphur trioxide. When, however, the concentration of the oxygen is relatively small, its rate of diffusion through the sulphur trioxide layer would be, according to this theory, the determining factor in the reaction; this was found to be the case. The effect of the presence of indifferent gases (CO_2, N_2) was in agreement with the theory. The temperature coefficient for 10° was unusually small: 1·22, which also indicates that this reaction is a diffusion phenomenon. In general, the final state in an adsorption equilibrium is reached very quickly. The law of adsorption is that the amount of substance adsorbed on a given surface is proportional to the concentration of that substance in the homogeneous medium raised to a power (n) less than unity, *i.e.*, $M = KCn$. In general, n increases with the temperature and approaches unity. At the temperature of these experiments, n for sulphuric acid must be assumed to be nearly equal to 0·5 in order to explain the kinetic measurements. An attempt to prove this by direct measurement failed because the amount of sulphur trioxide adsorbed by the platinum under fixed conditions was not constant. This variation the authors connect with the poisoning of the platinum; they consider both phenomena to be due to a variation in the adsorption coefficient, K, of the above equation, caused by the presence of extremely small quantities of impurities.

Ammonium molybdate; Hydrolysis of —— *in presence of iodides and iodates.* S. E. Moody. Amer. J. Science, 1908, **25**, 76—78.

According to Glassmann (this J., 1905, 211) on boiling a solution containing potassium iodide, potassium iodate, and ammonium molybdate, the last-named salt is hydrolysed according to the equation:

$$3(NH_4)_6Mo_7O_{24},4H_2O = 9(NH_4)_2MoO_4 + 12H_2MoO_4,$$

and the molybdic acid then reacts with the iodide and iodate, with liberation of iodine:

$$12H_2MoO_4 + 20KI + 4KIO_3 = 12K_2MoO_4 + 12I_2 + 12H_2O.$$

As the author had previously found that certain ammonium salts are hydrolysed completely when their solutions are distilled in presence of a mixture of potassium iodide and iodate (see this J., 1907, 199), he carried out similar experiments with ammonium molybdate, and found that in this case also, hydrolysis is complete, Glassmann's results being vitiated by reaction between the ammonia produced by hydrolysis and the iodine liberated from the iodide-iodate mixture. To obtain correct results it is necessary to conduct the vapours from the distilling flask through sulphuric acid, in order to absorb the ammonia, before absorbing the iodine in potassium iodide solution.—A. S.

Chlorates and perchlorates in reduction processes; Behaviour of ——. D. Venditori. Gaz. chim. ital., 1907, **37**, II., 383—386.

The action of finely-divided metallic aluminium affords a means of distinguishing between chloric acid and perchloric acid in aqueous solution. On treating a solution of potassium or ammonium perchlorate with sulphuric acid and finely-divided aluminium, a vigorous reaction ensues, but no chloric acid or hydrochloric acid is produced. On the other hand, if potassium chlorate in aqueous solution be heated with sulphuric acid and aluminium, it is reduced quantitatively to chloride.—A. S.

Chlorates, bromates, iodates, and periodates; Determination of ——. H. Brunner and R. Mellet. *See* XXIII.

Calcium and magnesium compounds; Colloidal and gelatinous ——. C. Neuberg. Sitzungsber. Kgl. Pr. Akad. Wiss. Berlin, 1907, 820—821. Chem. Zentr., 1908, **1**, 102.

In continuation of earlier work (this J., 1906, 926), the author describes the preparation of some gelatinous and colloidal calcium and magnesium salts. By dissolving calcium oxide in methyl alcohol, a liquid which is opaque in reflected light, is obtained, and from this the sulphate, phosphate and oxalate can be precipitated in the gelatinous condition by addition of the respective acids.

On saturating the methyl alcoholic solution with carbon dioxide, a clear strongly viscous liquid is obtained, which after being concentrated to the consistence of thick collodion, solidifies to a jelly soluble in methyl alcohol. A similar jelly is formed when carbon dioxide is led into a suspension of calcium oxide in wood spirit. Colloidal calcium carbonate, like the corresponding barium salt, is miscible with benzene, toluene, chloroform, and anhydrous ether, and is soluble in fats. "Magnesia usta" when shaken with methyl alcohol, dissolves to a colloidal alkaline solution, from which the colloidal phosphate, oxalate and carbonate can be prepared. The separated gelatinous calcium and magnesium salts contain no combined methyl alcohol. Colloidal barium carbonate dissolved in methyl alcohol will not dialyse into water. —A. S.

Calcium oxide and sulphur ; The reaction between ——. R. W. Thatcher. J. Amer. Chem. Soc., 1908, **30**, 63—68.

Solutions prepared by boiling calcium oxide and sulphur with water have been used extensively in America as insecticides for scab on animals and insects on fruit trees, and the author has studied the reactions which take place during the preparation of such solutions. Two characteristic compounds, namely calcium pentasulphide and calcium thiosulphate, alone are formed, small amounts of sulphite and sulphate occasionally found resulting from the oxidation of the true products of the reaction. One part of calcium oxide was found to combine with 2·24 parts of sulphur, this proportion being slightly less in the presence of excess of calcium oxide and probably due to the solubility of calcium oxide in water. Any excess of calcium oxide or of sulphur remained uncombined in the mixture. Concentrated solutions, made by boiling the ingredients together until the maximum amount of sulphur was dissolved which would remain in solution after cooling, were analysed and found to contain per 100 c.c. :—Sulphur, total, 17·65 to 35·89 grms. ; as pentasulphide, 14·00 to 34·29 grms. ; as thiosulphate, 1·23 to 4·10 grms. ; as sulphite and sulphate, 0·12 to 0·81 grm. ; calcium oxide, total, 8·17 to 14·28 grms.—W. P. S.

Barium carbonate, carbon, and nitrogen ; Influence of additions of barium chloride on the reaction between ——. O. Kühling and O. Berkhold. Ber., 1908, **41**, 28—32.

The experiments were carried out with mixtures of barium carbonate and carbon alone, and with addition of 2, 5, 10, 15, 20, and 30 per cent. respectively of barium chloride, at temperatures ranging from 900 to 1200° C. The results show that on addition of more than 2 per cent. of barium chloride, the temperature at which the mixture of barium carbonate and carbon begins to absorb nitrogen, is reduced, but at temperatures at which the mixture without any addition will absorb nitrogen, no quantitative acceleration of the absorption by addition of barium chloride could be observed. The yield of cyanide was either approximately the same or else somewhat less in presence of barium chloride than when the salt was not added. The yield of cyanamide-salt was diminished by addition of barium chloride. The yields of both cyanide and cyanamide-salt were smallest in presence of the largest addition of barium chloride. (See also this J., 1907, 147.)—A. S.

Formaldehyde-sodium hydrosulphite ; [Non-existence of] the so-called ——. E. von Meyer. J. prakt. Chem., 1908, **77**, 61—64. (Compare this J., 1906, 472.)

It is already known that by the action of formaldehyde on sodium hydrosulphite solution, the two compounds formaldehyde-sodium bisulphite and formaldehyde-sodium sulphoxylate are obtained, instead of the supposed formaldehyde-sodium hydrosulphite (this J., 1904, 1211 and 1905, 329). It would appear, from a consideration of the facts which follow, that these substances do not separate as a double salt, nor exist as such in the solution. (*a*) Fractional precipitation by methyl alcohol throws out most of the bisulphite compound. (*b*) Fractional crystallisation at 0° C. and at 25° C. yields mixtures of the two, in varying proportions, the less soluble sulphoxylate preponderating at first ; and these results are confirmed by fractionating a solution made from the two salts themselves in molecular proportions. On mixing solutions of the two salts there is no change of temperature or of viscosity. (*c*) An examination by the thermometric method, as well as by the dilatometric method, shows that no transition point exists between the temperatures — 14° C. and +55° C.—F. Sodn.

Water, mercuric chloride and potassium chloride ; Equilibrium in the system ——. W. Tichomirow. J. Russ. Phys.-Chem. Ges., 1907, **39**, 731—743. Chem. Zentr., 1908, **1**, 11—12.

Determinations of the solubility of mixtures of potassium chloride and mercuric chloride at 20° C. gave the following results, the figures representing grms. of the salts dissolved by 100 grms. of water :—

$HgCl_2$	0	2·1	5·97	10·28	13·06	15·76	18·00
KCl .	34·41 (A)	35·32	36·35	37·87	38·77	39·66	40·80
$HgCl_2$	19·33	20·33	21·98	24·30	27·71	30·63	35·16
KCl .	41·33 (B)	40·70	38·72	37·72	36·80	35·54	34·34
$HgCl_2$	38·56	39·34	41·15	42·84	42·38	39·10	34·83
KCl .	34·13	34·18	34·21	34·12 (C)	33·23	30·32	26·31
$HgCl_2$	29·00	26·12	25·70	22·87	20·60	20·17	19·93
KCl .	20·35	17·57	17·13	15·00	11·37	9·88	8·95
$HgCl_2$	21·24	22·03	24·70	25·48	26·41	26·00	25·66
KCl .	8·17	7·78	7·46	7·43	7·39 (D)	7·09	6·71
$HgCl_2$	25·24	25·14	25·13	25·14	25·16	22·17	16·91
KCl .	6·31	5·79	5·60	5·12	4·84 (E)	4·05	2·87
$HgCl_2$	15·72	11·63	(7·39)				
KCl .	2·39	1·12	0 (F)				

Analyses showed that the solid phases corresponding to the different portions of the solubility curve were as follows :—Along A B, KCl ; along B C, $HgCl_2, 2KCl$; along C D, $HgCl_2$, KCl ; along D E, $2HgCl_2$, KCl ; and along E F, $HgCl_2$.—A. S.

Silicon ; Analysis of commercial ——. F. Limmer. Chem.-Zeit., 1908, **32**, 42.

The following method, based on the volatility of silicon tetrachloride, was found to give trustworthy results for the separation of silicon from silica. A weighed portion of about 0·5 grm. of the sample is placed in a porcelain boat and heated for 3 hours in a combustion tube through which is passed a current of dry, oxygen-free chlorine. The boat must be maintained at a bright red heat and the heating is not commenced until the tube is filled with chlorine. In the case of simple mixtures of silicon and silica, the course of the action of the chlorine on the silicon can be followed readily : the mixture glows until only a white residue of silica is left. Commercial samples of silicon may, however, contain carborundum and other impurities which colour the residue, so that the end of the reaction is only ascertained by re-weighing and again heating the boat and its contents in a current of chlorine until a constant weight is obtained. The boat is allowed to cool in the current of chlorine before being weighed. A second portion of the sample is fused with a mixture of sodium and potassium hydroxides in order to obtain the total amount of silicon and silica ; this operation also enables the iron, calcium, etc., present in the sample to be determined. An analysis of commercial silicon yielded the following results :—Silicon, 95·27 ; iron together with a little aluminium, 2·35 ; non-volatile residue, 2·35 per cent. This residue consisted principally of silica and magnesium chloride, traces of calcium, phosphorus, and carborundum being also present. Determinations of the quantities of residue left after treatment with chlorine were also made in the case of several samples of crystallised, fused, and amorphous silicon. The results obtained were:—Amorphous silicon, 23·24, 57·32, and 65·56; fused silicon, 11·90, and 2·35; crystallised silicon, 1·47 and 1·56 per cent. of residue. From this it will be seen that amorphous silicon, as sold, is frequently very impure, whilst the crystallised variety is almost free from silica. During the experiments it was noticed that crystallised silicon was much more readily attacked by chlorine than amorphous silicon. It might be mentioned that the iron and aluminium present in the samples volatilised as chlorides together with the silicon tetrachloride. It was proved by experiment that neither pure silica nor the porcelain boat underwent any loss in weight when heated in the current of chlorine.—W. P. S.

Ozone; Acid properties of ——. W. Manchot and W. Kampschulte. Ber., 1907, **40**, 4984—4990.

Ozone conducted into liquid ammonia cooled by means of a mixture of solid carbon dioxide and acetone gives an intense orange-red coloration, which disappears, on removing the ammonia from the cooling mixture, even at a temperature at which the ammonia still remains liquid. Hydrogen peroxide may be detected even after the liquid has become colourless again. At the ordinary temperature ozone fumes on contact with ammonia, and also with strong organic bases such as methylamine, piperidine, aniline, toluidine, etc. The authors were unable to detect any trace of nitrite in the fumes formed with ammonia. The oxides of magnesium, calcium, strontium and barium decompose ozone at the ordinary temperature. When cooled by means of solid carbon dioxide and acetone, barium oxide gives a yellow coloration with ozone, whilst calcium oxide gives a fainter coloration, and magnesium oxide none, the stability of the compounds formed thus decreasing with the atomic weight, in an analogous manner to *e.g.* the carbonates of the alkali metals. The combination of ozone with caustic alkalis is accompanied by an evolution of heat. Faint but unmistakable reactions of hydrogen peroxide are observed in the products of the interaction of ozone and sodium peroxide, and strong reactions in the case of the ozone derivatives of potassium, rubidium, and cæsium hydroxides. The ozone compound of sodium hydroxide is decolorised when heated in a current of 8 to 9 per cent. ozone at about 90° C., that of potassium hydroxide at about 110° C. and that of rubidium hydroxide at about 140° C. In the case of cæsium hydroxide the colour becomes very faint at 160° C., but is still perceptible above the m. pt. (200° C.) and up to 220° C. Lithium hydroxide decomposes ozone, but gives no coloration at the ordinary temperature. Strong ozone fumes in moist air, and the fumes have an acid reaction towards indicators. It is also stated to make water electrically conductive, although Gräfenberg (Z. anorg. Chem., **36**, 355) affirms the contrary. In the authors' opinion the acid properties of ozone must be partially attributed to decomposition products of the compounds first formed. Thus the compound that fumes with ammonia must be such a decomposition product, since the primary derivative of ozone and ammonia decomposes below 0° C. (see also Ber., **40**, 2894).—C. A. M.

Ozone, nitrogen peroxide, and hydrogen peroxide; Detection of —— *in gas mixtures.* E. H. Keiser and L. McMaster. *See* XXIII.

Patents.

Sulphuric acid; Manufacture of ——. N. L. Heinz, La Salle, Ill., and M. F. Chase, Mineral Point, Wis. U.S. Pat. 875,909, Jan. 7, 1908.

The burner gases are passed successively through a Glover tower, a system of flues, and a Gay-Lussac tower. Steam and nitric acid are admitted to the flue-system in quantities sufficient to convert only a portion of the sulphur dioxide into sulphuric acid, and to condense the sulphuric acid mist produced. Different proportions of steam are introduced at different parts of the flue-system, so as to produce acid of different strengths, "appropriate to the elimination of different impurities." The purified and dried gases from the flue-system are passed through a contact apparatus and then through an absorption tower. The Gay-Lussac tower is fed with acid of more than 60° B., obtained by diluting the acid from the absorption tower with acid from the Glover tower and if necessary with acid from a portion of the flue-system.
—A. S.

Sulphur dioxide from moist combustion gases; Process of separating —— *by cooling the mixture.* J. Babé and H. Pape. Fr. Pat. 381,454, Sept. 2, 1907. Under Int. Conv., Sept. 10, 1906.

See Eng. Pat. 19,973 of 1907; this J., 1908, 75.—T. F. B.

Caustic alkali or alkali carbonate; Process for decomposing the chlorides, nitrates and other salts of the alkalis to produce ——. J. Masson. Fr. Pat. 381,441, Aug. 31, 1907.

Hydrofluoric acid, generated by the action of sulphuric acid on calcium fluoride, is led into a vessel containing a solution of, say, sodium chloride. A precipitate is thus produced consisting of sodium fluoride combined with one equivalent of hydrofluoric acid. The hydrochloric acid liberated remains in solution in the liquid which is drawn off and concentrated. The sodium fluoride precipitate, collecting on a movable false bottom in the vessel, is withdrawn, and placed in a drying chamber. The hydrofluoric acid thus driven off is led back into the vessel, containing a fresh quantity of sodium chloride, in order to effect a further decomposition. The sodium fluoride, coming from the drying chamber, is mixed with water and calcium hydroxide or calcium carbonate. On heating the mixture, sodium hydroxide or sodium carbonate, as the case may be, is obtained in solution and calcium fluoride is precipitated and used again for the production of hydrofluoric acid in the cycle of operations.—G. W. McD.

Zinc oxide from zinc ores; Process of obtaining ——. H. L. Sulman, London. U.S. Pat. 875,866, Jan. 7, 1908.

See Eng. Pat. 21,672 of 1906; this J., 1907, 1144.—T. F. B.

Ferrous carbonate; Composition for the production of ——. J. K. Lilly, Assignor to E. Lilly and Co., Indianapolis, Ind. U.S. Pat. 876,366, Jan. 14, 1908.

The claims are for a composition consisting of a solution of a ferrous salt and an alkali carbonate in a neutral liquid (*e.g.*, glycerol) miscible with water, and forming a protection against oxidation of the ferrous salt.—A. S.

Lithium compounds; Process of preparing pure ——. W. E. Wadman, Bayonne, N.J., Assignor to Hygienic Chemical Co., New Jersey. U.S. Pat. 876,851, Jan. 14, 1908.

Solutions containing the sulphates of lithium and potassium are treated with sufficient ammonia to render the potassium sulphate insoluble and to precipitate any iron, aluminium and manganese as hydroxides. The precipitate is removed, the ammonia expelled from the solution, and the lithium then precipitated as carbonate.—A. S.

Chrome alum; Manufacture of —— *for use in tanneries and otherwise.* E. Meyzonnier, fils. Fr. Pat. 381,152, Sept. 2, 1907.

A solution of sodium or potassium bichromate is reduced by sulphur dioxide in presence of sulphuric acid, the proportions being indicated by the equation:—
$23H_2O + Na_2Cr_2O_7 + 3SO_2 + H_2SO_4 = Cr_2Na_2(SO_4)_4,24H_2O$.
The reaction takes place immediately, and the solution may be used as such or set to crystallise. A soluble acid sulphite may, if desired, be substituted for sulphur dioxide, to effect the reduction of the alkali bichromate.
—E. S.

Antimony oxides; Process and apparatus for condensing ——. Miniere e Fonderie d'Antimonio Soc. Anon. Fr. Pat. 381,517, Sept. 4, 1907.

The fumes from furnaces in which antimony ores, or antimonial by-products are roasted, are drawn, sometimes after previous cooling, through a series of bags of cotton,

linen, or the like suspended in a closed chamber. The chamber has a sheet-iron roof which is cooled by means of water or air. The antimony oxide collects in the bags, whilst the gaseous products pass through and are withdrawn from the chamber through a suitable outlet.
—E. S.

Hydrogen peroxide ; Process for the manufacture of ——. F. Fischer, Berlin. Eng. Pat. 20,868, Sep. 19, 1907. Under Int. Conv., Oct. 20, 1906.

Steam, either alone, or mixed with oxygen or other gases, is blown against incandescent solid substances or against voltaic arcs, a series of sparks, etc. The source of heat may also be moved towards the current of steam ; the mutual movement of the source of heat and of the steam towards one another must be at a speed of at least 1 metre per second. When the steam is condensed subsequently, the hydrogen peroxide formed condenses with it. (See also this J., 1906, 808.)—W. P. S.

Hydrogen peroxide ; Stable solution of —— *and method of making same.* W. Heinrici, Halle on Saale, Germany. U.S. Pat. 876,179, Jan. 7, 1908.

See Addition to Fr. Pat. 356,880 of 1905 ; this J., 1906, 1219.—T. F. B.

(1). *Silicon ; Method of making* ——. (2), *Silicon monoxide ; Art of producing* ——. (3), *Silicon ; Method of making* ——. (4), *Silicon carbide ; Method of making* ——. (5), *Silicon dioxide ; Method of making* ——. (6), *Silicon monoxide ; Method of producing* ——. (7), *Silicon monoxide powder ; Method of preparing* ——. H. N. Potter, New Rochelle, N.Y. Assignor to G. Westinghouse, Pittsburg, Pa. U.S. Pats. 875,285 ; —6 ; 875,672 ; —3 ; —4 ; —5 ; —6. Dec. 31, 1907.

(1). Silicon is produced by heating together one equivalent each of silicon monoxide and carbon. (2). A powder containing silicon monoxide is produced by highly heating silicon under reduced pressure, in presence of oxygen (air) insufficient to form silica. (3). Silicon monoxide is reduced to silicon by heating with silicon carbide. (4). Silicon carbide is produced by heating a mixture of one equivalent of silicon monoxide and two equivalents of carbon. (5). Silicon dioxide, in a comminuted condition, is made by oxidising silicon monoxide, for example, by blowing an oxidising gas through a furnace in which silicon monoxide is being formed. (6). Silicon monoxide is produced by heating a mixture of granular silicon and granular silica in an indifferent atmosphere, under reduced pressure. (7). Vitreous silicon monoxide, either alone or with the addition of a suitable "reactive mixture," is distilled, under reduced pressure, in an electric furnace, in the absence of oxidising gases. The following are references to the subject of silicon monoxide : (Eng. Pats. 26,788 and 12,210 ; U.S. Pats. 830,739 and 830,740, and Fr. Pat. 366,644 ; this J., 1907, 434, 684, 938, 939 and 1056 ; also this J., 1907, 1277).
—A. S.

Graphite ; Method of disintegrating ——. E. G. Acheson, Stamford, Canada. U.S. Pat. 875,881, Jan. 7, 1908.

Graphite is ground together with a "soluble body," whereby the two are intimately mixed and the graphite is disintegrated. The mixture is then treated with a solvent liquid to dissolve the soluble body.—E. S.

VIII.—GLASS, POTTERY, AND ENAMELS.

Lime-alumina-silica mixtures ; Fusibility of ——. R. Rieke. Stahl u. Eisen, 1908, 28, 16—19.

The materials chosen for the mixtures were pure precipitated calcium carbonate, ground quartz sand containing 99·6 per cent. of silica, and ground alumina of the requisite purity for the production of aluminium. The materials were dried at 120° C., and weighed quantities were mixed with water into a thin paste, which was passed through a fine sieve several times, and then evaporated to dryness, and the residue, with the addition of some starch paste was made into small cones similar to Seger cones. The fusibility tests were made in an electric furnace, provided with a fine-grained carbon resistance, the test-pieces being mounted on plates of graphite, and not of fireclay, on account of the fluxing action of the lime present. The temperatures at which the test-pieces softened were measured by comparing them with the bending produced in Seger cones in the furnace at the same time, except that from cone No. 14 upwards, comparison was made with some cones, designated as Z-cones, which give slightly higher readings than the Seger cones bought in the open market. In order to secure a uniform rate of heating, intervals of 4 to 5 minutes were allowed to elapse between the bending over of one cone and that of the next higher-melting cone in the series. The mixtures examined, do not for the most part correspond with definite silicates or di-silicates, and do not possess true melting points, but pass more or less rapidly through all stages of viscosity from the solid to the molten condition. Four series of tests were made, in each of which the molecular relation of alumina to silica was kept constant, namely at 1 : 1, 1 : 2, 1 : 3, and 1 : 4 respectively, whilst the quantities of lime added were increased in the members of each series from 0·1 to 12 mols. of CaO to 1 mol. of pure aluminium silicate. The general formulæ are :—Series I., $Al_2O_3.SiO_2.0{\cdot}1—12\ CaO$; Series II., $Al_2O_3.2SiO_2.0{\cdot}1—12\ CaO$; Series III., $Al_2O_3.3SiO_2.0{\cdot}1—12\ CaO$. Series IV., $Al_2O_3.4SiO_2.0{\cdot}1—12\ CaO$. The tables given below, in which the expression +15 signifies a temperature between cones 15 and 16, and —15, a temperature somewhat under cone 15, show the maximum and minimum temperatures observed in the first three series, and the composition of the members of the series with those melting points. In each series, the pure aluminium silicates of course possess maximum melting points. The lowest-melting member of Series IV., with a composition $Al_2O_3.4SiO_2,3CaO$, melts at about 1225° C., but the curve representing the melting points of this series does not show any noticeable maxima, and follows a more continuous course than the curves of the other series. The mixtures possessing maximum, and probably those possessing minimum melting points, apparently correspond with definite di-silicates, many of which are unknown at present, though the mixture, $Al_2O_3.2SiO_2.CaO$, the first maximum in Series II., occurs in nature as anorthite, and the mixture, $Al_2O_3.3SiO_2.3CaO$, which gives one of the minimum values of Series III., corresponds with a pure lime-alumina-garnet. In a general way, from the last mentioned minimum given in each series, the melting points show a continuous rise with increasing amounts of CaO. Mixtures containing more than 50 per cent. of CaO, on being slowly cooled after being previously completely fused, crack into a microcrystalline powder.

Table I.—*Maximum melting points.*

Series.	Molecular composition.	Percentage content of :—			M. pt. cf cone in	
		Al_2O_3.	SiO_2.	CaO.	Z-cones.	° C. (Approx.)
I.	$Al_2O_3.\ SiO_2$	62·9	37·1	—	+38	About 1850°
I.	$Al_2O_3.\ SiO_2.\ 2CaO$	37·2	22·0	40·8	—26	,, 1550°
II.	$Al_2O_3.\ 2SiO_2$	45·8	54·2	—	—36	,, 1780°
II.	$Al_2O_3.\ 2SiO_2.\ CaO$	36·6	43·3	20·1	18—19	,, 1515°
II.	$Al_2O_3.\ 2SiO_2.\ 4CaO$	22·9	27·0	50·1	19	,, 1525°
III.	$Al_2O_3.\ 3SiO_2$	36·0	64·0	—	33	,, 1725°
III.	$Al_2O_3.\ 3SiO_2.\ CaO$	30·1	53·4	16·5	15—16	,, 1450°
III.	$Al_2O_3.\ 3SiO_2.\ 2CaO$	25·9	45·8	28·3	10	,, 1350°
III.	$Al_2O_3.\ 3SiO_2.\ 4CaO$	20·1	35·7	44·2	7	,, 1285°
III.	$Al_2O_3.\ 3SiO_2.\ 6CaO$	16·5	29·3	54·2	19—20	,, 1530°

Table II.—*Minimum melting points.*

Series.	Molecular composition.	Percentage content of :—			M. pt. of cone in	
		Al_2O_3.	SiO_2.	CaO.	Z-cones.	° C.
I.	$Al_2O_3 . SiO_2 . CaO$	46·7	27·7	25·6	9—10	About 1340°
I.	$Al_2O_3 . SiO_2 . 3CaO$	30·9	18·3	50·8	11	,, 1360°
II.	$Al_2O_3 . 2SiO_2 . 0·45CaO$	41·2	48·7	10·1	+15	,, 1440°
II.	$Al_2O_3 . 2SiO_2 . 2CaO$	30·5	36·1	33·4	− 7	,, 1280°
II.	$Al_2O_3 . 2SiO_2 . 5·9CaO$	18·5	21·8	59·7	+13	,, 1400°
III.	$2Al_2O_3 . 6SiO_2 . CaO$	32·8	58·2	9·0	14—15	,, 1420°
III.	$4Al_2O_3 . 12SiO_2 . 7CaO$	26·8	47·5	25·7	+9	,, 1340°
III.	$Al_2O_3 . 3SiO_2 . 3CaO$	22·6	40·2	37·2	6—7	,, 1270°
III.	$Al_2O_3 . 3SiO_2 . 5CaO$	18·1	32·2	49·7	+6	,, 1265°
III.	$2Al_2O_3 . 6SiO_2 . 13CaO$	15·8	28·0	56·2	19	,, 1525°

—W. C. H.

Patents.

Glass-working furnaces. I. A. Milliron and C. W. Irwin, Franklin, Pa., U.S.A. Eng. Pat. 18,162, Aug. 10, 1907.

The apparatus consists of a small furnace, of rectangular shape, mounted on a truck, which can be moved on rails to or from a tank or other supply of molten glass. The furnace can be rotated on the truck in a horizontal plane. A pot is fixed in each end of the top of the furnace, and a heating chamber is arranged beneath each pot. A hood, provided with a heating chamber, is mounted on the top of the furnace, and constructed in such a way that it can be moved to cover either of the pots. Fuel is supplied to the several heating chambers by a system of pipes, provided with swivel and telescopic joints. There is an opening in the bottom of each of the pots, through which any excess glass left after the drawing operation can be emptied out, before the pot is re-filled. Each opening is provided with a closure, which is raised or lowered by means of levers, actuated by the rotation of the furnace. —W. C. H.

Sheet glass ; Mode of and means for the manufacture of ——. F. Oppermann, St. Servais-lez-Namur, Belgium. Eng. Pat. 20,975, Sept. 21, 1907.

This patent refers to modifications of the apparatus described in Eng. Pat. 21,721 of 1906 (see Fr. Pat. 369,986 ; this J., 1907, 203). The glass sheet is not cooled in a vertical chamber or chimney, but by means of hollow or solid cylinders maintained at the required temperature to ensure the gradual cooling of the sheet. The cylinders or rollers are supported by two frames, which can be rotated about a horizontal axis, situated in the same vertical plane as the axis of rotation of the pot. Some of the cylinders serve to guide, support, or draw the glass sheet, whilst other cylinders are arranged between these, and by touching them tangentially, form a closed space, in which air circulation is prevented, and through which the sheet can pass. A closed chamber, for annealing the sheet, is arranged over the drawing slot, and between it and the first cooling roller.—W. C. H.

Glass ; Process of moulding and colouring devitrified ——. L. A. Garchey and C. Bourqui. Fr. Pat. 380,926, Oct. 23, 1906.

A hollow mould is filled with granulated glass, and heated for the requisite time, and at a temperature sufficiently high, to cause complete devitrification, and the whole is then allowed to cool. The finest-grained glass is filled into the bottom of the mould, and the coarser-grained above it. The moulds consist of a mixture of plaster of Paris and ground refractory materials, such as fire-brick, faïence, porcelain, etc. They may be provided with covers of the same material, which exert a certain pressure on the glass during the devitrification. The coloration of the objects is effected by putting, on those parts of the bottom of the mould corresponding with the parts of the object to be coloured, a suitable mixture of finely-powdered white glass and a colouring material, and devitrifying the whole mass. Grooves of any shape can be formed on the wrong side of the objects by arranging cores of plaster on the top of the mass of glass to be devitrified, and withdrawing them when the mass has cooled.—W. C. H.

Kilns for firing or drying ceramic and similar wares. A. Meakin, Ltd., and W. Jackson, Tunstall, Staffs. Eng. Pat. 28,297, Dec. 12, 1906.

A set of two or more kilns for firing and drying ceramic ware is provided with a producer-gas flue with branches under each kiln, a secondary air flue with branches adjacent to the gas flues, and with outlets for the air and gas from these branch flues. Each kiln is provided with at least one combustion chamber which passes up on one side of the kiln, over the top, down the other side, and then under the floor and around the kiln again, extending finally to a branch of the chimney flue. Each kiln has a cold-air inlet at its lower part and a hot-air outlet at its upper part communicating with the secondary air flue, and so arranged with dampers that the secondary air to support combustion in one or more kilns which are being fired, can be drawn through and heated by the goods which have been fired and are cooling in another kiln or kilns. The chimney flue may be provided with a recuperator arranged to heat the secondary air passing to the main secondary flue. In this case, the secondary air is heated by passage through a previously fired kiln only during the first stage of firing ; when the cooling kiln has become so cold as not to heat the air sufficiently any more, the chimney flue will be hot enough to do so, and the secondary air is admitted through the recuperator. —A. G. L.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Patents.

Marbles, stones, granites, or limestones ; Process of manufacture of artificial ——. A. Mora, fils, and C. Mora, père. Fr. Pat. 381,227, Nov. 3, 1906.

The base of these artificial stones is a suitable mixture of basic magnesium carbonates, double silicates of potassium and calcium, and of potassium and aluminium, calcium carbonate, and fibrous asbestos ; this mixture being moistened and worked up with a liquid consisting of water, hydrochloric acid, magnesia, alum, and caustic potash. The mass obtained may be rendered impervious to water and acids by immersing it in a bath containing a mixture of paraffin, oil of turpentine and petroleum spirit (" mineral essence ").—W. C. H.

Refractory material and its application in the manufacture of slabs, bricks, tubes, muffles, crucibles, receivers, etc. P. J. E. Velter. First Addition, dated July 27, 1907, to Fr. Pat. 376,179, Mar. 28, 1907.

The carborundum in the substance described in the principal patent (this J., 1907, 1010) is replaced by other compounds made at a high temperature, *e.g.*, carbides, silicides, chromite, alumina, etc.—A. G. L.

Stones called "salpêtreuses"; Means to render unattackable by nitre and to arrest altogether the attack by nitre ("salpêtrisation") of ——. J. A. Leucerand. Fr. Pat. 381,260, Aug. 24, 1907.

The stones are washed with water, impregnated with an aqueous solution of copper sulphate, and coated with mortar or plaster which has been mixed with water containing a little copper sulphate.—A. G. L.

Malachite, lapis-lazuli, agate and marbles in general; Substance imitating ——. L. J. Teissier. Fr. Pat. 381,337, Aug. 28, 1907.

Finely-ground ophite or green serpentine is mixed with an aqueous solution of magnesium chloride. The pasty mass is tinted according to the stone to be imitated, and spread out on a smooth nickel or copper plate to dry for about 12 hours.—A. G. L.

Clay; Process and apparatus for sorting and purifying ——. M. Bohn. Fr. Pat. 381,486, Nov. 9, 1906.

Clays to be sorted and purified are fed into a cylinder, the greater part of the length of which is occupied by an endless screw which forces the clay forwards over one or more screens attached to the wall of the cylinder. The endless screw is in intimate contact with the inner surface of the screens, which are perforated with holes of equal or varying size, through which clays, ready for use, are discharged. The stones and other impurities in the clays cannot pass through the perforations in the screens, and are carried forward by the endless screw into a closed space at the further end of the cylinder, this space having neither screw nor screens, but only an opening, the size of which can be regulated, for the removal, when necessary, of the accumulated impurities.—W. C. H.

Cement or cementitious material from slag; Manufacture of ——. Collos Portland Cement Co. Ltd., London. From H. Colloseus, Berlin. Eng. Pat. 15,764, July 9, 1907.

Milk of lime, and a solution of salts of the alkalis, alkaline-earths, or earthy metals are introduced separately, but simultaneously, into hot liquid slag, in quantities small enough to ensure that the solutions are at once completely evaporated. (See also Fr. Pat. 356,276 of 1905; this J., 1905, 1307.)—W. C. H.

Cement; Manufacture of ——, or of a similar material, by means of slag. Latin Countries Cement Co. Fr. Pat. 381,132, July 8, 1907.

Cement is manufactured from hot, liquid blast-furnace slag by injecting into it, in a very finely-divided condition, small quantities of one or more of the following hydroxides, viz., of the alkalis, alkaline-earths, or of iron or aluminium. The process may be conveniently carried out in the apparatus described in Fr. Pat. 356,379 of 1905 (this J., 1906, 26).—W. C. H.

X.—METALS AND METALLURGY.

Rusting of iron. A. Schleicher and G. Schultz. Stahl u. Eisen, 1908, **28**, 50—53.

The experiments made consisted chiefly in measuring the voltage obtained by immersing clean and rusty plates of wrought-iron and cast-iron in water, and connecting them electrically. The author finds that if the E.M.F is zero, or remains constant, both the plates used are affected in the same way, *i.e.*, are oxidised to the same extent. If the E.M.F. changes, one plate is acted on more strongly than the other. The largest E.M.F. obtained between two wrought-iron plates was 0·36 volt, the current produced being about 0·00018 ampère. On connecting a rusty wrought-iron plate with a clean one, it was found that the latter acted as cathode, iron being dissolved, and the voltage falling rapidly. In a pair of clean wrought-iron and cast-iron plates, the cast-iron plate formed the cathode; the E.M.F. at first obtained fell to nearly zero, rose again after a time, and finally remained constant, both plates becoming oxidised. Experiments made on planings showed that both cast-iron and wrought-iron rusted more rapidly in water containing both carbon dioxide and air than in water containing only carbon dioxide. (See also this J., 1907, 1051.)—A. G. L.

Ruthenium in platinum alloys; Detection of ——. N. A. Orlow. Chem.-Zeit, 1908, **32**, 77.

A portion of the alloy is melted with lead, the regulus treated with nitric acid, and the residue ignited in the air in order to expel the osmium. The residue, containing platinum, iridium, rhodium, and ruthenium is heated with a mixture of potassium nitrate and potassium hydroxide, and after cooling, the mass is extracted with water, and excess of nitric acid added to the solution, when the following reaction takes place: $2K_2RuO_4 + 4HNO_3 = RuO_4 + Ru(OH)_4 + 4KNO_3$. The brown liquid is poured into a beaker or test-tube, and the latter covered with a piece of filter-paper. If the alloy contained ruthenium, the paper will be blackened in the course of 12—24 hours, owing to the liberation of vapours of ruthenium tetroxide. It is stated that 0·01 grm. of ruthenium can be easily detected in this way. Care must be taken that the whole of the osmium is removed, as this gives a similar reaction.—A. S.

Manganese ores; their uses, occurrence, and production. Bull. Imp. Inst., 1907, **5**, 273—293.

Manganese ores for metallurgical purposes are quoted at so much per ton for each unit per cent. of the metal present, but if below the standard, which in the United Kingdom is fixed at 50 per cent., the price per unit is diminished by about ½d. for every unit per cent. of the deficiency. There is not much demand for ores containing less than 40 per cent. of manganese. The price per unit reached 15d. in 1900, fell to 10d. in 1904, but has now risen to 14d. Deductions are made for any excess of phosphorus and silica present which seriously depreciate the value of the ore. In the United States the standard is 49 per cent. and 1 c. per unit is deducted for each 0·02 per cent. of phosphorus in excess of 0·1 per cent., and 15 c. per ton for each per cent. of silica in excess of 8 per cent. The percentages of some of the principal constituents of some of the manganese ores of commerce are shown in the following table:—

Origin.	Mn.	Fe.	SiO_2.	P.
Russia—				
Caucasus high grade .	52·2	0·41	5·22	0·13
Do. low do. .	45·5	—	7·38	0·48
Ekaterinenberg	53·7	0·86	8·10	trace
Brazil—				
Average 1900	53·35	—	1·02	0·03
India—				
Gosalpur	54·29	1·41	3·27	0·16
Spain—				
Huelva carbonate ore .	41·15	0·77	14·10	—
Greece—				
Milos average	34·73	3·00	22·92	0·06
Japan—				
Average	48·86	—	10·40	0·08
United States—				
Virginia, Crimora mine	57·29	0·37	—	0·08

The consumption of manganese ores by the countries which utilises the greatest amount is as follows :—

	1903.	1904.	1905.
	Tons.	Tons.	Tons.
Germany	260,568	303,110	309,658
United Kingdom	232,682	213,931	253,174
United States	148,881	111,665	261,146

The amounts in metric tons and values of the manganese ores mined in the chief producing countries are given below :—

	1903.		1904.		1905.	
	Metric tons.	Value £.	Metric tons.	Value £.	Metric tons.	Value £.
Australia	1,425	5,605	843	3,540	1,541	5,925
Austria	6,179	—	10,189	—	13.788	—
Belgium	6,100	3,141	485	174	—	—
Brazil*	161,926	248,010	208,260	306,799	224,377	332,827
Canada*	82	570	112	556	20	353
Chile	17,110	—	2,324	—	1,324	—
Cuba	21,070	24,771	17,683	18,269	12,133	12,230
France	11,583	11,676	11,254	11,189	6,751	7,949
Germany†	47,994	25,458	52,886	28,934	51,463	29,277
Greece	9,340	11,204	8,549	5,147	8,171	4,861
United Kingdom†	831	656	8,897	4,370	14,706	11,634
Italy	1,930	2,327	2,836	3,438	5,384	5,869
India	174,562	151,530	152,707	129,632	257,970	248,309
Japan	5,616	3,828	4,324	3,604	11,162	8,546
New Zealand	71	210	199	570	56	165
Russia*	458,948	618,906	485,228	660,638	357,796	467263
Spain	26,194	18,183	18,732	5,237	26,020	7,475
Sweden	2,576	2,376	2,471	2,475	2,150	2,153
United States†	2,870	5,693	3,197	6,040	4,184	8,239

*Exports only. †Value at mines.

These figures are exclusive of manganiferous iron and zinc ores. In 1906 the output of manganese ore for India was nearly half a million metric tons.—E. F. A.

Alloys ; Electro-potential and nature of metallic ——. *IV.* N. Puschin. J. Russ. Phys.-Chem. Ges., 1907, **39**, 869—897. Chem. Zentr., 1908, **1**, 108—110. (See this J., 1907, 826, 1141 ; 1908, 77.)

Lead alloys. (*a*) *Lead-copper alloys.*—It is confirmed that the two metals form neither chemical compounds nor solid solutions. (*b*) *Lead-silver alloys.*—Potential measurements indicate the formation of solid solutions of lead in silver, but the maximum concentration could not be fixed. (*c*) *Lead-bismuth alloys.*—Evidence was obtained of solid solutions of lead in bismuth, but not of bismuth in lead, although Kurnakow and the author found by the pyrometric method that solid solutions of bismuth in lead containing up to 35 atoms of bismuth per cent. are formed. (*d*). *Lead-antimony alloys.*—Solid solutions of lead in antimony are formed, containing up to 12 atoms of lead, per cent. (*e*). *Lead-arsenic alloys.*—Alloys containing up to 15 atoms of arsenic per cent. are soft, but those containing about 30 atoms of arsenic per cent. are hard and brittle and exhibit a distinct crystalline structure. The potential measurements indicate the existence of solid solutions of lead in arsenic, but no evidence of compounds of the two elements was obtained (compare Descamps, Compt. rend., **86**, 1065 ; also Shemtschushny, J. Russ. Phys.-Chem. Ges., **37**, 1283 ; and Friedrich, Metallurgie, **3**, 41). *Alloys of tin with metals of the iron group.*—The potential measurements were made in *N*/1 potassium hydroxide solution in which tin behaves as a less " noble " metal than the metals of the iron group. (*a*) *Tin-nickel alloys.*—By addition of small quantities of nickel to tin or of tin to nickel, the hardness of either metal is considerably increased. Potential-measurements indicate the existence of a compound, SnNi. The alloy of this composition has a pinkish-violet colour, is very brittle, and has an E.M.F. lower than that of either of the component metals. (*b*). *Tin-cobalt alloys.*—These are analogous to the tin-nickel alloys, and here also the compound, SnCo, has an E.M.F. lower than either of the two metals of which it is composed. (*c*). *Tin-manganese alloys.*—The potential measurements indicate the existence of a compound, $SnMn_3$, and probably also one of the composition, MnSn. The alloys containing up to 30—40 atoms of manganese per cent. are white and soft ; those with about 50 atoms of manganese per cent. are hard and occasionally porous. With still larger proportions of manganese, the alloys become brittle, the one containing 66 atoms of manganese per cent. being the most brittle ; this alloy has an " earthy " appearance and falls to powder when filed. The alloys containing about 75 atoms of manganese per cent. are crystalline, hard and brittle. (*d*). *Tin-iron alloys.*—The alloys are relatively soft, and those containing about 80 atoms of iron per cent. exhibit a granular crystalline fracture. The existence of a compound, $SnFe_4$, is indicated by the potential-measurements. (*e*). *Tin-chromium alloys.*—Those containing up to nearly 90 atoms of chromium per cent. are soft, resembling tin, whilst those richer in chromium are hard and brittle. There appears to be no formation of compounds or of solid solutions.

As a general result of the whole investigation, the author concludes that the method of measuring the electro-potential is capable of furnishing trustworthy information of the nature of alloys. The intermetallic compounds formed correspond generally to the usual types. For example, the metals belonging to the first three groups of the periodic system unite with metals of the fifth and sixth groups and partly also with those of the fourth group to form compounds of the type of the corresponding hydrogen compounds.—A. S.

Lead-antimony alloys ; Hardness and micro-structure of ——. A. Saposhnikow and J. Kaniewski. J. Russ. Phys.-Chem. Ges., 1907, **39**, 901—907. Chem. Zentr., 1908, **1**, 110—111.

The hardness of the alloys was determined according to Brinell's method, a steel ball of 10 mm. diameter being forced into the metal by means of a weight of 100 kilos. The relative hardness of the different alloys (expressed in kilos. per sq. mm.) is shown in the following table :—

% Sb	0	2	4	6	8·3
Hardness	4·31	6·36	8·00	10·60	12·05
% Sb	10·4	12	13	14	17
Hardness	13·25	15·90	17·70	15·90	13·25
% Sb	20	45	74·3	82·3	100
Hardness	15·90	18·75	21·20	27·60	30·80

These results when compared with the cooling curve of the alloys as determined by Gosselin, show that the eutectic alloy (13 per cent. of antimony) exhibits a relative maximum of hardness; this alloy also, according to Charpy, shows a relative maximum resistance to compression. It is also capable of being tempered.—A. S.

Cadmium-zinc alloys; Hardness and micro-structure of ——. A. Saposhnikow and M. Sacharow. J. Russ. Phys.-Chem. Ges., 1907, **39**, 907—914. Chem. Zentr., 1908, **1**, 111.

The hardness was determined by forcing a steel ball of 10 mm. diameter into the alloy under a pressure of 500 kilos. The results (expressed in kilos. per sq. mm.) were as follows:—

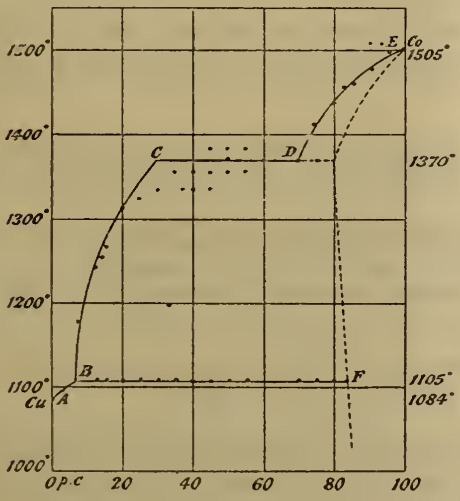
% Zn	0	10	12·5	17·2	17·6	20
Hardness	15·9	31·5	33·0	36·8	38·8	34·5
% Zn	24·4	30	40	50	60	70
Hardness	32·2	27·2	31·2	35·0	34·0	34·5
% Zn	79	80	81	82·2	90	100
Hardness	43·0	52·0	46	39·0	39·0	35·0

As in the case of lead-antimony alloys (see preceding abstract), the eutectic alloy (17·6 per cent. of zinc) exhibits a relative maximum of hardness. There was also a second (absolute) maximum of hardness shown by the alloy containing 80 per cent. of zinc. The limits of elasticity (kilos. per cm.) of the alloys were as follows:—

% Zn	0	3	10	17·2	20	30
Limit of elasticity ..	245	688	747	840	866	742
% Zn	50	60	70	80	90	100
Limit of elasticity ..	778	750	775	745	698	750

Here also the eutectic alloy gives a maximum value. Microscopic examination of the alloys indicates that solid solutions containing from 93 to 95 per cent. of zinc are formed.—A. S.

Cobalt-copper alloys. N. Konstantinow. J. Russ. Phys.-Chem. Ges., 1907, **39**, 771—777. Chem. Zentr., 1908, **1**, 111—112.



The cooling curve of the alloys is composed of four distinct branches: AB, BC, CD, and DE (see figure). The portion, AB, corresponds to the separation from the liquid metal of solid solutions of cobalt in copper, which at B attain the maximum content of 6·5 atoms of cobalt per cent. At this point also, solid solutions of copper in cobalt containing 15 atoms of copper per cent., make their appearance. From B the curve rises to C, at which point a decomposition of the melt into two co-existent liquid phases occurs. Along the branch DE, solid solutions of copper in cobalt separate. The formation of solid solutions in the alloys corresponding to the branches AC and DE was confirmed by examination of the micro-structure of the alloys. The formation of layers (*i.e.*, two liquid phases) in the alloys corresponding to the branch CD, could be observed distinctly, on microscopic examination, only in the case of alloys to which a small percentage of carbon had been added.—A. S.

Patents.

Iron ores; Concentration of argillaceous ——. T. Twynam, Redcar. Eng. Pat. 1615, Jan. 22, 1907.

Impure carbonated argillaceous iron ores are calcined in the absence of free oxygen, thus forming magnetic iron oxide and a gas which may be purified and utilised for heating purposes. The oxide of iron is separated from the gangue by magnetic means, and used for the extraction of iron in the blast furnace.—B. N.

Scale and oxide from metallic surfaces; Process for removing —— *and preparing metallic surfaces for coating with other metals and materials.* S. O. Cowper-Coles, London. Eng. Pat. 4313, Feb. 21, 1907.

The metal plate, etc., to be treated, is heated in a closed box into which pure hydrogen gas is passed so as to anneal the plate and reduce the scale to metal. Towards the end of the operation there is introduced into the box hydrogen which has been passed through or over a molten metal, *e.g.*, zinc, whereby a thin coating of this metal is produced on the plate. (See Eng. Pats. 12,452 and 23,664 of 1906; this J., 1907, 928.)—A. G. L.

Furnaces [for case-hardening, etc., of steel]; Gas-heated ——. A. W. Onslow, Woolwich. Eng. Pat. 5342, Mar. 5, 1907.

The furnace is provided with a table or bed for supporting the articles to be treated, the table being supported on a partition or baffle-plate extending longitudinally across the furnace, thus forming cells on either side of the partition under the table. The heating gases are injected through lateral inlets, and, striking the baffle-plate, they are deflected around and on to the table, the products of combustion escaping through suitable outlets at the top of the furnace. Muffles may be substituted for the table, the baffle-plate projecting upwards between the muffles, so that the gas is deflected and made to pass completely round the exterior of the muffles.—B. N.

Ores and the like; Separation of the constituents of ——*, and apparatus therefor.* The Morgan Crucible Co., Ltd., London. From H. P. Herbert, Travancore, India. Eng. Pat. 6010, Mar. 12, 1907.

The invention consists in separating graphite (and other minerals) from associated gangue by gently dropping the crushed material, which may have been previously treated with oil, on to a thin sheet of water flowing down an inclined plane, over a body of water in a trough, and finally over a weir. An improved separation is now effected by leading the overflowing water down a second incline and over another weir, or down a series of inclines and over a succession of weirs. The inclinations of the different planes should be adjustable for different ores, and the first plane should have the least inclination.
—A. G. L.

Aluminium; Process or means for soldering ——. F. F. Payne, London. Eng. Pat. 14,157, June 19, 1907.

For soldering aluminium the lead contained in the alloy described in Eng. Pats. 3310 and 3310a (this J., 1907, 258, 259) is replaced by about 3 per cent. of silver, the alloy used consisting of 4½ lb. of tin, 1½ lb. of zinc and

3 oz. of silver. It is made by melting the ingredients together with about 1 oz. of tartaric acid per 20 lb. of alloy, and granulating the alloy or casting it into sticks as usual.—A. G. L.

Aluminium; Solder for ——. T. J. Wibrin and R. Wibrin. Fr. Pat. 380,952, July 27, 1907. Under Int. Conv., May 7 and July 10, 1907.

The solder consists of an alloy of tin, zinc, and copper, *e.g.*, tin, 1,000; zinc, 750; and copper, 100 grms. —O. F. H.

Briquetting iron and other ores, blast-furnace flue dust and the like; Method of ——. H. Wedekind, London. From F. W. Dünkelberg, Wiesbaden, Germany. Eng. Pat. 14,538, June 24, 1907.

Iron ore, flue dust, etc., is briquetted by mixing it with kieselguhr and kieserite or carnallite (Stassfurth waste salts) in suitable proportions to form silicates melting at a low temperature.—A. G. L.

Metallic alloy and its process of manufacture. P. I. Juppont and J. Teil, Toulouse, France. Eng. Pat. 16,351, July 16, 1907. Under Int. Conv., July 16, 1906.

See Fr. Pat. 368,370 of 1906; this J., 1907, 52.—T. F. B.

Metal alloy. E. Haynes, Kokomo, Ind. U.S. Pat. 873,745, Dec. 17, 1907.

The alloy consists of cobalt with more than 10 per cent. and less than 60 per cent. of chromium.—O. F. H.

Metal alloy. E. Haynes, Kokomo, Ind. U.S. Pat. 873,746, Dec. 17, 1907.

The alloy consists of nickel with more than 30 per cent. and less than 60 per cent. of chromium.—O. F. H.

Metallic composition [*anti-friction alloy*]. C. J. Reed, Philadelphia, Pa. U.S. Pat. 874,866, Dec. 24, 1907.

The composition is an anti-friction metal consisting of lead, arsenic and copper. The proportion of lead present exceeds that of the arsenic, which latter should not amount to less than 10 per cent., but its proportion is to be greater than that of the copper.—A. G. L.

Alloy for use in steel-casting; Process of producing an ——. M. Meslans, Paris. U.S. Pat. 875,668, Dec. 31, 1907.

See Eng. Pat. 14,693 of 1902; this J., 1903, 96.—T. F. B.

Steel alloy; Process of manufacture of ——. W. Rübel. Fr. Pat. 381,091, Aug. 23, 1907.

A self-hardening steel of high tensile strength is made by adding vanadium carbide to an alloy of iron and nickel, manganese, chromium or tungsten, the amount of vanadium added varying from 0·3 to 3 per cent.—O. F. H.

Alloy; Metallic —— *resembling silver.* E. Barraja. Fr. Pat. 381,347, Aug. 29, 1907.

The alloy is composed of, silver, 566·67; copper, 1000; and zinc, 433·33 parts.—A. G. L.

Alloy. L. M. Becker and E. F. Lamb. Fr. Pat. 381,552, Sept. 6, 1907. Under Int. Conv., July 18, 1907.

See Eng. Pat. 16,504a of 1907; this J., 1907, 1283.—T.F.B.

Coating metals; Process for ——. F. Plathner and V. Dorn, Berlin, Germany. Eng. Pat. 17,613, Aug. 1, 1907.

Mixtures or alloys of lead and zinc, or of tin and zinc, having a melting-point below that of lead, are mixed, in the form of fine powder, with a flux, *e.g.*, ammonium chloride, or zinc chloride, and with a liquid, *e.g.*, water or alcohol, which readily and completely evaporates. The mixture is applied to the metal to be coated, and is either allowed to dry and then the whole heated until the alloy melts, or the metal is at once heated.—A. G. L.

Solutions [*from ore pulp*]; *Method of recovering* ——. W. A. Hendryx, Denver, Colo. U.S. Pat. 870,289, Nov. 5, 1907.

A charge of the material is introduced into a tank, preferably rectangular, having a converging bottom. The upper part of the tank contains a number of filter cells each consisting of a rectangular wooden framework covered with a filter-bag. The interior of each filter cell is connected at its lower end with a main discharge pipe. The bottom of the tank is covered with a layer of canvas secured by cleats, and serves as a distributor for the wash water which enters by pipes opening into the spaces beneath the canvas filter. The wash water or solution thus enters from below, rises through the charge and is discharged through the filter cells. The upper part of the tank is provided with stopcocks at different levels for drawing off any solution that may be clear enough to require no further filtering. The accumulated pulp is discharged by a sludge gate in the bottom of the tank.—O. F. H.

Ores; Process of treating ——. F. M. Johnson, San Francisco, Cal. U.S. Pat. 873,943, Dec. 17, 1907.

Sulphide and arsenical pyritic ores are placed in a tank, agitated with a solution ot caustic soda, and at the same time subjected to an electric current of high amperage and low voltage. The contents of the tank are then transferred to a cyanide tank, and treated with cyanide solution in the presence of caustic soda.—O. F. H.

[*Finely-divided*] *Ores; Process of treating* ——. J. Savelsberg, Papenburg, Germany. U.S. Pat. 875,852, Jan. 7, 1907.

Finely-divided ores, free from sulphur, are mixed with slag-forming materials and carbonaceous fuel, and the mixture is "blown" in a converter until sintered. —A. G. L.

Detinning and producing tin compounds and other products; Method for ——. E. A. Sperry, New York. U.S. Pat. 874,040, Dec. 17, 1907.

Tin scrap is dried and then treated with chlorine in the presence of anhydrous stannic chloride. The tin scrap and chlorine are supplied continuously, and means are provided for controlling the temperature of the reaction. —O. F. H.

Detinning and producing tin compounds and other products; Method of ——. E. A. Sperry, Brooklyn, N.Y. U.S. Pat. 875,632, Dec. 31, 1907.

The tin scrap is treated with chlorine in the presence of an anhydrous liquid such as stannic chloride. The gaseous products obtained, or only the gaseous products left after condensation by cooling, are treated with water. —A. G. L.

Wrought-iron or steel; Process of manufacturing ——. J. A. Potter, Los Angeles, Cal. U.S. Pat. 874,536, Dec. 24, 1907.

Iron containing only a small amount of carbon is made directly from iron oxide, by continuously feeding ore into a furnace in which it is met by a reducing gas and by flames from burning fuel, the last being in sufficient quantity to melt the iron reduced by the former. (See next abstract.)—A. G. L.

Wrought-iron or steel; Apparatus for producing —— direct from ore. J. A. Potter, Los Angeles, Cal. U.S. Pat. 874,537, Dec. 24, 1907.

The apparatus consists of a furnace, and apparatus for charging the ore into it. A stack is connected with the furnace, and serves to heat a still to which a pipe supplies crude oil, another pipe serving to draw off the residues from the still. A third pipe conveys the hydrocarbon vapour from the still into the furnace, the vapour being forced to pass through the body of ore in the furnace so as to reduce the ore. Air conduits controlled by dampers maintain and promote combustion of the hydrocarbon vapour at the surface of the body of ore, thereby highly heating the latter. (See preceding abstract.) —A. G. L.

Cementation process. M. Ruthenburg. Fr. Pat. 381,531, Sept. 5, 1907.

See Eng. Pat. 19,547 of 1907; this J., 1907, 1286.—T. F. B.

Copper and other metals from roasted pyrites; Extraction of ——. A. Tixier and C. Tortel, Assignors to Les Prod. Chim. de Croissy, Paris. U.S. Pat. 875,012, Dec. 31, 1907.

See Fr. Pat. 364,512 of 1906; this J., 1906, 935.—T. F. B.

Smelter smoke; Process of treating —— and extracting values from ores or metallurgical waste products. S. S. Sörensen and G. C. Westby, Murray, Utah. U.S. Pat. 875,222, Dec. 31, 1907.

The sulphurous "smelter smoke" is caused to act on finely-divided ores or metallurgical waste products in a moist or wet state, with constant agitation. Metallic salts of sulphur acids are obtained in solution.—A. G. L.

Thermic [metallurgical] process. H. Goldschmidt, Assignor to Th. Goldschmidt, Essen on Ruhr, Germany. U.S. Pat. 875,345, Dec. 31, 1907.

See Addition to Fr. Pat. 361,197 of 1905; this J., 1906, 765.—T. F. B.

Zinciferous ores and metallurgical products; Process for the treatment of ——. J. H. Gillies, Auburn, Victoria. U.S. Pat. 875,424, Dec. 31, 1907.

See Eng. Pat. 1004 of 1906; this J., 1907, 618.—T. F. B.

Ores; Apparatus for leaching —— and the subsequent separation of the liquids from the solids. J. H. Gillies, Auburn, Victoria. U.S. Pat. 875,425, Dec. 31, 1907.

See Eng. Pat. 994 of 1906; this J., 1907, 617.—T. F. B.

Zinc and lead sulphide ores; Process of treating ——. A. H. Imbert, Grand-Montrouge, France. U.S. Pat. 875,578, Dec. 31, 1907.

See Eng. Pat. 10,303 of 1906; this J., 1906, 933.—T. F. B.

Sulphurous ores; Metallurgical treatment of —— by the precipitation process. A. H. Imbert, Grand-Montrouge, France, Assignor to Imbert Process Co., New York. U.S. Pat. 875,579, Dec. 31, 1907.

See Eng. Pat. 10,303 of 1906; this J., 1906, 933.—T. F. B.

Zinc ores (calamines, oxides, silicates); Metallurgical method of treating oxidised —— by the precipitation process. A. H. Imbert, Grand-Montrouge, France, Assignor to Imbert Process Co., New York. U.S. Pat. 875,580, Dec. 31, 1907.

See Eng. Pat. 10,303 of 1906; this J., 1906, 933.—T. F. B.

Lead and zinc; Process for the treatment of complex sulphide ores of ——. E. Vuigner. Fr. Pat. 381,038, Oct. 26, 1906.

A mixture of the raw ore, roasted ore, carbon and a flux such as salt or fluorspar is melted in a reverberatory furnace with the production of sulphide of zinc and metallic lead containing the precious metals, if present. —O. F. H.

Zinc; Process for the extraction of —— from its sulphide ores, especially those containing copper. E. Vuigner. Fr. Pat. 381,039, Oct. 26, 1906.

The ore is rendered fusible by the addition of a small quantity of a fusible chloride or fluoride, such as salt or fluorspar, and then melted in a reverberatory furnace. When melted, the charge in the reverberatory furnace is transferred in the molten state to a converter, carbon is added, and air blown through the charge. The sulphur is oxidised to sulphur dioxide, the zinc is reduced, volatilised and recovered as zinc oxide, while any copper present remains either as metal or as sulphide in the converter. —O. F. H.

Smelting-furnace with oil fire. A. Koch, Hanover-List, Germany. U.S. Pat. 876,275, Jan. 7, 1908.

See Fr. Pat. 367,470 of 1906; this J., 1906, 1154.—T. F. B.

Platinum; Apparatus for melting ——. R. Berton. Fr. Pat. 380,936, July 10, 1907.

A shallow magnesia crucible in which the platinum is melted in the direct flame of a blow-pipe for two gases, *e.g.*, coal-gas and oxygen, and an arrangement for tilting the crucible.—O. F. H.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(*A.*)—ELECTRO-CHEMISTRY.

Electric furnace reactions under high gaseous pressures. R. S. Hutton and J. E. Petavel. Phil. Trans. Roy. Soc., 1908, A, **207**, 421—462.

Two steel chambers of 20 and 2 litres capacity respectively provided with valves, windows and insulated electrode holders have been constructed and employed at working pressures up to 200 atmospheres. Inside these pressure-vessels any desired arrangement for arc or resistance heating is mounted. Apart from the influence of pressure, which was the primary object of the investigation, special attention was paid to the effect of the nature of the gaseous atmosphere upon the reactions. Some measurements were made of the electrical constants of carbon and metal arcs in different gases at high pressures, and the rate of oxidation of heated metals was also considered. With a charge of 10 kilos. of lime and carbon, the preparation of calcium carbide was studied in atmospheres of carbon monoxide, coal gas, and hydrogen under reduced and high pressures. Contrary to expectation no unfavourable influence of carbon monoxide upon the yield was noticeable, the back reaction being limited to the surface.

Silica fused under pressure exhibits a marked decrease in vaporisation but no appreciable increase in fluidity and transparency. The production of carborundum under pressure is much limited owing to this decreased volatility of silica.

The authors as a result of a long detailed investigation of the reduction of alumina, conclude that this oxide is reducible by carbon at all temperatures above the melting point, but the metal is set free in the form of vapour and can only be collected if it be protected from reaction with carbon monoxide.—R. S. H.

Patents.

Furnaces ; Electric induction ——. The Gröndal Kjellin Co., Ltd., and J. Härdén, London. Eng. Pat. 29,019, Dec. 19, 1906.

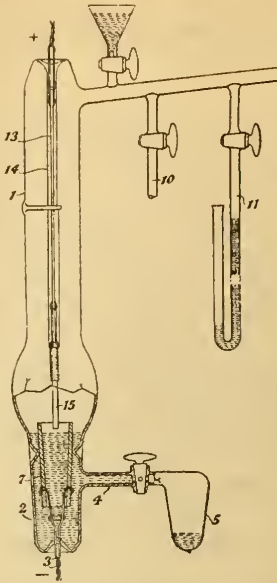
In order to employ polyphase alternating currents in the working of electric induction furnaces, one or more transformers are directly or indirectly combined with the furnace, so as to convert the current of the supply main into single-phase current in the furnace. Thus, the primary winding of the furnace may be connected to the secondary windings of one or more transformers, the primary windings of the latter being connected to the different phase windings of a polyphase system, the connections being such that the currents induced in the secondary windings are all in the same direction, but possess the same phase differences, corresponding or proportionate to those of the polyphase system. With a two-phase system, the two transformers may be connected into a single transformer, or the transformers may be combined with the furnace itself, so that the windings of the transformers are wound upon the outer members of the core of the furnace, and the middle member may or may not be provided with windings. With a three-phase system, any suitable method, such as Scott's, may be employed to convert it into a two-phase system, and afterwards, as above described, into a single-phase system in the furnace.—B. N.

Furnace ; Granular [electric] ——. H. N. Potter, New Rochelle, N.Y., Assignor to G. Westinghouse, Pittsburg, Pa. U.S. Pat. 875,284, Dec. 31, 1907.

The furnace comprises a vertical hollow body of refractory material held in position by a plate of refractory material through which it passes. This hollow body is partially surrounded by granules of graphite retained between walls of a refractory material having an electrical conductivity lower than that of graphite. The granules of graphite are pressed together between electrodes of refractory material, one or both of which may be movable, so that they can be kept continuously pressed against the graphite.—A. S.

Refractory materials [for incandescence filaments] ; Treatment of —— by electricity. The British Thomson-Houston Co., Ltd., London. From General Electric Co., Schenectady, N.Y. Eng. Pat. 1197a, Jan. 16, 1907.

The refractory material, for example boron, is rendered suitable for the manufacture of incandescence filaments, by subjecting it to the action of a vapour electric arc, in the presence of an inert gas which serves to concentrate the heating effect of the arc on a portion of the material. The material, 15, is suitably mounted in a hermetically sealed chamber, 1, by means of a carbon rod or tube attached to a rod, 13, surrounded by a protecting sleeve, 14. The vessel, 1, is exhausted, and mercury is allowed to flow in to make contact in the cathode chamber, 2, with the rod, 15. The inert gas, such as hydrogen, is introduced through the tube, 10, and the pressure is suitably regulated by the manometer, 11. To start the arc, mercury is run out through the tube, 4, into the vessel, 5, and the arc is prevented from wandering over the cathode surface by means of an alumina cup, 7, supported on the wires, 3.—B. N.



Insulating electric conductors ; Processes of ——. The British Thomson-Houston Co., Ltd., London. From the General Electric Co., Schenectady, N.Y. Eng. Pat. 4363, Feb. 21, 1907.

A coating of flexible enamel is applied to the conductor as described in Eng. Pat. 4346 of 1903, the coating being then hardened, after which a similar enamel, containing a material of a non-drying character, is applied.—B. N.

Insulating material and processes for making the same. The British Thomson-Houston Co., Ltd., London. From the General Electric Co., Schenectady, N.Y. Eng. Pat. 5574, Mar. 7, 1907.

Silica and an oxide or hydroxide of a heavy metal, such as zinc or lead, are mixed with a binding material, such as asbestos, and the whole is moistened, moulded into form, and treated with dry steam under pressure, in order to cause chemical action, with the production of a hydrous silicate of the metal.—B. N.

Secondary or storage battery. H. Rodman and G. M. Howard, Philadelphia, Assignors to The Electric Storage Battery Co. U.S. Pat. 875,213, Dec. 31, 1907.

See Eng. Pat. 5957 of 1907 ; this J., 1907, 1204.—T. F. B.

Electrical generators for flour bleaching, and subsidiary purposes. F. H. Loring, London. Eng. Pat. 3724, Feb. 15, 1907.

The invention relates to dynamo electric machines for simultaneously activating air for the bleaching of flour and supplying a current for lighting and other purposes. They are provided with an armature or winding which furnishes current to, or takes current from, a sparking commutator, through or over which air is circulated by means of a pump built into one of the bearings. Various patterns of machines are described.—J. F. B.

Filaments for electric incandescent lamps, &c. U.S. Pat. 874,938. *See* II.

Metallic filaments, &c. Fr. Pat. 381,515. *See* II.

Saturated fatty acids, etc. Ger. Pat. 187,788. *See* XII.

(*B.*)—ELECTRO-METALLURGY.

PATENTS.

Iron ; Electro-deposition of ——. S. O. Cowper-Coles, London. Eng. Pat. 29,300, Dec. 22, 1906.

IRON is deposited electrolytically from a solution of ferrous sulphate as electrolyte, the latter being maintained slightly acid by the employment of insoluble anodes in conjunction with soluble anodes.—B. N.

Steel ; Manufacture of ——, *and electro-metallurgical induction furnaces for use therein.* H. Biewend, Frankfort-on-the-Maine. Eng. Pat. 18,398, Aug. 14, 1907. Under Int. Conv., Aug. 14, 1906.

SEE Fr. Pat. 380,800 of 1907, this J., 1908, 28.—B. N.

Electroplating ; Apparatus for ——. S. O. Cowper-Coles, London. Eng. Pat. 16,098, July 12, 1907.

THE apparatus comprises a vat, the bottom of which forms the cathode, and which contains an endless band carrying a series of anode bars electrically connected together by a flexible wire. Between the anode bars, wood carriers or blocks are attached to the band, so as to draw the materials to be plated from the inlet to the outlet end. A series of such vats may be used for continuously carrying out the complete processes of cleansing, plating and washing the articles.—B. N.

Metals ; Apparatus for depositing ——. W. A. Hendryx, Denver, Colo. U.S. Pat. 866,859, Sept. 24, 1907.

THE apparatus, which is intended to be used principally for depositing gold, silver and copper from their cyanide or other solutions, consists of an anode surrounded by a cathode of mercury or an amalgam of mercury and zinc enclosed between two stout walls of porous material, having suitable inlet and outlet.—O. F. H.

Copper electrotypes ; Apparatus for the manufacture of ——. S. O. Cowper-Coles, London. U.S. Pat. 875,784, Jan. 7, 1908.

SEE Eng. Pat. 4668 of 1905 ; this J., 1906, 322.—T. F. B.

Nickel ; Process for the recovery of —— *from ore.* C. H. Ehrenfeld and J. R. Grove, York, Pa. U.S. Pat. 868,769, Oct. 22, 1907.

THE powdered ore mixed with an electrolyte is placed in a porous jar contained in a bath of the electrolyte. By placing in the jar a carbon conductor, the jar and its contents constitute the anode, and the nickel is deposited on a suitable cathode. As an example of a suitable electrolyte, a solution may be used composed of water, 80 per cent. ; sulphuric acid, 10 per cent. ; and ammonium acetate, 10 per cent.—O. F. H.

[*Copper-nickel*] *Metallic ores and matte ; Method of extracting* ——. E. Günther and R. Franke, Eislcben, Germany. U.S. Pat. 875,259, Dec. 31, 1907.

GARNIERITE and magnetic pyrites containing nickel and copper are smelted to a regulus rich in copper and nickel. This regulus is used as the anode in an electrolytic bath containing copper sulphate and free sulphuric acid. The anode slime formed is roasted and treated with spent electrolyte from the above process, the liquid being then again used as electrolyte with a copper-nickel regulus as anode. When sufficiently rich in nickel, the electrolyte is freed from the last portions of copper and other impurities by treatment with substances containing nickel suboxide. The resulting solution of pure nickel sulphate is then electrolysed, using an insoluble anode.—A. G. L.

Chromium ; Process for the manufacture of pure —— *by means of commercial ferrochrome or of a natural oxide such as chromite.* E. Viel. Fr. Pat. 381,266, Aug. 26, 1907.

FERROCHROME, or a mixture of chromite with sufficient carbon to reduce the chromium only, is fused at 3500° C. in an electric furnace with a basic silicate of lime and aluminium, which readily takes up the iron but not the chromium. The product is purified by melting it in an electric Bessemer furnace with a little oxide of chromium, using a flux composed of lime and a little silica, and blowing air through the molten metal to remove iron and carbon.—A. G. L.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

Oil seed of Croton Elliotianus. Bull. Imp. Inst., 1907, **5**, 237—238.

THE decorticated seeds yielded 27·7 per cent. of a yellowish oil having the sp. gr. 0·9266 at 15° C., acid value, 4·24 ; saponification value, 201·5 ; iodine value, 138·5 ; Hehner value, (percentage of insoluble acids) 94 ; and titer test (solidifying point of fatty acids), 13·7—13·8° C. It is thus quite different from ordinary croton oil (*C. tiglium*) and unlike this does not appear to possess vesicating properties. It is less suitable for soap making than cottonseed oil.—E. F. A.

Cottonseed oil ; Halphen's test for ——. H. Sprinkmeyer. Z. Unters. Nahr. u. Genussm., 1908, **15**, 19—20.

A SAMPLE of cottonseed oil, kept for three years, of the acid value 27·7, and the iodine value 54·2, gave, with Halphen's reagent, a strong brown colour instead of the usual characteristic red.—J. A.

Sesamé oil ; Testing margarine for ——. H. Sprinkmeyer. *See* XVIIIA.

PATENTS.

Emulsion of oil and the like. O. A. H. H. Kösters, Hemelingen, Germany. U.S. Pat. 875,665, Dec. 31, 1907.

SEE Eng. Pat. 4688 of 1906 ; this J., 1906, 767.—T. F. B.

Oleaginous seeds ; Process and apparatus for pressing —— *in open presses.* A. Austerlitz. Fr. Pat. 381,350, Aug. 29, 1907.

THE seeds, after a preliminary cleansing, grinding and boiling, are fed into the pressing part of the apparatus. The latter consists of a movable frame through the bottom of which passes a piston actuated by hydraulic pressure. The piston is raised until its upper surface is level with the lower edge of the table-top of the frame, a plate provided with channels is placed on the top of the piston, and the seed paste is allowed to flow on to this plate until level with the upper edge of the table ; a second plate is placed on this layer of material, the piston is lowered slightly, material is again introduced, and so on, so as to fill the frame with layers of material. The frame is then run under a hydraulic press, the oil is pressed out of the material, and the cakes are discharged from the frame. —W. P. S.

Fatty substances ; Process of purifying ——. A. E. Urbain and A. Feige. First Addition, dated Nov. 7, 1906, to Fr. Pat. 361,966, Dec. 5, 1905.

SUFFICIENT alkali to neutralise the free fatty acids is added to the alcohol used in the process described in the main patent (this J., 1907, 211).—A. S.

Saturated fatty acids and their esters; Process for the preparation of —— from unsaturated fatty acids and their esters by electrolytic reduction in presence of acids. C. F. Boehringer und Söhne. Ger. Pat. 187,788, March 10, 1906.

The claim is for the use of cathodes of platinised platinum. —A. S.

Disinfectant soaps, etc. Ger. Pat. 189,208. *See* XVIII*C*.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(*A.*)—PIGMENTS, PAINTS.

Patents.

Lakes from azo-dyestuffs containing sulphonic groups; Preparation of ——. Wülfing, Dahl und Co. A.-G. Fr. Pat. 381,205, Aug. 16, 1907. Under Int. Conv., Nov. 2, 1906.

Azo dyestuffs containing one or more sulphonic groups are precipitated in the usual way with barium chloride and the resulting insoluble salt, after being dried, is ground with a diluent such as gypsum, barium sulphate, dry aluminium hydroxide, etc.—J. C. C.

Azo lakes; Preparation of ——. Wülfing, Dahl und Co. A.-G. Fr. Pat. 381,206, Aug. 16, 1907. Under Int. Conv., Oct. 12, 1906.

The usual double decomposition between the sodium salt of an azo dyestuff and the salt of a heavy metal in the manufacture of lakes is avoided by preparing the barium, calcium, etc., salts of the azo dyestuffs directly. Thus barium sulphanilate is diazotised by adding hydrochloric acid and sodium nitrite, the diazo solution neutralised with barium carbonate and added to a mixture of sodium β-naphtholate and Turkey-red oil. The lake is finally mixed with aluminium hydroxide.—J. C. C.

Size for use with paints; Process of manufacturing a —— from Iceland moss. H. Bruhn and C. Timpke. Fr. Pat. 381,323, Aug. 28, 1907.

Iceland moss is dried, heated for about 25 minutes at a temperature of 170° C. and then ground. The product may be mixed with a small quantity of sodium carbonate. The portion of the product which does not dissolve in water need not be removed by filtration as it is not visible when mixed with the pigment.—W. P. S.

Paints for submarine work; Method of preparing ——. C. Dubois. First Addition, dated Aug. 30, 1907, to Fr. Pat. 358.827, Oct. 24, 1905.

Lead arsenite may be substituted for the whole or for part of the lead arsenate employed in the preparation of the paints described in the main patent (this J., 1906, 325).—A. S.

Dyestuff for preparation of lakes, etc. Fr. Pat. 381,204. *See* IV.

(*B.*)—RESINS, VARNISHES.

Patent.

Lincrusta and similar materials; Process and apparatus for producing shaded effects on ——. Cie. Lincrusta Walton Française. Fr. Pat. 381,448, Nov. 8, 1906.

The sheets of lincrusta are passed over a roller where their painted surface is subjected to the absorbent action of one, or many strips, of blotting paper or similar material; the blotting paper travels over separate rollers and is pressed on the surface of the lincrusta by other rollers provided with springs. The blotting paper removes the colour from the relief portions of the lincrusta and the edges of the coloured parts may be toned down by the action of a revolving brush which is itself cleaned by contact with the other side of the above-mentioned strip of blotting paper.—W. P. S.

(*C.*)—INDIA-RUBBER, &c.

Para rubber from the Federated Malay States. Bull. Imp. Inst., 1907, **5**, 246—248.

The sixteen samples of Para rubber (*Hevea brasiliensis*) examined were of excellent quality, the amount of caoutchouc ranging from 92·6 to 96·35 per cent., and being over 94 per cent. in 11 cases; the protein from 1·35 to 3·18; resin from 1·38 to 3·58; ash from 0·14 to 3·18, and moisture from 0·22 to 0·6 per cent. The sample with the highest percentage of caoutchouc has the lowest content of protein, moisture and ash. The analyses indicate the high degree of purity which can be obtained in the preparation of rubber from cultivated trees.—E. F. A.

Rubbers from the Gold Coast. Bull. Imp. Inst., 1907, **5**, 248—251.

Ceara rubber (from *Manihot Glaziovii*) was light brown, free from vegetable impurity and exhibited very fair elasticity and tenacity. It gave on analysis: Moisture, 4·4; caoutchouc, 67·7; resin, 4·4; protein, 20·4; and ash, 3·1 per cent. The large amount of protein is remarkable, but not unusual in Ceara rubber.

Assam rubber (*Ficus elastica*) contained: Moisture, 1·5; caoutchouc, 80·1; resin, 11·6; proteins, 2·6; insoluble matter, 4·2; and ash, 1·12 per cent., and exhibited very good elasticity and tenacity.

"Krepiball" rubber (*Landolphia owariensis*) showed: Moisture, 1·0; caoutchouc, 91·3; resin, 4·7; proteins, 0·9; insoluble matter, 2·1; and ash, 0·42 per cent.

"Ofruntum" rubber (*Funtumia elastica*).—Of the samples analysed, in the one case the latex was coagulated by exposure to the atmosphere and in the other by boiling. These showed: 7·9 and 6·3 per cent. of moisture, and calculated on the dry rubber, caoutchouc, 84·6 and 86·9; resin, 5·8 and 9·1; proteins, 8·3 and 3·4; and ash, 1·3 and 0·6 per cent. respectively.—E. F. A.

"*Lumbua*" *rubber.* Bull. Imp. Inst., 1907, **5**, 235—236.

The sample ball was dark reddish-brown throughout and contained lumps of vegetable matter distributed through it. It was free from stickiness and exhibited good elasticity and tenacity. Analysis showed: Moisture, 2·7; caoutchouc, 82·2; resin, 9·3; insoluble matter, 5·8; and ash, 2·1 per cent. The percentage of resin is rather higher than is desirable.—E. F. A.

"*Mgoa*" *rubber.* Bull. Imp. Inst., 1907, **5**, 236—237.

The sample, derived from *Mascarenhasia elastica*, was light brown in colour and contained a considerable quantity of vegetable impurity. It contained: moisture, 10·0; caoutchouc, 69·0; resin, 6·1; proteins, 3·5; insoluble matter, 11·4; and ash, 2·29 per cent. —E. F. A.

Rubber investigations in Amani, German East Africa. [Coagulation of the latex.] F. Eduardoff. Gummi-Zeit., 1908, **22**, 387—388.

Experiments on the spot with the latex of *Kickxia elastica* indicate that different coagulants produce rubbers differing in firmness, colour, and resin-content, and that a 2 per cent. solution of cresol (1 part to 4 of latex) is the

best coagulant. Acetic acid has no effect on this latex. (Compare Schidrowitz and Kaye, this J., 1907, 1264).
—W. A. C.

PATENTS.

Rubber, gutta-percha, and balata from lactescent plants; Process for obtaining ——. D. Sandmann, Berlin. Eng. Pat. 10,848, May 9, 1907. Under Int. Conv., June 1, 1906.

See Fr. Pat. 377,526 of 1907; this J., 1907, 1058.—T.F.B.

Rubber; Method of and apparatus for vulcanising ——. J. R. Gammeter, Akron, Ohio, U.S.A. Eng. Pat. 16,325, July 16, 1907.

The invention relates to the vulcanisation of any desired length of rubber hose, tubing, solid tyres, etc. The apparatus consists of a number of endless wire bands travelling through a tube surrounded by a steam-jacket; the end of the tube is provided with a "flared" mouth so that the bands are formed into a circle as they enter the tube. These bands may be formed of separate wires, and means are provided for adding more lengths of wire when required. The end of the rubber tube to be vulcanised is plugged and introduced between the bands, the machinery for moving the bands is set in operation, and the rubber tube is thus passed through the steam-heated tube. Air under pressure is introduced into the other end of the rubber tube so that the vulcanisation takes place under pressure. When one length of rubber tube has been vulcanised, another piece may be spliced to it and the process continued indefinitely.—W. P. S.

Rubber and ebonite; Regeneration of vulcanised ——. B. Roux. First Addition, dated July 13, 1907, to Fr. Pat. 338,945, July 25, 1903 (this J., 1904, 991).

The material, according to the original patent (*loc. cit.*) was pressed in heated moulds, and the pressure continued until the moulds were cold. The present claim is for the use, in succession, of a hot and a cold mould for carrying out the process.—G. W. McD.

XIV.—TANNING, LEATHER, GLUE, SIZE.

Tanning industry of the United States. U.S. Forest Service Circular. [T.R.]

The greater part of the tanning industry is carried on in Pennsylvania, New York, Michigan, and Wisconsin. The consumption of tanbark in 1906 by 617 tanneries was 1,371,342 cords, valued at 12,774,071 dols. Of the total amount, about two-thirds was hemlock, whilst almost all the rest was oak, the quantity of chestnut and unclassified barks being relatively unimportant. In addition, 658,777 barrels of extract, valued at 8,713,322 dols., were consumed. Of the extract manufactured from domestic woods and barks, chestnut extract formed the largest amount, being double the combined quantities of that from oak and hemlock. Quebracho extract, which is imported, constituted by far the largest amount of any one kind.

Sampling tanning materials; Provisional methods for ——. J. Amer. Leather Chem. Assoc., 1908, 3, 5—7.

Tannin analysis; Official method of the American Leather Chemists Association for ——. J. Amer. Leather Chem. Assoc., 1908, 3, 1—5.

The official method of analysis for the present year is given in detail. The chief alteration is in connection with the prescription for the determination of "non-tannins," a note being inserted that the amount of dry hide powder used for each analysis should be limited by means of the method of Procter and Bennett (this J., 1906, 1203).—H. G. B.

Leather analysis; Provisional method for ——. J. Amer. Leather Chem. Assoc., 1908, 3, 7—13.

The determination of moisture, fats, ash, water-soluble material, glucose (dextrose) and nitrogen are specified in detail with a view to their adoption as official methods of analysis.—H. G. B.

Hop tannin. A. C. Chapman. *See* XVII.

PATENTS.

Hides and skins; Apparatus for treating ——. H. H. Lake, London. From The Turner Tanning Machine Co., Peabody, U.S.A. Eng. Pat. 296, Jan. 4, 1907.

See Fr. Pat. 375,747 of 1907; this J., 1907, 936.—T. F. B.

Bating hides and skins; Process of ——. O. Röhm, Stuttgart, Germany. U.S. Pat. 875,382, Dec. 31, 1907.

The hides and skins are treated with an aqueous solution of sulphuretted hydrogen, carbonic acid, and ammonia.
—A. S.

Tanning; Process of ——. G. H. Pendleton, Busch, Okla. U.S. Pat. 876,583, Jan. 14, 1908.

The hides or pelts, after removing the flesh, are treated in a bath prepared by boiling together water, "soda," and ammonia, adding gum gambier, again boiling, and allowing to cool. After the hides have been in the bath for some time, gum arabic, oil of hops, and extract of wild cherry are added, and the hides are allowed to remain until they are tanned, whereupon they are removed and oiled.—A. S.

Chrome alum, etc. Fr. Pat. 381,452. *See* VII.

Albuminous substances suitable for fertilisers, etc. Ger. Pat. 186,764. *See* XV.

XV.—MANURES, &c.

PATENTS.

Fertilising and filtering materials; Production of ——. J. Brightmore. Fr. Pat. 381,511, Sept. 4, 1907.

See Eng. Pat. 15,922 of 1906; this J., 1907, 1248.—T. F. B.

Albuminous substances suitable for fertilisers; Process for obtaining —— *from the unhairing residues of tanneries.* B. Schümann and C. Elschner. Ger. Pat. 186,764, May 6, 1905.

The residues are treated with sulphur dioxide, whereby the protein substances are precipitated without evolution of sulphuretted hydrogen. The products obtained contain from 6 to 10 per cent. of nitrogen.—A. S.

XVI.—SUGAR, STARCH, GUM, &c.

Beetroot; Significance of soda in connection with the sugar content. K. Andrlik and J. Urban. Z. Zuckerind. Böhm., 1908, 32, 208—216.

The authors have analysed a number of beetroots and have found that, with a given variety of beetroot grown on a given soil in the same year, the sugar-content of the root is less as the amount of soda absorbed from the soil, both by the whole plant and by the root, is greater. A similar statement applies to the sugar-content of the root and the amount of nitrogen absorbed by the plant. Of course nitrogenous nutriment is essential to the growth of the beet, but soda is probably not indispensable. The authors' experiments also show that the proportions of potash and nitrogen to soda are higher in beets rich in sugar than in those poor in sugar and also, that as the plant develops, the proportion of potash to soda increases. As to whether the soda is the cause of the decreased sugar-content is not yet clear and further experiments must be made to decide this point.—L. E.

PATENT.

Crystals, especially sugar candy; Process of obtaining large well developed ——, without threads, from cold or hot saturated solutions. M. E. T. Melcher. Fr. Pat. 381,021, Aug. 20, 1907. Under Int. Conv., Aug. 26, 1906.

THE mother crystals are disposed on horizontal sieves, superimposed one over the other, to which is imparted a slow, reciprocating, vertical motion in the liquid from which the crystals are growing. As the result of this motion, the crystals are always changing their positions and thus increase uniformly on all sides. The crystallising vessel consists of a jacketed tank which may be heated or cooled systematically as crystallisation proceeds, so as to maintain the right degree of supersaturation of the liquid. A series of these vessels may be connected one with the other and the same liquid circulated through the whole series.—J. F. B.

XVII.—BREWING, WINES, SPIRITS, &c.

Barley; Questions concerning the steeping of ——. A. J. Brown. J. Inst. Brewing, 1907, **13**, 658—673.

WHEN the barley corn is brought into contact with water, moisture is conducted by the pericarp over the whole surface of the kernel. So far as experiments have gone, they appear to show that the moisture is absorbed into the interior through all parts of the covering of the grain, but that probably the absorption is most rapid at the germ end. Some kinds of barley [*H. vulgare* var. *cœrulescens*] contain a blue colouring matter under the skin, which, like litmus, is turned red by acids. But when the corns are steeped in dilute sulphuric acid, no such change of colour occurs unless the skin be damaged. This is due to the fact that the inner skin or testa of the corn partakes of the nature of a semi-permeable membrane, allowing water to penetrate but preventing the passage of dissolved substances, such as acids and salts; iodine however is an exception and is able to pass inwards with the water. Undamaged corns may even be immersed in sulphuric acid of 58 per cent. strength for 48 hours, and when subsequently washed, will germinate in a normal manner. The observation that no soluble matters can enter the barley during the steeping process leads to the hypothesis that no soluble matters are extracted from the interior of the corn during that operation. Experiments described by the author appear to confirm this, and tend to show that, except when the skins are damaged, the matters extracted during steeping are derived solely from the husks. Barley corns absorb less moisture from concentrated solutions than from dilute solutions, in fact, from 58 per cent. sulphuric acid no moisture enters the corn, and if previously steeped corns be immersed in this acid, water passes out of the corn. There appears to be a tendency to absorb moisture more slowly from hard waters than from soft waters, but the difference is very slight, and the influence of a few degrees difference in the temperature is far more marked. After the corns have sprouted, the testa is broken, and matters may both enter and leave the corns in the process of sprinkling on the floors. —J. F. B.

Starchy raw materials of distilleries; Presence of diastase in ——. G. Heinzelmann. Z. Spiritusind., 1908, **31**, 12.

REFERRING to the saccharification of starch in unmalted cereals by the diastase present in them (this J., 1908, 84), the author points out that the industrial application of this principle was recognised in 1882 in a French patent granted to Bachet (see next abstract), but that the yields of alcohol obtained were not sufficient to make the process a success. Criticising the results of Windisch (*loc. cit.*) the author maintains that a preliminary gelatinisation of the starch is necessary for its saccharification by the diastase in the grain. Rye starch gelatinises at a temperature below 65° C. (at which Windisch's mashes were prepared), and was therefore completely saccharified. Wheat starch only begins to gelatinise at 65° C., and the yields of alcohol were therefore not so good. All the other starches named gelatinise at temperatures considerably above 65° C., whence it is argued that the inferior results obtained with these other raw cereals were not necessarily due to a deficiency of diastase but may possibly be explained by the fact that the starches would not be sufficiently gelatinised, since unmalted grains do not contain a starch-liquefying diastase such as is present in malt. Fernbach and Wolff have observed that the saccharification of liquefied starch paste by an extract of raw barley is incomplete however much of the extract be employed, because the raw grain diastase does not saccharify amylopectin. The results recorded by Windisch for potatoes do not prove that the latter contain a diastatic enzyme, since the small quantity of alcohol obtained by mashing without malt would be accounted for by the fermentation of the ready-formed sugars. Still, an enzyme has been extracted from potato juice, but so far it has not been observed to possess any diastatic properties. The quantity of diastase occurring in the various cereals would depend on their physiological condition and would therefore be variable. It is recognised that the physiological condition of rye is exceptionally active, and this grain may be classed as "hot" ["hitzig"]; its proteids are in a state of unstable equilibrium and the formation and activity of enzymes would be great.—J. F. B.

Grain mashes saccharified by gluten instead of diastase; Fermentation experiments with ——. G. Heinzelmann. Z. Spiritusind., 1908, **31**, 12; reprinted from *ibid.*, 1882, 457.

THE author has carried out experiments with a process invented by F. M. Bachet, according to which raw rye meal is steeped in luke-warm water equal to 6—7 times the weight of its starch contents. The mash is slowly heated to 60° C., at which temperature it is maintained for 30—60 minutes, and then cooled for fermentation. The saccharification of the starch is effected by the action of the gluten of the grain, which amounts to about 20 per cent. of the quantity of starch present, but complete saccharification may be effected when the proportion of gluten is only 10 per cent. The author's results fell far short of those claimed by the inventor of the process, owing apparently to the fact that he could not succeed in suppressing the development of acidity which is so prejudicial to diastatic action. When sulphuric acid was added in small quantities with a view to preventing the further souring of the mash, no saccharification or fermentation took place. Parallel experiments made with the addition of malt extract showed that the quantity of alcohol obtained without malt was practically the same as that obtained with malt under the same conditions.—J. F. B.

Wort; Influence of mashing temperature upon the composition of ——. C. G. Matthews and R. A. Anty. J. Inst. Brewing, 1907, **13**, 685—703.

THE authors have made conversions of malt at different temperatures, analysing the products before and after

fermentation of the boiled and unboiled worts. They conclude that the starch in a well-made malt exists in a state very different from that of the original barley starch. The modified malt starch is readily acted on by diastase at temperatures to which potato starch (and most probably barley starch) would not respond. Malt starch may be degraded almost completely to maltose at comparatively low temperatures, if the worts be fermented without previous boiling. Mashes made at temperatures from 110° to 130° F. showed this condition of the products. There is strong analytical evidence of the formation of dextrose in the case of mashes converted at low temperatures. The bulk of the extract of a good malt, ground to about 25° Seck. is obtainable at a mashing temperature of 130° F. The values found for the ready-formed sugars of malt by the O'Sullivan and Heron method agree very well with the estimate of these sugars made from the decrease in specific gravity during fermentation. The authors propose to carry out similar experiments with purified malt and barley starches. These two starches behave quite differently when heated with water: whereas barley starch shows a definite gelatinisation at a temperature of 170°—175° F., malt starch yields very readily and becomes mobile in the same way as soluble starch.
—J. F. B.

Hop tannin. A. C. Chapman. J. Inst. Brewing, 1907, **13**, 646—652.

The author has worked out a new method for the determination of tannin, based on the observation that the precipitate formed by this substance with cinchonine has a constant composition and is nearly insoluble in a solution of cinchonine sulphate. The method was tested on pure gallotannic acid, 0·1 grm. of this acid yielding 0·146 grm. of cinchonine compound dried at 100° C. On the assumption that 2 molecules of gallotannic acid ($C_{14}H_{10}O_9,2H_2O$) combine with one of the alkaloid, the theoretical yield would be 0·141 grm. The precipitates obtained from a large number of hop tannin extracts contained 4 per cent. of nitrogen, and therefore were nearly identical with the corresponding gallotannic acid compound. Hence, if it be assumed that the proportion of hop tannin in the cinchonine precipitate is 60 per cent., the results are very near the truth. The method of procedure is as follows:—10 grms. of hops are placed in a flask marked to contain 508 c.c.; 400 c.c. of boiling water are added and the hops are macerated with a glass rod. The flask is placed in a boiling water-bath for 2 hours. The contents are then cooled to 15° C. and diluted to the 508 c.c. mark. The liquid is filtered through a dry filter, and 50 c.c. of the filtrate are evaporated slowly in a small beaker on the top of a boiling water bath. When the liquid has been concentrated to 15 c.c., it is cooled and 50 c.c. of a saturated solution of cinchonine sulphate are added. After 1—2 hours the liquid is poured into a weighed Gooch crucible with asbestos filter-bed previously rinsed with a 0·5 per cent. solution of cinchonine sulphate and dried. The tannate is allowed to filter at first without suction, but the pump may be applied when about half the liquid has run through. The precipitate is washed with a 0·5 per cent. solution of cinchonine sulphate, drained as far as possible on the pump and dried in the steam oven until the weight is constant.—J. F. B.

Beers; Turbidity of ——, due to chill. E. Schmidt. Woch. für Brau., 1908, **25**, 26.

In the cold weather the development of hazes in lager beers becomes a frequent source of trouble. One of the causes of this kind of turbidity is the subsequent exposure of the beer to temperatures lower than that prevailing in the lager cellar in which clarification was effected. It occurs chiefly in breweries which have no provision for artificial freezing or which, having such arrangements, disconnect their ice-machines during frosty weather. So long as the temperature of the lager cellar remains below 0° C., there is nothing to fear, but when a thaw sets in, the beer put in the cellar, not having been properly chilled, develops a haze if sent out when the frost returns. Thus relatively high temperatures in the lager cellar, which are not particularly dangerous in the summer, become so in the winter, and care is necessary during the latter season to keep the temperature of the cellar below 0° C. It is advantageous to have the racking room artificially warmed in the winter and to maintain a sufficient stock there to avoid sending out beer which has recently come from the lager cellar. Thus a beer which has acquired a temperature of 7°—10° C. in the racking room will, if the casks be properly protected during the journey, generally retain sufficient heat to enable them to arrive at their destination without becoming turbid. If then the customer be instructed to keep his cellar at a temperature of 7°—10° C., any slight haze which may have arisen during transport will be re-absorbed in the course of a few days. In breweries which are liable to suffer from chill-hazes, care should be taken to avoid mashing large proportions of short-grown, insufficiently modified malt.—J. F. B.

Kaffir beer. A. C. Chapman and F. G. S. Baker. J. Inst. Brewing, 1907, **13**, 638—643.

The authors have examined two samples of native beverages sent from the Cape under the names of "Leting" and "Kaffir beer"; it is possible however that the former is not true "Leting" but another sample of the ordinary Kaffir beer. The samples resembled each other closely; they became cloudy on shaking, owing to the presence of suspended matters, chiefly maize starch, but containing also some particles of root structure and many kinds of micro-organisms.

	"Leting."	"Kaffir beer."
	per cent.	per cent.
Total solid matters	5·19	5·76
Reducing carbohydrates (as maltose)	0·23	0·07
Absolute alcohol (by weight) .	3·19	2·44
(=Proof spirit...............	6·97	5·37)
Fixed acidity (as lactic acid) .	1·26	1·03
Volatile acid (as acetic acid)..	0·48	0·41
Insoluble matters	—	3·62
Ash	—	0·38
Present gravity	1014·4°	1014·4°

The Kaffir beer would appear to have been made by the following method (described by Juritz): The grain (maize) is steeped in water, placed in bags until it sprouts and is then dried in the sun. The malted grain is mixed with raw maize and the whole is roughly ground between stones. The grist is placed in casks with water and allowed to remain for some time; the liquor is poured off and the sediment is finely ground. Both are then mixed and boiled together, the mash is cooled and returned to the casks. A further portion of malted grain is added, whereupon the mixture in the casks liquefies and ferments, and is subsequently strained. Hops are sometimes used for flavouring, but not in the present case; the bark of the umkwenkwe tree might have been used, but more probably the "kiri" root. This root is supposed to supply a yeast for fermentation, but this is unlikely, and fermentation is started either adventitiously or by the addition of residues from previous brews. The beer contains immense numbers of bacteria, by the activity of which the acids of the beer are evidently formed. No specific or peculiar yeast could be detected, the fermentation being apparently due to a species of *S. ellipsoideus.*
—J. F. B.

Proteïn hydrolysis; Measurement of ——. S. P. L. Sorensen. Compt. rend. des Trav. du Lab. de Carlsberg, 1907, **7**, 1—57.

The proteïn molecule may be regarded as built up, in great part, of amino-acids joined together by anhydride linking between the amino and carboxyl groups, and there is ground for the view that proteïn hydrolysis consists in the rupture of these linkings with formation of free amino and carboxyl groups. The extent to which hydrolysis has proceeded in any given experiment would be measured if it were possible to estimate either the amino or carboxyl groups so liberated. These being equal in number neutralise each other, but H. Schiff pointed out long ago that, after treatment with formaldehyde, the proteins and amino-acids acquire an acid reaction. Under this treatment the amino group reacts with the formaldehyde giving rise to methylene derivatives which the author now finds can be titrated against decinormal alkali, exactly as though they were carboxylic acids, unrestricted by an amino group. In Schiff's experiments the reaction did not seem to proceed quantitatively; titration with alkali gave numbers which varied widely as the concentration of the solution and the amount of formaldehyde were varied, but which never reached the theoretical number for the quantity of pure amino-acid taken. The reaction is in fact a reversible one, but the tendency for the reverse action to take place may be minimised by reducing the total volume of water, and increasing the amount of formaldehyde and alkali present. The author makes the end point of his titrations such that there is always excess of alkali present. 1 c.c. of phenolphthalein solution (0·5 grm. in 100 c.c. of 50 per cent. alcohol) is added to 50 c.c. of formalin and $N/5$ baryta added till a faint red colour is produced. A control solution is next prepared by adding to 20 c.c. of boiled water, 10 c.c. of the neutralised formalin, 5 c.c. of $N/5$ baryta and 5 c.c. of $N/5$ hydrochloric acid. The tint is then a very pale rose; addition of four drops (0·2 c.c.) of $N/5$ baryta makes it an intense red. To 20 c.c. of the solution to be examined, 10 c.c. of the neutral formalin is added, the mixture shaken, and $N/5$ baryta added until the liquid is red. 2 c.c. more baryta are added (to precipitate any carbonates or phosphates), and then hydrochloric acid till the colour is paler than that of the control liquid. Baryta is again added drop by drop till the tint of the control liquid is exactly matched, when the volume of baryta solution used, less that of the acid and the 0·2 c.c. used in the control experiment, gives the measure of the carboxyl group present. The author has applied the method to $N/10$ solutions of 17 typical amino-acids, and to the dipeptide, glycyl-glycine, and he obtains values which average 97·5 per cent. of the theoretical. The method should prove of service in the investigation of the protein-hydrolysis of malt.

Patents.

Malt; Preparation of green and kilned ——. A. Heymann. Fr. Pat. 381,149, July 16, 1907.

Green or kilned malt is prepared from grain decorticated in the dry state. Several variations of the process are claimed: The grain may be decorticated before steeping, or after a short germination and kiln-drying, or after a sufficient germination and partial drying until the kernel is strong enough to withstand the treatment, or after a sufficient germination and complete curing with subsequent re-conditioning of the kernel to give it the necessary tenacity, or lastly, decortication may be effected partly before steeping and partly after germination and curing.—J. F. B.

Mashing apparatus. O. Wehrle, Emmendingen, Germany. Eng. Pat. 27,924, Dec. 7, 1906. Under Int. Conv., June 27, 1906.

A mechanism is described for loosening the bed of grains during the running-off of the mash and for breaking it up after sparging is finished. It consists of two horizontal rotating arms from which thin knife blades extend downwards through the grains. These knives are fixed in pairs to carriers fitted on to the arms. Between each pair of fixed blades is placed a stout broad blade or vane, slightly curved in horizontal section but straight vertically. During the process of lixiviation these latter blades are kept in a position parallel to the fixed blades, and travel edge foremost, but when it is required to break up the bed of grains, the blades are turned on their axes through an angle of 90° so that their faces are brought into the direction of travel.—J. F. B.

Filters for beer and other sedimentary liquids. H. C. Russell, London. Eng. Pat. 29,723, Dec. 31, 1906.

A modification in the mode of constructing the filtering sections of the filter-press described in Eng. Pat. 15,046 of 1906 (this J., 1906, 1168) is specified. In or on the underside of the boss of the filtering section there are secured a rubber or other compressible packing ring and a downwardly depending, shouldered and flanged sleeve, cut away so as to clear the filtering holes in the periphery of the boss of the next section underneath.—J. F. B.

Brewing soy; Apparatus for ——. T. Suzuki, Sunamura, Japan. U. S. Pat. 874,041, Dec. 17, 1907.

A number of brewing tanks are disposed in a closed heating chamber, and the bottoms of the tanks are provided with jackets through which a heating or cooling agent can be passed in order to rapidly change the temperature of the contents of the tanks. The tanks are provided with valved draw-off pipes which pass outwards through the wall of the heating chamber. In each tank is a central shaft on which a number of stirrers is mounted. Each stirrer is composed of pairs of radial arms connected by transverse slats, the arms of adjacent stirrers being of different radial lengths. The stirrers are separated from each other and from the walls of the tank by short spaces, and are so arranged on the shaft that the arms and slats of adjacent stirrers are out of alignment, in order that the soy shall be alternately forced from the path of one stirrer laterally into the path of adjacent stirrers.—A. S.

Wine musts; Process of preparing concentrated solutions for improving —— by congelation. E. Monti. Fr. Pat. 381,303, Aug. 27, 1907.

Highly-coloured grapes are crushed and treated with from 40 to 100 grms. of sulphur dioxide per hectolitre. The mass is then diluted until it contains from 5 to 10 grms. of sulphur dioxide per hectolitre, and is allowed to ferment slightly. From 2 to 5 per cent. of alcohol is formed, this quantity being sufficient to dissolve the colouring matters of the grapes. The mixture is then passed through a filter-press and the filtrate is subjected to concentration as described in Fr. Pats. 324,474 of 1902 and 357,770 of 1905 (this J., 1903, 567; 1906, 113). Solutions of varying concentration are obtained which are added in the requisite quantity to musts or wines. —W. P. S.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

(*A.*)—FOODS.

Wheat flour; Effect of nitrogen peroxide on ——. F. J. Alway and R. M. Pinckney. J. Amer. Chem. Soc., 1908, 30, 81—85.

The yellow colour of flours is due to a minute quantity of a coloured substance which is contained in the fat; when the fat is removed, high-grade flours become colourless. Exposure to sunlight or treatment with nitrogen peroxide changes the coloured compound into one or more colourless compounds. Flours which have been treated with too much of the bleaching agent have, however, a yellow to brownish-yellow colour. The acidity of the flour is not increased by treatment with nitrogen peroxide, nor does the latter affect the "expansion" of the gluten, but an increase in the acidity is noticed when excess of the bleaching agent has been used. Bread made from bleached flours does not differ in weight, lightness, odour, or taste from that made from unbleached flours; it is in all cases whiter, where high-grade flours are used. Low-grade flours, when bleached, yield bread possessing an uninviting colour. Nitrites are sometimes present in bread made from bleached flour, but the quantity in the bread is always smaller than in the flour. The authors consider that many of the conflicting opinions in regard to the effect of nitrogen peroxide on flour are to be attributed to the probability that the flours examined had been "over-treated" with the bleaching agent.—W. P. S.

Gliadin [*in flour*]; *Determination of* ——. W. E. Mathewson. J. Amer. Chem. Soc., 1908, **30**, 74—81.

As the result of an investigation of some of the usual methods for the determination of gliadin in flour, the author finds that from 8 to 17 per cent. more nitrogenous matter is extracted when 4 grms. of flour are treated with 100 c.c. of 70 per cent. alcohol than when 16 grms. of flour are taken. After drying for 6 hours in the water oven, from 10 to 20 per cent. less gliadin is obtained on extraction with cold alcohol; with hot alcohol the results are nearly the same. Pure gliadin remains soluble in dilute alcohol after the same treatment. Glutenin does not appear to remove gliadin from its alcoholic solution. Although anhydrous phenol dissolves a large proportion of the protein matter from flour, the dissolved matter is not pure gliadin or gliadin mixed with but one other protein.—W. P. S.

Sesame oil; *Testing margarine for* ——. H. Sprinkmeyer. Z. Unters. Nahr. u. Genussm., 1908, **15**, 20—21.

In some of the prescribed methods for applying Baudouin's test for sesamé oil to margarine, cottonseed oil is added in considerable proportion. It is absolutely necessary that the cottonseed oil should be free from rancidity as otherwise the test is rendered useless, the rose colour given by sesamé oil being entirely hidden by the dark brown colour produced by the rancid cottonseed oil. Soltsien's test is affected in a similar manner.—J. A.

Ozone, nitrogen peroxide, and hydrogen peroxide; *Detection of* —— *in gas mixtures*. E. H. Keiser and L. McMaster. *See* VII.

Patents.

Cereal-meal gluten; *Process for converting* —— *into a colloidal condition by cooking.* B. Bielschowsky, Breslau, Germany. Eng. Pat. 27,744, Dec. 5, 1906.

Gluten, obtained from wheat flour by washing out the starch, is added to wheat flour, and the mixture is dried and ground. Before being used for baking purposes, the mixture is treated with water so that the ferments present in the flour are able to convert the added gluten into a colloidal condition. Sufficient gluten is added to the flour to bring the total gluten-content up to about 25 per cent.—W. P. S.

Food product [*from barley and figs*] *capable of being used as a beverage, and process for preparing same.* J. A. Caverhill, Tillonsburg, Ontario. Eng. Pat. 16,664, July 20, 1907.

Barley is treated as described in Eng. Pat. 26,002 of 1906 (this J., 1907, 546), that is, it is steeped in water, kept at a temperature of over 90° F. for 30 hours, then suddenly heated to 150°—225° C., and dried. The husks are next removed, and the kernels of the grains are passed through cutting machinery. The product thus obtained is treated with one-eighth part of its weight of a pulp prepared by grinding ordinary pressed figs with water so as to form a thin paste. The mixture of barley and fig-pulp is then roasted and used as a coffee or cocoa substitute. If the mixture be intended for use as a food, a smaller proportion of fig-pulp is added and the product is only slightly roasted.—W. P. S.

Coffee beans; *Process for refining* [*washing and cleaning*] ——. J. Thum, Dresden, Germany. Eng. Pat. 21,397, Sep. 26, 1907. Under Int. Conv., Oct. 2, 1906.

Raw coffee beans are placed in a heap at one side of a tank provided with a perforated or sieve-like bottom. This tank is then suspended in a vessel containing water at a temperature not higher than 60° C. so that the water rises to not more than one-quarter of an inch above the perforated bottom. The beans are then brushed or scrubbed across the bottom of the tank; the tank is next removed, the beans are further washed with water, then dried, and roasted. The process removes all dirt from the beans and at the same time extracts about 30 per cent. of the caffeine.—W. P. S.

Edestine [*from cotton seeds*]; *Process of extracting* ——. R. Levi. Fr. Pat. 381,503, Sept. 3, 1907.

See Eng. Pat. 19,392 of 1907; this J., 1908, 34.—T. F. B.

Electrical generators for flour bleaching, etc. Eng. Pat. 3724. *See* XIA.

(*B.*)—SANITATION; WATER PURIFICATION.

Water used industrially; *Effect of free silica in* ——. L. Tirelli. Rass. min., **26**, 134—36.

In Cesenate, Italy, steam-generating boilers are subject to a corrosion by which they are quickly put out of service. An analysis of the water of that locality gave the following results: Residue from one litre, 3·654 grms.; Cl 0·0426. SO_3 1·3142, CO_2 combined 0·0892, CO_2 free and half bound 0·0991, SiO_2 1·1633, Na_2O 0·0155, MgO 0·2936, CaO 0·6490, Fe_2O_3 and Al_2O_3 0·0016 grm. This proves the silica to be uncombined; it is probably responsible for the corrosion. An analysis of boiler incrustation proved the presence of sulphates, chlorides, oxides, carbonates and silicates of iron. Samples of the incrustation deposited from waters which had been partially purified by the use of sodium carbonate contained: SiO_2 26, CaO 10, and Fe_2O_3 0·3 per cent. By using lime instead of sodium carbonate, a large part of the silica can be removed. Barium hydroxide gives better results, especially when added in excess; such excess can be removed by the addition of sodium carbonate.

Manganese in water; *Determination of* ——. E. Ernyei. Chem.-Zeit., 1908, **32**, 41—42.

In the method proposed, the manganese salts present in the water are converted by means of potassium persulphate into permanganate and the latter is then determined iodometrically. The water must not contain more than the faintest trace of iron; if much iron be present, a quantity of the water is acidified with a few drops of sulphuric acid, an excess of zinc oxide is added, and the mixture is filtered. One hundred c.c. of the filtrate are then placed in a flask, 5 c.c. of 30 per cent. sulphuric acid and a quantity of silver sulphate, slightly in excess of the amount required to precipitate the chlorine present, are added. After the addition of 2 grms. of potassium persulphate, the contents of the flask are boiled for 20 minutes, water being added from time to time if much evaporation takes place. When cold, the solution is treated with potassium iodide and the liberated iodine is titrated with $N/100$ thiosulphate solution, starch solution being used as indicator. The silver iodide suspended in the solution does not interfere with the observation of the end point of the titration. The results of experiments are given from which it is seen that, with the exception of iron, the substances occurring in spring and other waters (chlorides, nitrates, nitrites, ammonia, and organic matter) do not influence the results obtained by the method. Ammonium persulphate cannot be used for the oxidation of the manganese as a considerable quantity of the ammonia is converted into nitric acid which interferes with the titration of the iodine. The potassium persulphate should be purified, before use, as follows:—150 grms. of the salt and 15 grms. of potassium hydroxide are dissolved in 1 litre of water at a temperature of 60° C.; the solution is filtered through cotton-wool and the filtrate is allowed to cool slowly.

The crystals of potassium persulphate which separate out are then washed with a little water, and dried at the ordinary temperature.—W. P. S.

PATENT.

Water ; Purification of ——. J. Howard, London. Eng. Pat. 29,596, Dec. 29, 1906.

THE water is admitted to a small tank containing a stirring apparatus where it is treated with a definite quantity of aluminium sulphate. Soft water is treated with milk of lime before adding the aluminium sulphate. The water then flows through a number of chambers, situated side by side and communicating alternately at their upper and lower parts, and thence flows upwards through a chamber provided with a filtering bed at its upper part. Finally, the water is passed through a sand filter the surface of which has been coated previously with a film of coagulated matter obtained in the treatment of the water with the aluminium sulphate. A small quantity of copper sulphate may be added to the water as it passes through the mixing chambers.—W. P. S.

(*C.*)—DISINFECTANTS.

Calcium oxide and sulphur ; The reaction between ——. R. W. Thatcher. *See* VII.

PATENTS.

Cresol, creolin, tar oils, etc. ; Process for fixing [*solidifying*] ——. E. Huss and F. Kümmel. Fr. Pat. 380,275, July 26, 1907.

CRESOL, creolin, or other tar oils are heated with a solution of soda soap in alcohol until a homogeneous liquid is produced ; this is then poured into suitable moulds to solidify.—T. F. B.

Disinfectant soaps ; Process for the preparation of —— *by means of paraformaldehyde.* S. Berliner. Ger. Pat. 189,208, Aug. 23, 1906.

PARAFORMALDEHYDE is dissolved in lime water and added to the liquid soap shortly before the mass solidifies.
—A. S.

XIX.—PAPER, PASTEBOARD, &c.

Cellulose ; Investigation on ——. Times, Jan. 21, 1908. [T.R.]

AT the annual conference of the Verein der Zellstoff und Papier Chemiker, held in Berlin in December, a proposal was adopted to investigate "the changes which wood-cellulose is liable to undergo on the paper machine, with special regard to the various processes which come under consideration," and it was decided that the work should be carried out in the paper-making department of the Manchester Municipal School of Technology by Dr. Hans Hofmann and Mr. Julius Hübner. The results of the investigation will be published simultaneously in English and German. The cellulose necessary for the research is to be provided by the Society, and three makes of cellulose are to be investigated—one of English and two of German origin.

PATENTS.

Dyeing paper pulp. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 10,729, May 8, 1907.

SULPHIDE dyestuffs could not hitherto be used for dyeing paper pulp because the sodium sulphide, used in dissolving them, decomposed the aluminium sulphate added in the sizing of the pulp, hydrogen sulphide being evolved. The new process consists in introducing, during the dyeing process, air or gases which contain oxygen into the mixture of pulp and dye-liquor in the hollander, whereby the sodium sulphide is oxidised to thiosulphate. This conversion in no way interferes with the dyeing operation, and the shades obtained are fast, full and brilliant.—S. H. H.

Paper ; Machine for coating ——. M. Cantine, Saugerties, N.Y. U.S. Pat. 875,241, Dec. 31, 1907.

SEE Eng. Pat. 2770 of 1907 ; this J., 1907, 712.—T. F. B.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

Tannates of quinine ; True and false ——. P. Biginelli. Gaz. chim. ital., 1907, **37**, II., 205—226.

TANNIC acid is capable of forming yellowish addition-compounds with salts of quinine. By the action of solutions of tannic acid on the sulphates and hydrochlorides of quinine, products are obtained composed of the quinine salt with varying proportions of tannic acid. These products form the basis of many of the commercial "quinine tannates." They often possess the properties of the quinine salt that they contain and are not true tannates of quinine. These pseudo-tannates can be obtained of uniform composition if they are prepared always under the same conditions. Their content of tannic acid may vary from 18 to 39 per cent. Some of the products examined by the author had the following composition :— (1) From quinine acid sulphate :

(*a*) $(C_{20}H_{24}O_2N_2,H_2SO_4)_4,5C_{14}H_{10}O_9,13H_2O$;
(*b*) $(C_{20}H_{24}O_2N_2,H_2SO_4)_2,5C_{14}H_{10}O_9,20H_2O$;
(*c*) $(C_{20}H_{24}O_2N_2,H_2SO_4)_2,7C_{14}H_{10}O_9,25H_2O$.

(2) From quinine sulphate : $(C_{20}H_{24}O_2N_2)_2H_2SO_4,5C_{14}H_{10}O_9,20H_2O$. (3) From quinine dihydrochloride :
(*a*) $(C_{20}H_{24}O_2N_2,2HCl)_2,5C_{14}H_{10}O_9,13H_2O$;
(*b*) $C_{20}H_{24}O_2N_2,2HCl,5C_{14}H_{10}O_9,xH_2O$. True tannates of quinine cannot be prepared according to the prescriptions of the German and Swiss Pharmacopœias. They can only be obtained by mixing together solutions of the alkaloid and tannic acid in suitable proportions. By mixing together ethereal or alcoholic solutions of molecular proportions of quinine and tannic acid, the compound, $C_{20}H_{24}O_2N_2,C_{14}H_{10}O_9,3H_2O$ is formed. It is an amorphous, nearly white powder, very slightly soluble in water giving a solution which is alkaline to litmus. After being dried *in vacuo*, it takes up 2 mols. of water again on exposure to the air. In aqueous solution, especially on warming, it decomposes with formation of the compound, $C_{20}H_{24}O_2N_2,2C_{14}H_{10}O_9,6H_2O$. The latter can also be prepared by mixing together suitable proportions of quinine and tannic acid in ethereal or alcoholic solution, or by triturating in a mortar the mono-tannate with an aqueous solution of the calculated quantity of tannic acid. It is an amorphous dirty-white powder reacting acid to litmus, and more stable and soluble than the mono-tannate. A tri-tannate, $C_{20}H_{24}O_2N_2,3C_{14}H_{10}O_9.10H_2O$, can also be prepared, but is less stable than the other two salts. By treating the mono-tannate with excess of aqueous acetic acid, a quinine tannate-acetate, $C_{20}H_{24}O_2N_2,C_{14}H_{10}O_9.2C_2H_4O_2,6H_2O$, was prepared.
—A. S.

Cheiroline, an alkaloid containing sulphur. P. Wagner. Chem.-Zeit., 1908, **32**, 76—77.

Cheiroline was isolated from the seeds of the wallflower (*Cheiranthus cheiri*). The finely-ground seeds were moistened with a 5 per cent. solution of sodium carbonate, extracted with ether, and the alkaloid removed from the extract by means of 5 per cent. sulphuric acid. The acid solution was filtered, treated with sodium carbonate, and extracted with ether. After purification, cheiroline, $C_9H_{16}N_2O_7S_2$, crystallises from ether in prisms which melt at 46—48° C. It is easily soluble in alcohol, chloroform and ethyl acetate, but is almost insoluble in water and petroleum ether. It exerts an antipyretic action. By treatment with mercuric oxide in dilute aqueous solution, cheiroline is desulphurised, yielding a new compound, *cheirol*, which crystallises in needles, m. pt. 172·5° C.—A. S.

Nitration: Reaction-kinetics of ——. H. Martinsen. Z. physik. Chem., 1907, **59**, 605—634.

The author has shown previously by experiments with nitrobenzene that nitration in presence of concentrated sulphuric acid is a reaction of the second order, the velocity being proportional to the concentration of the nitric acid and of the substance which is being nitrated. In the present investigation the reaction was studied more closely with 6-chloronitrobenzene and 4·6-dinitro-*m*-xylene, the nitration of which proceeds much more slowly than that of nitrobenzene. Experiments were also made with other substituted benzene derivatives. In one series the nitration was carried out in presence of 95 per cent. sulphuric acid (sp. gr. 1·839 at 15°/4° C.), and in a second series, in presence of monohydrate sulphuric acid (H_2SO_4). In all cases the rate of nitration was greater with the 95 per cent. acid, and the benzene derivatives studied can be divided into two groups, according to the difference in the rates of nitration in the two media. In the case of substances of the first group, comprising alkyl, halogen, nitro, hydroxy, and hydroxyalkyl derivatives of benzene, the ratio between the rate of nitration in presence of 95 per cent. sulphuric acid to that in presence of monohydrate sulphuric acid is about 3, but for substances of the second group, *viz.*, carboxy and sulphonic derivatives of benzene, this ratio is much greater. For substances of the first group, the rate of nitration increases threefold for a rise of temperature of 10° C. (25°—35° C.). Addition of phosphoric anhydride to the 95 per cent. sulphuric acid has no influence on the rate of nitration. In the case of nitrobenzene, the rate of nitration falls regularly with a decrease in the water-content of the sulphuric acid between the limits, $H_2SO_4,0{\cdot}3H_2O$ to $H_2SO_4,0{\cdot}04SO_3$. The influence of various substituent groups on nitration may be expressed as follows:—

$$NO_2 > SO_3H > COOH > Cl < CH_3 < OCH_3 < OC_2H_5 < OH.$$

The introduction of chlorine into the molecule sometimes accelerates and sometimes retards nitration. Of the other groups, that furthest to the left from chlorine retards the reaction most strongly, whilst that furthest to the right has the greatest accelerating action. It will be noted that compounds containing groups which have a retarding effect generally yield *m*-nitro-derivatives, whilst those containing groups which have an accelerating action yield mostly *o*- and *p*-nitro-derivatives.—A. S.

Methyl alcohol; Conversion of —— into formaldehyde, and the preparation of formalin. E. Orlow. J. Russ. Phys.-Chem. Ges., 1907, **39**, 855—868. Chem. Zentr., 1908, **1**, 114—115.

A measured quantity of air was passed through methyl alcohol of different strengths and at various temperatures, and the mixture of alcohol vapour and air was led over the catalytic agent (copper, platinum, lower oxides of vanadium, coke impregnated with freshly-reduced copper, etc.), the latter being heated to 30—45° C. and in some cases to higher temperatures. It was observed that besides formaldehyde, carbon dioxide, carbon monoxide, and frequently oxygen and hydrogen are formed. The best yield of formaldehyde is obtained when the volume of air passed amounts to 2·33—2·66 litres per minute, and when the temperature is so adjusted that each litre of air carries over 0·5—0·8 grm. of methyl alcohol. The yield also depends upon the nature, quantity, and temperature of the catalytic agent.—A. S.

Patents.

Camphene; Treatment of —— for obtaining valuable products [isobornyl ethers] therefrom. J. N. Goldsmith and The British Xylonite Co., Ltd., Brantham. Eng. Pat. 5429, March 6, 1907.

Isobornyl ethyl ether is prepared by heating one part of camphene with from one to two parts of ethyl alcohol, in presence of sulphuric acid, the concentration of which lies between 5 and 25 per cent. of the whole mixture. A continuous process of making the ether is described, in which the crude isobornyl ether is removed as made, and further quantities of camphene and ethyl alcohol added to the residue; sulphuric acid is added after every third or fourth operation, to keep its concentration within the above limits.—T. F. B.

Camphene and by-products; Manufacture of ——. R. E. Ellis, London. From Chem. Fabr. vorm. Sandoz, Basle, Switzerland. Eng. Pat. 10,784, May 8, 1907.

See Fr. Pat. 375,897 of 1907; this J., 1907, 947.—T. F. B.

Camphene; Process of making ——. A. Bischler and A. Baselli, Assignors to J. Basler et Cie, Basle, Switzerland. U.S. Pat. 876,137, Jan. 7, 1908.

See Eng. Pat. 19,960 of 1906; this J., 1907, 32.—T. F. B.

Isobornyl oxalates from camphene; Process for the manufacture of ——. A. Bischler and A. Baselli, Assignors to J. Basler et Cie., Basle, Switzerland. U.S. Pat. 876,310, Jan. 7, 1908.

See Eng. Pat. 19,961 of 1906; this J., 1907, 67.—T. F. B.

Borneol and camphor [from Blumea balsamifera]; Process for manufacture of ——. Soc. A. Kuner and P. Millet. Fr. Pat. 381,226, Nov. 2, 1906.

The invention consists in the extraction of borneol from the Asiatic plant, *Blumea balsamifera*, of the group of Senecionideæ, family of Compositæ, which grows in the region north of Tonkin where it is known by the native name of "Bang-fouinn." The plant yields *l*-borneol by the usual processes of distillation, and the product is a suitable raw material for the manufacture of camphor.—J. F. B.

Anti-streptococci serum; Manufacture of a new ——. O. Imray, London. From Farbw. vorm. Meister, Lucius, und Brüning, Hoechst a/Main, Germany. Eng. Pat. 10,981, May 10, 1907.

Septic streptococci from human beings, if cultivated on the usual nutrient media, rapidly lose their virulence towards test animals. On the other hand if they are propagated by successive "animal passages" they retain their virulence but lose their specific characteristics towards human beings. According to this invention, streptococci (*e.g.* from septic peritonitis) are first cultivated for a considerable time in defibrinated human blood and then transferred to animals, four or five successive "animal passages" being made. The product from the last animal is then further cultivated on nutrient bouillon and these virulent cultures are inoculated into large animals for the purpose of obtaining a protective serum.—J. F. B.

Acid esters of cyclical terpene alcohols; Process for the manufacture of ——. O. Zeitschel, Hamburg, Germany. Eng. Pat. 16,532, July 18, 1907.

See Fr. Pat. 379,430 of 1907; this J., 1907, 1253.—T. F. B.

Succinyl-dioxytoluic acid and succinyl-disalicylic acid. R. Berendes and J. Callsen, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pats. 874,928 and 874,929, Dec. 31, 1907.

See Fr. Pat. 378,220 of 1907; this J., 1907, 1109.—T. F. B.

Formaldehyde; Process of generating ——. A. Eichengrün, Düsseldorf, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfelod, Germany. U.S. Pat. 875,415 Dec. 31, 1907.

See Addition of Feb. 15, 1907, to Fr. Pat. 366,605 of 1906; this J., 1907, 839.—T. F. B.

Condensation products from formaldehyde, tannin, and aromatic monohydroxyl compounds; Process of manufacturing ——. H. Hildebrandt, Halle on Saale, Germany. U.S. Pat. 876,311, Jan. 7, 1908.

See Eng. Pat. 3665 of 1907; this J., 1907, 947.—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Photography; Screen-plate colour ——. C. E. Kenneth Mees. J. Soc. Arts, 1908, **56**, 195—204.

The subject of this monograph was treated under the following heads:—I, Basis of colour photography. II, Production of the screen. III, Conditions for the production of the filters. IV, Testing the filters. V, First black condition. VI, Limiting conditions for the size of screen-plate units. VII, Sensitizing conditions, and VIII, Production of positives.

Patents.

Photographic printing out papers. W. F. Cooper, Watford. Eng. Pat. 2156, Jan. 28, 1907.

An emulsion of agar-agar is applied to paper sized with a resinous sizing. The advantage claimed for the process is that the emulsions set and dry much more rapidly than those ordinarily used for the purpose, applied to baryta-coated or similar paper.—T. F. B.

Photographic processes of toning and intensifying. H. S. Wellcome, London, A. G. Bates and F. C. Starnes, Dartford. Eng. Pat. 12,304, May 28, 1907.

Silver prints may be toned to a sepia colour by immersion in 1 per cent. solutions of thiostannates of the alkalis or alkaline-earths, prepared by the action of the alkali, etc., sulphide on stannic sulphide. The solutions are also suitable for use in the intensification of negatives.—T. F. B.

Colour photography and photographic printing. F. W. Donisthorpe, Bath. Eng. Pat. 13,874, June 15, 1907.

Negatives, taken in the ordinary way, are treated with solutions which render the parts more affected by light, less capable of absorbing dyestuffs than the parts less affected by light; the following instances are given: (*a*), treatment with uranium ferricyanide followed by ferric chloride; (*b*), lead ferricyanide followed by sodium sulphide; (*c*), vanadium ferricyanide followed by ferric oxalate. The negatives are subsequently treated with the requisite dyestuff solution, and prints taken from them by contact with gelatin-coated paper.—T. F. B.

Pictures, photographic printing plates, and the like; Processes for producing ——. R. Boerner, Berlin. Eng. Pat. 19,889, Sept. 5, 1907. Under Int. Conv., Sept. 11, 1906.

The formation of silver halides and ferrocyanides by the action of ferricyanides and alkali halides on silver forms the basis of this process. A silver print, for example. previously hardened by alum, etc., is pressed against a paper containing on its surface a pigment, an alkali bromide, a ferricyanide, a bichromate, and a small quantity of a salt which catalytically hastens the oxidation of the ferrocyanide formed to ferricyanide by the chromic acid. The pigment paper is developed in hot water in the usual manner, and the original positive is restored by treatment with a suitable reducing agent for silver halides.—T. F. B.

Preparations sensitive to light, suitable for photography; Production of ——, *and of pictures stable to light by their aid.* J. de Ruiter. Fr. Pat. 380,502, June 19, 1907.

Paper coated with gelatin, albumin, etc., is treated with a solution of molybdic acid, tungstic acid, or uranic acid, or of a salt of these containing some free acid. After exposure under a negative, the portions of the surface not reached by light are rendered insoluble by treatment with a solution of barium or aluminium acetate, the excess of the salt being removed by washing. Molybdic acid is said to give the best results with this process, the pictures obtained being blue; they can be toned, if desired, with gold or platinum.—T. F. B.

Heliographic printing process. L. Fiorillo. Fr. Pat. 381,020, Aug. 20, 1907.

Paper is coated with gum arabic and impregnated with bichromate; after exposure in sunlight beneath a design, the paper is washed, dried, coated with an alcoholic solution of a suitable colour, sandarac, rosin, and shellac, and treated with dilute hydrochloric acid. A reproduction of the design in colour is said to result.—T. F. B.

XXII.—EXPLOSIVES, MATCHES, &c.

Patents.

Nitrated starch; Stabilised ——. F. B. Holmes, Woodbury, N.J., Assignor to the E. I. du Pont de Nemours Powder Co., Wilmington, Del. U.S. Pats. 875,913—875,928, Jan. 7, 1908.

The patents relate to explosives consisting mainly of nitrated starch, but containing small proportions (2—5 per cent.) of one of the following substances: ammonium orthophosphate, ammonium arsenate, normal ammonium chromate, ammonium palmitate, normal ammonium tartrate, normal ammonium pyrotartrate, triammonium citrate, oxamide, thiourea, nitraniline, aniline oxalate, acetanilide, nitrotoluidine, toluidine oxalate, acet-toluide, and benzamide.—G. W. McD.

Powders and explosive materials; Use of silicates, silicic acids or their derivatives in the composition of ——. F. Chailly. Fr. Pat. 381,311, Aug. 27, 1907.

The introduction of silicates and silicic acids among the components of an explosive mixture is said to facilitate the working up of the ingredients, accelerate the drying process, increase the chemical stability of the explosive, and prevent decomposition.—G. W. McD.

Explosive; Stable safety —— *and its manufacture.* N. Ceipek. Fr. Pat. 381,484, Sept. 3, 1907.

See Eng. Pat. 7838 of 1907; this J., 1907, 1296.—T. F. B.

Volatile liquids [Acetone, in manufacture of explosives]; Process and apparatus for the recovery of ——. C. Harrison, W. Bate and W. G. Perks. Fr. Pat. 381,529, Sept. 5, 1907.

The air, or gas containing the vapour (acetone) is caused to bubble through an aqueous solution of calcium chloride contained in a series of washers. The acetone is dissolved and is recovered from the solution by distillation.
—W. H. C.

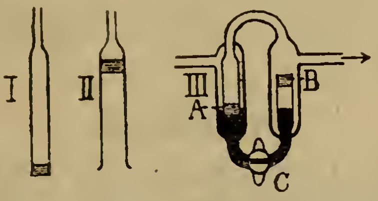
XXIII.—ANALYTICAL CHEMISTRY.

APPARATUS.

Porous material as a substitute for stop-cocks in gas analysis A. Stock. Ber., 1907, **40**, 4956—4959.

Prytz (this J., 1905, 1325) recommended the use of porous material as a substitute for taps in gas analysis.

His device consists of a tube closed near the top by a plug of the material covered with a layer of mercury; a smaller tube having its end closed by a similar porous plug fitted into this, and on bringing the two porous layers into contact, the gas could be drawn through both, and its passage instantly stopped by raising the end of the smaller tube into the mercury. The author finds that the most suitable porous material for this purpose is a mixture of clay, soluble glass, and indiarubber heated together and formed into small plates. These are relatively very porous to gas, a plate 8 mm. in diameter and 2 to 3 mm. in thickness allowing 600 to 800 c.c. of air to pass through in a minute under a pressure of 60 cm. of mercury. A layer of mercury will resist a greater pressure than that of one atmosphere without being driven through the material. The plates may be fused to the middle or end of a glass tube, and the latter heated to above 100° C. without breaking. They will also resist the action of boiling water and dilute acids, and may thus be easily cleaned. Two forms of these tubes are shown in the figure, I and II, whilst III represents an apparatus particularly suitable for use with a mercury pump. It contains two porous plates, A and B, and a tap, C. When the latter is opened, the apparatus is filled with sufficient mercury to close the porous plate as here shown. If now C is closed and a vacuum created on the side indicated by the arrow, the valve, A, closes the tube connected with the gasometer, etc. To fill the vessel in which the vacuum was created, the tap, C, is opened, the mercury rises under the influence of the pressure to the plate, B, so that A is opened and allows the gas to pass. A simple porous valve may be extemporised by glueing a cap of toughened filter paper to the end of a glass tube. This, too, will resist the passage of mercury under a pressure of one atmosphere.—C. A. M.



Patents.

Analysing gases; Method of and apparatus for ——. W. L. Wise, London. From Jones, Julia Manuf. Co., New York. Eng. Pat. 1562, Jan. 21, 1907.

See U.S. Pat. 854,696 of 1907; this J., 1907, 717.—T.F.B.

Combustible gases in closed spaces; Apparatus for indicating the presence of ——. A. Philip and L. J. Steele. Fr. Pat. 381,468, Sept. 2, 1907.

See Eng. Pat. 22,129 of 1906; this J., 1907, 1212.—T.F.B.

INORGANIC—QUALITATIVE.

Ozone, nitrogen peroxide and hydrogen peroxide; Detection of —— *in gas mixtures.* E. H. Keiser and L. McMaster. Amer. Chem. J., 1908, **39**, 96—104.

Modern commercial processes of treating air so as to convert it into a more active chemical agent, particularly in connection with flour bleaching, require a method of estimating ozone, nitrogen peroxide and hydrogen peroxide each in the presence of the others. On passing the gases through even dilute potassium permanganate solution, nitrogen peroxide and hydrogen peroxide are decomposed, but ozone passes unchanged, and can be detected with starch and potassium iodide. Ozone and hydrogen peroxide are decomposed on passing through a tube of powdered manganese dioxide, but nitrogen peroxide passes unchanged, and its presence can be shown by passing the gas so purified into very dilute permanganate. A more delicate test is to pass the gas into caustic soda solution free from nitrites and apply the sulphanilic acid and α-naphthylamine reagent. Hydrogen peroxide is identified by passing the gas mixture into a solution of potassium ferricyanide and ferric chloride which becomes first green and then blue, a change produced neither by ozone nor nitrogen peroxide.—E. F. A.

Ruthenium in platinum alloys; Detection of ——. N. A. Orlow. *See* X.

INORGANIC—QUANTITATIVE.

Barium; Quantitative separation of —— *from strontium.* Z. Kahan. Analyst, 1908, **33**, 12—14.

The method is based upon the reduction of the solubility of barium chromate by means of an addition of ammonium acetate. The solution of the barium and strontium salts is treated with ammonium bichromate solution (120 grms. per litre) added drop by drop with continual stirring, until the precipitation of the barium is nearly complete. Ammonium acetate solution (about 300 grms. per litre) is next added until the liquid becomes colourless; then a few drops of the chromate solution so that the liquid has a faint yellow colour; and lastly more ammonium acetate solution. By adding the smallest possible excess of the ammonium bichromate solution, the formation of strontium chromate is reduced to a minimum, and the necessity of a double separation of the strontium is obviated. After standing for two or three hours, the contents of the beaker are filtered through a Gooch's crucible, and the precipitate washed first by decantation and then in the crucible with diluted ammonium acetate solution (20 to 30 c.c. per litre) until the filtrate gives only a slight coloration with neutral silver nitrate solution. The crucible is then dried at 180° to 260° C. until constant in weight, the final weighing being made after it has stood for at least an hour in the balance case. In the test experiments described, the barium chloride solution contained 0·1109 grm. of barium and the strontium chloride solution, 0·0651 grm. of strontium per 10 c.c., and from 250 c.c. to 350 c.c. of the diluted ammonium acetate solution were used for washing the precipitate obtained from 100 to 250 c.c. of the mixed solutions. The error in the amount of barium found in 10 c.c. ranged from — 0·0037 grm. to +0·0036 grm., and the error in the strontium from — 0·0021 grm. to +0·0017 grm.—C. A. M.

Chlorates, bromates, iodates, and periodates; Determination of ——. H. Brunner and R. Mellet. J. prakt. Chem. 1908, **77**, 33—42.

Chlorates, bromates, iodates, and periodates, when warmed with formaldehyde and potassium persulphate, in the presence of silver nitrate and nitric acid, are reduced, giving the silver halide. The reaction may be quantitatively applied as follows:—About 0·1 grm. of the salt is dissolved in 20 c.c. of water and warmed with 10—20 c.c. of *N*/10 silver nitrate, 5 c.c. of nitric acid (sp. gr., 1·4), 1 grm. of potassium persulphate, and 1 c.c. of formaldehyde, until the smell of the aldehyde is no longer apparent. After cooling, the excess of silver nitrate is determined volumetrically by Volhard's method. For iodates and periodates 2 grms. of the persulphate and 5 c.c. of formaldehyde are necessary, but too large an excess of formaldehyde should be avoided, because of its violent action on nitric acid. In the case of iodates and bromates, the mixture should be heated over a small flame: for chlorates a water-bath suffices. No loss of halogen need be feared when working in open vessels. The method is not applicable to perchlorates. The part played by the persulphate has not been definitely determined.—F. Sodn.

Silicon; Analysis of commercial ——. F. Limmer. *See* VII.

Manganese in water; Determination of ——. E. Ernyei. *See* XVIII*B*.

ORGANIC—QUALITATIVE.

Cottonseed oil; Halphen's test for ——. H. Sprinkmeyer. *See* XII.

Sesamé oil; Testing margarine for ——. H. Sprinkmeyer. *See* XVIII*A*.

ORGANIC—QUANTITATIVE.

Oils of the aromatic and aliphatic series; Action of dimethyl sulphate on ——. T. W. Harrison and F. M. Perkin. *See* III.

Acetone; Determination of ——. G. Heikel. *See* III.

Tannin analysis; Official method of the American Leather Chemists' Association for ——. *See* XIV.

Leather analysis; Provisional method for ——. *See* XIV.

Hop tannin. A. C. Chapman. *See* XVII.

Gliadin [*in flour*]*; Determination of* ——. W. E. Mathewson. *See* XVIII*A*.

XXIV.—SCIENTIFIC & TECHNICAL NOTES.

The Andrew Carnegie Research Scholarship of the Iron and Steel Institute.

A Research Scholarship or scholarships, of such value as may appear expedient to the Council of the Iron and Steel Institute from time to time, founded by Mr. Andrew Carnegie (Past-President) will be awarded annually, irrespective of sex or nationality, on the recommendation of the Council of the Institute. Candidates, who must be under thirty-five years of age, must apply on a special form before the end of February to the Secretary of the Institute. The object of this scheme of Scholarships is to enable students, who have passed through a college curriculum or have been trained in industrial establishments, to conduct researches in the metallurgy of iron and steel and allied subjects, with the view of aiding its advance or its application to industry. There is no restriction as to the place of research which may be selected, whether university, technical school, or works, provided it be properly equipped for the prosecution of metallurgical investigations. The appointment to a Scholarship shall be for one year, but the Council may at their discretion renew the Scholarship for a further period instead of proceeding to a new election. The results of the research shall be communicated to the Iron and Steel Institute in the form of a Paper to be submitted to the Annual General Meeting of members, and if the Council consider the Paper to be of sufficient merit, the Andrew Carnegie Gold Medal shall be awarded to its author. Should the Paper in any year not be of sufficient merit, the Medal will not be awarded in that year.

Trade Report.

United Kingdom; Imports of —— *during* 1907.

The following table gives the amount and value of chemicals, drugs, dyestuffs, colours, etc., imported during the year ended December 31st, 1907, as compared with 1906:—

Articles.		Quantities.		Value.	
		Year ended Dec. 31st,		Year ended Dec. 31st,	
		1907.	1906.	1907.	1906.
				£	
Chemicals:					
Bleaching materials	cwts.	176,586	238,123	43,430	61,988
Boracite, borate of lime, borate of magnesium, and borax	,,	387,022	373,413	178,494	156,933
Brimstone	,,	346,854	500,650	88,107	116,476
Coal products, not dyes	,,	71,506	91,264	90,536	101,480
Cream of tartar	,,	70,117	64,287	270,819	237,680
Glycerin	,,	54,535	49,052	100,097	78,613
Ammonium chloride	,,	5,287	9,410	7,314	12,006
Potassium nitrate	,,	236,355	223,272	232,205	213,089
Soda compounds	,,	343,537	310,267	127,599	104,938
Sulphuric acid	,,	75,086	89,904	6,103	5,055
Tartaric acid	,,	36,274	36,779	175,307	175,721
Unenumerated, including calcium carbide and nickel sulphate	Value £	—	—	2,766,080	2,105,125
Drugs and medicines:					
Bark, Peruvian	cwts.	24,470	24,602	53,817	51,446
Quinine and its salts	ozs.	2,345,180	1,973,039	81,809	68,050
Unenumerated	Value £	—	—	1,079,786	1,028,675
Dyestuffs (other than dye woods) and substances used in tanning or dyeing:					
Bark, for tanning	cwts.	477,622	336,479	197,114	139,291
Cutch	tons	7,539	5,217	172,533	116,139
Dyes, coal tar:					
Alizarin and alizarin dyes	cwts.	62,860	57,291	268,850	239,957
Aniline	,,	218,428	188,592	1,271,070	1,084,311
Synthetic indigo	,,	41,379	39,042	158,481	147,325
Other coal tar dyes	,,	1,562	676	7,510	2,274
Extracts	Value £	—	—	769,777	777,850
Gambler	tons	7,885	7,318	158,325	148,811
Indigo	cwts.	11,116	7,641	151,297	111,445
Myrabolans	,,	670,749	676,419	172,771	176,521
Valonia	tons	20,442	18,099	212,896	194,294
Painters' colours and pigments:					
White lead	cwts.	298,643	283,371	308,196	259,769
Nickel oxide	,,	24,282	16,148	124,788	84,606
Zinc oxide	,,	288,872	278,441	332,060	302,215
Other sorts	,,	1,590,615	1,605,408	886,539	860,329
Total	,,	2,202,412	2,183,368	1,651,583	1,506,919
Manures:					
Bones, whether burnt or not	tons	46,115	42,604	206,598	194,633
Guano	,,	31,278	24,906	148,723	127,719
Sodium nitrate	,,	113,894	108,486	1,256,658	1,183,082
Phosphate of lime and rock phosphate	,,	504,529	442,970	825,619	678,696

British India; Revised tariff valuations.

A Customs Notification, taking effect from Jan. 1st, 1908, revises the tariff valuation fixed for imports into British India. The full text of the notification appears in the issues of the " Board of Trade Journal " for Jan. 16th and 23rd.

New Books.

Die Englischen Elektrochemischen Patente. Auszüge aus den Patentschriften, zusammengestellt und mit ausführlichem Sach- und Namenregister versehen. Von Dr. F. Ferchland. Erster Band. Elektrolyse. Wilhelm Knapp's Verlag, Halle a. S., Germany. 1907. Price M.9.

8vo volume, forming part of Vol. XXIX. of the " Monographien über angewandte Elektrochemie," and containing 163 pages of subject matter, with numerous illustrations, followed by indexes of subjects and names of patentees. Abstracts of British patents relating to Electrochemistry are given, dating from 1842 to 1906.

The Paper Mill Chemist. By Henry P. Stevens, M.A., Ph. D. Scott, Greenwood and Son, 8, Broadway, Ludgate Hill, London, E.C. The Copp Clark Co., Ltd., Toronto, Canada. D. van Nostrand Co. New York, U.S. America. 1908. Price 7s. 6d. net.

Royal 12mo volume, containing 268 pages of subject matter, with 67 illustrations, 82 tables, and an alphabetical index. It is stated that this little book " has been written with the object of providing in a handy form the necessary information for carrying out chemical and physical tests on paper, and the raw materials used in its manufacture, and to supply in a convenient form those analytical and practical paper-making data which may be useful for the purpose of reference."

Développement et Progrès de la Fabrication du Malt pendant les Quarante dernières années. Par Ed. Eckenstein. Librairie Scientifique A. Hermann, 6, rue de la Sorbonne, Paris. 1908. Price frcs. 5.

Large 8vo volume, containing 211 pages of subject matter with 64 illustrations. The subjects treated of comprise the following:—I. The steeping process. II. The malting process. III. Pneumatic and mechanical malting processes. IV. History of the development of the malting process. V. Application of electricity to malting. VI. The malting kiln. VII. Changes in the organisation of the malt-house. VIII. The science of the malting process.

Statistical Abstract for the several British Colonies, Possessions and Protectorates in each year from 1892 to 1906. Forty-fourth number. [Cd. 3,707.] Wyman and Sons, Fetter Lane, London, E.C. Price 1s. 11d.

This publication, which is prepared annually in the Statistical Department of the Board of Trade, contains in a succinct form the principal official data regarding the trade, shipping, agriculture, production, revenue, and expenditure, &c., of the various British Colonies, Possessions and Protectorates, as well as an abstract of the rates of import duty levied in the various Colonies on the principal articles of trade. New features of the present issue include the imports and exports into and from British South Africa, as a whole, distinguishing principal articles and countries of origin and destination of the articles, and also particulars of the production, imports, and domestic exports of manganese ore in British India.

Patent List.

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

Applications.

18,750a (1907). Beilby and Beilby. Apparatus for rapidly exposing powdered material in thin layers to the action of heat in presence of gases.* Jan. 17.

1108. Sprenger. Heating and drying chambers. [Ger. Appl., Jan. 31, 1907.]* Jan. 16.

1168. Schmatolla. Furnaces, kilns, etc. Jan. 17.

1455. Black, Lennox, and Lennox. Continuous drying machines. Jan. 21.

1630. Passburg. Drying process and apparatus.* Jan. 23.

1681. Hampson. Separating gases of different densities. Jan. 24.

Complete Specifications Accepted.

635 (1907). British Thomson-Houston Co. (General Electric Co.). Instruments for measuring the weight of steam or gas passing through a pipe. Jan. 22.

1077 (1907). Camacho (Eastman). Vacuum production. Jan. 22.

1363 (1907). Allan. Apparatus for treating smoke and gases. Jan. 29.

5167 (1907). Spiby. Apparatus for mixing plastic or dry material. Jan. 29.

13,790 (1907). Hildebrandt. Apparatus for liquefying gases of low boiling-point and distilling such liquefied gases. Jan. 22.

18,767 (1907). Melcher. Winning large, well-formed, threadless crystals. Jan. 29.

20,849 (1907). Bock. Continuous drying and carbonising kilns. Jan. 29.

21,068 (1907). Lagosse. Drying steam. Jan. 22.

II.—FUEL, GAS, AND LIGHT.

Applications.

829. Stewart and Stewart. Gas producers. Jan. 14.

837. Sharpe and Sharpe. Apparatus for producing air gas. Jan. 14.

841. Kirby and Taylor. Manufacture of coal gas. Jan. 14.

907. Suchowiak. Production of artificial fuel.* Jan. 14.

1082. Cowper-Coles. Manufacture of coal briquettes.* Jan. 16.

1409. Seymour. Coke ovens. Jan. 21.

1504. Coelho (Pinto). Production of gas from oily seeds. Jan. 22.

1553. Coales. Manufacture of artificial fuel.* Jan. 22.

1643. Broad. Apparatus for producing gas. [Addition to No. 1780 of 1907.]* Jan. 23.

1653. Millar. Treatment of peat for fuel. Jan. 24.

1673. Ries. Retort and chamber furnaces for coal, ore, etc. [Ger. Appl., Jan. 26, 1907.]* Jan. 24.

1695. Nickel et Méthane Soc. Anon. Producing gas and nitrogen compounds simultaneously. [Fr. Appl., Jan. 24, 1907.]* Jan. 24.

1764. Talbot. Gas producers.* Jan. 25.

COMPLETE SPECIFICATIONS ACCEPTED.

5575 (1907). British Thomson-Houston Co. (General Electric Co.). Manufacture of electric conductors suitable for incandescence bodies in electric lamps. Jan. 29.

6921 (1907). Jones. Coke ovens. Jan. 22.

10,667 (1907). Wagner. Manufacture of briquettes. Jan. 22.

11,717 (1907). Siemens und Halske A.-G. Manufacture of incandescence electric lamp filaments of tungsten or its alloys. Jan. 22.

24,028 (1907). Wolfram Lampen A.-G. Decarbonising tungsten filaments containing carbon or carbide. Jan. 22.

IV.—COLOURING MATTERS AND DYESTUFFS.

APPLICATIONS.

1165. Newton (Bayer und Co.). Manufacture of anthracene derivatives. [Addition to No. 28,765 of 1906.] Jan. 17.

1334. Durand, Huguenin, et Cie. Manufacture of the leucogallocyanine corresponding with pyrogallol. [Ger. Appl., Jan. 21, 1907.]* Jan. 20.

1678. Newton (Bayer und Co.). Manufacture of anthraquinone derivatives. [Addition to No. 28,765 of 1906.] Jan. 24.

COMPLETE SPECIFICATIONS ACCEPTED.

2255 (1907). Ostrogovich and Silbermann. Production of induline and induline-like colours. Jan. 22.

2768 (1907). Bloxam (Act.-Ges. f. Anilinfabr.). Manufacture of blue colouring matters of the safranine series. Jan. 29.

6930 (1907). Imray (Meister, Lucius, und Brüning). Manufacture of arylthioglycollic-*o*-carboxylic acids. Jan. 29.

7147 (1907). Bloxam (Act.-Ges. f. Anilinfabr.). Yellow azo dyestuffs. Jan. 22.

14,846 (1907). Imray (Meister, Lucius, und Brüning). Manufacture of dyestuffs of the thioindigo series. Jan. 22.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

APPLICATIONS.

759. Milard. Treatment of textiles, etc., by liquid processes.* Jan. 13.

858. Dreaper. Manufacture of threads or films of cellulose.* Jan. 14.

963. Pickles and Pickles. Means for "schreinering" fabrics. Jan. 15.

993. Venter. Purifying the soda lye from the mercerisation process. [Ger. Appl., March 28, 1907.]* Jan. 15.

1265. Guadagni. Production of artificial silk. [Ital. Appl., Sept. 28, 1907.]* Jan. 18.

1273. Crepin. Bleaching textile vegetable substances. [Fr. Appl., Feb. 4, 1907.]* Jan. 18.

COMPLETE SPECIFICATIONS ACCEPTED.

1549 (1907). Johnson (Kalle und Co.). Production of discharge effects on textiles. Jan. 29.

3606 (1907). Müller. Spinning apparatus for producing single threads from solutions. Jan. 22.

4902 (1907). Ransford (Zundel). Producing varied silk-like or velvet effects. Jan. 29.

13,132 (1907). Newton (Bayer und Co.). Production of colour effects on mixed cotton and wool fabrics by sulphide dyestuffs. Jan. 29.

VII.—ACIDS, ALKALIS, AND SALTS.

APPLICATIONS.

921. Verrier. Manufacture of sodium metasilicate and its amorphous and crystalline hydrates. [Fr. Appl., Jan. 24, 1907.]* Jan. 14.

993. Venter. *See under* V.

1110. Buendia. Treating ores containing carbonate of lime. [Span. Appl., Oct. 1, 1907.]* Jan. 16.

1352. Fritsche. Production of perborate of soda containing borax.* Jan. 20.

1425. Auzies and Ségoffin. Obtaining magnesia from dolomite. [Fr. Appl., Jan. 24, 1907.]* Jan. 21.

1436. Gooch. Separation and application of certain constituents of air. Jan. 21.

1461. Brandenburg. Manufacture of tin chloride.* Jan. 21.

1608. Percy and Byrom. Extracting hydrocyanic acid from waste gases. Jan. 23.

1610. Cunnington. Manufacture of double alkaline carbonates. Jan. 23.

1611. Cunnington. Manufacture of alkaline salts of sodium, etc. Jan. 23.

1639. Robeson. Briquettes of sulphur-bearing material.* Jan. 23.

1695. Nickel et Méthane Soc. Anon. *See under* II.

1752. Ellis. Utilising the impure precipitate produced during the manufacture of borax. Jan. 25.

COMPLETE SPECIFICATIONS ACCEPTED.

1197 (1907). British Thomson-Houston Co. (General Electric Co.). Treatment of boron. Jan. 29.

1256 (1907). Jaubert. Decomposition of chlorates and perchlorates by combustion. Jan. 29.

1744 (1907). Knowles. Manufacture of carbonic acid gas. Jan. 22.

9407 (1907). Krauss, and Ges. f. Stickstoffdunger. Producing ammonia from nitrogen compounds. Jan. 22.

20,653 and 20,654 (1907). Hartenstein. Manufacture of carbide. Jan. 22.

VIII.—GLASS, POTTERY, AND ENAMELS.

APPLICATION.

1434. Ling and Carden. Reproduction of images on glass, ceramic, metallic, and other surfaces. Jan. 21.

COMPLETE SPECIFICATIONS ACCEPTED.

4155 (1907). Gee. Treatment of china clay, ochre, etc. Jan. 29.

23,063 (1907). Fischer. Production of highly glazed, coloured earthenware. Jan. 22.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

APPLICATIONS.

860. Wilson. Fire-resisting composition. Jan. 14.

1172. Cowper-Coles. Manufacture of cement. Jan. 17.

1339. Bonnefont. Manufacture of artificial stone.* Jan. 20.

1452. Castéran. Artificial wood. [Fr. Appl., Jan. 22, 1907.]* Jan. 21.

Complete Specifications Accepted.

22,425 (1906). Cowper-Coles. Manufacture of cement. Jan. 22.

15,761 (1907). Siegmann. Wood substitute. Jan. 22.

X.—METALLURGY.

Applications.

913. Birkeland. Treating or smelting ores, etc.* Jan. 14.

955. Stuart. Calcining furnace for ores and the like. Jan. 15.

1079. Hill (Lay). Recovering precious metals from cyanide solutions.* Jan. 16.

1438. Ling and Carden. *See under* VIII.

1442. Thwaite. Treatment of refractory ores. Jan. 21.

1582. Birkbeck (Just Mining and Extraction Co.). Extraction of precious metals from ores.* Jan. 23.

1604. Hollings and Hollings. Recovery of metals from ores, etc. Jan. 23.

1673. Ries. *See under* II.

1676. Wikström. Smelting furnaces. [Swed. Appl., Jan. 25, 1907.]* Jan. 24.

1699. Talbot. Manufacture of iron and steel. Jan. 24.

1761. Heskett. Continuous extraction of zinc from its sulphide. Jan. 25.

Complete Specifications Accepted.

712 (1907). United Alkali Co., and others. Recovery of zinc from liquors from the wet copper process. Jan. 22.

899 (1907). Hollidge. Magnetic separators. Jan. 22.

1259 (1907). Frith (Grist). Treatment of metals such as steel or steel alloys. Jan. 29.

1699 (1907). Pratt. Treatment of copper. Jan. 29.

2058 (1907). Sulman. Separation of zinc from its sulphate. Jan. 29.

2361 (1907). Schieber. Welding copper, nickel, and their alloys. Jan. 22.

4428 (1907). Deuts. Wachwitzmetall A.-G. Plating iron or steel with aluminium alloys. Jan. 22.

9559 (1907). Lake (Strout and Parker). Fluxes for brazing. Jan. 22.

16,726 (1907). F. Krupp, A.-G. Aluminium alloy. Jan. 29

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

Applications.

997. Cowper-Coles. Apparatus for the electrodeposition of metals. Jan. 15.

1344. Salzer. Production of electrolytic deposits of chromium. [Ger. Appl., Jan. 21, 1907.]* Jan. 20.

1420. Chloride Electrical Storage Co., and Heap. Treatment of wood for use in electric batteries and electrolytic cells.* Jan. 21.

1470. British Thomson-Houston Co. (General Electric Co.). Electric furnaces. Jan. 21.

Complete Specifications Accepted.

22,920 (1906). Hatfield. Electrolytic cells. Jan. 29.

7757 (1907). Billitzer. Electrolysis of alkali chlorides, etc. Jan. 22.

17,968 (1907). Classen. Electrolytic production of lustrous metal coatings on other metals. Jan. 22.

17,969 (1907). Classen. Electrolytic production of dark metallic coatings on metals. Jan. 22.

20,650 (1907). Hartenstein. Electric furnaces. Jan. 22.

26,130 (1907). Brewer (Taylor). Electric furnaces. Jan. 22.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

Application.

741. Electrolytic Alkali Co., Ltd., Connor, and Stubbs. Treatment of resins, wax, gums, fats, oils, etc., with chlorine. Jan. 13.

Complete Specification Accepted.

23,146 (1907). Berliner. Extraction of fats, oils, and the like. Jan. 22.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc.

(*A.*)—Pigments, Paints.

Applications.

861. Meulener. Fire-resisting pigments.* Jan. 14.

1768. Boivie. Manufacture of paints. Jan. 25.

(*B.*)—Resins, Varnishes.

Application.

741. Electrolytic Alkali Co. and others. *See under* XII.

(*C.*)—India-Rubber.

Application.

1254. Fischer. Manufacture of solutions of caoutchouc. [Ger. Appl., Jan. 19, 1907.]* Jan. 18.

Complete Specifications Accepted.

2289 (1907). Passmore. Regenerating rubber or caoutchouc. Jan. 22.

6065 (1907). Hutchinson. Composition containing rubber. Jan. 29.

15,542 (1907). Ohm. Production of a caoutchouc-like elastic substance. Jan. 22.

XIV.—TANNING, LEATHER, GLUE, SIZE, Etc.

Complete Specification Accepted.

15,794 (1907). Pollak. Manufacture of leather substitute. Jan. 22.

XVI.—SUGAR, STARCH, GUM, Etc.

Complete Specification Accepted.

11,801 (1907). Duryea. Process for highly modifying starch. Jan. 22.

XVII.—BREWING, WINES, SPIRITS, Etc.

Complete Specifications Accepted.

2591 and 2591A (1907). Reynaud and Frestadius. Treatment of pot ale. Jan. 22.

11,882 (1907). Bailey. Obtaining wort from unmalted grain. Jan. 22.

XVIII.—FOODS; SANITATION, WATER PURIFICATION; AND DISINFECTANTS.

(*A.*)—Foods.

Application.

1247. Von Skorzewski. Manufacture of a vegetable food product.* Jan. 18.

Complete Specifications Accepted.

1667 (1907). Harrison. Food materials. Jan. 29.

25,796 (1907). Stachelhaus and others. Preserving meats. Jan. 22.

(*B.*)—Sanitation; Water Purification.

Complete Specifications Accepted.

11,282 (1907). Howard. Preparation of filter beds. Jan. 29.

14,704 (1907). Ellis. Apparatus for treating and purifying sewage. Jan. 29.

XIX.—PAPER, PASTEBOARD, Etc.

Application.

858. Dreaper. *See under* V.

Complete Specification Accepted.

1903 (1907). Schmidt. Utilising the waste waters of paper machines. Jan. 29.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

Applications.

855. Wellcome and Pyman. Manufacture of therapeutic compounds. Jan. 14.

1256 and 1257. Bloxam (Act.-Ges. f. Anilinfabr.). Manufacture of camphene. Jan. 18.

1330. Lake (Geh. Kommerzienrat K. A. Lingner). Manufacture of condensation products from phenols and formaldehyde.* Jan. 20.

1617. Ges. f. Chem. Ind. in Basel. Obtaining the active constituent of *Cascara sagrada* bark. [Ger. Appl., Aug. 23, 1907.]* Jan. 23.

1682. Zimmermann (Chem. Fabr. auf Actien, vorm. E. Schering). Manufacture of bromisovaleric acid esters of the borneols. Jan. 24.

Complete Specifications Accepted.

3068 (1907). Newton (Bayer und Co.). Manufacture of alkylphenolic ethers from compounds containing phenolic groups. Jan. 29.

12,889 (1907). Scheitlin. Production of 1-phenyl-2.3-dimethyl-4-sulphamino-5-pyrazolone. Jan. 29.

26,415 (1907). Nördlinger and Nördlinger. Preparation of pure lactic acid. Jan. 29.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES

Applications.

1027. Gibson. Pigment photographic processes. Jan. 16.

1689. Caldwell. Sensitized surfaces of films for photographic purposes. Jan. 24.

XXII.—EXPLOSIVES, MATCHES, Etc.

Application.

1677. Sparre. Manufacture of explosives. [U.S. Appl., Jan. 25, 1907.]* Jan. 24.

Complete Specification Accepted.

1704 (1907). Rhein. Dynamitfabrik. Making plastic nitroglycerin explosives. Jan. 29.

XXIII.—GENERAL ANALYTICAL CHEMISTRY.

Application.

1636. Brown and Duvel. Apparatus for the rapid determination of moisture in grain. [U.S. Appl., March 2, 1907.]* Jan. 23.

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Official Notice.

DRAFT BY-LAWS.

AS FINALLY SETTLED BY THE COUNCIL.

Take Notice that in pursuance of the provisions of Clause 37 of the Charter a General Meeting of the Society will be held at the House of the Royal Society of Arts, John Street, Adelphi, London, on Friday, the 13th day of March, 1908, at 3.30 o'clock in the afternoon, for the purpose of considering and adopting the draft By-laws, which, after due consideration of the observations received from members in response to the invitation in that behalf, have been finally settled by the Council, and a print of such finally settled By-laws was sent to each Member of the Society in the January 31st number of the Journal.

By order of the Council.

Charles G. Cresswell, *Secretary.*

Liverpool Section.

The Hurter Memorial Lecture will be delivered by Sir Oliver Lodge, F.R.S., Principal of the Birmingham University, on "The Structure of the Atom," on Thursday, 12th March, 1908, at 8 p.m., in the Theatre of the Chemical Department of the University of Liverpool.

London Section.

Meeting held on Monday, Jan. 6, 1908.

DR. J. LEWKOWITSCH IN THE CHAIR.

The Chairman expressed in feeling terms the great loss the Section had sustained in the death of the Hon. Treasurer of the Society, Mr. Samuel Hall.

Owing to illness, a paper prepared by the Chairman, Mr. R. J. Friswell, entitled "Preparation of paratoluidine from mixed toluidines by means of paratoluidine hydrate," could not be read.

Dr. Lewkowitsch gave an address dealing with the Origin of Petroleum.

Newcastle Section.

Meeting held at Armstrong College, on Thursday, January 16th, 1908.

MR. N. H. MARTIN IN THE CHAIR.

NOTES ON THE PROXIMATE CONSTITUENTS OF COAL.

BY PROFESSOR P. PHILLIPS BEDSON.

It is now some eight years since in a note read before the North of England Institute of Mining Engineers I drew attention to the remarkable solvent action of pyridine on coal. Subsequently, at my suggestion, Mr. J. Baker undertook the examination of the action of this solvent on different classes of coal, the results of this investigation were communicated to the same Society. The method employed by Baker consisted in submitting a weighed amount of the finely divided coal to the action of pyridine in a Soxhlet extraction apparatus for several hours. From the pyridine solution, after removal of the greater portion of the solvent by distillation under reduced pressure, the dissolved matter was precipitated by dilute hydrochloric acid, filtered off, washed, dried, and weighed. The portion undissolved by the pyridine was also washed to free it from pyridine, then dried and weighed. The coals examined by Baker were four in number and represented different classes of coal. A sample of anthracite from South Wales yielded practically nothing to pyridine, whilst from a bituminous coal, viz., that of the Hutton Seam in the County of Durham, and sold as a gas coal, as much as 20·4 per cent. was extracted; another bituminous coal, viz., the coal from the Brockwell Seam in the same county, and one highly prized for its coking properties, gave an extract amounting to 11·5 per cent. of its weight. The fourth coal examined was one from New Zealand, resembling brown coal in composition, and, like the coals of that class, contains a considerable proportion of moisture. The loss in weight of this coal when treated with pyridine amounted to 21·4 per cent., which, when the water removed is deducted, represents an extract of coal substance of some 5·65 per cent. The pyridine solutions are dark red to brown in colour, and in some instances exhibited a green fluorescent.

The extracts in each case were found to be rich in volatile constituents, and in the coking assay gave highly intumescent cokes, whereas the residues left after extraction were almost devoid of coking properties. In the case of the coking coal from the Brockwell Seam, the portion insoluble in pyridine had not completely lost the caking power, but yielded a coke much less bulky than that left by the original coal. I informed Dr. Carrick Anderson, of Glasgow, who had made a complete examination of the coals of the Scotch Coal Fields, of this action of pyridine, and in 1902 (this J., 1902, 242), he published the results of an investigation of the coals of Bengal and Japan, in which he also gave an account of the results obtained by submitting these and also some Scotch coals to extraction with pyridine. In general terms, Dr. Carrick Anderson confirmed the experience of Mr. Baker and myself. Recently my attention has been directed to this question, and at my request Mr. Herbert Blair has examined a number of coals of different types, and also certain allied substances.

An examination of the different constituent parts of the Busly Seam Coal, from Boitley, County Durham, viz., the "Bright Coal" and the "dant," showed that whilst the former yielded some 19·38 per cent. to pyridine, from the latter only a fraction of a per cent. was dissolved These values were obtained by weighing the residue left undissolved by the pyridine, after it had been washed with dilute hydrochloric acid and water and then dried, and the difference in weight before and after extraction taken to represent the amount dissolved out. This procedure was adopted, as it was found that the solid matter was not completely precipitated from the pyridine solution by treatment with hydrochloric acid.

The proportion extracted by pyridine shows "dant" to be similar to anthracite, containing very little, if any, soluble matter, a similarity which is borne out by the comparison of the proximate analysis of the two. The volatile matter in the "dant" was found to be 9·92 per cent., whilst in the anthracite used by Baker the proportion was 8·23 per cent. The "bright coal" resembles very nearly the Hutton Seam coal, both in the amount dissolved by pyridine and in the proportion of volatile matter yielded on assay.

With the object of obtaining further information as to the solvent action of pyridine on different classes of coal, samples of six coals were procured from the Redhaugh Gas Works, through the kindness of Mr. Hardie, the Manager, who also supplied us with the average results obtained with these coals under actual working conditions in the gas retorts.

In the extraction of these coals with pyridine the method of treatment was modified, as follows: The coal, after sampling, is finely ground and passed through a sieve, 30 meshes to the linear inch. Five grms. of the coal are mixed with sand, in amount sufficient to make a column rising to the top of the syphon tube of a Soxhlet apparatus. The coal and sand rest on a layer of broken clay pipe stems and a pad of absorbent wool. The Soxhlet tube was fitted to a round-bottom flask, holding the pyridine, and to the tube was attached a reversed condenser. The distillation of the solvent and its percolation through the coal was allowed to proceed for several hours until it was judged to be complete, by the absence of colour in the pyridine flowing through the siphon tube. The solution was then brought into an evaporating basin and the pyridine evaporated off in a good current of air, the dried residue was then broken up and the heating in the water bath continued until the odour of pyridine had disappeared. The basin and contents were then weighed and from the weighings the amount of extract ascertained. In this manner fairly concordant results are obtained.

In the tables below are given the results of these experiments, also the proximate analyses of the coals, as made in the Laboratory and also as deduced from the results obtained in working at the Gas Works.

Table I.

Results obtained in Gas Works.

Mark.	Yield of gas in cubic feet per ton.	Illuminating power of gas in candles.	Yield of coke, per ton.	Percentage of ashes in coke.
A	11381	16·63	13·55	8·53
B	11392	16·50	13·51	8·92
C	11646	16·40	13·73	8·50
D	11108	16·00	14·25	7·80
E	10913	16·39	13·36	10·80
F	10730	15·76	13·29	15·12

"None of the coals are really very bad, but the last are the worst two we get. We would call A and B good, C and D medium and E and F bad." This conclusion is in the main borne out by the proximate analyses of those coals, as shown in Table II., the proportion of volatile matter in E does not, however, justify its association with F. Again, from Table III., it is seen that the percentages of extract and of volatile matter are not far removed from one another, and if arranged in the order of the percentage of extract the coal, E, falls out of its order, just as it does when the coals are arranged according to the proportion of volatile matter. But such statistical consideration can be very readily pushed too far, and the proximate assay of a coal while it is useful for many purposes the information it affords as regards the composition of a coal is after all not great. There appears, at first sight, to be some approximation between the proportion extracted by pyridine and the volatile matter, as indicated in Table II., in which the numbers in the last line give the quotient of the percentage of fixed carbon divided by extract, which approximates somewhat to the factor c/v. In the case of the Cannel coals no such relationship is evident. But even in a series of coals, which are industrially grouped together as "gas coals," it would be futile to try and make any deductions from these numbers. For, as we know, identity in chemical composition is so frequently associated with differences in chemical behaviour and physical properties, that the problem is not a purely statistical one. In connection with the facts elicited by a proximate assay of coal may be cited the observation recorded by Muck in his "Chemie der Steinkohlen," 1891, p. 5, which demonstrates what very different results are obtained when cellulose, starch, and gum are heated in a closed platinum crucible under like conditions. The coke-like residue obtained in each case is not alone different in appearance and other physical properties, but also the amount yielded is different, cellulose yielding 6·71 per cent., starch 11·30 per cent. and gum 20·42 per cent. of fixed carbon. Dr. Smythe, in an account of the examination of peaty deposits from a pit-fall at Tantobie, County Durham, published in the Proceedings of the University of Durham Philosophical Society (Vol. II., pt. 6), gives the results of his proximate analysis of cellulose and starch, showing these substances to be very different in the proportion of fixed carbon they yielded. Dr. Smythe, in this paper referred to, gives some interesting observations on the results obtained by treating this peaty deposit with pyridine. The chief interest in the use of pyridine as a solvent of coal centres in the possibility that its application may lead to an extension of our knowledge of the proximate constituents of coal, a problem to the solution of which many have directed their attention; and I shall be pardoned if in what I have to say I on this occasion deal only with those attempts which have come within my own personal experience. In an interim Report of the Committee of Section B of the British Association, published in 1894, is given an account of some observations on the action of solvents,

Table II.

Proximate Analysis of Coals.—Based on Gas Works Results (I.).—On Laboratory Results (II.).

	A.		B.		C.		D.		E.		F.	
	I.	II.	I.	II.	I.	II.	I.	II.	I.	II.	I.	II.
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Moisture	—	0·79	—	0·68	—	—	—	—	—	—	—	2·62
Volatile matter ..	32·25	34·10	32·45	33·28	31·35	31·91	28·75	31·7	33·20	33·65	33·55	30·87
Fixed carbon	61·97	61·48	61·53	62·21	62·72	59·81	65·69	63·04	58·59	58·79	56·40	58·76
Ash	5·78	4·43	6·02	3·83	5·83	8·28	5·56	5·25	7·21	7·56	10·05	7·75
$\frac{\text{Fixed carbon}}{\text{Vol. matter}}$	1·92	1·76	1·89	1·82	2·00	1·87	2·28	1·98	1·76	1·74	1·68	1·75
$\frac{\text{Fixed carbon C}}{\text{Extract E}}$		1·90		1·85		2·43		2·76		1·96		2·60

Table III.

	Pyridine extract.	Pyridine extract, "ashless coal."	Volatile matter, "ashless coal."	Volatile matter.
	Per cent.	Per cent.	Per cent.	Per cent.
A	32·36	33·86	35·69	34·10
B	33·59	34·93	34·60	33·28
C	24·58	26·8	34·78	31·91
D	22·81	24·08	33·47	31·7
E	29·97	32·42	36·39	33·65
F	22·53	24·43	33·48	30·87

Four other coals, described as "Cannels," were treated in the same way, as also was a sample of the Broxburn Oil Shale. The results obtained together with those of the proximate analysis are given in Table IV.

Table IV.

	Pyridine extract.	Volatile matter.	Fixed carbon.	Ash.
	Per cent.	Per cent.	Per cent.	Per cent.
Cannel coal.............	6·95	49·62	39·83	10·53
(Blaydon Burn)	8·31	37·43	56·28	5·91
(Canadian)	26·05	49·90	49·32	0·78
(Parkgate Seam, Barnsley)	28·90	34·37	63·52	2·11
Broxburn shale	1·59	29·7	0·51	64·79

In forwarding the samples of coal, Mr. Hardie, speaking of the experience gained in the gas works, states that such as ether, alcohol, benzene, petroleum ether and aniline on a bituminous coal, *viz.*, Hutton Seam Coal from the County of Durham. These solvents certainly dissolve a little from the coal, giving coloured and fluorescent solutions. From this report it would appear that oxidation with an aqueous solution of potassium permanganate promised to give more satisfactory results, but the difficulties experienced in obtaining pure products from the dark, almost black, alkaline solutions which result from this oxidation, led to this method of attack being abandoned. In the second report of this Committee, presented to Section B at the Liverpool Meeting, 1896, is given an account of the investigation by Dr. Smythe of the compounds formed by the action of a mixture of hydrochloric acid and potassium chlorate upon a bituminous coal. Some years previously, Cross and Bevan (Phil. Mag. V. XIII. 328) had shown that Wigan coal is attacked by chlorine, with the production of a chlorinated derivative similar to that obtained by them from lignified fibres; further these chemists showed that the coal substance is so profoundly changed by the action of dilute hydrochloric acid and potassium chlorate as to be subsequently entirely soluble in alkalis. The prolonged boiling of the finely ground bituminous coal with dilute hydrochloric acid to which potassium chlorate is added from time to time converts the greater portion of the coal into a brown solid, which is considerably heavier than the coal taken, and from which 30—35 per cent. is dissolved by alcohol or acetone.

From the material dissolved in alcohol by treatment with various solvents, chlorinated compounds were obtained, the composition of which indicate the following formulæ:—$C_{30}H_{22}Cl_8O_{10}$, $C_{24}H_{18}Cl_4O_9$. The first of these was obtained by extraction of the acetone extract of the oxidised coal with benzene, the second was obtained from the residue insoluble in benzene by extraction with hot alcohol, and from the portion still undissolved two other complex chlorinated compounds were obtained. The acid liquors of marked yellow colour contained in addition to potassium chloride, etc., organic compounds from which by dissolution in acetone a yellow liquid having the composition, $C_{35}H_{36}Cl_4O_{20}$, was isolated.

In a report printed for the Commissioners of the 1851 Exhibition, Dr. Smythe, as an 1851 Exhibition Scholar, gave an account of the results of an investigation of the proximate constituents of brown coal, which he had carried out in the University of Göttingen. The brown coal used was obtained from Brühl, near Cologne; in its behaviour to hydrochloric acid and potassium chlorate brown coal does not differ very markedly from a bituminous coal, and compounds of a similar character to those mentioned above were obtained. It should be stated that a notable difference was observed, in the fact that the oxidised product of brown coal weighed considerably less than the coal itself. These chlorinated oxidation products are complex bodies, decidedly acidic in properties. The investigation of these reactions yielded very little, if any, information as to their constitution. In the report of Dr. Smythe's work at Göttingen, from which I have quoted, another method of attacking the problem of the nature of the proximate constituents of brown coal is described. This consisted in submitting the coal to a thorough exhaustion with solvents. Of this work Dr. Smythe gives the following account. "The solvents were used in the following order:—Benzene, chloroform, alcohol, ethyl ether, petroleum ether, acetone. The ether, petroleum ether, and acetone extracts were very small. The benzene extract amounted to 3 per cent. of the coal taken, the chloroform extract to 1·8 per cent. and the alcohol extract to 2·4 per cent. The colour of these solutions varied from yellow to deep reddish brown. The alcoholic extract could only be obtained as a gluey mass of dark brown colour, the solution possessing a splendid deep red colour. The chloroform solution had a deep brown colour; on pouring into petroleum ether brown flocks separated, which on drying and powdering gave a dark brown powder. This melts at 94° C. with slight decomposition.

Analysis of two specimens, purified several times by precipitation from solutions, gave the following mean figures:—Carbon, 76·45 per cent.; hydrogen, 9·91 per cent.; oxygen, 13·64 per cent. Calculated for $C_{15}H_{24}O_2$:—Carbon, 76·26 per cent.; hydrogen, 10·17 per cent.; oxygen, 13·56 per cent.

The benzene extract, like the above, does not contain either nitrogen or sulphur. The solution possesses a reddish brown colour, and by pouring into petroleum ether, brown flocks are precipitated.

Treatment with ethyl ether gives two portions. The one soluble in ether is a brown amorphous powder melting at 135° to 140° C. A portion of this, purified by precipitation of its benzene solution with petroleum ether, was analysed. The figures agree fairly well with those calculated for the formula, $C_{14}H_{18}O_2$.

That portion of the benzene extract insoluble in ether is much lighter in colour. It melts at 80 degs. to 83 degs. and at a high temperature is capable of volatilization. The mean results of two analyses were:—Carbon, 77·75 per cent.; hydrogen, 11·77 per cent.; oxygen, 10·48 per cent.

After these last analyses had been made it was discovered that this portion of the extract yields something to boiling acetone. Accordingly this portion was extracted with that solvent, and a pale yellow substance dissolved out, melting at 78° to 80° C. The residue melts at 82° to 86° C. Analyses of this portion of the benzene extract, insoluble in ether but soluble in acetone, gave carbon, 79·37 and 79·09 per cent.; hydrogen, 12·75 and 12·92 per cent.

An attempt was made to distil that portion of the benzene extract insoluble in ether. Under a pressure of 8 mm. the distillation proceeds very slowly, the temperature rising from 300° to 350° C. The distillate consisted of a small quantity of amber coloured liquid, which readily solidified to a light yellow waxy solid. This was dissolved in benzene, and the solution allowed to evaporate spontaneously. A white solid was thus obtained melting at 77° to 80°. Dissolving again in a mixture of benzene and petroleum ether it separated out on evaporation of the solvent as a perfectly white solid, melting at 81° to 82°, and exhibiting imperfectly formed radiating crystals. After drying on a porous plate in a vacuum, it contained carbon, 79·18 per cent.; hydrogen, 13·04 per cent. This is obviously the same compound as that obtained by extracting the benzene extract with acetone. These analyses accord fairly well with the formula, $C_{13}H_{26}O$.

The oxidation of the coal left after thorough exhaustion with solvents has been studied. As before, the oxidation products are very complex. The action of potassium chlorate and hydrochloric acid is powerful, though slow. In general, we may say that after oxidation for 30 hours the oxidised mass weighs 70 per cent. of the original, and of this oxidised product some 75 per cent. is soluble in acetone or alcohol. The acid oxidised filtrate was shaken out with ether, as before. After evaporation of the ether, a brownish yellow acid was obtained, which was distilled in vacuo. The distillate on standing deposited crystals which melt at 86° to 88°, and these are at present under examination. After several fractionations of the liquid decanted from these crystals, a liquid portion was obtained boiling at 192° to 194° under ordinary pressure. The odour of this portion recalled that of chloracetic acid. Conversion into the amide has given well defined crystals at present under examination. The solid product from the oxidised coal was extracted in succession with benzene, chloroform, ether and alcohol. The benzene solution was precipitated by petroleum ether. In this way, a light brown flocculent precipitate is obtained, which, unfortunately, always dries to a resin. The chloroform extract was purified several times by precipitation of its solution with petroleum ether. It is thus obtained in the form of a light brown homogeneous powder. The following figures were obtained on analysis:—Carbon, 44·11 per cent.; hydrogen, 3·30 per cent.; chlorine, 31·78 per cent.

The ethereal extract gave a yellowish brown powder. This was purified as far as possible, by precipitation from its solutions, dried on a porous tile in vacuo and analysed. The formula, $C_{22}H_{18}Cl_4O_{10}$, was deduced from these results.

The alcohol extract is the only one which contains nitrogen. It has not yet been analysed. All attempts to obtain these compounds in a crystalline form have hitherto failed. There can hardly be any doubt that the chloroform extract is a mixture, and it is probable that the ethereal extract is also a mixture. It is evident that these chlorinated acids are similar to those obtained from bituminous coal."

Since I first observed the remarkable solvent action of pyridine on coal, the investigation of the extracted material has been pursued in a somewhat intermittent manner in the laboratory of this College; latterly I have been successful in enlisting the interest of Mr. Herbert Blair, who has taken up this subject in a way which promises to lead some way towards the goal of the solution of the problem as to the nature of the proximate constituents of coal. This communication of the results which Mr. Blair has so far obtained, must be regarded in the light of a preliminary note, and has been rendered necessary by the fact that this subject is receiving attention elsewhere. Recently my attention was drawn by the reference in Meyer's Jahrbuch der Chemie, 1906, 314, to an article in the Zeit. angew. Chem., 1906, 657, by E. Donath, dealing with the subject of coal, from the point of view of the nature of its constituents. Donath refers to Baker's results, but gives a reference to some American Journal as the source of his information, and states that Baker examined American coals. It is evident that this knowledge of Baker's work has been gained from some abstract of the original paper. Donath, however, goes on to state that he reserves to himself the examination of the materials extracted from coal by pyridine. That Donath should have expressed his determination to undertake the investigation of these bodies is a matter of satisfaction, but the right of reserving to himself this field of inquiry can scarcely be considered to arise, for if such a question of reservation were to be made, then possibly I might be expected to raise it. The field is large enough and the material to be examined sufficiently diverse to allow of a number of workers, and considering the nature of the problem and the little progress that has been made towards its solution in the past, the greater the number of chemists actively engaged on this subject the nearer will be the time when a satisfactory answer can be given to the question of what is coal.

For the purposes of his investigation Mr. Herbert Blair selected the "bright coal" from the Busly Seam, of the Boitley Colliery, to which reference has already been made, and of which the proximate analysis is given in a communication to this Section by F. G. Trobridge (this J., 1906, 1129). The bright coal separated mechanically from the "dant" or "mother of coal," was reduced to a fine powder, then mixed with sand and the mixture filled into a large Soxhlet apparatus constructed of copper, with a copper vessel attached of about half a gallon capacity in which the pyridine was vaporised. The working of this apparatus did not prove altogether satisfactory, and it was, therefore, decided to use a method of extraction by percolation in the cold. For this purpose a charge of 8 lb. of the finely ground coal mixed with sand was introduced into a percolator, in which the coal and sand rested upon a layer of broken glass, etc., covered by a layer of absorbent wool. The pyridine solution was next concentrated on a water-bath under reduced pressure, and the recovered pyridine used over again in the percolator. Repeating these operations from day to day for several weeks, ultimately a concentrated solution of the extract was obtained, from which after the pyridine had been driven off completely, a dark resinous scaly solid was obtained in quantity sufficient for further work. This residue was next thoroughly incorporated with sand and the mixture dried in a steam bath, the dried mixture was then introduced into a percolator and submitted to the action of the following solvents, used in the order named: petroleum ether, ethyl ether (sp. gr. 0·717), absolute alcohol, chloroform. As this work is still in progress detailed results would be out of place, but in general terms it may be stated that the several extracts have been treated as follows. The solvent having been removed by distillation, the residue is treated with dilute sulphuric acid and distilled in steam. The distillate examined for any volatile organic substance, the acid liquor decanted off and examined, the residue insoluble in the acid solution was next treated with caustic potash and distilled in steam. The steam distillate, the alkaline solution and the insoluble residue in the retort are all separately examined.

Treated in this manner, the petroleum ether extract gives a substance volatile in steam, imparting to the water distillate a reddish colour, the distillate extracted with ether gives a viscous red liquid from which by distillation under reduced pressure a liquid is obtained which ultimately crystallises to form transparent red crystals, melting at 65° C. The portion of the petroleum ether extract non-volatile in steam is a brown solid, which can be distilled under reduced pressure.

The ether extract consists of a brown resinous solid, but in the treatment of this extract as described above, it has yielded small quantities of a substance volatile in steam, and of a basic and an acidic substance.

A complete account of the results of the examination of the substances obtained from the several extracts is reserved for a future communication.

DETERMINATION OF ARSENIC BY THE GUTZEIT METHOD.

BY CHARLES ROBERT SANGER.

With reference to the note by T. F. Harvey on this subject (this J., Dec. 16, 1907, p. 1226), I regret that his communication of 1905 was not accessible to me. I wish to point out, however, that our method (this J., 1907, p. 1115) differs essentially from the one he describes, in that the stain is in the form of a band, and is not deposited as a spot or disc.

Obituary.

RICHARD JOHN FRISWELL,

R. J. Friswell was an original member of this Society. He was born Feb. 24th, 1849, and was the elder son of the late James Hain Friswell, the author, essayist, and poet. He was educated at King's College School, and became a pupil of Blanchard, the art photographer. Feeling the need of chemical knowledge, he entered the Royal College of Chemistry, as a student under Professor E. Frankland. In 1868–9 he joined R. Meldola in photographing the spectra of the metals, and in assisting in the work of solar research for Professor Lockyer in the physical laboratory of South Kensington. He went with Lockyer to India to observe the eclipse of 1871. Friswell was the editor of the Journal of the Photographic Society until Feb., 1877. He took a leading part with Professor Edw. Frankland and others, in promoting the formation of the Institute of Chemistry, which ever afterwards engaged much of his attention. He served during two periods on the Council of the Chemical Society. From 1874 to the end of 1900, he acted as chemist on the staff of Messrs. Brooke, Simpson and Spiller at their Atlas Colour Works, Hackney Wick, ultimately becoming managing director. He then superintended the erection of the British Uralite Company's factory at Higham, near Gravesend. In 1902, he opened a consulting practice and laboratory in London. In 1906, Friswell was elected Chairman of the London Section. Taken ill on New Year's Eve with pleuro-pneumonia and enteric fever, he died after five weeks' suffering, on Feb. 6th.

In conjunction with A. J. Greenaway (Chem. Soc. Trans., 1877, ii., 251) he published a "Note on thallous platinocyanide." In 1904, Friswell published a paper entitled "Some intramolecular and originally reversible changes extending over prolonged periods of time" (this J., 1904, 275), besides others in conjunction with A. G. Green (this J., 1885, 740, and 1897, 671).

WILLIAM ASHWELL SHENSTONE.

The death of William Ashwell Shenstone, F.R.S., of Bristol, on Feb. 3rd, has deprived our Society of another of its original members. Shenstone was born in 1850, and became Senior Science Master of Clifton College in 1880. In 1898, he received the Fellowship of the Royal Society. His published scientific work is considerable. The part of it of interest and importance in the applications of chemistry to the arts consists, firstly, of his papers on ozone, which have probably given more exact knowledge of the conditions of its production than that afforded by any other investigation; and, secondly, his success in establishing the adaptability and advantage of fused quartz, or pure-silica glass for use in the construction of apparatus. He may be said to have put beyond doubt the fact that chlorine retains its activity upon mercury when in even the purest and driest state (this J., 1897, 474), and that dry ozone in contact with mercury is completely decomposed without any perceptible oxidation of the metal (Chem. Soc. Trans., 1887, **51**, 610). He was the author of several useful books on chemical subjects, and one of the few chemists possessed of the highest dexterity in the glass-blowing of delicate and elaborate chemical apparatus.

Journal and Patent Literature.

Patent Specifications may be obtained by post by remitting as follows:—
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I.—PLANT, APPARATUS, AND MACHINERY.

Patents.

Measuring the weight of steam or other gas flowing through a pipe; Instruments for ——. The British Thomson-Houston Co., Ltd., London. From General Electric Co., Schenectady, N.Y. Eng. Pat. 635, Jan. 9, 1907.

The instrument is constructed on similar principles to the "Pitot" tube and the "Fletcher" anemometer, but the difference between the levels of the liquid (in the case of steam, mercury is used) in the legs of the inclined U-tube is magnified. This is effected by fitting nozzles to the ends of the tubes which project into the main through which the steam, or gas, to be measured is flowing. On one of the tubes a trumpet-shaped nozzle is fixed having its larger orifice opposed to the current of steam or gas to increase the pressure on one side of the level tube. On the second tube a nozzle is fixed which acts as an injector and decreases the pressure on the other side of the level. A scale, graduated to read directly in pounds of steam per unit of time, is mounted on an adjustable drum between the level tubes, and adjustable pointers slide on the level tubes. To prevent violent oscillation of the mercury, a throttling valve is placed at the bend of the U-tube, and this is so connected to the double valve which connects the ends of the level tube to the tubes projecting into the main, that the throttling valve must be shut before the double valve is opened.—W. H. C.

Vacuum production. A. Camacho, London. From T. O. Eastman, Supia, Columbia. Eng. Pat. 1077, Jan. 15, 1907.

The apparatus is constructed on the principle of the water-jet pump, or "tromp," but the water jet is divided into a large number of separate jets or into concentric annular jets to increase the surface of contact between the water and the air, so that greater efficiency is obtained.—W. H. C.

Packing material formed of perforated V-shaped plates for reaction- or absorption towers, gas purifiers and similar apparatus. H. Petersen. Fr. Pat. 382,262, Sept. 27, 1907. Under Int. Conv., Sept. 27, 1906.

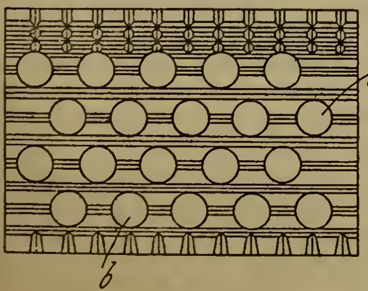


Fig. 1.

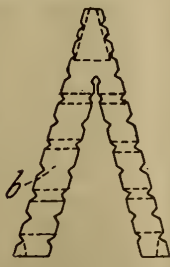
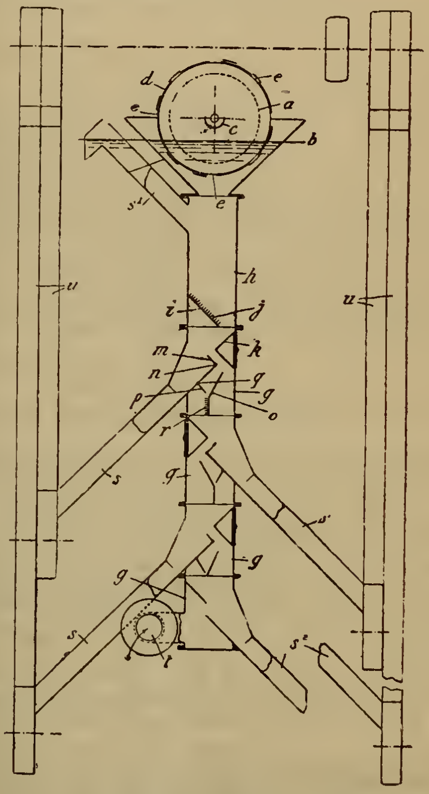


Fig. 2.

The packing material claimed has the form shown in elevation in Fig. 1, and in cross-section in Fig. 2, with horizontal perforations as indicated at *b*.—W. H. C.

Classifying solid materials [ores]. R. E. Trottier, Hussein-Dey, Algeria. Eng. Pat. 7648, March 30, 1907.



The materials (ores) to be classified are fed by the shoot, *c*, into the perforated, rotating, distributing drum, *a*, surrounded by the jacket, *d*, falling through the adjustable openings, *e*, in the form of uniform sheets, at regular intervals into the upper portion, *h*, of the classifying tube. This portion, *h*, is empty, and classification takes place here by equivalence, by which is meant that particles although of different specific gravity arrive at the same point in their fall at the same time, owing to their difference in size, etc. The materials then fall on to the distributing plate, *i*, provided with pins, *j*, and pass into the deflection classifiers, *g*, of which there are several, one below the other. A current of water or air enters the bottom of the apparatus through *t*, and overflows through s^1, carrying with it any light valueless material, but the speed of the current is so adjusted that it does not itself deflect the particles but serves as a medium in which they are deflected more or less out of their vertical path by the adjustable plates and flaps, *k*, *m*, *n*, *p*, *q*, and *o*. These are so adjusted that the lighter particles are deflected more than the heavier and pass away by the side shoots, *s*, into the elevators, *u*, or to automatic fluid-tight discharge boxes. The heavier particles pass over the plate, *o*, to the distributor, *r*, and then into the next classifier, *g*, or from the bottom of the apparatus by the shoot, s^2. If desired a slight pulsating or vibrating motion may be given to the contents by a vibrating diaphragm or pulsating plunger acting at the side of the tube.—W. H. C.

Filter-presses; Strainer for ——. G. and R. Koeber, Harburg, Germany. Eng. Pat. 8253, April 9, 1907. Under Int. Conv., Nov. 23, 1906.

The slots in the strainer-plates which increase in width from the inside to the outside of the plate are cut in two stages. A comparatively wide saw is first used to cut the outer portion of the slot which only passes part of the way through the plate, and then a much narrower saw is used to cut through the remaining thickness of the plate.—W. H. C.

Drying devices. O. Busse, Duisburg-Meiderich, Germany. Eng. Pat. 10,340, May 3, 1907.

See Fr. Pat. 377,124 of 1907; this J., 1907, 1040.—T. F. B.

Drying steam; Method of and apparatus for ——. E. Lagosse, Poissy, France. Eng. Pat. 21,068, Sept. 23, 1907. Under Int. Conv., Sept. 24, 1906.

Baffle-plates placed in the steam dome cause the steam to be separated into streams, which are afterwards forced to impinge upon one another to cause the agglomeration of the fine particles of water mist into heavier drops which fall back through a collecting funnel into a pipe, which dips into the water in the boiler.—W. H. C.

Liquefying gases having low boiling points or distilling such liquefied gases; Apparatus for ——. C. G. Hildebrandt, Berlin. Eng. Pat. 13,790, June 14, 1907.

See Fr. Pat. 378,918 of 1907; this J., 1907, 1190.—T. F. B.

Kilns; Rotary ——. W. R. Warren, New York. Eng. Pat. 14,093, June 18, 1907.

See U.S. Pat. 864,816 of 1907; this J., 1907, 1040.—T. F. B.

Separating liquids from gases or vapours; Apparatus for ——. K. Brunner and O. Bühring, Mannheim, Germany. U.S. Pat. 877,460, Jan. 21, 1908.

See Fr. Pat. 374,300 of 1907; this J., 1907, 752.—T. F. B.

Distillation and rectification apparatus; Segment, or tray with multiple and methodical circulation, for the columns of ——. E. A. Barbet. First Addition, dated Dec. 1, 1906, to Fr. Pat. 379,037, Aug. 28, 1906 (this J., 1907, 1190).

The addition relates to the application of the system to segments, or trays of circular, or other shape than the rectangular trays claimed in the original specification. —W. H. C.

Concentration of aqueous liquids. P. Spiess and A. Chatelan. Fr. Pat. 382,288, July 13, 1907.

See Eng. Pat. 16,344 of 1907; this J., 1907, 1269. —W. H. C.

Generation and purification of gases in a dry and pure condition using only the theoretical quantity of water or other liquid. G. F. Jaubert. Fr. Pat. 381,605, Nov. 14, 1907.

Gases which are prepared by the action of a liquid upon a solid, for instance, hydrogen by the action of water on calcium hydride, are obtained pure and free from the water vapour which is frequently generated by the heat of the reaction, in the following manner. The solid is placed in a connected series of separate vessels, or in superposed compartments of the same vessel, and the liquid is admitted to the first, or lowest of the series. The gas given off, along with some vapour of the liquid, passes through the next vessel, or compartment and so through the series and leaves the last in a dry condition, the water vapour having been retained by the fresh material. When the first vessel is exhausted, it is recharged and connected to the end of the series, the second vessel becoming the first. In this way the process becomes continuous.—W. H. C.

II.—FUEL, GAS, AND LIGHT.

Illuminating gas from vertical retorts; Amount of carbon bisulphide in ——. Imp. Continental Gas Assoc. and Deutschen Kontinental Gas Ges. J. Gasbeleucht., 1908, **51**, 83—84.

A comparison of results obtained on the large scale in the carbonisation of English, Westphalian, and Silesian coals in horizontal and in vertical retorts, shows that the gas from the vertical retorts contains much less carbon bisulphide than the gas from the horizontal retorts.—A. S.

Patents.

Extracting water or liquid from washed coal and the like; Apparatus for ——, *more particularly applicable for treating washed fine coal for coking.* C. Burnett, Durham. Eng. Pat. 10,062, April 30, 1907.

The washed coal is fed from a hopper into a horizontal cylinder from which it is forced by a reciprocating plunger into a perforated chamber having a weighted hinged lid, also perforated. The water escapes through the perforations and the coal is discharged at the rear end of the chamber on to a conveyor which delivers it to the boot of an elevator for loading into trucks.—A. T. L.

Briquettes having a binding material soluble in water and capable of being rendered weather-proof by coking; Manufacture of ——. B. Wagner, Stettin, Germany. Eng. Pat. 10,667, May 7, 1907.

See Fr. Pat. 377,557 of 1907; this J., 1907, 1078.—T. F. B.

Briquettes; Process of treating —— *to consolidate them, by carbonising the agglutinant soluble in water.* B. Wagner. Second Addition, dated Sept. 4, 1907, to Fr. Pat. 350,536, Jan. 5, 1905.

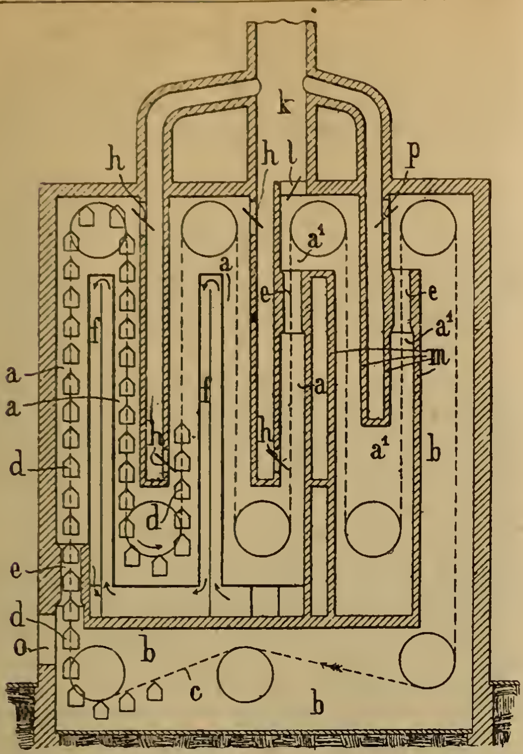
Each of the compartments of the carbonising drum described in the principal patent and in the first addition (this J., 1905, 721; 1906, 422) is provided with longitudinal ribs in addition to the spiral guides, in order to ensure more regular rotation of rounded or egg-shaped briquettes during their passage through the drum. —A. T. L.

Drying and carbonising kilns [for briquettes, &c.]; Continuously operating ——. R. Bock, Prague, Austria. Eng. Pat. 20,849, Sept. 19, 1907.

See Fr. Pat. 382,220 of 1907; following.—T. F. B.

Oven; Continuous —— *for drying briquettes and similar purposes.* R. Bock. Fr. Pat. 382,220. Sept. 25, 1907.

The drying chamber is divided into three compartments, *a*, *a′* and *b*, and the material to be dried is supported in swinging buckets, *d*, carried by the endless chain, *c*, which moves over rollers in the direction indicated. The openings, *e*, between the compartments are constricted as shown and are always nearly closed by one, or more of the buckets, so that the compartments, *a* and *a′*, neither communicate with one another, nor with the air. The materials are introduced through the opening, *o*, and are dried in the compartment, *a*, by heat from the hollow partitions, *f*, through which fire gases circulate as indicated by the arrows. The vapours given off escape through the openings, *h*, to the flue, *k*. The dried materials are first cooled out of contact with the air in the compartment, *a′*, either by a spray of water,



in which case the vapour escapes through *l*, into the flue, *k*, or by causing a stream of water to flow over the exterior of the walls, *m*, which are for this purpose made of sheet iron. In the compartment, *b*, the materials are completely cooled by air which enters through *o*, and escapes through *p*, into the flue, *k*. The dried and cooled material is finally withdrawn through the opening, *o*. —W. H. C.

Fuel and coke; Production of artificial ——. H. S. Robertson and J. R. Graham, Assignors to Robgrey and Co., Ltd., London. U.S. Pat. 877,738, Jan. 28, 1908.

See Eng. Pat. 20,281 of 1906; this J., 1907, 1190.—T. F. B.

Coke ovens. A. O. Jones, New Brancepeth, Durham. Eng. Pat. 3270, Feb. 9, 1907.

In horizontal coke ovens in which the heating flues are fired at the ends, the gas or mixture of gas and air is passed through pipes placed transversely in the heating flues. The side heating flues may be shorter than the ovens, and the tubes for heating the gas arranged across vertical end flues.—A. T. L.

Coke ovens. A. O. Jones, Monpseaton, Northumberland. Eng. Pat. 6921, Mar. 22, 1907.

The patent relates to vertical ovens of the kind described in Eng. Pat. 11,660 of 1906 (this J., 1906, 1138), in which the coke is discharged by removing the sole. The removable sole comprises a metal tray with an external bevelled flange bearing against the framework at the base of the oven. The tray, which is filled in with fire-brick, has a central depending screwed column supported in a threaded sleeve mounted in bearings in a wheeled trolley on a track beneath the oven. To lower the sole, the sleeve is rotated by worm gearing operated from the front of the oven by means of a long key. Heating flues may be formed in the sole.—A. T. L.

Retort-furnace; Regenerative ——. R. Ziesing, Cleveland, Ohio. U.S. Pat. 876,891, Jan. 14, 1908.

A system of combustion chambers with regenerators beneath them is arranged on each side of a centre wall extending nearly to the top of the furnace. Hollow shelves, running transversely along the front faces of the combustion chambers, serve for the supply of a gaseous medium for furthering combustion adjacent to the front faces of the furnace.—A. T. L.

Gas for use in gas engines and other purposes; Method of and means for producing ——. H. M. and A. R. Bellamy, Stockport. Eng. Pat. 7076, Mar. 25, 1907.

The gas producer comprises a main chamber in which bituminous fuel is burnt and into which air or steam may be introduced, and contiguous auxiliary chambers or retorts grouped round the main generator so as to absorb heat from and practically form part of the latter. The auxiliary chambers are all in direct communication, save when charging, and act in rotation or succession, first as distilling retorts and then as reducing chambers; they are charged with coal in rotation, so that hot reducing columns are produced in succession, and the tarry gases are led through these to be converted into permanent gases.—H. B.

Water-gas apparatus. L. D. Carroll, London. Eng. Pat. 17,986, Aug. 7, 1907.

In order to prevent gas or air from leaking past the air-blast valves of water-gas apparatus, and so mixing with air or gas beyond the valves, each air-blast valve (formed of two parallel discs adapted to be seated transversely across the blast-pipe) is provided with a vent from the space between the discs. Any gas or air that leaks past either valve-disc, thus escapes harmlessly. Each vent is provided with a valve, so connected by means of interlocking mechanism to the other valves of the apparatus that, during the blast period, whilst the air-blast valve is open, the intermediate vent is closed, and *vice versa*.—H. B.

Mixing, measuring, and carburetting gaseous bodies; Apparatus for ——. A. Bouvier and E. Collon, Paris. Eng. Pat. 20,199, Sept 10, 1907.

The gasholders or the reservoirs of constant volume described in Eng. Pat. 21,022 of 1906 (this J., 1907, 600) are dispensed with, and the gas is delivered direct into the air pipe. The apparatus is controlled by a pressure diaphragm holding open the inlet valves of the gas and air pumps simultaneously. A small flexible reservoir is placed on the delivery pipe. The gaseous mixture contains sufficient air to burn with a reducing flame, but air may be added at the burner when an oxidising flame is required.—A. T. L.

Gas-producer. W. J. McClurg, Pittsburg, Pa. U.S. Pat. 876,575, Jan. 14, 1908.

The producer comprises two gas-generating chambers connected together above the fuel-bed. Independent passages for steam and air are formed in the dividing wall between the two chambers and terminate in a single chamber from which mixed air and steam pass to one or other of the gas-generating chambers below the normal fuel level. An air engine may force air into the air passages or may draw gas from the lower part of the producer. The "generating gases" may be passed through water in receptacles below the generating chambers.—A. T. L.

Gas-producing furnace. C. Garner, Fort Worth, Tex. U.S. Pat. 876,903, Jan. 14, 1908.

Two movable grates made in sections are arranged one above the other, beneath the furnace chamber of the gas-producer. The grates have bearings at each end, engaging with right- and left-handed screws which are rotated by gearing so that the sections of the grates are moved sideways into and out of recesses in the casing of the producer.—A. T. L.

Suction gas generator. J. Fielding, Gloucester. U.S. Pat. 877,068, Jan. 21, 1908.

See Eng. Pat. 26,829 of 1905; this J., 1907, 41.—T. F. B.

Gas for motive power; Manufacture of ——. J. E. Dowson. Fr. Pat. 381,922, Sept. 16, 1907. Under Int. Conv., Sept. 25, 1906.

See Eng. Pat. 21,258 of 1906; this J., 1907, 1078.—T. F. B

Combustible gas ; Process and apparatus for obtaining ——. C. H. Rider. Fr. Pat. 382,150, Sept. 23, 1907.

See Eng. Pat. 21,078 of 1907 ; this J., 1908, 67.—T. F. B.

Mantles for gas lighting ; Manufacture of incandescent ——. H. Sussmann, Berlin. Eng. Pat. 16,867, July 23, 1907.

To prevent destruction or shrinkage of the fibre during the process of incineration, the impregnating salts are precipitated with organic bases or a mixture of the same. As examples, aniline, *o*-toluidine, xylidine and pyridine are mentioned. By this method, impurities in the earths are not precipitated as when alkalis are used. The bases may be used as liquids, or in aqueous or alcoholic solution (preferably hot). For economy, the vapour of the base may be employed. The mantle may be impregnated with different salts successively, precipitation following each impregnation.—A. T. L.

Incandescence electric lamp filaments of tungsten or alloys thereof ; Manufacture of ——. Siemens und Halske Akt.-Ges., Berlin. Eng. Pat. 11,717, May 18, 1907. Under Int. Conv., May 19, 1906.

See Fr. Pat. 377,846 of 1907 ; this J., 1907, 1079.—T. F. B.

Tungsten filaments containing carbon or carbide ; Process for decarbonising ——. Wolfram Lampen Akt.-Ges., Augsburg, Germany. Eng. Pat. 24,028, Oct. 30, 1907. Under Int. Conv., Oct. 31, 1906.

In decarbonising tungsten filaments by heating in steam and hydrogen as described for osmium filaments in Eng. Pat. 1535 of 1898, or in an atmosphere of hydrogen containing air or free oxygen as described in Eng. Pat. 18,814 of 1905 (this J., 1906, 527), the filament is liable to be "spoiled" by local oxidation when the last trace of carbon is eliminated. The invention consists in excluding moisture ; the gases are dried with phosphorus pentoxide and used at greatly reduced pressure, and the filament is heated above the dissociation temperature of water vapour.—A. T. L.

Incandescent lamp filaments ; Process of making ——. W. G. Clark, Assignor to Parker-Clark Electric Co., New York. U.S. Pats. 876,330, 876,331, and 876,332, Jan 14, 1908.

See Fr. Pat. 376,412 of 1907 ; this J., 1907, 1002.—T. F. B.

Gas-converting process. U.S. Pat. 876,437. *See* X.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

Triolein ; Conversion of optically-inactive —— *into an optically-active glyceride and an optically-active acid* J. Lewkowitsch. *See* XII.

Petroleum industry of Burmah. Board of Trade J., Feb. 6, 1908. [T.R.]

A profitable outlet for benzine manufactured in Burmah, has been discovered in Europe, and 800,000 gallons were shipped to Rotterdam during the last official year. This particular development, which promises to continue, is also likely to be greatly assisted by the recent decision of the Suez Canal Committee to rescind the regulation preventing the passage of benzine in bulk through the canal. Equally important is the development in connection with liquid oil fuel. The Burmah Oil Company have considerably enlarged their refinery, and it is expected that large shipments will be made in future years. The work of constructing a pipe-line for the conveyance of oil from the oil-fields in the Magwe District to Rangoon, has also been put in hand, and on completion is expected to result in a considerable increase in the output.

Mineral oil exports from the United States. Bureau of Statistics Report. [T.R.]

The exports of mineral oils from the principal customs districts in 1906 and 1907, representing about 92 per cent. of the shipments from all ports, were as follows :—

	1906.	1907.
	Gallons.	Gallons.
Crude oil	118,664,999	88,494,616
Naphthas	25,144,155	28,080,439
Illuminating oil..............	827,727,219	844,996,003
Lubricating oil and paraffin ..	146,715,235	147,558,283
Residuum	63,292,493	74,162,347
Totals	1,181,544,101	1,183,291,688

According to the census of 1905, the percentage distribution of crude petroleum, among the several products, was as follows :—Burning oils, 61 ; residuum, 5·7 ; paraffin oils, 2·9 ; paraffin wax, 1·4 ; reduced oils, 7·7 ; naphtha and gasoline, 10·3 ; neutral filtered oils, 0·9.

Carbon bisulphide in benzene ; Determination of ——. I. Bay. Compt. rend., 1908, **146**, 132.

The amount of carbon bisulphide occurring as an impurity in benzene may be determined by precipitation with phenylhydrazine, with which it forms a white crystalline precipitate of phenylhydrazinephenylsulphocarbazinate, $CS_2(C_6H_5.NH.NH_2)_2$. This body is sufficiently stable in the absence of water to afford reliable results if the analysis be completed in the course of a day. The precipitation is complete after 2—3 hours ; the substance is collected on a tared double filter-paper, washed with pure benzene and dried in a vacuum desiccator.—J. F. B.

Patents.

Petroleum and other hydrocarbons ; Refining crude —— *by distillation.* W. McMullen, London. Eng. Pat. 21,060, Sept. 23, 1907.

Claim is made for a more effective and economical method of separating the constituents of petroleum by the process described in Eng. Pat. 22,395 of 1906. (See Fr. Pat. 370,603 of 1906 ; this J., 1907, 250.) The crude oil is heated in the still to temperatures considerably below those at which the respective fractions would distil under the influence of heat alone. Distillation of the lighter constituents is then effected by means of an abundant current of air introduced at a temperature below that of the crude oil, whilst the heavier substances are distilled in a current of an inert gas or mixture of gases containing little or no oxygen, the oxidising and thickening effect of air at this part of the process being thus obviated. The oil vapours are separated from the air and gas respectively by being conducted through water, oil, or other condensing substance.—C. A. M.

Oils [petroleum] ; Process of refining, fractionating, and reducing ——. W. C. and F. E. Wells, Columbus, Ohio. U.S. Pat. 877,620, Jan. 28, 1908.

See Fr. Pat. 379,521 of 1907 ; this J., 1907, 1233.—T. F. B.

Petroleum or its distillation products ; Process and apparatus for treating —— *by ionisation, to obtain an explosive mixture for internal combustion motors.* D. Martini. Fr. Pat. 382,281, June 15, 1907. Under Int. Conv., June 16, 1906.

See Eng. Pat. 13,840 of 1906 ; this J., 1907, 958.—T. F. B.

Bituminous composition, etc. Eng. Pat. 10,064. *See* IX.

IV.—COLOURING MATTERS AND DYESTUFFS.

The Patents Act, 1908, and the dyestuff industry. Times, Comm. Suppl., Feb. 14, 1908. [T.R.]

The English Patents Act of January 1, 1908, which provides for the compulsory exercise of existing patents within 12 months of the promulgation of the Act, and of patents granted under the Act within a period of four years after the concession of the patent, has been communicated by the Patent Office to a number of German firms, especially in the chemical industry. A large number of German patent holders are consequently trying to find facilities for producing their inventions in England, in order to take the fullest advantage of their existing rights. Licences are being granted to English manufacturing firms, and in some instances German manufacturers are opening branch establishments in England.

Dyestuffs; Disazo —— from phenols and cresols. G. Schultz and E. Ichenhaeusser. J. prakt. Chem., 1908, **77**, 100—124.

THE authors have prepared a series of disazo-dyestuffs from benzidine or tolidine on the one hand and phenol or the cresols on the other. The alkyl derivatives were also obtained. The simpler dyestuffs were prepared in the usual way by adding the tetrazo-solution to a solution of the phenol in caustic soda. The dyestuff from benzidine and 2 mols. of phenol, $OH.C_6H_4.N_2.C_{12}H_8.N_2.C_6H_4.OH$, is soluble in caustic soda and gives a reddish-violet solution in concentrated sulphuric acid. The corresponding dyestuffs from benzidine and 2 mols. of *o*-, *m*-, or *p*-cresol are similar except that the latter is insoluble in caustic alkali, and the authors suggest that its constitution may be ortho-quinonoid:

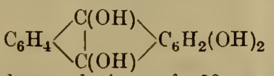
$$O : C_6H_3(CH_3) : N.NH.C_{12}H_8.NH.N : C_6H_3(CH_3) : O.$$

All these dyestuffs dye vegetable fibres direct, but the shades are weak and vary from yellow to orange-yellow. With alkali or soap the colour changes to red. The corresponding dyestuffs from tolidine are similar to the above; they have rather more affinity for the fibre but are also not fast towards soap.

Certain ethyl, diethyl and dibenzyl ethers of the benzidine disazo-dyestuffs are also described. It was found impossible to prepare a sulphonic acid by treating the dibenzyl ethers with sulphuric acid, but these compounds were obtained by first preparing the dyestuffs, benzidine or tolidine + 2 mols. *o*-, *m*-, or *p*-phenolsulphonic acid, and then benzylating these. The dyestuffs thus obtained show very little affinity for cotton.—J. C. C.

Leuco-alizarin (1 : 2-*dihydroxyoxanthranol*). E. Grandmougin. Rev. Gen. Mat. Col., 1908, **12**, 44—45.

LEUCO-ALIZARIN,



$$C_6H_4\left\langle\begin{matrix}C(OH)\\|\\C(OH)\end{matrix}\right\rangle C_6H_2(OH)_2$$

is obtained by reducing a hot solution of 20 grms. of dry alizarin in 1½ litres of water and 20 c.c. of 25 per cent. aqueous caustic soda, with 60 grms. of dry sodium hydrosulphite. On standing overnight the precipitated leuco-compound is filtered off. It crystallises from glacial acetic acid in brown leaflets, m. pt. 150° C.—J. C. C.

Quinizarin and aromatic amines; Products of condensation of ——. E. Grandmougin. Rev. Gen. Mat. Col., 1908, **12**, 37—40.

THE author has prepared certain condensation products of quinizarin and aromatic amines by condensing the latter with leucoquinizarin and oxidising the product. Leucoquinizarin is obtained by moistening 6 grms. of quinizarin with alcohol and dissolving it by boiling with 1 litre of water and 10 c.c. of 25 per cent. caustic soda solution; to this solution are now added 10—15 grms. of dry sodium hydrosulphite and the leucoquinizarin (m. pt. 155° C.) separates as a yellow precipitate which is collected, washed and dried. 1-*o*-Tolylamino-4-hydroxyanthraquinone is obtained by heating for 1 hour at 120—125° C. one part of the leuco-compound just described, 10 parts of *o*-toluidine and 2 parts of glacial acetic acid. The product is treated with hydrochloric acid to remove excess of toluidine and fractionally crystallised from glacial acetic acid to separate any leuco-compound not converted; finally the condensation product is crystallised from alcohol from which it separates in deep violet crystals, m. pt. 166° C. The sulphonated product dyes wool violet blue. Di-*o*-tolyl-1 : 4-diaminoanthraquinone is obtained by heating for 3 hours at 120—125° C. 1 part of leucoquinizarin, 10 parts of *o*-toluidine, 1½ parts of glacial acetic acid and 1 part of boric anhydride. The product after purification consists of deep blue needles, m. pt. 223° C., and the sulphonated derivative dyes wool green. Similar compounds were prepared from 1 molecule of quinizarin and 2 molecules of *m*-toluidine, and 2 molecules of *as*-diethyl-*p*-phenylenediamine respectively.
—J. C. C.

Rosindone and isorosindone; Constitution of ——. F. Kehrmann and K. L. Stern. Ber., 1908, **41**, 12—17.

THE conclusions of Decker and Würsch (this J., 1906, 978) although favourable to Kehrmann's formula for isorosindone, depended on the non-reaction with phenylmagnesium bromide, and the present authors, having now studied the behaviour of rosindone, isorosindone, and their leuco-derivatives towards acetic anhydride, show that the results can only be satisfactorily explained if the constitution referred to is adopted.—J. C. C.

Dyestuffs; Volumetric determination of basic —— by means of acid dyestuffs. L. Pelet and Garuti. Bull. Soc. Vandoise des Sciences naturelles, 1907; Z. Farben-Ind., 1908, **7**, 44—45.

THE authors have studied the following volumetric methods of estimating basic dyestuffs. (1) Titration of Methylene Blue with Crystal Ponceau, Carmine in sodium carbonate solution, Pyramine Orange (B.A.S.F.) and Cotton Brown (B.A.S.F.). (2) Titration of Safranine with Helvetia Blue, Naphthol Yellow S and Acid Violet 6BN. (3) Titration of Magenta and New Magenta with Helvetia Blue, Alkali Blue and Light Green SF bluish. (4) Titration of Auramine O and Auramine G with Congo Red, Acid Violet 5BN, Oxamine Red, Alkali Blue and Violet Black. (5) Titration of Chrysoidine with Helvetia Blue. (6) Titration of Vesuvine with Violet Black, Rocelline, Chromazone Red and water-soluble Fast Blue R. The end reaction is determined by spotting on filter-paper in the usual way, but the titrations can be carried out only with pure substances. Instead of the spot method of determining the end reaction, the electrical conductivity may be observed, this being at a minimum when the precipitation is complete. The two methods give identical results.—J. C. C.

Dyestuffs; Preparation of stable aqueous solutions of —— F. Nottbrack. Chem.-Zeit., 1908, **32**, 100.

STABLE aqueous solutions of dyestuffs such as Metanil Yellow, Rhodamine, etc., of neutral reaction and having the correct shade of colour can, it is stated, be prepared by the addition of from 5 to 20 per cent. or more of Turkey-red oil. For instance, 20 grms. of 70 per cent. Turkey-red oil are mixed with 80 grms. of water, and enough potassium hydroxide solution added to give a clear, neutral liquid, which will dissolve, in the cold, dyestuffs that otherwise can only be dissolved on heating. In order to obtain solutions of dyestuff which are usually incompatible when dissolved, *e.g.*, Metanil Yellow and Rhodamine, a solution of each dyestuff in Turkey-red oil is prepared separately, and the solutions mixed.—A. S.

Charcoal; Decolorising action of ——. L. Rosenthaler. *See* XXIV.

PATENTS.

Induline and induline-like colours; Process for the production of —— A. Ostrogovich, Bucharest, and T. Silbermann, Charlottenburg. Eng. Pat. 2255, Jan. 29, 1907.

SEE Fr. Pat. 374,715 of 1907; this J., 1907, 865.—T. F. B.

Colouring matters of the safranine series; Manufacture of blue —— and of materials therefor. A. G. Bloxam, London. From Act.-Ges. f. Anilinfabr., Berlin. Eng. Pat. 2768, Feb. 4, 1907.

SEE Fr. Pat. 374,833 of 1907; this J., 1907, 865.—T. F. B.

Azo dyestuffs; Yellow ——, and manufacture thereof. A. G. Bloxam, London. From Actienges. f. Anilinfabr., Berlin. Eng. Pat. 7147, Mar. 25, 1907.

pp′-Diaminophenyl ether-mono- or di-sulphonic acid is tetrazotised and combined with two molecular proportions of phenol or cresol. If the disazo dyestuffs thus obtained are methylated or ethylated, dyestuffs are produced which dye wool from an acetic acid bath in clear and intense yellow shades very fast to milling.—J. C. C.

Orthohydroxymono- and disazo dyestuffs capable of being chromed on the fibre. Act.-Ges. f. Anilinfabr. Fr. Pat. 381,941, Nov. 24, 1906.

See Eng. Pat. 26,416 of 1906; this J., 1907, 1273.—T. F. B.

Indigo; Manufacture of halogen derivatives of ——. O. Imray, London. From Soc. Chem. Ind. in Basle, Switzerland. Eng. Pat. 10,326, May 3, 1907.

See U.S. Pat. 872,115 of 1907; this J., 1907, 1274—T F. B.

Monoazo dyestuffs capable of being chromed on the fibre; Production of ——. Soc. pour l'Ind. Chim. à Bâle. Fr. Pat. 381,567, Nov. 12, 1906.

See U.S. Pat. 844,814 of 1907; this J., 1907, 404.—T. F. B.

Thioindigo dyestuffs; Manufacture of ——. O. Imray, London. From Farbw. vorm. Meister Lucius und Brüning, Hoechst a/Main, Germany. Eng. Pat. 14,846, June 27, 1907.

Although sulphonic acids of nitro-hydrocarbons cannot be used alone for oxidising α-oxythionaphthenes to the corresponding thioindigo dyestuffs, the oxidation proceeds readily if an alkali sulphide be present. For example: to a solution of 30 parts of α-oxythionaphthene in 100 parts of 8 per cent. caustic soda solution are added an aqueous solution of 30 parts of crystallised sodium sulphide and 40 parts of potassium nitrobenzenesulphonate. The separation of thioindigo begins at once and is complete in a few minutes.—J. C. C.

Nitrobenzanthrone compound and process of making same. O. Bally, Mannheim, and H. Wolff, Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 876,679, Jan. 14, 1908.

See Eng. Pat. 12,518 of 1906; this J. 1906, 844.—T. F. B.

Anthracene dyestuff and process of making same. M. A. Kunz, Mannheim, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 876,810, Jan. 14, 1908.

See Eng. Pat. 10,505 of 1906; this J., 1906, 751.—T. F. B.

[Thioindigo] dyestuff; Red —— and process of making same. R. Pummerer, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 876,839, Jan. 14, 1908.

See Fr. Pat. 374,287 of 1907; this J., 1907, 757.—T. F. B

Triphenylmethane dyestuffs and process of making same. A. Conzetti, Assignor to Aniline Colour Works, formerly J. R. Geigy, Basel, Switzerland. U.S. Pats. 877,052—877,054, Jan. 21, 1908.

o-Sulphobenzaldehyde, 5-nitro-*o*-chlorobenzaldehyde, or *oo*-dichlorobenzaldehyde is condensed with *o*-cresotinic acid in presence of sulphuric acid and the resulting leuco-compound is oxidised by a solution of sodium nitrite, nitrosyl sulphate, or an oxide of nitrogen in sulphuric acid. The dyestuffs obtained dye wool from an acid bath in bright red, pale yellowish-red, or red shades, becoming blue-violet, greenish-blue, or blue respectively on chroming. The shades produced on chroming may also be obtained by printing the dyestuffs on cotton with a chrome mordant.—J. C. C.

Nitro- and amino-diacetyldiaminophenol; Preparation of —— and of o-hydroxymonoazo dyestuffs derived therefrom. L. Cassella und Co. Fr. Pat. 381,943, Nov. 24, 1906.

See Eng. Pat. 27,322 of 1906; this J., 1907, 1234.—T. F. B.

Indigo; Manufacture of ——. Clayton Aniline Co., Ltd. Fr. Pat. 382,285, July 13, 1907. Under Int. Conv., July 17, 1906.

See Eng. Pat. 16,181 of 1906; this J., 1907, 466.—T. F. B.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

Bleaching [of cotton]; Determination of the degree of ——. C. G. Schwalbe. Färber-Zeit., 1908, **19**, 33—34.

Over-bleached cotton reduces Fehling's solution, whereas with pure cotton cellulose no such action takes place. By estimating the amount of copper produced by the reduction of Fehling's solution, the degree of bleaching of the cotton can be ascertained. A weighed quantity of the cotton is boiled with a measured quantity of Fehling's solution, the liquor being well stirred during the reduction. The copper separated is filtered off, washed with hot water, dissolved in nitric acid and estimated by electrolytic deposition; the electrolysis is carried out in a platinum bowl with the aid of a revolving anode. In this way the "copper value" for the sample of cotton is obtained. Different varieties of cotton give different figures, those for mercerised cotton being higher than those for ordinary cotton. The "copper value" is referred to dry cotton. The moisture in the sample of cotton is determined by using a toluol drying stove. The estimation is recommended for application in the artificial silk industry.—S. H. H.

Artificial silk; Bleaching and dyeing of ——. E. Jentsch, Färber-Zeit., 1908, **19**, 36—39.

The properties of the different kinds of artificial silk are described. Chardonnet silk is peculiar in that it takes up basic colours without the aid of a mordant; the substantive cotton colours are best absorbed by "Glanzstoff." These observations are explained by the facts that Chardonnet silk is made from nitrated cellulost and therefore probably contains oxycellulose, whilst "Glanzstoff" is merely cotton cellulose in a different form. Chardonnet silk, however, gives fuller and faster dyeings with basic colours when previously mordanted with tannic acid and tartar emetic. Details of the methods of dyeing artificial silk and of the colours most suitable for the purpose are given. It is stated that dyeings with the substantive cotton colours are often "topped" with basic colours in order to brighten them. Shades which appear dull on drying are often brightened by steaming for a short time. In dyeing both Chardonnet silk and "Glanzstoff," the temperature of the bath should not exceed 70° C., and a lukewarm bath is used at the commencement of the operation. The dyeing usually takes from one to two hours.—S. H. H.

Aniline Black on woollen and mixed cotton and woollen tissues; Könitzer's method for dyeing ——. H. Schmid. Bull. Soc. Ind. Mulhouse, 1907, **77**, 387—388.

The tissues to be dyed are first boiled in a bath of dilute sulphuric acid, to which a little potassium ferricyanide is added. This treatment, while it does not much affect the physical properties, more or less completely destroys the reducing properties of the wool, which at the same time becomes dyed Prussian Blue. The tissues thus prepared are next padded in a solution of aniline hydrochloride, sodium chlorate, copper sulphate and ammonium chloride. They are then dried, and hung in, or passed through, an ageing room, to develop the Black. Finally they are passed through a bath of sodium bichromate slightly acidified with sulphuric acid. In mixed tissues composed of cotton and wool, the wool alone becomes dyed in Prussian Blue, but Aniline Black forms readily on both fibres when the tissues are treated as described. The Black produced upon the wool is of satisfactory depth and is not liable to turn green on exposure.—E. B.

Aniline Black ; New reserving agent [Sodium phenylhydrazinesulphonate] for use in producing coloured reserves under ——. Sealed Notes. No. 1502, dated Oct. 24, 1904 and No. 1720. dated March 14, 1907. A. Dondain and G. Corbumel. Bull. Soc. Ind. Mulhouse, 1907, 77, 375—379.

Oehler's "Reserve H" (sodium phenylhydrazinesulphonate) is added, along with sodium acetate, zinc oxide, magnesium acetate and a little ammonia solution, to suitably thickened solutions of basic dyestuffs, such as Thioflavine T. Thionine Blue GO, Malachite Green, Methyl Violet, Capri Blue GON, Rhodamine 6G, etc. The tissues, previously padded in a solution of potassium ferrocyanide, aniline hydrochloride and sodium chlorate, and dried at a low temperature, are printed with these mixtures, dried, steamed, and passed successively through baths of (i), sodium chromate (5 grms. of sodium bichromate and 2 grms. of sodium carbonate per litre) at a temperature of 50° C., (ii), water, and (iii), Turkey-red oil (6 grms. per litre) and sodium ferrocyanide (3 grms. per litre) at 50° C. The dyestuffs thus fixed are, it is stated, brighter and deeper than when the "Reserve H" is omitted or replaced by other substances. In the supplementary note (No. 1720), it is pointed out that when two pieces of tissue are steamed together, back to back, as is frequently done, so much chlorine oxide gas is generated that the dyestuffs as *e.g.* Malachite Green and Methyl Violet, which are especially sensitive to the action of this gas, are more or less destroyed. The "Reserve H" offers considerable resistance to the gas but does not afford sure protection for such dyestuffs. This is secured, however, by the addition to the colour-mixtures of small quantities of stannous chloride (10—20 grms. per litre) or of sodium thiosulphate.—E. B.

Report on the preceding article (Sealed notes Nos. 1502 *and* 1720). H. Schmid. Bull. Soc. Ind. Mulhouse, 1907, 77, 381.

Sodium phenylhydrazine sulphonate, which Kallab (Fr. Pat. 327,554 of 1902; this J., 1903, 949) proposed for use in calico printing as a reserving agent for Paranitraniline Red, acts as both a basic and a reducing compound. It has the power of absorbing to some extent the chlorine and chlorine oxide gases evolved in the steaming apparatus. It does not, however, do so effectively. The compounds mentioned in the additional note (No. 1720), namely stannous chloride and sodium thiosulphate, in regard to efficiency and economy, are to be preferred to it for the purpose in question. The author suggests that thiocyanates might act similarly.—E. B.

Patents.

Silk-like or velvet effects [on fabrics] ; Method of and apparatus for producing ——. R. B. Ransford, Upper Norwood. From Calico Printing Works Co. E. Zündel, Moscow, Russia. Eng. Pat. 4902, Feb. 28, 1907.

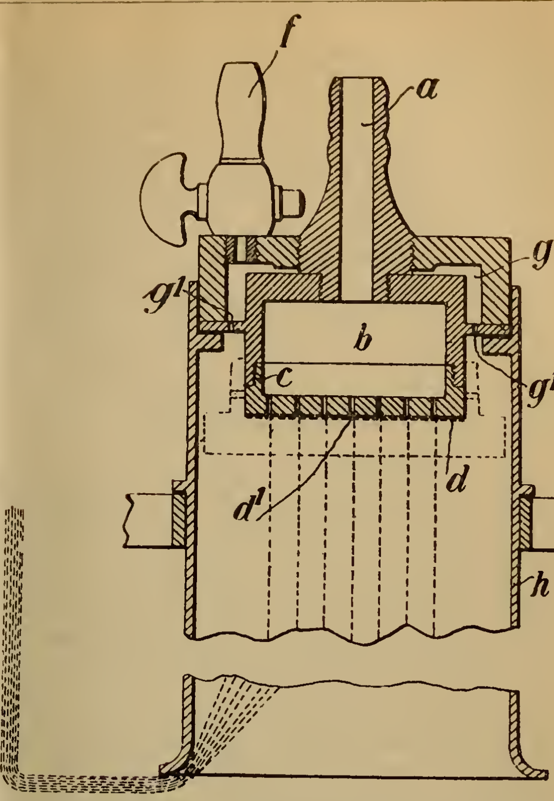
See Fr. Pat. 375,072 of 1907 ; this J., 1907, 870.—T. F. B.

Artificial silk ; Production of ——. J. A. E. H. Boullier, Paris. Eng. Pat. 16,512, July 18, 1907. Under Int. Conv., July 19, 1906.

See Fr. Pat. 368,190 of 1906 ; this J., 1906, 1217.—T. F. B.

Threads from solutions ; Spinning apparatus for the production of single ——. O. Müller, Cologne, Germany. Eng. Pat. 3606, Feb. 13. 1907.

The figure shows the apparatus claimed. The pipe supplying the particular solution from which the threads are to be formed is attached at *a*, and the liquid, passing through the chamber, *b*, issues from the orifices d^1, which have a cross-section corresponding with that desired for the filaments. The number of orifices is the same as the number of filaments required to compose the thread. For the purpose of preventing the filaments from sticking together, they are allowed to come into contact with a coagulating or solidifying liquid which enters the chamber, *g* through *f* and leaves it at the orifices, g^1, thereby meeting the filaments in the cylinder, *h*. The solid filaments are then drawn off as figured in the lower part of the diagram and wound on to a reel, which can be arranged above the level of the solidifying liquid. It is stated that by the aid of this invention threads may be produced "of desired fineness, from a large number of separate filaments."
—J. C. C.



Cellulosic and albuminoid substances [artificial silk, &c.] ; Strengthening ——. X. Eschalier. Addition, dated Nov. 5, 1906, to Fr. Pat. 374,724, April 24, 1906.

The claims are for : (1), the treatment of cellulosic or albuminoid substances with a salt having an acid reaction, or with an oxidising agent or other compound producing directly or indirectly the necessary acid, together with an aldehyde and either with or without a dehydrating agent ; (2), the drying of the substances treated with an aldehyde in an acid medium and subsequent heating in presence of a dehydrating agent.—T. H. P.

Dyeing of union goods ; Process for the ——. H. Levinstein and Levinstein, Ltd., Manchester. Eng. Pat. 19,840, Sept. 5, 1907.

After dyeing the cotton in union goods with sulphide dyestuffs in presence of hydrosulphite or a formaldehyde compound of hydrosulphite with or without the addition of a suitable colloid, darker shades are obtained and less washing is required if an acid or an acid salt be added to the water used for washing the goods. Any suitable acid or acid salt may be used, but sodium bicarbonate or an organic acid such as formic, acetic or lactic acid is preferable. The amount of acid should not be sufficient to throw the washed-out dyestuff out of solution nor to cause an evolution of sulphuretted hydrogen or to give an acid reaction to the cloth, but should be sufficient to convert any free sodium sulphide present, into the acid salt. According to the amount of dye-liquor left in the goods, from 1—4 per cent. of acetic acid (for example) may be added to the first wash water.—A. B. S.

Printing or dyeing of textile fibres ; Process for the ——. The Calico Printers' Assoc. Ltd. and E. A. Fourneaux, Manchester. Eng. Pats. 764 and 765, Jan. 11, 1907.

(1.) If a mixture of Nitrosamine Red (the sodium salt of inactive *p*-nitrodiazobenzene) and an alkaline β-naphthol solution be employed in the production of Paranitraniline

Red, the red is affected by the alkali set free. A good red can be obtained if this excess of alkali be reduced by dissolving the naphthol in soap solution instead of in alkali, but the colours so obtained are not stable. If Nitrosamine Red be used with an alkaline naphthol solution and an ammonium salt, an ammonium salt of Nitrosamine Red is first obtained, and the red produced is tarnished by brown bodies formed by the decomposition of this salt. According to the present invention, the excess of alkali is neutralised by the addition of suitable acid ethers to the mixture The term "acid ethers" includes all organic substances which yield acids by hydrolysis, especially those derived from halogen acids such as dichlorhydrin. These are added in a quantity sufficient to neutralise a large part or the whole of the alkali. In this manner a good red is obtained, and the printing or dyeing colours are relatively stable. Speaking generally those ethers are most suitable which are soluble in water, not too volatile, and which do not hydrolyse so readily as to cause the premature formation of Paranitraniline Red. The best method of carrying out the process is to print or pad the material with a suitable mixture, thickened if necessary, of alkaline naphthol solution, Nitrosamine Red and an acid ether, with or without the usual additions of Turkey-red oil, etc. The stability of the mixture is improved by the addition of mineral salts such as sodium sulphate. The red is developed by allowing the goods to lie for a sufficient time or by a short steaming, preferably after the red has been partly fixed by allowing the goods to lie. Example:—Twenty-five parts of β-naphthol and 25 parts of castor oil soap (containing about 60 per cent. of fatty acids) are dissolved in 50 parts of caustic soda solution of 36° T. and 120 parts of water. This solution is stirred with 550 parts of a gum tragacanth solution in which 60 parts of sodium sulphate have been previously dissolved. Before use 15 parts of chlorethyl alcohol, 15 parts of neutral acetin (containing 42 per cent. of combined acetic acid) and 125 parts of a 25 per cent. nitrosamine paste are added. This colour is printed on the white material and the goods are allowed to lie for 24 hours. They are then aged, or not, as required. The process may be varied by padding with naphthol solution, drying, and then padding or printing with a nitrosamine mixture containing the acid ether.

(2.) A good Paranitraniline Red is obtained by printing or padding the textile material with a suitable mixture of one of the metallic salts of 2-naphthol-1-sulphonic acid and Nitrosamine Red, with or without the customary additions such as Turkey-red oil, etc. In the present patent the property which this sulphonic acid possesses of parting with its sulphonic group in the presence of a diazo compound and yielding an azo compound, is utilised. The basic magnesium salt of the sulphonic acid gives the best results and the nitrosamine should also be converted into its magnesium salt. Example:—(A.) Dissolve 36 parts of magnesium sulphate in 100 parts of gum tragacanth solution and stir in a mixture of 125 parts of a 25 per cent. nitrosamine paste and 183 parts of water. (B.) Mix together 400 parts of gum tragacanth solution, 20 parts of castor oil fatty acids, 20 parts of oil of turpentine, 15 parts of neutral acetin and 103 parts of a solution of the basic magnesium salt of 2-naphthol-1-sulphonic acid (obtained by stirring the normal salt with excess of magnesium hydroxide) and containing about 364 grms. per litre of the basic salt. Shortly before use, mix A and B, print on the material, dry, steam for one minute without pressure, wash, and soap.—A. B. S.

Dressing of textile substances; Process and materials for the ——. J. Boyeaux, Villeurbanne, France. Eng. Pat. 233, Jan. 3, 1907.

The material is impregnated with an artificial grease which imparts body or strength to the threads. This coating with grease is especially suitable for raw silks and also for cotton and linen goods. The artificial grease consists of linseed oil to which is added beeswax and, in some cases, a resinous substance, the whole being dissolved in some volatile solvent such as benzene. For raw silk the solution contains 1 kilo. of benzene, 450 grms. of boiled linseed oil and 15 grms. of beeswax. This solution is heated to about 30° C. and the filaments of raw material are immersed in the solution until saturated. The excess of liquid is then removed and the material spread out on tables in a room at a temperature of about 30° C., where it remains for about 30 hours or until the benzene has evaporated. The composition of the solution may be altered according to the added weight which it is desired to give to the threads or finished fabric. The solution described above increases the weight by about 5 per cent. (Reference is directed to Eng. Pats. 1393 of 1858, 2137 of 1864, 1930 of 1875, 2534 of 1885, and 2711 of 1895; this J., 1886, 96; 1896, 196.)—A. B. S.

Sizes for treating yarns. W. Seaman, Manchester. Eng. Pat. 737, Jan. 11, 1907.

In order to soften the starches used in sizing yarns, they are mixed with a solution obtained by the addition of castor oil to a solution of resin in caustic soda. The size thus prepared remains in the liquid state.—A. B. S.

Insulating material, etc. Ger. Pat. 188,546. *See* XIA.

VII.—ACIDS, ALKALIS, AND SALTS, AND NON-METALLIC ELEMENTS.

Ammonia; Synthesis of ——. Woltereck. Compt. rend., 1908, **146**, 124—125.

In view of the recent publication by Brunel and Woog (this J., 1907, 1277), the author points out that in 1903 he published work on this subject. He found that a mixture of air (78 volumes) and hydrogen (1 vol.), bubbled through water at 80° C., and passed over reduced iron or the oxides of certain metals (those of bismuth, chromium and iron acted best) at 300°—350° C., yielded considerable amounts of ammonia. Similar results were obtained when air, saturated with water-vapour at 80° C., was passed over coke, wood charcoal, dried peat, or sugar charcoal, at temperatures not above 700° C.—J. T. D.

Ammonio-cuprous sulphate. M. Bouzat. Compt. rend., 1908, **146**, 75—77.

To strong aqueous ammonia are added cuprous oxide and ammonium sulphate, which dissolve. From this solution alcohol precipitates ammonio-cuprous sulphate. If the whole of the operations (precipitation, filtration, washing with alcohol and ether, and final drying *in vacuo*) be conducted with scrupulous exclusion of air, the dried substance can be heated to 60°—80° C., when it loses about 1 per cent. of its weight, and then has the composition corresponding to $Cu_2SO_4,4NH_3$. It is stable while dry, but oxidises rapidly in air when moist (this J., 1907 93).—
—J. T. D.

Hypochlorites; Electrolytically produced fluids containing ——, their manufacture, and the rationale and chemistry of the process for securing stability. F. W. Alexander. Lancet, Jan. 18, 1908.

The bleaching liquid produced by the Hermite process can be made, to contain 4·2—4·8 grms. of available chlorine per litre, but loses its strength very rapidly. If, however, the freshly made liquid be thoroughly stirred up with magnesium oxide or hydroxide, it retains its strength for many days. The author's view is that the fresh liquor contains, besides magnesium hypochlorite, free hypochlorous acid or other unstable chlorine-oxygen compound, which is converted by the magnesia into magnesium salt. Magnesium carbonate cannot be substituted for the oxide. The advantage of magnesia over lime, or caustic soda or potash is that it is not strongly alkaline or caustic, and that any excess remains undissolved.—J. T. D.

Borates; Anhydrous ——. W. Guertler. Sprechsaal, **45**, 612—6.

The preparation of borates by fusing boric anhydride with the oxides, nitrates, and carbonates of different metals in a specially constructed furnace for 3 hours, at a temperature from 1350—1450°, is described. Many oxides like those of iron, aluminium, chromium, silicon, zirconium, tin, molybdenum, tungsten, and uranium were found to be insoluble, or but slightly soluble in boric acid. Some oxides were reduced to a lower stage of oxidation, others were oxidized still higher. In tin compounds the stannic oxide was partially reduced to tin. Sulphates, chlorides, bromides, and iodides were found to be unsuitable in the preparation of the borates; and from alkali carbonates the carbon dioxide was difficult to expel. The oxides soluble in boric acid form three groups: (1) Those which, in equivalent admixture (valency of metal atoms = valency of boron atoms) produce clear, homogeneous fusions, either crystallizing on cooling or leaving clear glasses without segregation. (2) Those which produce clear, homogeneous fusions at the higher temperatures but show dissociation and the formation of an emulsion at a definite degree of concentration. This is a case of limited mutual solubility of two liquids which are miscible at higher temperatures in all proportions. (3) Those which do not give homogeneous fusions even at 1400°, two distinct layers of liquids being produced, like oil and water. The equivalent mixtures crystallise as orthoborates. To the first group belong the oxides of lithium, potassium, sodium, rubidium, cæsium, thallium, and silver. Sodium and potassium metaborate, $NaBO_2$ and KBO_2, fuse at 820° and 890° and deliquesce in the air. They are remarkably volatile and dissolve alumina, chromic oxide and silica freely. To the second group belong cuprous oxide and the oxides of lead, bismuth, antimony, arsenic, titanium, molybdenum, and tungsten. They produce emulsions, but show no crystallization. Some of the glasses are of different hardness: PbO,B_2O_3 is as hard as flint glass, while $3PbO,B_2O_3$ softened in boiling oil. The third group embraces the oxides of calcium, strontium, barium, magnesium, zinc, cadmium, manganese, iron, cobalt, and nickel. Magnesia produces two compounds, orthoborate, $3MgO,B_2O_3$, and pyroborate, $2MgO,B_2O_3$. No other anhydrous magnesium borate exists. The corresponding borates of cobalt and nickel were likewise found. It was not possible to produce the ferrous borate, since oxidation invariably took place. The fusion produced two layers, of which the lower showed crystals having approximately the composition, $3B_2O_3,2FeO,2Fe_2O_3$. In melting cupric oxide the length of fusion played an important rôle and two layers were produced. The lower layer showed crystals of CuO,B_2O_3, which decomposed on longer heating, evolving oxygen. On complete decomposition the residue again consisted of two layers, the lower of which contained crystals of $3Cu_2O,2B_2O_3$, which, on still further heating, decomposed into cuprous oxide and boric anhydride, forming an emulsion. Crystals of $3ZnO,2B_2O_3$ and $3ZnO,B_2O_3$ were obtained. The manganese boric acid fusion resulted in two layers which devitrified on heating and formed crystals of the formula, MnO,B_2O_3. Other borates, produced by previous investigators, are $3MnO,B_2O_3$ and $3MnO,2B_2O_3$. According to the author, the following compounds of the alkaline-earths with boric acid exist, of which the pyroborates have been first prepared by him.

Orthoborates ..	$3CaO,B_2O_3$	$3SrO,B_2O_3$	$3BaO,B_2O_3$
Pyroborates ...	$2CaO,B_2O_3$	$2SrO\ B_2O_3$	$2BaO,B_2O_3$
Metaborates ..	$CaO\ B_2O_3$	$SrO\ B_2O_3$	$BaO\ B_2O_3$
Biborates	$CaO,2B_2O_3$	$SrO,2B_2O_3$	$BaO,2B_2O_3$

The author recognises five types of anhydrous borates in place of the four of Le Chatelier: (1) $3Me''O,B_2O_3$, orthoborate; (2) $2Me''O,B_2O_3$, pyroborate; (3) $3Me''O,2B_2O_3$, sesquiborate; (4) MeO,B_2O_3, metaborate; (5) $MeO,2B_2O_3$, biborate. With reference to devitrification the author states that it is a process closely akin to an explosive chemical reaction, set up at a definite temperature, since an amorphous substance is as unstable a system as a mixture of hydrogen and oxygen.

Zinc oxide: carbon dioxide: water; The system ——. [*Basic zinc carbonate*]. H. Mikusch. Z. anorg. Chem., 1908, **56**, 365—374.

The formation of basic carbonates of zinc has been studied in the light of the phase rule. In one series of experiments zinc hydroxide was shaken with a solution of sodium acetate saturated with carbon dioxide, at various temperatures, until equilibrium was established, and the solid and liquid phases were then analysed. Sodium acetate was used, because of the insolubility of zinc carbonate and hydroxide in water. In other experiments pure crystalline zinc carbonate, $2ZnCO_3,H_2O$, was shaken with sodium acetate solution, and the composition of each phase determined. The results obtained confirm the work of Kraut on the precipitation of zinc salts by alkali carbonates (Z. anorg. Chem., 1897, **13**, 1), and show that only one basic salt exists, the compound, $5ZnO,2CO_2,4H_2O$, which has been prepared pure by the hydrolysis of the normal carbonate with water. All other supposed basic carbonates of zinc are regarded as solid solutions of zinc hydroxide and the normal carbonate.—F. Sodn.

White into red phosphorus; Transformation of solutions of ——. A. Colson. Compt. rend., 1908, **146**, 71—73.

The rapidity of transformation of white phosphorus in solution into red phosphorus depends first upon the temperature, being much greater at 285° than at 260° C., and secondly upon the concentration, with which it increases. In all cases, however, the solvent retards the transformation, for white phosphorus in a vacuous tube heated in the solution is always completely converted long before any precipitation of red phosphorus occurs from the solution, whether the solvent be oil of turpentine or carbon bisulphide. There is no reaction between phosphorus and oil of turpentine at 260° C.—J. T. D.

"Arsenicals"; Manufacture of ——. A. Rzehulka. Berg.- u. Hüttenmänn. Rundsch., 1907, **4**, 49, 72. Chem.-Zeit., 1908, **32**, Rep., 68.

In the manufacture of arsenic from iron arsenide and arsenical pyrites:

$$Fe_2As_3 = 2FeAs + As$$
$$2FeAs_2 + 2FeS_2 = 4As + 4FeS,$$

a considerable proportion of the arsenic remains in the residue, and is subsequently worked up into arsenic trioxide. The author describes the galley furnaces used and the preparation of the so-called arsenic "pots." A yield of about 60 per cent. of arsenic and 10 per cent. of a mixture of arsenic powder and arsenic sulphide is obtained. The consumption of coal amounts to about 1·5 per cent. of the weight of the ore. The manufacture of crude arsenic trioxide is carried on in reverberatory furnaces, with a capacity of 8—10 tons of ore (with 0·15 ton of fuel per ton of ore) per 24 hours. The residues contain not less than 3 per cent. of arsenic. For the condensation of the arsenic trioxide ("poison-powder"), "poison-towers" are no longer used. The crude "poison-powder" is prepared for sale by re-sublimation in reverberatory furnaces, a yield of 85 per cent. of arsenic trioxide of 99—100 per cent. purity being obtained. The preparation of white arsenic glass (amorphous arsenic trioxide) is carried on by heating to 400° C. in iron retorts built up of sections; 95 per cent. of the "poison-powder" is thus converted into the "glass." For the preparation of red arsenic glass, the required proportions of sulphur and arsenic in the charge to yield a glass of the desired colour, can be ascertained only by practical experience. A non-homogeneous red glass is therefore made first, and this is subjected to a refining process by fusing with the necessary addition of sulphur or arsenic. In the first process the charge consists of a mixture of equal parts of iron arsenide and pyrites, or a mixture of arsenical pyrites with a quantity of sulphur equal to 25 per cent. of the arsenic present. A yield of 27·5—28 per cent. of red glass is obtained, of which 26 per cent. is suitable for the subsequent refining process. In the latter operation 150—175 kilos. of the red glass are mixed with from 18 to 27 kilos. of sulphur according to the colour desired. The loss during the melting amounts to 6 per cent. The refined red glass contains approximately 75 per cent. of arsenic and 25 per cent. of sulphur. For the preparation of yellow arsenic glass, arsenic trioxide is mixed with 3—4 per cent. of sulphur, and the mixture sublimed in furnaces similar to those used for the manufacture of white arsenic glass. The yield is about 90 per cent. The yellow glass consists of about 94 per cent. of arsenic trioxide and 6 per cent. of arsenic trisulphide.—A. S.

Patents.

Nitric acid or nitric oxide; Apparatus for the manufacture of —— from air. H. Pauling, Assignor to Salpetersaüre-Ind.-Ges., G.m.b.H., Gelsenkirchen, Germany. U.S. Pat. 877,446, Jan. 21, 1908.

For the manufacture of nitric acid or oxide from air, a current of the air is blown through the space between electrodes for producing electric discharges. On the further side of the electrodes are a number of plates, insulated from each other, and capable of rotation in a plane at right angles to that of the electrodes.—F. Sodn.

Nitric acid; Process for the production of pure ——. H. Pauling, Assignor to Salpetersäure Ind.-Ges., Gelsenkirchen, Germany. U.S. Pat. 877,447, Jan. 21, 1908.

See Eng. Pat. 7871 of 1906; this J., 1906, 758.—T. F. B.

Sulphuric acid; Manufacture of ——. F. G. Cottrell. Fr. Pat. 382,179, Sept. 24, 1907.

See U.S. Pat. 866,843 of 1907; this J., 1907, 1138.—T.F.B.

Alkali hydroxides; Method of making ——. P. B. and S. P. Sadtler, Philadelphia, Pa. U.S. Pat. 877,376, Jan. 21, 1908.

In order to convert an alkali sulphate into the corresponding hydroxide, the finely divided sulphate is intimately mixed with at least an equal quantity of alumina, and the mixture is subjected to an incipient yellow heat, so as to produce alkali aluminate. This compound is decomposed partly by agitation to separate a portion of the combined alumina, and the rest is precipitated by milk of lime. Reducing agents must be absent during the process of heating.—F. Sodn.

Ammonia from nitrogen compounds; Process of producing ——. C. Krauss, and Ges. f. Stickstoffdünger, Westeregeln, Saxony. Eng. Pat. 9407, April 23, 1907.

See Fr. Pat. 375,979 of 1907; this J., 1907, 925.—T. F. B.

Chlorates and perchlorates; Decomposition of —— by combustion. G. F. Jaubert, Paris. Eng. Pat. 1256, Jan. 17, 1907. Under Int. Conv., May 23, 1906.

See Fr. Pat. 375,816 of 1906; this J., 1907, 924.—T. F. B.

Carbonic acid gas; Process and apparatus for the manufacture of ——. A. E. Knowles, Sutton Coldfield. Eng. Pat. 1744, Jan. 23, 1907.

See Fr. Pat. 380,631 of 1907; this J., 1908, 23.—T. F. B.

Felspar; Process of decomposing ——. A. J. Swayze, Great Meadows, N.J., U.S.A. Eng. Pat. 16,850, July 23, 1907.

See U.S. Pat. 862,676 of 1907; this J., 1907, 1008.—T.F.B.

[*Calcium*] *carbide; Method of manufacturing ——.* H. L. Hartenstein, Duluth, U.S.A. Eng. Pats. 20,653 and 20,654, Sept. 17, 1907.

The waste or dust carbide ordinarily occurring in the manufacture of calcium carbide, is added to molten carbide, as the latter is run into moulds for cooling. The addition of a small proportion of sodium chloride to the mixture of molten carbide and fines, assists combination. According to the second patent, the waste carbide dust is analysed, and on the result shown, so much carbonaceous material is intimately mixed with the dust as may more than compensate for the carbon lost by exposure of the dust to the atmosphere, and also for the carbon liable to be consumed in electrically heating the charge to a molten condition. The mixture is then fused, and is stated to yield carbide of a high grade of purity.—E. S.

Calcium carbide; Manufacture of ——. H. L. Hartenstein. Fr. Pats. 381,951 and 381,953, Sept 17, 1907.

See Eng. Pats. 20,653 and 20,654 of 1907; preceding. —T. F. B.

(1), *Stannic chloride; Apparatus for making ——.* (2), *Stannic chloride; Method of purifying ——.* (3), [*Stannic chloride*]; *Apparatus for effecting reactions between liquids and gases.* (4), *Solids and gases; Method of effecting reactions between ——.* (5), *Stannic chloride; Method of making ——.* E. A. Sperry, Assignor to Chemical Reduction Co., New York. U.S. Pats. 877,243; —4; —5; —6; —7. Also (6), *Stannic chloride; Method of making ——.* E. A. Sperry. U.S. Pat. 877,248, Jan. 21, 1908.

(1). The reaction vessel for making stannic chloride communicates with condensers and a scrubber. It is furnished with feed and discharge orifices, and with gas inlet and outlet pipes above the normal level of the liquid. There are means for imparting motion to the contents of the vessel and for heating it and the gas pipes and also the valves, with which the various parts of the apparatus are provided. (2). To remove free chlorine from stannic chloride, the solution of the latter is heated to boiling, so as to expel both chlorine and stannic chloride, and the vapours are then cooled to separate the stannic chloride, which is continuously returned to the body of the liquid. When free from chlorine, it is distilled. (3). The apparatus consists of a shallow vessel containing a horizontal septum, around which the liquid is caused to circulate. The gas passes through a gas chamber in the upper portion of the vessel, above this septum and above the liquid level, and thereby an extended liquid surface is exposed to the gas. (4). Solids and gases are made to react together by suspending the solid in the liquid containing the gas in solution, at a suitable temperature, the whole being agitated and kept in circulation, so that fresh gas is absorbed by one portion of the liquid at a lower temperature, and the solid is maintained in suspension in another portion at a higher temperature. (5). Stannic chloride is made by causing chlorine, dissolved in stannic chloride, to react with a tin-bearing material in suspension (see preceding patent), fresh chlorine being passed in an elongated path over the surface of the liquid. (6). Stannic chloride is made by suspending a tin-bearing material in liquid anhydrous stannic chloride, and introducing "moist chlorine" beneath the surface of the liquid, the chlorine inlet being heated to prevent obstruction. Circulation of the liquid is effected by the gas.—F. Sodn.

(1), *Stannic chloride; Method of producing ——.* (2), *Stannic chloride; Method of purifying ——.* (3), *Stannic chloride; Apparatus for producing ——.* C. P. Townsend, Assignor to (1), American Can Co., and (2), and (3), Chemical Reduction Co., New York. U.S. Pats. 877,261; —2; —3, Jan. 21, 1908.

(1). Stannic chloride is produced by subjecting a tin-bearing material to the action of chlorine, in excess, in such a way that the product is volatilised and then separated by condensation from the unused chlorine, the latter being then made to act on a further quantity of material at a temperature sufficient to vaporise stannic chloride. The process is repeated until all the chlorine is absorbed. (2). Stannic chloride, containing free chlorine, is purified by causing a portion of the chlorine to combine with tin and expelling the remainder, which is utilised for the production of more stannic chloride. (3). For the production of stannic chloride a number of retorts are used, communicating in series and having

condensing means interposed between them. Dehydrated chlorine can be supplied to any or all of these retorts.
—F. Sodn.

Oxidising means for solutions. W. B. McPherson, Assignor to Non Acid Copper Extracting Co., Los Angeles, Cal. U.S. Pat. 877,445, Jan. 21, 1908.

The solution to be oxidised is conveyed from the lower part of a tank, in which it is heated, to a distributor at the top, from which it passes down through a succession of perforated partitions, meeting a current of hot air forced in from below, and returns to the lower portion of the tank again, from which it may be removed.
—F. Sodn.

Electrolytic apparatus. Eng. Pat. 29,655. *See* XIA.

VIII.—GLASS, POTTERY, AND ENAMELS.

Zettlitz kaolin, quartz, and felspar; Melting points of mixtures of —— expressed in Seger cones. M. Simonis. Sprechsaal, 29, 390—3; 30, 402—6.

Mixtures of felspar and kaolin usually fuse at higher temperatures than felspar-quartz mixtures, although the melting point of quartz is higher than that of the kaolin. With a content of 70 per cent. of felspar the two curves were found to intersect. With 85 per cent. of felspar the kaolin mixture fused lower than the corresponding quartz mixture. The fusion curve of kaolin and quartz showed that the minimum fusing point appertained to a mixture wherein the ratio of 1 molecule of alumina to 17 molecules of silica existed. The minimum fusing point of 25 per cent. of kaolin and 75 per cent. of quartz was found to lie between cone 26½ and 26¾. The following table indicates the melting points of a number of felspar-quartz-kaolin mixtures.

Zettlitz kaolin.	Quartz.	Felspar.	Melting point in Seger cones.
Per cent.	Per cent.	Per cent.	
..	15	85	9—10
..	30	70	14
..	45	55	15—16
..	55	45	17
..	70	30	26—27
..	85	15	30—31
15	..	85	9
15	15	70	10—11
15	30	55	13—14
15	45	40	15
15	55	30	17—18
15	70	15	—26
15	85	..	28—29
30	..	70	14
30	15	55	16—17
30	30	40	17—18
30	45	25	—26
30	55	15	26
30	70	..	27
45	..	55	26
45	15	40	26—27
45	30	25	27—28
45	45	10	29
45	55	..	29—30
55	..	45	28
55	15	30	29—30
55	30	15	30 +
55	45	..	30—31
70	..	30	31 +
70	15	15	32
70	30	..	32 +
85	..	15	33—34
85	15	..	33—34

The author plotted the compositions on a triaxial diagram and connected the points by isothermals. In this way the two refractory areas, one high in clay, the other high in quartz, are clearly located, as well as the areas of soft porcelain, whiteware, and hard porcelain. The felspar invariably acts as a neutral and constant flux. Hence, in order to determine the melting point of a porcelain or whiteware mixture, it is necessary only to divide the clay and quartz in the ratio of 1 : 3 and to consider the balance as raising, and the felspar content, as lowering the fusibility. This consideration applies only to bodies containing not more than 60 per cent. of felspar, and the mode of calculation is simply one which has succeeded well in practice. If the percentages of kaolin, quartz, and felspar be z, qu and f, for bodies high in clay in which $z > \frac{qu}{3}$, the refractory index $= z - \frac{qu}{3} - f + 60$. For bodies high in quartz, where $\frac{qu}{3} > z$, the index $= \frac{qu}{3/2} - z - f + 60$. For the purpose of obtaining the value of the refractory index in terms of the Seger cones, the following table is given:

Ref. index	17·5	22·6	28	33·7
Seger cone	14	15	16	17
Ref. index	39·2	44·6	50	57·6
Seger cone	18	19	20	26
Ref. index	65	72	80	89
Seger cone	27	28	29	30
Ref. index	102	114	127	141
Seger cone	31	32	33	34

The melting points of these mixtures were determined in electric carbon resistance furnaces.

Patents.

Glass; Apparatus for melting and drawing ——. O. Imray, London. From The Window Glass Machine Co., Pittsburg, U.S.A. Eng. Pat. 22,094, Oct. 7, 1907.

See U.S. Pat. 868,034 of 1907; this J., 1907, 1199.—T.F.B.

Glass sheets; Mechanical manufacture of ——. F. Oppermann. Addition, dated Sept. 16, 1907, to Fr. Pat. 369,986, Sept. 24, 1906.

See Eng. Pat. 20,975 of 1907; this J., 1908, 124.—T. F. B.

Earthenware; Producing highly glazed coloured ——. K. Fischer, Sulzbach, Germany. Eng. Pat. 23,063, Oct. 18, 1907.

The unfired or half-fired article is coated with a coloured layer, composed of clay sludge and some colouring material. The coated articles are then polished and afterwards fired, in order to produce on them a "velvety" glaze.
—W. C. H.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Grog (scrap) fire clay bodies; The crushing strength of ——. E. Cramer. Sprechsaal, 38, 509—11.

The author determined the crushing strength of fire clay bodies after repeated burning, since practice has shown that some fire clay ware deteriorates in strength when subjected to heat in metallurgical and other furnaces. Six different bodies were employed which had the following compositions. Body 26: 30 parts grog, 20 sand, 25 Halle clay, 25 raw kaolin. Body 60: 60 parts Swedish slate, 40 Groeden clay. Body 63: 60 Rackonitz shale, 40 Westerwald clay. Body 72: 60 grog, 15 Schwepnitz clay, 25 raw kaolin. Body 96: 60 Westerwald grog, 40 Westerwald clay, 25 raw kaolin. Body 103: 100 raw kaolin. Part of these were burnt once, part twice, part of them three, and part four times between cones 10 and 12. Each body was moulded in four different ways: (*a*) moulded moist and repressed; (*b*) dry pressed; (*c*) moulded wet, by hand; (*d*) cast as a slip in plaster moulds. The size of the briquettes was 12·5 × 12·5 × 6·5 cm. Twenty of these were built into test bodies of approximately cubical form. These bodies were smoothed with cement and crushed. The results are shown in the accompanying table:

Crushing strength of the cubical shaped test body in kilos. per sq. cm.

Body.	Method of Moulding.	Number of bakings. Kilos. per square cm.			
		1	2	3	4
26	a	112·7	123·1	104·4	109·1
	b	85·5	59·9	83·6	64·6
	c	84·4	87·5	81·8	80·3
	d	88·1	124·6	106·9	110·0
60	a	164·4	176·3	173·6	174·9
	b	53·8	47·7	54·3	53·1
	c	75·7	88·6	70·8	82·6
	d	143·7	145·2	166·6	198·8
63	a	114·6	124·4	129·0	135·6
	b	75·4	61·8	66·1	55·6
	c	47·8	50·6	56·0	54·7
	d	86·6	61·6	56·5	69·5
72	a	86·8	85·4	86·5	84·1
	b	46·5	78·4	68·1	61·8
	c	49·3	67·2	50·3	57·5
	d	118·5	137·5	134·5	124·1
96	a	82·3	101·4	100·2	97·3
	b	82·7	80·0	80·0	92·4
	c	63·1	61·9	65·7	84·6
	d	103·1	99·6	100·4	109·6
103	a	146·9	163·9	158·9	164·2
	b	176·8	181·4	172·0	161·8
	c	197·8	207·3	200·0	216·7
	d	194·6	298·5	286·6	274·3

Of the figures for crushing strengths obtained in the foregoing table, only the average values of 10 crushed sample bodies are shown.

Patents.

Refractory articles; Manufacture of ——. H. A. D. Collins, London. Eng. Pat. 27,619, Dec. 4, 1906.

According to this process, powdered silicious material is mixed with calcium hydroxide (or other equivalent alkaline substance), and the mass is heated, and then moulded into the required shapes under great pressure. The articles may be subjected to steam pressure, and are burnt at a high temperature.—W. C. H.

Bituminous composition [*for paving slabs, etc.*] *and method of preparing the same.* W. H. Coward, Bath. Eng. Pat. 10,064, Apr. 30, 1907.

Limestone or other calcareous material is burnt to produce quicklime, which is incorporated with bitumen or bituminous matter (*e.g.* bituminous shale), and the mixture formed into slabs by means of rollers. These slabs are exposed to the atmosphere upon a perforated floor or the like, so that as the lime becomes air-slaked, the powder falls through the perforations in a finer state of division than could be attained by grinding. The product may be used for all purposes for which asphalt is employed.—C. A. M.

Wood substitute. W. G. F. Siegmann, Baltimore, U.S.A. Eng. Pat. 15,761, July 9, 1907.

The wood substitute consists of about 1 part of ground straw, 1 part of sawdust, two parts of asphaltum, and two parts of a binding material composed of 1 part of calcined magnesite (the use of which forms an essential part of the invention), ½ part of boric acid, ½ part of ammonium chloride, and ½ part of colophonium. All the ingredients are thoroughly mixed together, and after the mass has been moistened with a solution of magnesium chloride, it is subjected to a heavy pressure.—W. C. H.

Stone, artificial; Process for the manufacture of ——, *and of moulded articles.* H. Dresler, Assignor to Cöln-Müsener Bergwerks Act.-Ver., Creuzthal, Germany. U.S. Pats. 876,782 and 876,783, Jan. 14, 1908.

See Fr. Pat. 362,808 of 1906 and addition thereto; this J., 1906, 760 and 1907, 612.—T. F. B.

Kiln for burning brick, lime, and similar material. P. Czigler, Székes-Fejérvár, Hungary. U.S. Pat. 877,300, Jan. 21, 1908.

See Fr. Pat. 373,000 of 1906; this J., 1907, 612.—T. F. B.

Clay; Self-glazing fire-proof ——. B. Kuntze, London. Eng. Pat. 547, Jan. 8, 1907.

About 66 lb. of dry powdered clay are thoroughly mixed with 46 lb. of very finely ground dry sand and 9 ounces of finely powdered rock salt. By the addition of a suitable quantity of water, the mass can be moulded into any required shape, or applied as a thin furnace lining, and when fired will stand a high temperature for a long time.—W. C. H.

Cement; Manufacture of ——. S. O. Cowper-Coles, London. Eng. Pat. 22,425, Oct. 10, 1906.

The clinkering of the cement-forming materials is effected by means of an electric current. The raw materials, especially a mixture of disintegrated blast-furnace slag and the requisite amount of calcium carbonate, are wetted with a weak acid solution to reduce the resistance of the mass to the passage of the current, until the mass has reached such a temperature that it conducts the current itself. The raw materials may be subjected to a preliminary heating to a certain extent, and then discharged on to a travelling belt or table, by which they are carried between the electrodes.—W. C. H.

Cement-burning furnace. W. E. Snyder, Nazareth, Pa. U.S. Pat. 876,602, Jan. 14, 1908.

The furnace consists of a rotating annular hearth provided with a fixed reverberatory hood. Means are supplied for forcing a current of air in a direction opposite to that in which the hearth moves. A series of arc-electrodes is arranged within the hood above the hearth, the individual carbons composing the series being "staggered," so that the arcs produced extend diagonally across the entire width of the hearth; the distance between the successive carbons diminishes progressively from the charging to the discharging end. Means are provided for raising or lowering the hearth relatively to the carbons. An electro-magnet is placed above the electrodes, and a current is passed from this electro-magnet through the hearth so as to increase the effect of the arc-electrodes.—A. G. L.

Cement; Process and apparatus for burning —— *in tubular, rotary furnaces.* T. M. Morgan. Second Addition, dated Sept. 16, 1907, to Fr. Pat. 365,523, April 24, 1906.

See Eng. Pat. 8760 of 1907; this J., 1908, 23.—T. F. B.

X.—METALS AND METALLURGY.

Manganiferous pig-irons. L. Guillet. Compt. rend., 1908, **146**, 74—75.

Further study of these alloys has shown that the author's former conclusions (this J., 1907, 1094) were erroneous. These alloys, like the corresponding nickel alloys, do contain γ-iron when the percentage of manganese is high enough. They also contain a carbide, the amount of which increases with the percentage of manganese. The manganese displaces the eutectic-point, which occurs with a lower percentage of carbon than in iron-carbon alloys: the alloy containing 3·6 per cent. of carbon and 15 per cent. of manganese is practically pure eutectic. Certain of the alloys contain carbide and γ-iron without any eutectic: this carbide is probably produced by segregation after solidification. As the percentage of manganese added to a grey pig-iron increases, γ-iron appears before the disappearance of the graphite.—J. T. D.

Ferro-chromes containing high percentages of carbon; Analysis of ——. A. Caflin and F. Dhuique-Mayer. Monit. Scient., 1908, 22, 88—91.

For the estimation of the total carbon the authors reject as unsuitable all methods involving the preliminary separation of the carbonaceous material, and estimation by direct combustion in oxygen alone was found to be tedious, with incomplete oxidation of the carbon in the case of rich ferro-chromes. The method recommended is direct combustion in oxygen in the presence of lead peroxide. The ferro-chrome is reduced to an impalpable powder, and 0·25 grm. is weighed out and mixed with 1·5 grm. of lead peroxide. The mixture is placed in a porcelain boat 9 cm. long and 2 cm. broad, and heated in a current of pure oxygen in a porcelain tube glazed inside. The tube is heated gradually to a dull red heat when gases due to the oxidation of impurities (sulphur, etc.) are rapidly given off, and soon after the carbon is oxidised, the carbon dioxide being absorbed in an ammoniacal solution of barium chloride. The barium carbonate formed in the absorption vessels is filtered off, dissolved in hydrochloric acid, converted into barium sulphate and weighed as such. The combustion is complete in 3—4 hours, but it is advisable to continue the heating for one hour longer. The chromium may be estimated by the usual method involving a fusion with sodium peroxide. In the case of the estimation of the iron after a sodium peroxide fusion, it was found that incomplete oxidation of organic matter (carbides) causes high results with the potassium permanganate titration. The finely powdered ferro-chrome is therefore subjected to a preliminary calcination for 2—3 hours before fusion with sodium peroxide.—O. F. H.

Converter-matte from copper-concentrates; Production of —— by pot-roasting and smelting. G. A. Packard. Bi-monthly Bull. Amer. Inst. Min. Eng., 1908, 75—79.

Owing to the lack of a reverberatory furnace, experiments were made as to the applicability of "pot-roasting" to the treatment of copper-concentrates. The materials used consisted of 8 mm. jig-concentrates and 0·5 mm. table-concentrates, from the San Juan district, Colo., containing pyrite, chalcopyrite, and galena, and also copper ore which had been crushed through an 8-mm. screen and partially roasted. The charge consisted of 253·5 lb. of the partially roasted ore, 174·5 lb. of table-concentrates, 158·5 lb. of jig-concentrates, and 63 lb. of limestone. It was well moistened, and filled into an iron pot, $\frac{1}{16}$ in. thick, 23 in. high, and 25 in. diam. at top and 15 in. at bottom. The pot had a circular grate of sheet iron, $\frac{1}{8}$ in. thick, 5·5 in. above the bottom and having a number of holes ($\frac{3}{8}$ in. diam.) $1\frac{1}{4}$ in. apart. The charge rested on a small quantity of glowing charcoal placed on a layer of coarse limestone on the grate. The pot was set on a brick foundation having an opening, 9·5 in. square, into which the blast of air was delivered, the pressure being indicated by a water-gauge. The charge was treated in three portions, the unsintered fines from the first two, together with the fines formed in crushing, being added to the third.

	Weight of mixture.	Time.	Pressure in inches of water.
	lb.	Hours.	
Charge No. 1	200	5·75	10—14
,, No. 2	280	7	8—14
,, No. 3	308	8·25	8—14

Total weight of ore and limestone ...... 649.5 lb.
Total weight of product .... 534·5 lb.

The product was well sintered. Analysis showed that 69 per cent. of the sulphur had been removed. It is concluded that under more favourable conditions, with a furnace of greater height and a greater volume and pressure of blast, it might be more economical where fuel is expensive, to treat copper concentrates by "pot-roasting" than by roasting and smelting in a reverberatory furnace, previous to converting. An important point is the coarseness of the charge: in the experiments described, the best results both as regards elimination of sulphur and sintering of the product, were obtained with the coarsest (8 mm.) concentrates.—A. S.

Silicon-copper. M. Philips. Metallurgie, **4**, 587—92, *et seq.* (Sept. 8, 22, 1907.)

A historical review of the attempts to prepare alloys of silicon and copper and to determine their constitution chemically. In order to clear up some of the points still unsolved, the author took some pure electrolytic copper (0·5 grm.), surrounded it with pulverised silicon, and heated it to redness in a porcelain crucible in the electric furnace, in a current of hydrogen for 10 hrs. No absorption of silicon by the copper was noted. Copper turnings were embedded in finely ground crystallised silicon and heated to between 700 and 750° for 5 hrs., the copper not showing signs of having melted during the experiment. The temperature was later verified by a blank experiment with a Le Chatelier's pyrometer. When removed the copper was found to have become very brittle, and showed a uniform fracture of silver white colour, and on analysis showed 9·56 per cent. of combined silicon. The behaviour is pointed to as very singular, indicating what one might term "a silicon cementation," hitherto only known in case of metals of great similarity to each other like iron, cobalt, nickel, and chromium. Two alloys of copper 87 and 91 and silicon 12 and 9 per cent., respectively, were made by fusion in a crucible. The silicide of copper could not be isolated from these alloys by any chemical or electrochemical means. Alloys made by melting copper with an excess of silicon did not show that the compound, Cu_2Si, was formed. The methods of analysis of these mixtures of copper, copper silicide and free silicon being found at fault, a new method was devised depending on the reaction: $Si + 4KOH = K_4SiO_4 + 2H_2$. The total silicon present was found from K_4SiO_4, and the free silicon from the hydrogen evolved. From this method the author concluded that a compound, Cu_7Si_2, exists in the alloys of copper and silicon. No copper-silicon alloy could be prepared, by heating at the highest temperature of the wind-blown coke furnace used by the author, from a mixture of carborundum and copper oxide, although copper was reduced. The sp. gr. of copper-silicon alloys is inversely proportional to the percentage of silicon present. An alloy containing free silicon was melted and cooled at various rates, the rate of cooling having no effect on the amount of silicon combined. Because of their great brittleness these alloys of high silicon content are not used in commerce, beyond serving as deoxidising agents in the foundry.

Iron in copper alloys; Colorimetric method for the determination of small percentages of ——. A. W. Gregory. Chem. Soc. Trans., 1908, 93, 93—95.

The method is based upon the red colour reaction given by ferric salts with a solution of salicylic acid in presence of sodium acetate and acetic acid, the blue or green colour due to the copper being destroyed by the addition of potassium cyanide. 0·2 grm of the alloy is dissolved in the smallest possible quantity of strong nitric acid, and if tin or antimony be present, the solution is diluted slightly and filtered. Lead, if present, is removed as sulphate. The solution is treated with 20 c.c. of a concentrated solution of sodium acetate and 10 c.c. of a 2 per cent. solution of salicylic acid in glacial acetic acid, and then a 3 per cent. solution of potassium cyanide (a strong solution will not answer the purpose) is added gradually until the green colour has disappeared and the precipitate of copper cyanide has re-dissolved. The solution is then made up to a definite volume and the red colour due to iron matched by adding a standard solution of ferric chloride to a mixture of 20 c.c. of sodium acetate solution and 10 c.c. of the acetic acid solution of salicylic acid diluted to about the same volume as the solution of the alloy. Results are given showing the accuracy of the method.—A. S.

Lead oxide and silica. W. Mostowitsch. Metallurgie, 1907, **4**, 647—655.

Mixtures of rock crystal (99·96—99·97 per cent. of silica) and lead oxide, in different proportions, were fused, and the products examined. Combination took place at 700°—800° C., in most cases below 750° C.; the products were solutions of lead oxide in lead glasses or silicates. The solubility of the lead oxide increases with the temperature. On cooling the products, the dissolved lead oxide gradually separates, with evolution of heat. The characters of the products are shown in the following table :—

	Composition.	SiO_2.	Physical characters.	Intervals of :	
				Temperatures of formation.	Softening and melting temperatures.
		Per cent.			
1	$6PbO : SiO_2$	4·32	Dark brown, hard and brittle ; dark yellow when powdered. Contains little "glass."	709 —794° C.	740°—789° C. ; melts to a thin liquid ; solidifies suddenly.
2	$5PbO : SiO_2$	5·14	Lighter colour than No. 1 ; wax-like, and contains more "glass" than No. 1. Resembles PbO when powdered.	727°—798° C.	736°—796° C. ; melts etc., like No. 1.
3	$4PbO : SiO_2$ (subsilicate)	6·34	Hard, brittle, amber-coloured mass. When powdered, is of lighter colour than PbO.	709°—726° C.	719°—729° C. ; melts, etc., like No. 1.
4	$3PbO : SiO_2$	8·51	Hard, wax-like mass.	700°—725° C.	714°—725° C.
5	$2{\cdot}5PbO : SiO_2$	9·78	Light yellow brittle mass ; greyish-white powder ; contains much "glass."	708°—732° C.	728°—740° C.
6	$2PbO : SiO_2$ (singulosilicate)	11·94	Dark amber-coloured glass ; powder of lighter colour than No. 5.	718°—720° C.	Begins to soften at 730° C. ; thin at 765° C.
7	$4PbO : 3SiO_2$ (sesquisilicate)	16·89	Light-yellow, strongly refractive and iridescent glass ; white powder.	709°—720° C.	Softens at 740° C., and remains viscous.
8	$PbO : SiO_2$	21·32	Colourless crystal glass : snow-white powder.	709°—724° C.	Softens at 740°—750° C.

All of the products, when finely powdered, are soluble in hot dilute nitric, hydrochloric and acetic acids, with separation of amorphous silica. The silicate, PbO,SiO_2, is also soluble in hot dilute alkalis with formation of alkali silicate and plumbate ; from the solutions, nitric acid precipitates amorphous silica, whilst hydrochloric acid precipitates crystalline lead chloride and silica. At 350°—600° C., the lead oxide in the silicates is reduced by hydrogen first to lead suboxide, Pb_2O, and then to metal. (The reduction of free lead oxide by hydrogen begins at 290°—300° C. with formation of the gray suboxide ; at 410° C. the reduced metallic lead collects in the form of globules.) The silicates can also be reduced by means of carbon monoxide or hydrocarbons.

These results indicate that in the roasting of galena, the proportion of silica in the charge is an important factor. When sulphide ores of lead are roasted in presence of silica at 700°—750° C., the lead oxide formed will combine with the silica. The silicate thus produced will dissolve further quantities of lead oxide, the solubility of the latter increasing with rising temperature. The silica will thus, at high temperatures, prevent the lead oxide from being converted into sulphate. This occurs for example in the slagging-roasting of galena in continuous reverberatory furnaces and in the Huntington-Heberlein and Savelsberg processes. In the cooler portions of the furnaces: for example, on the upper hearth of a furnace with two hearths, the temperature is not high enough for the formation of silicates, and the lead oxide is converted into sulphate by the sulphur trioxide in the furnace gases ; the sulphur content of the ore-charge remains unaltered or is only reduced by 1—2 per cent. This confirms the view that in the roasting proper, where the temperature rises to 700° C. and above, the silica exerts a very favourable effect. The separation of metallic lead in the furnace-charge frequently observed, is due, in part, to the reduction of lead silicates by reducing gases from the fire.—A. S.

Tin [*in alloys*]; *Volumetric determination of* —— *by means of potassium bichromate.* H. Reynolds. Chem. News, 1908, **97**, 13—15.

In the determination of tin by means of potassium bichromate, the chief difficulties are the prevention of oxidation during the dissolving operation and titration, and the observation of the end-point of the titration. The author proposes to use as indicator a sulphonation product of azobenzene, prepared by heating azobenzene with strong sulphuric acid until a violent reaction sets in, and then pouring the whole into water. The deep red solution thus obtained is decolorised by stannous chloride, and the colour is restored by potassium bichromate. In order to mask the green colour of the chromium salts, it is necessary, with 1 grm. of tin, to use about 3 c.c. of a solution of the indicator of a strength equal to 0·034 c.c. of the bichromate solution, of which 1 c.c. = 0·01 grm. of tin. The method, which has been found to give accurate results with tin, ferro-tin, and Britannia metal, is as follows :—20 c.c. of concentrated hydrochloric acid are placed in an Erlenmeyer flask through the neck of which pass a long tube reaching to about 1·5 cm. of the bottom, and a short tube about 6 mm. wide at the top and 2 mm. at the bottom, where it is cut off obliquely. The short tube has a side hole just below the cork. The flask is filled with carbon dioxide which has been freed from oxygen by passing it through titanous sulphate and then through sulphuric acid. The acid in the flask is now heated nearly to boiling, allowed to cool in the current of carbon dioxide, and 0·6—1 grm. of the metal in a basket of platinum gauze introduced. When no more gas is evolved, the solution is heated nearly to boiling, and standardised potassium bichromate solution run in through the short tube. Just before the end-point is attained, the indicator is added, the platinum basket removed, and the titration completed by running the bichromate direct into the solution.—A. S.

Colloidal silver solutions ; Action of some electrolytes on —— *and the coagulation process.* H. W. Woudstra. Z. physik. Chem., 1908, **61**, 607—625.

The author examined the effect of electrolytes on silver sols, *i.e.*, colloidal silver solutions, prepared by :—(1), reduction of silver citrate by hydrogen at 90° C., taking up in water, adding a little ammonia, and dialysing (Muthmann, Ber., **20**, 983) ; (2), reduction of silver nitrate by ferrous citrate (Carey Lea, Amer. J. Science, **7**, 481 ; also this J., 1901, 387) ; and (3), cathodic disintegration (Bredig, this J., 1899, 281). When the sols are allowed to drop slowly into solutions of electrolytes, coagulation takes place, with peculiar colour changes. The character of the colour is governed by the nature of the anion ; chlorides with the exception of lead chloride give a bluish-white similar to silver chloride precipitates. Lead chloride solutions coagulate the sols with production of a wine red colour. The coagulating influence of the electrolyte increases with the valency of the cation. The sensitiveness of Muthmann's silver sol towards electrolytes increases with time and rises with its concentration. Muthmann's sol like those of Carey Lea and Bredig, is electronegative.—W. S.

PATENTS.

Iron alloy. J. Ranch, South Tottenham. Eng. Pat. 25,304, Nov. 9, 1906.

It is found that iron and tantalum can be alloyed together much more readily in the presence of vanadium, producing alloys very suitable for the hard wearing parts of machinery. The process recommended is to add to the molten iron (100 parts) the melted vanadium (8—10

parts) with the final addition of molten tantalum (4—10 parts). The product is stirred and cast in a mould.
—C. A. W.

Iron and steel; Plating —— with alloys of aluminium. Deutsche Wachwitzmetall Akt.-Ges., Hersbruck, Bav. Eng. Pat. 4428, Feb. 22, 1907. Under Int. Conv. Nov. 22, 1906.

See Fr. Pat. 374,814 of 1907; this J., 1907, 874.—T. F. B.

Crucible furnace for melting weldable iron, ingot iron, steel or the like. A. Lindemann, Hagen, Westphalia. Eng. Pat. 14,924, June 29, 1907.

The air supply, which is heated by passing through the double walls of the furnace, is admitted partly through the grate and partly above the grate through corner openings in the walls so arranged that the blast from each opening is admitted in a similar direction along the wall. Air is also admitted through openings at the same level in the hollow crucible supports.—O. F. H.

Steel; Cementation of ——. C. Davis, U.S. Navy, Assignor to Carnegie Steel Co., Pittsburg, Pa. U.S. Pat. 876,862, Jan. 14, 1908.

Armour plates are treated by applying carbon to one face of the plate, excluding air from this side, and passing a current of electricity through the carbon and steel plate until this face is in an approximately molten condition, the other face being at the same time cooled by blowing air against it.—A. G. L.

Chromium and silica; Elimination of —— from iron ores. J. J. Hart and W. H. Wickham, London. Eng. Pat. 516, Jan. 8, 1907.

The finely pulverised ore is mixed with suitable quantities of soda ash and quicklime, these quantities being adjusted according to the amount of chromium present. If it be desired to remove silica also, equivalent amounts of soda ash or caustic soda must be added, with one per cent. of Chili saltpetre in each case. In this case, no lime need be used. The mixture is now roasted in a reverberatory furnace, the hearth of which consists of an endless band which moves forward towards the outlet. The passage of the charge occupies about two minutes at a temperature of about 700° F. The mass is then discharged into trucks, which are carried up a tower, encountering in their passage water sprays which wash out all soluble salts. The residue is finally dried by passage down a second tower, which is fitted internally with inclined baffle-plates heated by the flue gases from the furnace.—C. A. W.

Zinc; Recovery of —— from liquors resulting from the wet copper process. J. Raschen, J. M. Taylor, J. W. Kynaston and The United Alkali Co., Ltd., Liverpool. Eng. Pat. 712, Jan. 10, 1907.

Zinc hydroxide is precipitated (without boiling) from waste liquors containing iron, by adding the theoretical quantity of milk of lime or other alkaline-earth, the liquid being well stirred during the process. The precipitate is filtered off and any ferrous hydroxide present is oxidised by exposure to air, after which the hydroxide is treated with acid, or converted into zinc.—A. G. L.

Zinc from its ores or compounds; Separation of ——. H. L. Sulman. Fr. Pat. 382,241, Sept. 26, 1907. Under Int. Conv., Oct. 1, 1906.

See Eng. Pat. 21,672 of 1906; this J., 1907, 1144.—T. F. B.

Metallic surfaces; Process for the removal of scale and oxide from ——. S. O. Cowper-Coles, London. Eng. Pat. 906, Jan. 14, 1907.

The metal is heated to redness in a closed box, preferably of iron, through which is passed a current of carbon monoxide gas, free from carbon dioxide.—O. F. H.

Copper, nickel, copper alloys, and nickel alloys; Process for welding ——. W. Schieber, Klosterneuburg, Austria. Eng. Pat. 2361, Jan. 30, 1907.

See Fr. Pat. 374,145 of 1907; this J., 1907, 828.—T. F. B.

Fluxes for brazing; Manufacture of ——. H. W. Lake, London. From H. F. Strout, Brookline, J. C. Bassett, Cambridge, and T. E. Parker, Lowell, Mass., U.S.A. Eng. Pat. 9559, April 24, 1907.

See Fr. Pat. 377,168 of 1907; this J., 1907, 1053.—T. F. B.

Ore concentrating jigs. H. W. Foust, Baxter Springs, Kansas, U.S.A. Eng. Pat. 18,051, Aug. 8, 1907.

This invention relates to ore concentrating jigs, of the kind in which the ore is washed on stationary beds, by forcing up water from underneath by means of reciprocating plungers. These plungers work in chambers on each side of the cell containing the ore bed. A valve is arranged at some distance above this bed, so that the heavy ore as it accumulates, is forced by its own weight into the casing of the valve, lifting the latter, and thereby obtaining access to a discharge pipe. The invention is intended primarily for the separation of lead or zinc ores.
—C. A. W.

Filter for concentrating ores. H. W. Foust. Fr. Pat. 382,299, Aug. 23, 1907.

See Eng. Pat. 18,051 of 1907; preceding.—T. F. B.

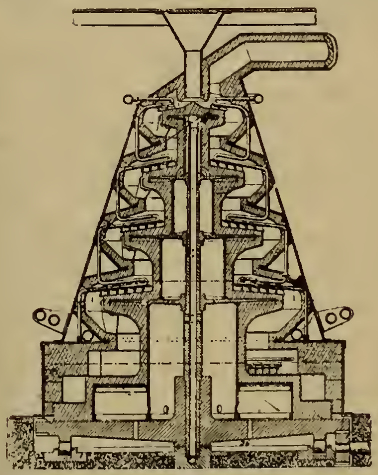
Roasting furnace; Mechanical ——. R. von Zelewski, Engis, Belgium. Eng. Pat. 21,961, Oct. 4, 1907. Under Int. Conv., Oct. 13, 1906.

The improvement claimed consists in an arrangement of the stirring apparatus by which the stirring arms in the lowest hearth or finishing end of the furnace may be worked independently of the others. By this means the ore at the finishing end of the furnace may be stirred until "finish-roasted" while the other portion remains at rest.—O. F. H.

Roasting furnace; Mechanical ——. R. von Zelewski. Fr. Pat. 382,138, Sept. 21, 1907.

See Eng. Pat. 21,961 of 1907; preceding.—T. F. B.

Ores; Furnace for roasting ——. A. D. Lee, Brookline, Mass. U.S. Pat. 876,567, Jan. 14, 1908.



The furnace is provided with an ore inlet at the top, and with means for supplying heat to it below. Beneath the inlet is arranged a rotating member provided at different levels with a number of projecting shelves sloping downwards, each shelf being of greater diameter than the one above it. A casing surrounds the rotating member, and is provided with fixed blades "co-operating" with each shelf, and with an annular extension below each shelf.—A. G. L.

Vanadium; Process of reducing metallic sulphides, and producing ——. F. M. Becket, Niagara Falls, N.Y. U.S. Pat. 876,313, Jan. 14, 1908.

Alloys are produced by smelting together a sulphide of one of the alloying elements, a compound of silicon and carbon, e.g., carborundum, and a substance containing the other alloying metal.—A. G. L.

Gas-converting process [*for gases from smelting furnaces, etc.*]. G. C. Carson, Denver, Colo. U.S. Pat. 876,437, Jan. 14, 1908.

A blast of air mixed with gases from smelting or other furnaces is passed through a bed of carbon having a central zone of high temperature. The oxides in the furnace gases and flue-dust are reduced to the corresponding metals and metalloids, and the carbon monoxide formed gives up its heat to cold carbon above the hot zone. The metalloids pass to condensing chambers through openings in the walls surrounding the fuel bed. The ash and reduced metals settle into water, which is agitated to wash them into a pit beneath the bed of carbon.—A. T. L.

Ores and furnace products; Method of obtaining oxide fumes from ——. H. Pape, Hamburg, Germany. U.S. Pat. 877,114, Jan. 21, 1908.

See Fr. Pat. 372,567 of 1906; this J., 1907, 533.—T. F. B.

Copper mattes; Bessemerizing or conversion of —— *into blister copper.* J. D. Burgess, Tucson, Ariz., Assignor to A. Taylor and W. H. Taylor, jun., San Francisco, Cal. U.S. Pat. 877,292, Jan. 21, 1908.

The apparatus claimed consists of a series of boxes, secured end to end on an inclined base. Each box has a fire-brick lining arranged so as to leave a longitudinal opening through the box, the bricks being laid in broken-joint arrangement. Each box is also provided with tuyères through which air is projected downwards and at an angle towards the discharge end of the box. The matte is fed into the upper end of the uppermost box, and moves progressively downwards towards the discharge end of the apparatus, its movement being assisted by the blasts of air forced through the tuyères. Hollow castings are arranged between the adjacent ends of the boxes, and powdered fluxes such as silica and limestone are fed in through these castings.—A. G. L.

"*Blue-billy*"; *Sintering* ——. J. G. Bergquist, Assignor to American Sintering Co., Chicago, Ill. U.S. Pat. 877,394, Jan. 21, 1908.

Finely-divided "blue-billy" is agglomerated into nodules suitable for reduction in a blast-furnace, by mixing it with flue-dust, or with powdered iron ore and slag-forming material, in such proportions as to lower the sintering-point of the mixture below the fusing-point of fire-brick, and then "tumbling" the mass gradually through a suitable receptacle whilst exposed to the action of a fusing temperature.—A. G. L.

Metals; Process for treating ——, *and converter therefor.* R. L. Lloyd. Fr. Pat. 381,808, July 17, 1907. Under Int. Conv., Aug. 4, 1906.

See U.S. Pat. 851,816 of 1907; this J., 1907, 619.—T. F. B.

Tin; Process for recovering —— *from iron-tin alloys* (*dross*). Robertson und Bense. Ger. Pat. 188,021, April 11, 1906.

The dross is dissolved in hydrochloric acid, chlorine, or other suitable solvent to obtain a solution of stannic and ferrous chlorides, from which the tin is precipitated by such means (electrolysis, hydrogen sulphide, etc.) as will not decompose the ferrous chloride. After the removal of the tin, the ferrous chloride is decomposed by heating, and the hydrochloric acid or chlorine liberated is used again for dissolving fresh quantities of the dross.
—A. S.

Classifying solid materials [*ores*], *etc.* Eng. Pat. 7648. *See* I.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(*A.*)—ELECTRO-CHEMISTRY.

Hypochlorites; Electrolytically produced fluids containing ——, *etc.* F. W. Alexander. *See* VII.

Patents.

Electrolytic apparatus. M. Ruthenburg, Lockport, N.Y. Eng. Pat. 29,655, Dec. 29, 1906.

The apparatus consists of a series of cells each containing a cylindrical cathode of wire cloth surrounding a porous cup in which is placed a large carbon rod as anode. The material treated in the apparatus is a solution of sodium chloride, and the porous cups being provided with sealed caps, the chlorine evolved at the anode is drawn off by pipes to be absorbed in any convenient fashion. Strong brine is delivered by pipes to the bottom of each porous cup, and the spent brine overflows through discharge pipes and is returned to the main supply of brine. The sodium hydroxide solution, which forms in the cathode chambers surrounding the porous cups, is withdrawn by siphon pipes from the bottom of each cell and delivered at the top of the next succeeding cell in the series, the concentrated solution being discharged from the last cell.
—O. F. H.

Electrolysis of alkali chlorides or the like; Process and apparatus for the ——. J. Billitzer, Vienna. Eng. Pat. 7757, April 2, 1907.

See Fr. Pat. 376,329 of 1907; this J., 1907, 1015.—T. F. B.

Electric furnaces. H. L. Hartenstein, Duluth, Minn., U.S.A. Eng. Pat. 20,650, Sept. 17, 1907.

The furnace is provided with electrodes enclosed completely within the furnace, but capable of being moved vertically or transversely from without. For this purpose, leads pass through the upper walls of the furnace to bent conductors of flexible material, *e.g.*, copper, which supply the current to rigid steel bars holding the carbon electrodes. Each of these steel bars passes through a yoke secured to a shaft passing horizontally through the furnace. The shaft carries a pinion wheel engaging a rack-shaft on one side of each steel bar, so that rotation of the shaft, which is effected from without, serves to give the electrodes an up-and-down motion, whilst quill shafts secured to these first shafts effect a transverse motion.—A. G. L.

Furnace; Electric ——. H. L. Hartenstein. Fr. Pat. 381,952, Sept. 17, 1907.

See Eng. Pat. 20,650 of 1907; preceding.—T. F. B.

Electric furnaces. G. Brewer, London. From E. R. Taylor, Penn Yan, N.Y., U.S.A. Eng. Pat. 26,130, Nov. 26, 1907.

See U.S. Pat. 871,971 of 1907; this J., 1908, 27.—T. F. B.

Furnace; Electric ——. P. Lacroix and Comp. Universelle d'Acétylène. Fr. Pat. 381,862, Nov. 22, 1906.

The furnace may be used for continuous or alternating current, two or more adjustable upper electrodes being connected in parallel to one of the poles, the other pole being connected to one or more electrodes placed in the base of the furnace. The material is supplied between the upper electrodes, and, in crossing the arcs produced between the upper and lower electrodes, it receives the full heating effects of the arcs.—B. N.

Smelting; Electric ——. F. Creelman, New York, Assignor to The Willson Carbide Works Co. of St. Catherines, Ltd., St. Catherines, Canada. U.S. Pat. 874,944, Dec. 31, 1907.

Calcium carbide is obtained by fusing the mixture to be treated in a zone of fusion produced by an electric arc, the latter being maintained by a source of energy of practically uniform "amperage," notwithstanding variations in the internal resistance of the furnace. The latter is regulated by means of the variations in electromotive force at the terminals, so as to restore the normal internal resistance, and thus restore the normal voltage, and maintain an approximately uniform expenditure of energy. The fused carbide is discharged as a crustless pig.—B. N.

Storage batteries; Electrolyte for alkaline ——. T. A. Edison, Llewellyn Park, Orange, N.J., Assignor to Edison Storage Battery Co., West Orange, N.J. U.S. Pat. 876,445, Jan. 14, 1908.

As active materials compounds of iron and nickel are used, together with an alkaline electrolyte consisting of the hydroxide of potassium or sodium, mixed with about 2 per cent. of lithium hydroxide.—A. G. L.

Voltaic strong-current arcs; Process for the production of ——. H. Pauling, Assignor to Salpetersäure Ind.-Ges., Gelsenkirchen, Germany. U.S. Pat. 877,448, Jan. 21, 1908.

See Eng. Pat. 8452 of 1906; this J., 1906, 1052.—T. F. B.

Insulating material; Process for the manufacture of a plastic mass for use as an ——, *and for impregnating fibres.* E. Meyer-Zimmerli. Ger. Pat. 188,546, Oct. 10, 1905.

The plastic material is prepared by mixing together, in a heated condition, a wax of vegetable, animal or mineral origin, and Chinese or Japanese wood oil or other oil of similar character.—A. S.

Tungsten filaments, etc. Eng. Pat. 24,028. *See* II.

Nitric acid or nitric oxide, etc. U.S. Pat. 877,446. *See* VII.

Cement manufacture. Eng. Pat. 22,425. *See* IX.

Saturated fatty acids, etc. Ger. Pat. 189,332. *See* XII.

(*B.*)—ELECTRO-METALLURGY.

Iron and steel; Electro-thermic production of ——. J. W. Richards. J. Franklin Inst., 1907, **164**, 443—459; 1908, **165**, 47—58.

Brasses; Electrolytic corrosion of ——. A. T. Lincoln, D. Klein and P. E. Howe. J. of Physical Chem., 1907, 11, 501—536.

The authors have studied the electrolytic corrosion of copper-zinc alloys ("brasses") by a method similar to that used by Curry (this J., 1906, 1104) for bronzes, the alloy being used as anode and a platinum wire as cathode in different saline solutions. Alloys containing 93·6, 86·6, 76·3, 73·4, 66·5, 60·3, 56·8, 51·3, 47·6, 22·6, 10·5, and 3·1 per cent. respectively of copper were annealed for two weeks at 400° C. The test alloys thus represent all the different solid solutions stable at 400° C., with the exception of the γ-phase (see this J., 1905, 241) which yields crumbly alloys. $N/1$ solutions of sodium chloride, sodium sulphate, sodium nitrate, sodium acetate, sodium carbonate, ammonium nitrate, and ammonium oxalate were used as electrolytes. The results show that in the electrolytic corrosion of brasses containing 50 per cent. of copper and above (*i.e.*, the α-, $\alpha+\beta$, and β-phases), the products of corrosion contain the metals in about the same proportions as in the original alloy. The presence of γ-crystals causes a considerable decrease in the amount of corrosion, and the products contain relatively less copper than the original alloy; in the case of $\gamma+\epsilon$ and $\epsilon+\eta$-alloys, practically only zinc is dissolved. In sodium chloride solutions the product of the corrosion is a light green flocculent precipitate which becomes dark yellow on standing; in these solutions, the corrosion decreases with increasing percentage of copper in the alloys. In sodium sulphate solution the amount of corrosion is practically the same with all the alloys, but in the other electrolytes used, the corrosion is greater, the lower the percentage of copper. Similar experiments with copper-zinc alloys containing also 0·7—1 per cent. of tin, gave analogous results.—A. S.

Patents.

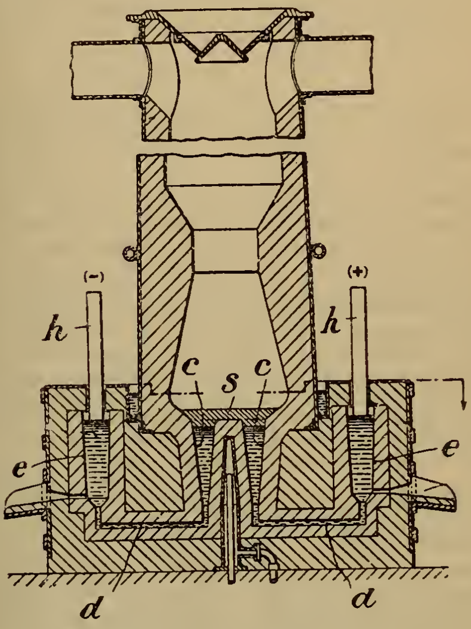
Furnace; Electric melting —— J. W. MacKenzie, London. From Bolle und Co., G.m.b.H., Berlin. Eng. Pat. 5751, Mar. 9, 1907.

The furnace is designed for the melting of quartz and other substances, where temperatures of 2000° C. and upwards are required. The current is conveyed to the furnace by means of electrodes, the inner faces of which form open or closed curves having their centre or focal point in the melting pot. The melting pot is thus the centre at which all electric current radii, starting from these curved surfaces, meet.—C. A. W.

Electric furnaces for metallurgical purposes; Means for obtaining thin liquid dross in ——. H. Röchling and W. Rodenhauser, Völklingen on the Saar, Germany. U.S. Pat. 877,739, Jan. 28, 1908.

See Fr. Pat. 368,631 of 1906; this J., 1907, 55.—T. F. B.

Furnace; Electric —— *for fusion and reduction.* A. Schatzmann. Fr. Pat. 381,700, Sept. 10, 1907. Under Int. Conv., Sept. 13, 1906.



Four vertical chambers, *e*, are disposed in the base of the furnace, at equal distances apart, these containing adjustable electrodes, *h*, and communicating by the channels, *d*, with four vertical cavities, *c*. The latter contain the fused material, and above this is a layer of slag, *s*, both material and slag acting as conducting and resistance material for the electric current. The charge is supplied at the top of the furnace, and, after reduction, the material falls drop by drop through the layer of slag into the chambers, *c*.—B. N.

Vanadium alloys; Production of ——. S. O. Cowper Coles, London. Eng. Pat. 13,978, June 17, 1907.

Vanadium oxide is fused in an electric furnace one of the electrodes of which is of carbon and the other of the metal, such as aluminium, with which the vanadium is to be alloyed.—O. F. H.

Ferrovanadium; Process of reducing —— [*electrically*]. E. F. Price, Niagara Falls, N.Y., Assignor to Central Trust Co., N.Y. U.S. Pat. 875,208, Dec. 31, 1907.

The vanadium sulphide ore is first treated to convert the metal into oxide, and the latter is mixed with a source of iron and carbon, in the minimum proportion required to effect reduction. An electric current is passed through the charge, the zone of reduction being surrounded by a considerable body of the charge, thus protecting the electrodes. The alloy is withdrawn, and the charge materials supplied as required. By mixing silica with the charge, a high-silicon ferro-vanadium may be obtained, this being converted into a low-silicon alloy, by treating with an oxidising agent, or an oxide of a constituent of ferro-vanadium.—B. N.

Metallic coatings upon other metals ; Electrolytic production of lustrous ——. A. Classen, Aachen, Germany. Eng. Pat. 17,968, Aug. 7, 1907.

See Third Addition to Fr. Pat. 350,964 of 1905 ; this J., 1908, 28.—T. F. B.

Metallic dark coatings upon metals ; Electrolytic process for the production of ——. A. Classen, Aachen, Germany. Eng. Pat. 17,969, Aug. 7, 1907.

See Fourth Addition to Fr. Pat. 350,964 of 1905 ; this J., 1908, 28.—T. F. B.

Copper ; Apparatus for refining —— [*electrolytically*]. F. L. Antisell, New York. U.S. Pat. 875,641, Dec. 31, 1907.

Between the electrodes, suspended in an electrolyte in a suitable tank, is a suspended diaphragm, consisting of a frame of non-conducting material, having removable wooden panels of "rotary cut wood veneer" secured between its side and cross pieces.—B. N.

Copper ; Process of precipitation of electrolytic —— *in the form of sheets or cylinders, by means of iron or other metals.* M. J. L. Wenger. Fr. Pat. 381,659, Sept. 9, 1907.

Copper is rapidly deposited in the form of sheets or cylinders by using a cell similar in construction to a Daniell cell. Iron, zinc, or some similar metal is used as the anode, with a copper cathode, the electrodes being separated by a porous diaphragm, non-permeable to the solutions. The diaphragm consists of tissue covered or impregnated with a layer of gelatin, albumin, or other similar substance permitting of the passage of an electric current, but preventing diffusion between the anode and cathode electrolytes. In order to permit of the employment of intense currents, the cathode solution is rapidly agitated, for instance, by a current of air, or the cathode may be given a rotatory motion.—B. N.

[*Gold and silver*] *Metals ; Process of precipitating* ——. J. E. Greenawalt, Denver, Colo. U.S. Pat. 876,346, Jan. 14, 1908.

Gold and silver are precipitated from solutions containing the metals as chlorides or bromides, by passing the heated solution through a sponge or mass of metallic shavings consisting of lead alloyed with one per cent. or less of zinc. The mass obtained is melted, the lead is separated from the gold and silver, and used again. Or else, the solution containing the gold and silver may be circulated around metallic surfaces which are slightly soluble in the solution, and which constitute the cathode of an electrolytic cell. A current of low voltage is applied until the gold and silver are precipitated, after which a current of higher voltage is used to precipitate the metal of the cathode which has passed into solution during the first stage.—A. G. L.

Aluminium ; Protection of —— *by plating with copper, for electric uses and especially for mains.* L. F. Royer. Fr. Pat. 381,475, Sept. 2, 1907.

The copper is deposited electrolytically from an alkaline bath, containing 1000 parts of water, 85 parts of sodium pyrophosphate, 25 parts of sodium bisulphite, and 20 parts of copper sulphate.—B. N.

Iron articles ; Manufacture of —— *by electro-deposition.* S. O. Cowper-Coles. Fr. Pat. 381,636, Sept. 7, 1907. Under Int. Conv., Dec. 18, 1906.

See Eng. Pat. 28,897 of 1906 ; this J., 1907, 699.—T. F. B.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

Triolein ; Conversion of optically-inactive —— *into an optically-active glyceride and an optically-active acid.* J. Lewkowitsch. Chem.-Zeit, 1908, 32, 54-55.

C. Neuberg and E. Rosenberg (Biochem. Zeits., 7, 191) claim to have hydrolysed, by means of lipase, optically-inactive oleinhexabromide (dibromostearic acid glyceride) into dextro-rotatory dibromostearic acid (oleic acid dibromide) and a dextro-rotatory glyceride. These workers appear to have used as their source of lipase, a "ferment-milk" obtained by centrifugalising a mixture of water and ground castor seeds. As is known, however, the emulsion thus obtained contains considerable quantities of castor oil, and until further evidence is brought forward, the author considers that Neuberg and Rosenberg's results are best explained by this introduction of an optically-active substance (castor oil) into their reaction mixture. Partly based on these results, Neuberg, in another work, has stated that on heating optically-active valeric and caproic acids with oleic acid and olein, optically-active petroleum is produced. The author questions whether the optically-active petroleum would not also be obtained if the oleic acid and olein were omitted, and he also emphasises the fact that a large proportion of petroleums show no optical activity.—A. S.

Cacao butter and its unsaponifiable constituents. H. Matthes and O. Rohdich. Ber., 1908, **41**, 19—23.

In experiments to determine whether cacao butter contains any constituent with a pronounced influence upon the flavour of cacao, 13 kilos. of the fat were distilled with steam, the distillate redistilled after the addition of 10 per cent. of sodium chloride, and the new distillate extracted with ether ; but only traces of a substance with a faint odour of cacao were obtained. Extraction of the residual fat with alcohol yielded a mixture of fatty acids, a small amount of phytosterol, and a brown oil with a pleasant odour but bitter taste in no way resembling that of cacao. The unsaponifiable matter from the 13 kilos. of cacao butter amounted to about 28 grms. of a yellow mass interspersed with crystals. It was fractionated into an oil with an odour recalling that of hyacinths, and 22 grms. of "crude phytosterol." The latter was separated into a hydrocarbon, $C_{30}H_{48}$, (m. pt. 133°—134° C.), apparently identical with amyrilene (Ber., 1887, **20**, 1244 ; 1891, **24**, 3834), and two phytosterols. One of these (m. pt. 146° C.) absorbed 2 mols. of bromine, and appeared to be identical with the stigmasterol isolated by Windaus from Calabar bean fat (this J., 1907, 69). The other had the characteristics of the "phytosterols" isolated from most vegetable fats. It absorbed one mol. of bromine, melted at 135°—136° C., and was apparently identical with the sitosterol which Windhaus also separated from Calabar bean fat (this J., 1907, 1150).—C. A. M.

Butter-fat ; Determination of the "caprylic acid value" of ——. R. K. Dons. *See* XVIIIA.

Patents.

Fats, oils and the like ; Process for extracting ——. E. Berliner, Koschewnki Moscow, Russia. Eng. Pat. 23,146, Oct. 19, 1907.

Removal of the water from oil-yielding substances is effected more rapidly, though more gradually and at a lower temperature by heating the material before extraction in an oil or fat similar to that which it contains. By using for the purpose the "natural" fat obtained by expression rather than the less pure extraction-fat, a more valuable product is obtained. Special claim is made for the use of tallow in place of bone-fat for the expulsion of the water from bones, with the object of obtaining the tallow contained in the bones, and of improving the bone-fat subsequently obtained by extraction with solvents.—C. A. M.

Saturated fatty acids and their esters ; Process for the preparation of —— *from unsaturated fatty acids and their esters by electrolytic reduction in presence of acids.* C. F. Boehringer und Soehne. Ger. Pat. 189,332, April 24, 1906. Addition to Ger. Pat. 187,788, March 10, 1906 (this J. 1908, 132).

Instead of using cathodes of platinised platinum, cathodes of other materials coated with a metallic deposit capable of exerting a catalytic action are employed.—A. S.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(*A.*)—PIGMENTS, PAINTS.

Red lead ; Examination of ——. J. F. Sacher. Chem.-Zeit., 1908, **32**, 62—63.

Experiments described in detail show that in the determination of the insoluble impurities in red lead by means of nitric acid, formaldehyde is the most satisfactory reducing agent for the lead peroxide. Hydrogen peroxide also gives good results provided it be sufficiently pure, but sugar, alcohol, oxalic acid, and lactic acid, tend to the formation of insoluble lead oxalate, and when they are used, accurate results can only be obtained by taking the exact quantity required for the reduction. In all cases it is essential to remove the whole of the free nitric acid by evaporation, since otherwise lead sulphate is dissolved.—C. A. M.

Patent.

Paints, coverings, or the like. Lörincz Festékgyár (Topp) Betéti Tarsasag, and G. Szajbely and K. Löunez, Budapest, Hungary. Eng. Pat. 13,136, June 6, 1907.

See Fr. Pat. 378,363 of 1907 ; this J., 1907, 1099.—T. F. B.

Poison sumach (poison dogwood, poison elder, etc.); Rhus vernix, L.). A. B. Stevens and L. E. Warren. *See* XX.

(*C.*)—INDIA-RUBBER, Etc.

Rubber ; Deterioration of raw ——. G. Brindejonc. Bull. Soc. Chim., 1908, **3**, 39—42.

The rubber derived from *Landolphia Hendelotii* frequently arrives in Europe (from E. Africa) very dark in colour and in a "tacky," inelastic condition, and various suggestions have been made from time to time as to the causes underlying the changes undergone by the rubber. The author has examined the behaviour of samples of the rubber obtained direct from the bark, and of other samples taken from the native-made "balls," towards: (1), direct sunlight; (2), diffused light; (3), "dark" heat; (4), sea-salt; and (5), solutions of weak acids such as might be produced by fermentation. Of these agents, sunlight has the most powerful effect in causing deterioration, acting in virtue of its heat rays. Diffused light, unless very bright, has very little action. When heated in the dark at temperatures varying from 25° to 40° C., rubber free from harmful impurities or dry rubber containing sea-salt suffers very little change; on the other hand rubber which has been soaked in salt-solution or in solutions of acetic acid or phenol, when subsequently heated in moist air in the dark deteriorates fairly rapidly. It was found that in every case in which deterioration was brought about by a particular agent, this deterioration continued in the dark after the exciting cause had been carefully removed, even though no apparent change in the rubber had occurred before removal. Storage in the hold of a ship would appear to present such conditions that deterioration, initiated by careless treatment at the hands of the native, would proceed rapidly.—E. W. L.

Antimony sulphide ; Analysis of "golden" ——. F. Jacobsohn. India-Rubber J., 1908, **35**, 77—78.

The method suggested involves the following determinations:—*Moisture*, by heating at 60° C. until the weight is constant; *free sulphur*, by extraction of the dried sample with carbon bisulphide; *total sulphur* by oxidation of the original sample with nitric acid, and precipitation as barium sulphate; *antimony*, by oxidation of (0·2 grm. of) the extracted sample with fuming nitric acid, subsequently volatilising the antimony as chloride by heating the tetroxide with ammonium chloride, and estimating the antimony from the loss in weight; the non-volatile residue represents *other mineral matter*, in the instances dealt with consisting of silica and calicum sulphate. A slight error may be introduced here if any calcium be present as antimoniate or sulphantimoniate, which salts are converted into calcium chloride on heating with ammonium chloride. *Mineral impurities* are otherwise determined by evaporating the original or extracted substances with hydrochloric acid, oxidising with nitric acid, taking up with hydrochloric acid and a little tartaric acid, filtering off the *silica* and determining the other constituents in the filtrate. *Sulphur combined with antimony*, is determined by distilling the extracted sample with concentrated hydrochloric acid, and collecting the sulphuretted hydrogen evolved as silver sulphide. The results of four analyses are recorded in the following table:—

	I.	II.	III.	IV.
	Per cent.	Per cent.	Per cent.	Per cent.
Moisture	1·03	1·15	0·77	0·60
Free sulphur	8·38	9·36	8·00	8·38
Total sulphur	33·76	31·99	33·62	32·98
Silica	0·23	0·23	—	—
Calcium sulphate(direct)	11·48	10·60	10·82	11·78
Calcium sulphate (residue in determination of antimony)	11·41	10·24	10·70	11·57
Sulphur combined with calcium	2·70	2·43	2·54	2·77
Antimony	50·55	51·29	53·74	53·30
Sulphur combined with antimony	22·40	20·16	22·88	21·62

—E. W. L.

Patents.

Rubber goods ; Process of treating or manufacturing —— and apparatus therefor. W. Price, Liverpool. Eng. Pat. 893, Jan. 12, 1907.

Old or waste rubber is washed and cut into fragments, which are dried and mixed with pure rubber or rubber substitute and mineral matter such as flint or other substance to impart strength and render the product indestructible by fire, etc. The mixture, which must be absolutely dry, is then coarsely or finely ground, pressed in a previouly heated mould at a pressure of 3 to 4½ tons to the sq. inch, and subjected whilst still under pressure in the mould to great heat in an oven or kiln. Toothed or serrated cylinders may be used for grinding the mixture of waste rubber and mineral matter, whilst the mould may be heated by means of a jacket or pipes for hot water or steam, and be provided with means for keeping its separate parts together after the source of pressure has been withdrawn. A special form of apparatus for carrying out this process is also claimed.—C. A. M.

Rubber or caoutchouc ; Preparation or regeneration of ——. F. W. Passmore, London. Eng. Pat. 2289, Jan. 29, 1907.

The material is extracted with eucalyptol (cineol), which dissolves the caoutchouc and leaves undissolved the mineral and other impurities. The caoutchouc may be recovered from the solution by distilling off the eucalyptol with steam, or by precipitation with alcohol, acetone, or other suitable substance. The separation of insoluble matters is facilitated by the addition of benzene or other volatile diluting agent, this being preferably removed before the separation of the caoutchouc. Special claim is made for the manufacture as commercial products of such solutions of caoutchouc in eucalyptol or cineol.
—C. A. M.

Caoutchouc-like, elastic substance ; Method of producing a ——. J. Ohm, Dortmund, Germany. Eng. Pat. 15,542, July 5, 1907.

See Fr. Pat. 379,526 of 1907 ; this J., 1907, 1245.—T. F. B.

XIV.—TANNING, LEATHER, GLUE, SIZE.

Tanning extracts ; Dissolving ——. W. Eitner. Gerber, 1908, **34**, 31—33.

The author discusses the best methods for the solution of tanning extracts so that the maximum amount of dissolved matter may be obtained for tanning, and that the insoluble and resinous matters may be used to the greatest advantage. Quebracho, oakwood and chesnut extracts are dealt with, alone and in mixture, the extracts being dissolved hot in three times their volume of water and the amount of sediment determined in each case at 40° C. and 20° C. The increase in the amounts of sediment found, and decrease in Baume strengths of the liquors on cooling from 40° to 20° C., are shown to be much the greatest in the case of quebracho extract on account of the difficultly soluble resinous matters it contains. Experiments with mixtures of equal parts of quebracho and chesnut extracts show that the sediment, when similarly determined, is less both at 40° and at 20° C. than would be expected from calculations from the results for pure extracts, and hence that chesnut extract has a solvent effect on both the difficultly soluble resinous matters and the more easily dissolved sediment of the quebracho extract. Similar experiments with a mixture of quebracho and oakwood extracts in equal proportions show that at 40° C. the sediment is greater than would be expected from calculation, but that on cooling to 20° C. a distinctly less quantity of sediment is obtained than indicated by calculation. This demonstrates that the solvent effect of oakwood extract on quebracho is only evident in the case of the more easily soluble part of the sediment, and that the resinous content of the sediment is, on the other hand, increased by the admixture. The so-called pinewood extract is also found to bring into solution quebracho extracts to a considerable extent both at 40° C. and at 20° C. Adulterated quebracho extracts are affected in a similar way to the pure extract. The viscosity of extracts is attributed to suspended and half-dissolved matter, in the form of minute particles, visible under the microscope with high magnifications. The author advocates the solution of all extracts in hot water after they have been mixed together, and then cooling to the required temperature. It is also recommended that liquors with resinous matters should preferably be used in the later stages of the tanning process.—H. G. B.

Oakwood extract ; Analysis of —— according to the new official method. J. Jedlicka. Collegium, 1908, 14—20.

Comparative analyses were made of oakwood extract by the old filter bell method and the new official method (this J., 1906, 1203 ; 1907, 79, 455, 702). Two hide powders from different sources were used with acidities of 1·7 and 1·3 respectively. The former gave an average difference of 1·85 per cent. in non-tannins and the latter an average difference of 1·54 per cent., than analyses by the filter method with Paessler's lightly-chromed powder, and the author declares the mean difference of 50 analyses to be 1·7 per cent. for the extract with which he worked. Duplicate analyses by the new method were found to agree well, and a repetition of the analyses at a later period gave still the same results. The author points out that although a certain amount of hide powder is lost during the washing process, and although the washed hide powder cannot be quantitatively separated from the linen on which it is washed, the error caused thereby has a negligible influence on the analytical results. The moisture content of the prepared powder is shown to be on an average 1·2 per cent. higher when estimated directly than is given by the indirect estimation which is involved in the analytical method. Difficulties were experienced, however, in obtaining the prepared powder sufficiently free from soluble matter and errors of 0·9 per cent. are said to occur in the percentage of non-tannins. As the error is variable it is proposed to eliminate it by a blank experiment and correction. Wet chromed powder is found not to keep very well, the "solubles" increasing and causing the necessity for further washing and a direct moisture determination. The inorganic part of the soluble matter in ordinary analyses is shown to be partly due to chlorides and evidence is given that these are produced by the shaking of the powder in the liquor. The amount of $N/10$ silver nitrate solution required was 0·3 c.c. for 50 c.c. of filtrate, corresponding to 0·26 per cent. in the analytical result. The author shows also that if the time of shaking be increased, a less coloured filtrate is obtained, and a greater absorption of non-tannin matters occurs ; and that if the number of rotations per minute be greater than 150, no agitation of the powder in the liquor will take place. It is also pointed out that although the "general regulations" stipulate a chromium content of 0·5 to 2·0 per cent. on the dry weight of the powder, the "official method" prescribes a process in which the maximum absorption is 0·39 per cent., and experiments are made in which 2, 3, 4 and 5 times more chromium is used for chroming than in the method of Procter and Bennett, bringing the chromium content of the powder thereby under the general regulations. It is shown that this increases the error due to soluble matter in the powder, but that this error is less variable, and that if a correction be determined and applied, results of greater concordance can be obtained. The author finds also that the soluble matter in the prepared hide-powder may be decreased by washing before chroming until the wash water is not rendered turbid by a tannin solution. In order to obtain the correct tannin content (about 0·4 per cent.) in the solution for analysis, it is necessary to weigh out rather more of the extract than for the old method, and it is pointed out that this raises the "insolubles" somewhat, but to a negligible extent with oakwood extract. This change in the concentration of the infusion, however, distinctly increases the quantity of both red and yellow in the tintometer measurements. In conclusion the author testifies to the general convenience, trustworthiness and quickness of the new method of analysis, but advocates such an increase in the degree of chroming that there shall be 1·0 to 1·5 per cent. of chromium used, a correction being applied for the increase in soluble matter.—H. G. B.

Leather manufacture ; Natural dyestuffs still used in ——. J. W. Lamb. Collegium, 1908, [294], 39—44.

It is pointed out here that logwood is the only natural dyewood that the leather stainer cannot so far dispense with, and, in conjunction with iron mordants for the production of blacks upon leather, is sure to be used for at least some years to come.

Tanning industry of the United Kingdom. [T.R.]

The statistics issued by the Board of Trade shew that in 1905 the value of the tanning extracts imported into this country reached £652,174 ; in 1906, £777,850 ; and in 1907, £769,777. The decrease last year was probably due to the fact that, owing to the high value of raw hides, tanners limited their working a good deal. The bulk of this tanning extract comes from France and Southern Europe, Canada also sending fair quantities. Italy, too, and Corsica are bidding for a share of the trade. The consumption of gambier remains practically stationary, last year's imports amounting to £158,325 ; for 1906, £148,811 ; and for 1905 £148,172. Myrobalans show a slight decline on the year, the value of the imports for 1908 being £172,771 as compared with £176,521 for 1906. Valonia shows an improvement, the year's consumption amounting to £212,896, as compared with £194,294 for the year previous.

Patents.

Vegetable [bark] extracts ; Process for making ——. W. Meikle, Glasgow. U.S. Pat. 877,660, Jan. 28, 1908.

See Eng. Pat. 26,550 of 1905 ; this J., 1907, 106.—T. F. B.

Leather substitute or artificial leather ; Manufacture of ——. A. Pollak, Leitmeritz, Austr. Eng. Pat. 15,794, July 9, 1907.

See Fr. Pat. 380,941 of 1907 ; this J., 1908, 82.—T. F. B.

Glue from mineral or chrome tanned leather ; Process for making strong ——. F. W. Weiss Dnls. Sohn m.b.H. Fr. Pat. 382,050, Aug. 20, 1907.

See Eng. Pat. 19,019 of 1907 ; this J., 1908, 82.—T. F. B.

Albuminoid materials ; Treatment of ——. R. Desgeorge and F. Lebreil. Fr. Pat. 382,122, Nov. 29, 1906.

By means of electrolysis, substances such as phosphates, acids, etc., can be eliminated from casein, so as to render it permeable to formaldehyde. Moreover the metal of the electrodes can, if necessary, be disseminated through the casein during the electrolysis. Formaldehyde, alone or associated with other substances can then be used to render this casein insoluble, thus making it suitable for various purposes.—F. Shdn.

XV.—MANURES, &c.

Carbon [*in soils*] ; *Determination of* ——. I. Pouget and D. Chouchak. Bull. Soc. Chim., 1908, **3**, 75—80.

In the method proposed, the soil is heated with a mixture of lead chromate and potassium bichromate in the usual way, and the carbon dioxide formed during the combustion is collected, after passing through a small tube filled with pumice and sulphuric acid, in a receiver containing a known volume of standard barium hydroxide solution. This receiver is provided with mercury traps. When the combustion is complete, the barium carbonate is allowed to settle and a definite volume of the clear barium hydroxide solution is titrated back, using phenolphthalein as indicator. The result obtained expresses the total carbon present in the sample either in organic combination, or as carbonates, etc. The latter are determined separately to ascertain the amount of organic carbon. Soils containing much calcium carbonate may be moistened with sulphuric acid, evaporated on the water-bath to remove all carbon dioxide, and the residue then used for the combustion.—W. P. S.

Soils ; Determination of the acidity of ——. H. Süchting. Z. angew. Chem., 1908, **21**, 151—153.

For the determination of the acidity of peaty soils the author recommends the following modification of Tacke's method (Chem.-Zeit., 1897, **21**, 174) in which the carbon dioxide, liberated from calcium carbonate by the acids of the soil, is determined volumetrically. A weighed quantity of from 10 to 50 grms. of the soil is placed in a flask together with a weighed amount of calcium carbonate. Water, previously boiled and cooled, is added and a current of hydrogen is passed through the flask for about two hours, the contents of the flask being stirred meanwhile. The delivery tube fitted to the flask is then connected with a receiver containing a known volume of standard sodium hydroxide solution, hydrochloric acid is introduced into the flask through a tapped funnel, and the current of hydrogen is allowed to pass through the apparatus until all the carbon dioxide has been collected in the receiver. The contents of the latter are titrated subsequently, and the amount of carbon dioxide thus found is subtracted from the total quantity added as calcium carbonate. The difference gives the amount of carbon dioxide liberated by the acids present in the soil.—W. P. S.

XVI.—SUGAR, STARCH, GUM, &c.

C_5-sugar from meta- and para-saccharinic acids. H. Kiliani. Ber., 1908, **41**, 120—124.

In a recent paper (this J., 1907, 1208), oxime derivatives of the two C_5-sugars obtained from meta- and para-saccharinic acids, respectively, under the action of hydrogen peroxide, were described. It was stated that these two oximes were very similar in their properties ; it has now been found that they are identical. Both oximes are identical crystallographically, mixtures of the two have the same melting point as the components (136° C.), and both yield the same tetrabenzoyl derivative, (m. pt. 140° C.). It has also been proved in a similar manner that both sugars are identical. Hence in spite of the undoubted difference in the constitution of the two saccharinic acids, both the meta- and para-compounds yield the same sugar, which is the aldose (*loc. cit.*). The ketose supposed to have been prepared from para-saccharinic acid does not exist. On oxidation with bromine, the sugar prepared from both saccharinic acids yields pentanetriolic acid, giving a phenylhydrazide melting at 134° C. It must therefore be assumed that the β-ketose which was to be expected from para-saccharinic acid is extremely liable to change, and is transformed at the moment of its production, under the influence of the distinctly alkaline condition of the oxidising agent agent, into the aldose.—J. F. B.

l-Arabinos ; Preparation of —— *from mercuric gluconate. Conversion of α-hydroxy acids into aldehydes.* M. Guerbet. *See* XX.

Patents.

Crystals, especially sugar candy crystals ; Process for winning large, well-formed, threadless —— *from cold or hot saturated solutions.* M. E. T. Melcher, Uerdingen, Germany. Eng. Pat. 18,767, Aug. 20, 1907. Under Int. Conv., Aug. 21, 1906.

See Fr. Pat. 381,021 of 1907 ; this J., 1908, 134.—T. F. B.

[*Synthetic cane-*] *Sugar ; Process of manufacture of* ——. C. P. Stewart. Fr. Pat. 381,292, Aug. 27, 1907.

Steam generated in a boiler is heated by means of a furnace to a temperature of about 1600° C., so that it is decomposed into hydrogen and oxygen ; a portion of these gases is passed over incandescent carbon with which the constituents combine to form carbon monoxide and acetylene. The other portions of hydrogen and oxygen are then mixed with these gases, and the mixture, under pressure, is " alternately subjected to a magnetic action and an electrical influence which cause it to combine to form saccharose or pure cane sugar." The proportions of the various gases brought into play should correspond with the following equation :

$$8CO + 8C_2H_2 + 14H_2 + 7O_2 = 2C_{12}H_{22}O_{11}.$$

—J. F. B.

Sugar-cane, beetroots and other sugar-yielding plants ; Process and apparatus for the diffusion of —— *with movement.* C. Corcuera. Fr. Pat. 381,538, Sept. 5, 1907. Under Int. Conv., Dec. 7, 1906.

The material to be treated is first reduced to pieces of a suitable size, and is then passed continuously through diffusion juice flowing in the opposite direction. The exhausted material is removed from the end of the diffusion apparatus which contains the weakest juice, and is pressed at its exit so as to free it from the residual liquid, which, together with fresh water, re-enters the diffusion apparatus at the point of exit of the material. —J. F. B.

Starch ; Process for highly modifying ——. C. B. Duryea, Grenville, Ontario. Eng. Pat. 11,801, May 21, 1907.

This process consists in converting the starch by suspending it in dilute acid, washing the mass to free it from impurities, and then continuing the conversion by drying the starch while a portion of the acid is still present. —T. H. P.

XVII.—BREWING, WINES, SPIRITS, &c.

Amylase ; Occurrence of —— *and its starch-saccharifying and liquefying powers.* [*Preliminary note.*] T. Chrzaszcz. Z. Spiritusind., 1908, **31**, 52.

From the results of a long series of experiments on barley, oats, rye, wheat, maize, beans, millet, on malts prepared from them, and on potatoes and beets, the author draws the following conclusions. All plants able either to saccharify or to liquefy starch are able to effect both these changes. The intensity of the liquefying power is proportional to the saccharifying power and both vary with the plant species. The optimum temperature for amylase from resting seeds is identical with that for the enzyme from germinating seeds. The behaviour of so-called translocation diastase is identical with that of secretion diastase, and there is no ground for regarding these enzymes as different. The starch-liquefying power is at its maximum at 60—65° C. In presence of starch, amylase is destroyed only by boiling. External conditions exert a marked influence on the behaviour of amylase.—T. H. P.

Kilning and mashing temperatures; Influence of different —— on the fermentability of worts by different yeasts. E. Dehaye. Bull. Assoc. de l'Ecole supr. de Brass. de l'Univers. de Louvain, 1907, 66; Woch. f. Brau., 1908, **25**, 58—60.

The author kilned one and the same malt at (1) 40—45°, (2) 75—80° C., and (3) a considerably higher temperature, and mashed each of the three malts thus obtained, in one case, at 55—60° and in the other, at 70—73° C., these temperatures being attained as quickly at possible. The mashes were finally heated to 95°, filtered and the grains washed with water at 95° C. After sterilisation, separate portions of each of the six worts were fermented with seven different yeasts, including three top and three bottom fermenting brewery yeasts and *Saccharomyces Ludwigii*. The extent of the fermentation was controlled in each case by determining the loss in weight of the wort and by measuring the rotation and the cupric-reducing power before and after the fermentation. The amount of the fermentation was found to be low when the kilning temperature was high or the mashing temperature low. With very high-dried malts, the mashing temperature has little influence on the fermentation, so that nothing is gained, in so far as the saccharification is concerned, by mashing these malts at low temperatures. The fermentative powers of different yeasts become approximately the same as time goes on, the so-called types, Saaz, Frohberg, Burton and Logos, are only artificial and conventional; one of the bottom fermenting yeasts examined, termed "van Bergen," is an exception to this rule, since, even in presence of diastase, the amount of fermentation it produces is very small. The rotatory power of the wort obtained at 70—73° C. increased with rise of the kilning temperature. But when the mashing temperature was 55—60° C., no such increase was observed, possibly owing to the fact that, at this temperature, the mash from the high-dried malt was very thick and difficult to manipulate. The fall in rotatory power during fermentation is found to be greatest with the malt dried at the highest temperature; the course of the fermentation is by no means parallel with the fall in rotatory power. The author regards valuation of malt by means of the rotation as difficult and untrustworthy. The cupric-reducing power of the wort falls as the kilning temperature of the malt rises. The proportion of maltose in wort mashed for 3 hours at 70° is always greater than that in wort mashed for the same time at 55—60° C. In general, the diminution occurring in the reducing power during fermentation is proportional to the fermenting power of the yeast. These results indicate the inaccuracy of Brown and Morris's rule stating that the reducing power of all starch conversion products corresponds with that of a mixture of maltose and non-reducing dextrin. The change in cupric-reducing and rotatory powers produced by inversion indicates the presence of about 3·5 per cent. of sucrose in malt. Estimation by means of *Sacc. Ludwigii* gives a considerably lower value.—T. H. P.

Bacteria and yeasts; Killing —— by ethyl alcohol. E. C. Hansen. Zentralbl. Bakt., I. Originale, 1907, **45**, 466. Z. ges. Brauw., 1908, **31**, 50—51.

Epidermal bacteria, (especially in cases of suppurating eczema), are, when in a moist condition, killed in one minute by absolute alcohol and in most cases by 60—50 per cent. alcohol; when dry, however, they resist the action of absolute alcohol for eight minutes, but are rapidly killed by 60—50 per cent. alcohol. Experiments on coli bacteria and *Bact. Pasteurianum*, dried on silk threads or platinum wires for three hours at 37° C., resulted as follows. After treatment for one minute with alcohol, coli bacteria on silk threads exhibit distinct growth after less than 24 hours' cultivation. Two out of forty cultures were killed by drying on platinum wires and the rest by the action of alcohol. In the case of a mucus-forming culture, drying on silk threads or platinum wires followed by one minute's treatment with alcohol, was found to be insufficient to cause death, the mucus apparently acting as a protective coating. Yeast cells are protected against the action of drying and alcohol by the gelatinous net-work in which the cells are embedded. Old and young vegetative cells and also young spores are, with few exceptions, killed when kept for one minute in absolute or 50 per cent. alcohol, but mature spores resist the action of the alcohol far longer. Dried vegetative yeast cells resist absolute alcohol for two minutes but not, as a rule, for five minutes, whilst they are killed in one minute by 50 per cent. alcohol. Dried spores remain alive after immersion in absolute alcohol for more than six days, but are killed by 50 per cent. alcohol in less than three days.—T. H. P.

Hordein. A. Kleinschmitt. Z. ges. Brauw., 1908, **31**, 34—36.

The proteins of barley are edestin, leucosin, a proteose, an insoluble protein, and hordein, which last makes up 4 per cent. of the barley and like gliadin and zein is soluble in 70 per cent. alcohol. It vanishes during malting being replaced by bynin, another protein soluble in alcohol. The following results were obtained on hydrolysing hordein by Fischer's method: the figures for gliadin and zein obtained by Abderhalden and by Langstein and Kossel are included for comparison.

	Gliadin.	Hordein.	Zein.
Glycocoll	0·68*	0·0	0·0
Alanine	2·66	1·34	0·5
Valine	0·33	1·40	present
Leucine	6·00	7·00	11·25
α-Proline	2·4	5·88	1·49
Phenylalanine	2·6	5·48	6·96
Glutamic acid	31·5	41·32	11·78
Aspartic acid	1·24	1·32	1·04
Serine	0·12	0·10	—
Histidine	1·7	0·51	0·81
Arginine	3·4	3·14	1·82
Lysine	0·0	0·0	0·0
Tyrosine	2·37	4·00	10·06
Ammonia	—	4·34	2·56

* The glycocoll formed is due to the presence of an impurity.

Hordein occupies a middle position between gliadin and zein: it differs markedly from gliadin in regard to the content of *α*-proline, phenylalanine and tyrosine. Osborne and Clapp have recently published very similar results for gliadin and hordein. (See following abstract.) In sprouting barley asparagine, leucine and tyrosine have been identified but not glutamic acid which is such a large constituent of hordein. The decomposition must either take place in another manner or the glutamic acid be immediately utilised for synthetical changes at the moment of its formation. The presence in beer of succinic acid which Ehrlich has shown to be formed from glutamic acid by fermentation is of interest from this point of view and the author advocates Ehrlich's suggestion that the degradation products of the proteins are the chief contributors to the bouquet and aroma of beer. —E. F. A.

Hordein; Hydrolysis of ——. T. B. Osborne and S. H. Clapp. Amer. J. Physiol., 1907, **19**, [1]; Woch. f. Brau., 1908, **25**, 74.

Hordein, which is soluble in 70—80 per cent. alcohol, was isolated in the following manner:—Finely-ground barley was extracted with 70 per cent. (by vol.) alcohol, and the extract filtered and concentrated *in vacuo* at 70° C. to a thin syrup. This was poured into a large volume of distilled water cooled by means of pure ice, the precipitate washed with water, re-dissolved in 70 per cent. alcohol, and the clear solution poured into several times its volume of absolute alcohol. The precipitate so obtained was treated with absolute alcohol until it was completely dehydrated, and the alcohol removed by allowing to stand in an exsiccator over sulphuric acid. The hordein was next finely ground, dried at 110° C., and treated for a long time with ether. It contains: carbon, 54·2; hydrogen, 6·8; nitrogen, 17·21; sulphur, 0·83, and oxygen, 20·87 per cent. On hydrolysis it yields: alanine, 0·43; valine, 0·13; leucine, 5·67; proline, 13·73; phenylalanine, 5·03; glutamic acid, 36·35; tyrosine, 1·67; arginine, 2·16; histidine, 1·28, and ammonia, 4·87 per cent., together with some cystine, hydroxyproline, and tryptophan, but no glycocoll, asparagine, serine, or lysine. The most interesting point is the very large quantity of proline formed on hydrolysis, *viz.*, about double that obtained from gliadin.—A. S.

Beer; Sarcinæ which cause diseases of ——. *II.* O. Miskovsky. Z. ges. Brauw., 1908, **31**, 3—6, 16—19, 27—29. (See this J., 1907, 269.)

The three species of sarcina previously described by the author grow with great readiness in the presence of Witte's peptone, either by itself or when added to wort. The assumption is made that the whole of the acid produced by these organisms does not remain in the free state, but that part of it is neutralised by alkaline salts in the wort or beer. This assumption is supported by the observation that the addition of increasing proportions of dipotassium phosphate to wort is accompanied by corresponding increases in the extent to which the sarcinæ grow; when, however, more than 1 per cent. of this salt is added, it weakens the growth of the bacteria. Monopotassium phosphate has no influence on these sarcinæ in amounts less than 0·5 per cent., but in larger proportions has a distinct inhibiting action; this result may be explained partly by the increase of the acidity of the wort and partly by the occurrence of free lactic acid at an earlier stage of the growth than when alkali or alkaline salts are present. The cause of the turbidity produced by these organisms varies in different cases and with different cultures, for it is found that one and the same beer is rendered turbid by two of the species examined, but not by the third. Further, turbidity is dependent on the chemical composition of the nutrient liquid, and is partly, at least, due to the life-products of the bacterial cells. The acid formed by one of the three species was examined and was found to be optically inactive lactic acid.—T. H. P.

Wines; The "graisse" sickness of ——. E. Kayser and E. Manceau. Compt. rend., 1908, **146**, 92—94.

In their investigations on the "graisse" sickness the authors have recognised two groups of specific organisms. The first of these was described in previous articles (this J., 1906, 386, 823); the bacilli grow in almost rectilinear chains, they multiply rapidly in artificial sugar-peptone media and resist fairly high degrees of acidity; they attack lævulose more rapidly than other sugars. The bacilli of the second group, whilst short like those of the first, are aggregated in very long, convoluted chains. The peptone media do not suit them, they are decidedly sensitive to acidity and they act more rapidly on dextrose than on other sugars. The products of the two groups of bacilli are the same (*loc. cit.*). Certain aërobic micro-organisms also play an important part in the "ropy" diseases of wines, first they assist the development of the pathogenic anaërobic organisms by protecting them against the air, and secondly, some of them are found associated with the disease organisms in true symbiosis. Such associations are capable of developing under conditions which would be inimical to one at least of the component organisms. The preference, noted above, of the "graisse" ferments for certain sugars may be modified in these circumstances, and the same organism may attack sometimes lævulose and sometimes dextrose more readily according to the aërobe with which it is associated. Among the latter have been found yeasts, mycoderma and four aërobes, which have already been recorded by Manceau as causes of the "blue" disease of Champagne wines. The authors have succeeded in producing the ropy disease in wines by means of pure cultures of the two groups of "graisse" organisms, but in naturally diseased wines pure or even nearly pure infections are never found, the specific organisms depending for their existence on the conditions set up by the symbiotic aërobes.—J. F. B.

Wines; Polarimetric examination of red —— *and determination of reducing sugars therein.* G. Guérin. J. Pharm. Chim., 1908, **27**, 57—58.

Sixty c.c. of the wine are treated with 30 c.c. of a 10 per cent. solution of mercuric acetate, allowed to stand for two hours, filtered, and the filtrate examined in a Laurent polarimeter in a 30 cm. tube. For the determination of the reducing sugars, 4 grms. of mercuric acetate are triturated in a glass mortar with 100 c.c. of the wine, added gradually, and after a few minutes the liquid is filtered. The filtrate is shaken with excess of zinc dust for a few minutes in order to precipitate the mercury, again filtered, and introduced from a burette, in small quantities at a time, into a flask containing a boiling mixture of 5 c.c. of Pasteur's alkaline copper solution (1 c.c. = 0·005 grm. of dextrose), 5 c.c. of potassium hydroxide solution, and 50 c.c. of distilled water, until the red colour of cuprous oxide appears, after which the liquid is added drop by drop until the blue colour of the copper solution just disappears.—A. S.

Whiskey stored in wood; Changes taking place in ——. C. A. Crampton and L. M. Tolman. J. Amer. Chem. Soc., 1908, **30**, 98—136.

Thirty-one barrels of new spirits, representing types of rye whiskeys and Bourbon [maize] whiskeys manufactured by different systems, were set apart in different stores and samples were withdrawn every year for eight years. These samples were stored in glass bottles and all were examined simultaneously at the end of the period. Except in a few cases, the American method of using charred wood casks was followed, and it was ascertained that none of the whiskeys thus coloured yielded any indications of caramel colouring matters when tested by the paraldehyde and Marsh's amyl alcohol tests for such colours. During the eight years of storage the volume of the spirit diminished in many cases by one-half; this loss of volume is not due strictly to evaporation but to osmosis through the pores of the wood, and depends very largely on the conditions of storage. Such osmosis is selective in its effects, the water passing out with much greater rapidity than the alcohol, which thus becomes concentrated. The higher alcohols remain completely behind, and the same selective action is shown with the acids, esters, aldehydes and furfural, these remaining behind in the barrel by the selective action of the wooden membrane. The chemical changes which take place during storage are also dependent on the porous receptacle, since no chemical change takes place in glass vessels nor even in paraffined woods. The results of analysis are expressed in terms of grms. per 100 litres of proof spirit and are also corrected for loss of volume for purposes of comparison. The rye whiskeys showed far greater losses of volume and chemical changes than the Bourbon whiskeys; this was due to the fact that the former were stored in artificially warmed warehouses, whereas the latter were not. Thus the rye whiskeys were in all respects "stronger" than the Bourbon which were "light bodied"; this difference, however, is not due to any intrinsic difference in the raw spirits. During the first three years, solids and colouring matters are extracted from the wood, but after that time the increase in concentration which takes place is due solely to loss of volume; the amounts of solids and colouring matters are closely related. The actual amount of higher alcohols present (free and combined) remains constant during the whole period of storage but their concentration increases. In new spirits the ratio of acids to esters is low (average 6 : 16 grms. per 100 litres proof); during the first year the formation of acids is more rapid than that of the esters and the position becomes reversed (average 44 : 33); during the second and third years the formation of esters becomes more rapid until at the end of the fourth year the proportions of acids and of esters are practically equal (average 62 : 61). After this equilibrium has been reached there is no further change if the results be calculated to the original volume, and so far as these constituents are concerned, the whiskey is mature in four years. The characteristic aroma of American whiskey, as distinguished from Scotch or Irish, is derived almost entirely from the charred wood of the casks. The improvement in flavour of whiskeys in charred casks after the fourth year is due largely to concentration. The colour of whiskey matured in a charred cask is twice as deep as that of a similar whiskey stored in an uncharred cask. The solids and colouring matters derived from the charred cask are less soluble in water than those extracted from an uncharred cask. The "oily" appearance of matured whiskey is due almost entirely to matters extracted from the charred wood, and this appearance is almost lacking in whiskeys aged in uncharred wood. The "body" of a whiskey is due largely to the solids extracted from the wood.

Average data for all samples and for rye and Bourbons separately. (Calculated to original volumes.)

Age.	Original volume.	Colour.	Solids.	Acids.	Esters.	Aldehydes.	Furfural.	Fusel Oil.
New	Whole	—	20·0	6·4	15·0	4·03	0·71	96·8
	Rye	—	13·6	4·7	13·7	4·91	0·97	83·2
	Bourbon	—	26·0	7·7	17·2	3·26	0·44	108·6
1 yr.	Whole	7·3	101·5	37·8	29·9	7·08	1·5	106·2
	Rye	8·4	114·6	41·8	35·3	8·71	1·7	106·8
	Bourbon	6·4	90·1	34·4	24·9	5·55	1·3	105·8
2 yrs.	Whole	8·6	124·2	46·1	42·9	8·34	1·7	108·1
	Rye	10·6	133·6	49·8	49·3	9·02	1·9	109·7
	Bourbon	6·7	114·8	42·7	37·3	7·78	1·4	107·3
3 yrs.	Whole	10·2	140·2	51·1	48·4	9·47	1·8	106·3
	Rye	11·5	150·4	54·4	54·3	9·80	2·2	104·4
	Bourbon	8·3	130·7	47·8	42·5	9·15	1·5	107·3
4 yrs.	Whole	10·2	140·4	51·6	50·9	10·2	1·9	104·3
	Rye	11·6	153·1	54·2	57·2	11·2	2·2	102·0
	Bourbon	8·9	127·7	48·9	45·0	9·3	1·5	106·3
5 yrs.	Whole	11·1	149·2	52·2	51·1	10·2	1·9	100·4
	Rye	12·2	158·8	54·8	57·5	11·3	2·5	100·1
	Bourbon	10·0	140·2	49·8	45·0	9·2	1·5	100·7
6 yrs.	Whole	11·1	151·4	53·2	50·7	10·2	1·9	104·7
	Rye	12·3	161·0	54·8	55·5	11·3	2·4	105·9
	Bourbon	10·1	142·5	51·8	45·2	9·1	1·4	103·8
7 yrs.	Whole	11·1	154·0	52·2	51·1	9·8	1·8	99·9
	Rye	12·0	161·3	51·9	56·6	10·6	2·2	98·8
	Bourbon	10·2	147·1	52·4	46·4	9·0	1·4	101·6
8 yrs.	Whole	10·5	155·2	53·1	50·9	9·6	1·8	98·0
	Rye	11·1	163·8	52·6	56·7	10·6	2·2	99·0
	Bourbon	10·0	147·7	53·6	45·9	8·8	1·5	97·1

This table gives the average of all the whiskeys and the average of the rye and Bourbon separately, calculated back to the original volume, in order to eliminate the effects due to the concentration taking place while the spirit was stored. These figures prove that after the third year, there is very little change in the amounts of the various substances present, any changes after the third or fourth year being almost entirely due to the concentration which occurs.—J. F. B.

Alcohol in Germany. Z. angew. Chem., 1908, **21**, 131—132.

ACCORDING to the report of the "Zentrale für Spiritusverwertung" for 1906-07, the sales of refined and crude or denatured spirit amounted to 49,000,000 litres. The total stocks of the "Zentrale" decreased in the course of the twelve months (Oct., 1906, to Oct., 1907) from 104,000,000 to 56,000,000 litres, so that 48,000,000 litres went on to the market from this source, together with 301,000,000 litres produced during the year. The sale price was 43 M. 25·81 Pf. per hectolitre, the "refining premium" paid to the distillers being 4·60 M. At the beginning of the year, abundant stocks of spirit were available, and a limitation of the production to 82 per cent. of the previous average quantity was decided upon, whilst the price on account to be paid to distillers was fixed at 40 M. In consequence of this limitation and of the high market possibilities for potatoes in other directions, the production of spirit during the year was considerably less than before; the actual production of 385,000,000 litres as against 437,800,000 litres of previous year, corresponded approximately to the quantity agreed upon. The sales were the highest yet recorded. The nominal amount consumed for drinking purposes—244,000,000 litres—was considerably higher than that of the preceding year. The consumption of incompletely denatured spirit showed a moderate increase, and the quantity of spirit exported rose considerably. According to official statistics 21,500,000 litres were exported, but this includes a certain quantity sold and delivered before Oct. 1, 1906, but only recorded during October or November. The sale price of the previous year was at first reduced by 6 M., but from November onwards, the basis price of 50 M. for prime spirit, "freight parity" in Berlin came into force. On Sept. 24, 1907, the price of prime spirit was advanced by 1·80 M. The price of completely denatured spirit remained unaltered during the year. The price abroad rose by 10 M. per hectolitre during the year. No agreement was reached with regard to the proposal to reduce the rebate of the "wash-back" duty on spirit destined for export or denaturing, from 16 to 12 M., and to establish an annual fund of 4,500,000 M. for supplementing the rebate. The acceptance of this proposal would doubtless have considerably injured the development of the use of duty-free spirit. A limitation of the production of spirit during the present year may be dispensed with, but owing to the small potato crop and the favourable market possibilities for potatoes in other directions, there will have to be an increase of the price on account to be paid to distillers and of the selling price of prime spirit.—A. S.

Royal Commission on Whisky. London Gazette, Feb. 18, 1908.

The King has been pleased to appoint a Royal Commission on whisky and other potable spirits.

The Chairman of the Commission is Lord James of Hereford, and the members are:—L. M. Guillemard, C.B., Deputy Chairman of the Board of Inland Revenue; Dr. W. E. Adeney; Dr. J. R. Bradford, F.R.S.; Dr. Horace T. Brown, F.R.S.; Dr. G. S. Buchanan, Inspector of Foods, Local Government Board; J. Y. Buchanan, F.R.S.; and Dr. A. R. Cushny, M.D., F.R.S. The Secretary to the Commission is Mr. A. V. Symonds, of the Local Government Board.

The terms of reference are: to inquire and report—

1. Whether, in the general interest of the consumer, or in the interest of the public health, or otherwise, it is desirable

(*a*) To place restrictions upon the materials or the processes which may be used in the manufacture or preparation in the United Kingdom of Scotch whisky, Irish whisky, or any spirit to which whisky may be applied as a trade description;

(*b*) To require declarations to be made as to the materials, processes of manufacture or preparation, or age of any such spirit;

(*c*) To require a *minimum* period during which any such spirit should be matured in bond; and

(*d*) To extend any requirements of the kind mentioned in the two sub-divisions immediately preceding to any such spirit imported into the United Kingdom.

2. By what means, if it be found desirable that any such restrictions, declarations, or period should be prescribed, a uniform practice in this respect may be satisfactorily secured.

And to make the like inquiry and report as regards other kinds of potable spirits which are manufactured in or imported into the United Kingdom.

Patents.

Malt-kiln. H. Wettig, Assignor to J. A. Topf und Soehne, Erfurt, Germany. U.S. Pat. 876,756, Jan. 14, 1908.

An air-distributing chamber is located between two of the floors of a three-floor kiln having lateral circulation passages: the chamber is divided into separate compartments, each of which is in communication with one or more of the lateral passages.—T. H. P.

Wort; Process for obtaining —— from unmalted grain. R. D. Bailey, Swillington, Yorks. Eng. Pat. 11,882, May 22, 1907.

Maize grits, cooked and granulated, "popped" or flaked maize are boiled in acidulated water in a conversion vessel, the boiling being continued until the starch is converted into either a mixture of maltose and dextrin or dextrose. The product is neutralised and forced under air-pressure through a filter into the copper. Part of the starch may be removed when converted into maltose and dextrin, the remainder being then further converted into dextrose; the two portions are neutralised separately and forced into the copper.—T. H. P.

Worts; Process of fermenting ——. Alliance Industrielle. Fr. Pat. 381,291, Aug. 29, 1907.

Small quantities of hydrogen peroxide or other substances which liberate nascent oxygen are added to bottom-fermentation beer worts, during the primary fermentation. The hydrogen peroxide may be produced by the action of air and steam on essential oils, such as oil of hops. It is stated that the hydrogen peroxide so influences the fermentation that it may be conducted at a temperature of 15° C. with the same results as are obtained in the ordinary way at temperatures of 3°—7° C. No exact quantity of peroxide can be prescribed, but in average cases it should not exceed 40 c.c. of 50 vols. peroxide per hectolitre of wort.—J. F. B.

Alcohol or any other product which is similarly treated; Rectification of ——. E. Guillaume, Paris. Eng. Pat. 8848, April 16, 1907. Under Int. Conv., April 19, 1906.

See Fr. Pat. 365,417 of 1906; this J., 1906, 947.—T. F. B.

Pot-ale; Treatment of ——, whereby products are obtained. G. Reynaud, Paris, and V. H. Frestadius, London. Eng. Pats. 2591 and 2591a, Feb. 1, 1907.

(1). Pot-ale alone or mixed with either molasses or any saccharified mash not containing sufficient nutrient matter for the growth of yeast, is fermented by yeasts found on the majority of wild berries, especially such as can be gathered in peaty and woody districts. The residue remaining after the distillation of the alcohol thus produced serves as a food for animals. (2). Pot-ale, before or after concentration, is mixed with molasses to neutralise its excessive acidity, the mixture serving as food for animals. Alcohol is manufactured by fermenting a mixture of pot-ale and molasses with ordinary yeast or with yeasts occurring on the majority of wild berries, the residue left after distillation of the alcohol thus produced serving as a food for animals or as a manure. Beer is brewed by fermenting a slightly acid mixture of pot-ale and molasses with beer yeast and adding suitable bitter and flavouring matters.—T. H. P.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, AND DISINFECTANTS.

(*A.*)—FOODS.

"*Meal of Netté*"; *The pulp known as ——.* A. Goris and L. Crété. Compt. rend., 1908, **146**, 187—189.

The meal of Netté is a product of the fruit of *Parkia biglobosa* Benth., and is used by the natives of tropical Africa as a food. It forms in the pod as the latter ripens, and at maturity is dry and friable. Analyses give the following proportions per cent.: water 4·9; ash 4·96; phosphates (P_2O_5) 0·383; total nitrogen 0·624; substances soluble in carbon bisulphide 1·30; substances soluble in alcohol 56·67; substances soluble in water 72·0. A "cholesterol" was found in the portion soluble in carbon bisulphide; it melted at 135° C., and had $[\alpha]_D = -26°$ in chloroform. The addition of alcohol to an aqueous extract produced a precipitate of pectins. If the powder be extracted with 90 per cent. alcohol after treatment with carbon bisulphide, a solution of a mixture of sugars is obtained. One of these is sucrose present to the extent of about 25 per cent., the others are dextrose and lævulose, which together amount to 20·5 per cent. The proportion of sucrose seems to diminish on keeping. The sample examined was nearly two months old.—F. Shdn.

Flour; Method to determine the water absorbing capacity of ——. J. F. Hoffmann and A. Ploetz. Z. Spiritusind., 1908, 31, 42—43.

Fifty grms. of flour are intimately mixed with 200 grms. of water and after standing an hour the excess of water is poured off, the dough carefully removed on to an unglazed porcelain slab (26 × 26 cm. and 6—8 mm. thick), covered with a similar slab and pressed with a weight of 1 kilo. for twenty minutes. Sheets of filter-paper are placed against the outer sides of the slabs to increase the rate of absorption of water. The dough is finally weighed and the mean of two determinations taken as the correct result—these should not differ by more than 1 per cent. The method has the disadvantage that the slabs require prolonged treatment with dilute acid, dilute caustic soda solution, water and finally drying for a day or more before they can be used again. The authors quote experiments to show that the higher the quality of the flour the less water it will absorb.
—E. F. A.

Wheat flour; Chemistry of strength of ——. II. Shape of the loaf. T. B. Wood. J. Agric. Science, 1907, 2, 267—277. (See this J., 1907, 1290).

In view of the modification of the state of aggregation of a colloid by the concentration of acid, alkali or salt, in the solution with which it is in contact, the properties of gluten immersed in solutions of varying concentration have been studied. In distilled water gluten retains its coherence; in $N/1000$ hydrochloric acid it begins to disintegrate and lose its coherence, and this change is more rapid as the concentration of the acid is increased up to $N/30$. Further increase retarded the rate of disintegration until with $N/12$ acid, the gluten again became permanently coherent and much harder and more elastic and less sticky than in its original condition. Sulphuric, phosphoric and oxalic acids behaved similarly, but for acetic, lactic, citric and tartaric acids no practicable concentration could be found above which coherence reappeared. The addition of soluble salts causes the gluten to cohere in less concentrated acid. $N/12$ sodium chloride solution is required to make gluten cohere in $N/50$ hydrochloric acid, more salt being required in either more or less concentrated acid. Sodium chloride and phosphate are equal in power of producing coherence, the chloride being more active with more concentrated acid. Sodium sulphate is more active than either. Magnesium and aluminium sulphates are more active than sodium sulphate. With lactic acid more and more sodium chloride must be added to preserve coherence, as the concentration of the acid is increased. The fact that the amount of soluble salt required to produce coherence at first increases with the acidity up to a maximum and then falls off again, probably explains the previous failure to connect acidity and soluble salt content with baking properties. The change of properties of gluten in contact with stronger solutions was measured by the determination of the ratio of the weight when wet, after treatment, to the weight when dry. The figures offer an explanation for the difference in water-absorbing capacity found in certain flours and connect both water absorption and toughness of gluten with acidity and content of soluble salt. These results are discussed in connection with the analytical results of actual flours. Good flours of the "Fife" class contain a preponderance of phosphate, flours like "Rivett" contain little phosphate and much chloride. It is considered that acids and salts influence the gluten when the endosperm is being formed.

The behaviour of acids and salts on casein is exactly similar to their behaviour with gluten, the consistency and water content of curd depending on the concentration of the acid and salt solution with which it is in contact.
—E. F. A.

Flour; Detection of bleaching agents in ——. E. J. Watkins. National Association Review, 1908, 61—64.

If the benzene extract of the flour be colourless, or nearly so, the flour is probably bleached; but an orange-red oily residue left after evaporating the solvent, would indicate nitric oxide, whilst a slightly yellow or nearly white residue points to chlorine or bromine, the use of which would be confirmed by the copper oxide flame test. Distilled water is added to the extracted flour residue and the Griess-Ilosvay reagent added (strong acetic acid containing a small amount of sulphanillic acid and α-naphthylamine). If nitrous bleaching agents have been employed, a pink colour results. In bleaching by nitric oxides, the Griess-Ilosvay reaction shows no coloration with the oil extracted from the flour, but gives a very marked rose colour with the crude gluten washed from the flour, showing that the nitric oxides are almost entirely fixed by the proteins. (See also this J., 1907, 1211).—E. F. A.

Butter-fat; Determination of the "caprylic acid value" of ——. R. K. Dons. Z. Untersuch. Nahr. Genussm., 1908, **15**, 75—79.

The method of determining the "caprylic acid value" of butter-fat (see this J., 1907, 1069) may be modified as follows, the mixed insoluble fatty acids obtained from the fat being extracted with hot water before distillation. The soluble acids, including the butyric and caproic acids, are thus removed, whilst the caprylic acid remains undissolved, and, on submitting the insoluble fatty acids to distillation, the distillate contains practically only caprylic acid. Five grms. of the butter-fat are saponified, the soap is dissolved in 100 c.c. of water, 50 c.c. of dilute sulphuric acid are added and the insoluble fatty acids are allowed to solidify. The aqueous portion is then removed and the cake of acids is extracted twice with 150 c.c. of water at a temperature of 80° C. The insoluble fatty acids are next treated in a flask with 20 grms. of glycerol, 150 c.c. of water and 5 grms. of sodium sulphate (the boiling point of the mixture is thus made to correspond with that of the ordinary Reichert-Meissl distillation). After the addition of a little pumice stone, the mixture is distilled until 110 c.c. of distillate have been collected. One hundred c.c. of the latter are neutralised in the usual way and then treated with 40 c.c. of $N/10$ silver nitrate solution. The excess of the latter is titrated back and the caprylic acid value calculated as described previously. Determined in this way, the value for pure butter-fat varies from 1·6 to 2·0, whilst for cocoanut oil it is 5·3. Butter-fat containing 10 per cent. of cocoanut oil gives a value of from 2·6 to 3·0.
—W. P. S.

Preserve tins; Action of acids and different preserves on ——. K. B. Lehmann. Arch. Hyg., **63**, 66—122. Chem. Zentr., 1908, **1**, 403.

Tin is not attacked, or is only dissolved to the extent of traces, by dilute acids if the liquid contains no free oxygen and is not exposed to the air. The action on the tin is most rapid when the metal projects out of the solution; it is much slower, even with free access of oxygen to the liquid, when the metal is completely immersed, and nearly ceases altogether when the metal is immersed in the liquid free from dissolved oxygen and contained in an air-tight vessel. In unlacquered tins, the amount of tin dissolved by solutions of organic acids depends upon the amount of dissolved oxygen and the volume of the air space between the level of the liquid and the cover of the vessel. The amount of oxygen present in the gaseous condition and dissolved in the liquid is sufficient to account for the quantities of tin found to be dissolved by fruit juices, *viz.*, up to 300 mgrms. per litre. In absence of free oxygen, the combined oxygen of nitrates may play a similar role, the nitrates being reduced to ammonia. Nitrates could not be detected in fruits, but the presence of up to 600 mgrms. (in one case, 1200 mgrms.) of nitrates per litre in preserves can be easily explained as due to the use of water or common salt containing nitrates. In open tins, the metal does not dissolve so rapidly as might have been expected. This is due to two causes. In sweet preserves, the sugar retards the corrosion, owing to its effect on the dissociation of tartaric acid. Other metals also (Fe,Cu) besides tin, are much less attacked by acids containing dissolved sugar, than by the acids themselves. In the case of preserved meat, etc., the fat covers more or less completely the walls of the vessel and the surface of the liquid, and thus hinders corrosion.
—A. S.

"Crude fibre" [in cacao, etc.]; Determination of —— and separation of cellulose, lignin and cutin in the product. J. König. Ber., 1908, **41**, 46—49.

Replying to an adverse criticism by Matthes and Streitberger (this J., 1907, 1211), the author upholds the validity of his method and points out that, in order to obtain concordant results, attention must be paid to the following points:—Substances rich in fat, such as cacao, must first be completely exhausted, as in the case of any other method. The glycerol employed must have a specific gravity of 1·23 and should be made to contain 20 grms. of concentrated sulphuric acid per litre. The product must be washed, first with sufficient boiling water (generally 400 c.c.), later with warm 90—95 per cent. alcohol and lastly with a warm mixture of alcohol and ether until the filtrate comes through perfectly colourless. For very finely ground substances, including of course cacao, the author has stated that the boiled or steamed liquid should be largely diluted in a beaker and allowed to settle, the perfectly clear liquor should then be decanted off and the sediment diluted, boiled and filtered. Should the decanted liquor be not absolutely clear, it should be diluted and filtered before the sediment is brought on the filter. In foodstuff analysis it has always been recognised that the substance called "crude fibre," containing lignin or so-called incrusting matters, is a mixture of various bodies, the relative proportions of which will vary according to the method employed in its preparation. It is impossible to speak of "too high or too low results"; if the method is a good one and accurately followed out, all that can be expected is that the results should be concordant for the same substance; they will then have a relative value for comparing substances treated in exactly the same manner.—J. F. B.

Cacao butter and its unsaponifiable constituents. H. Matthes and O. Rohdich. *See* XII.

Patents.

Foods or organic compounds; Process of sterilising ——. C. C. L. G. Budde, Copenhagen. U.S. Pat. 877,703, Jan. 28, 1908.

See Eng. Pat. 15,304 of 1905; this J., 1906, 862.—T. F. B.

Coffee or coffee beans; Process for purifying and improving raw ——. J. Thum. Fr. Pat. 382,238, Sept. 26, 1907. Under Int. Conv., Oct. 2, 1906.

See Eng. Pat. 21,397 of 1907; this J., 1908, 137.—T. F. B.

Pot-ale; Treatment of ——. Eng. Pats. 2591 and 2591a. *See* XVII.

(*B.*)—SANITATION; WATER PURIFICATION.

Lead and phosphorus poisoning, with special reference to the manufacture of lucifer matches. Shaw Lectures on Industrial Hygiene. II. Thos. Oliver. J. Soc. Arts, 1908, **56**, 311—317.

Speaking with reference to the phosphorus sesquisulphide lucifer match, the author points out that to France belongs the credit of being the first to solve the problem involved in the production of an effective substitute for the ordinary phosphorus match, "for," says he, "in the matches made with the sesquisulphide we have lucifers that are non-poisonous, which strike anywhere, and the manufacture of which is unattended by risks to the health of the workers."

With regard to the substitution of zinc white for white lead in France, he states that in the French Chamber of Deputies "Bill after Bill has been carried through this Chamber in favour of zinc white for all painting purposes, inside and outside, but the Senate has always thrown back these Bills. The dispute has become a national question."

Sludge; Destruction of —— in the septic tank. W. Favre. Gesundheits-Ingen., 1907, **30**, 809—816.

Experiments were made with various substances (proteins, fats, carbohydrates, cork, etc.): (1), in a septic tank; (2), in a tank containing stagnant effluent from a septic tank; and (3), in a tank containing constantly renewed tap-water. It was found that the protein substances and albuminoids, are the most easily decomposed, whilst fats are the most resistant, decomposition only taking place on the surface into fatty acids and glycerol. Carbohydrates or substances rich in carbohydrates are readily decomposed in the septic tank. Cellulose, also, appears to be decomposed, but cork remains unaltered. Stagnant water has a distinct retarding influence on the putrefaction of the solid substances, hence septic tanks should not be made too large, and they should contain no "dead" spaces, where the liquid may collect and become stagnant.—A. S.

PATENTS.

Sewage sludge or other organic waste or refuse; Method and apparatus for treating ——. G. Hird, Shipley, Yorks. Eng. Pat. 28,047, Dec. 8, 1906.

The sludge is placed in closed, inclined retorts provided with ribs or belts for strengthening purposes, etc. Sets of retorts are built into suitable settings, and each retort is fitted with a perforated movable partition which prevents the sludge from blocking the exit pipes of the retort. Furnaces or burners are provided under the retorts, and valved flues are so arranged that the vapours first distilled from the refuse are either conducted to the burners and there consumed, or led to a water-gas apparatus and thence conducted to the burners. The air supply to the burners may be drawn from around another set of retorts which have been heated and are undergoing the process of cooling. By suitably manipulating the valves on the exit pipes of the retorts, the gas, tar, oils, ammonia, etc., produced by further heating the contents of the retorts, are conducted away, collected, and recovered. The charcoal remaining in the retorts at the end of the distillation is useful for the purification of sewage, etc.—W. P. S.

Sewage and waste water; Process and apparatus for the purification of ——. L. C. Girerd, Paris. Eng. Pat. 8899, Apr. 17, 1907.

The sewage is admitted into the top of a closed tank which is divided into three parts by means of vertical partitions; the middle compartment is filled with porous filtering material. The partition plates are perforated, the lower part of the first plate, however, being non-perforated. The filtering material is charged previously with organisms possessing both aerobic and anaerobic properties. After passing through the first compartment, which is provided with a sand-trap, the sewage flows through the filtering material, and thence into the third compartment, from which it is discharged at regular intervals by means of a siphon. The latter is of special construction so that the liquid is discharged rapidly on to a perforated plate situated in a chamber below the above-mentioned tank; this plate distributes the liquid on to the surface of superposed oxidising beds supported on perforated plates. The lateral walls of the oxidising beds are formed of a number of blades or eaves inclined upwards from the interior of the bed. The effluent is collected at the bottom of the beds and discharged through a pipe.—W. P. S.

Aqueous solutions [water]; Process of clarifying ——. J. A. Maignen, Philadelphia, Pa. U.S. Pat. 875,088, Dec. 31, 1907.

A practically neutral, potable water is produced by treating soft, dirty water with a mixture of aluminium sulphate and soda ash. The two chemicals are previously mixed together in the proportions of 2·9 parts of the former and 3·1 parts of the latter, and are added to the water in the form of a dry powder.—J. F. B.

Sand filters; Process for increasing the efficiency of ——. J. M. K. Pennink. Fr. Pat. 382,232, Sept. 26, 1907. Under Int. Conv., Oct. 8, 1906.

The upper surface of the sand is covered with a cloth made of ramie, or other suitable material, which is fastened to the sides of the filter-tank and has a central orifice the edges of which hang down freely into the upper end of a vertical pipe which passes through the filter and is provided with a valve. When working normally, this valve is closed, and the liquid to be filtered is delivered into the open top of the tank, passes through the cloth and the sand, and flows away through pipes which are embedded in the sand and pass through the sides of the filter-tank. The fine detritus which forms the real filtering medium collects on, in the interstices of, and just below the cloth, and when this deposit has accumulated to such an extent as to impede the filtration, it is removed by opening the valve on the vertical pipe, when the water above the cloth flows rapidly away, carrying the deposit with it. If necessary the deposit in the upper layers of sand and within the interstices of the fabric itself may be removed by introducing water through pipes which are imbedded in the sand three-quarters of the distance from the bottom. Further, the cloth may be removed, and after being cleansed, be replaced. The whole of the cleansing can be rapidly performed and without materially disturbing the bed of sand.—W. H. C.

(C.)—*DISINFECTANTS.*

PATENT.

Waste sulphite liquor disinfectant. C. Ellis, Larchmont, N.Y., Assignor to Ellis-Foster Co., New Jersey. U.S. Pat. 877,414, Jan. 21, 1908.

Claim is made for a disinfecting composition comprising creosote of about 1·1 sp. gr. and concentrated waste sulphite cellulose liquor of about 1·3 sp. gr., the latter being present in excess.—T. H. P.

XIX.—PAPER, PASTEBOARD, &c.

Paper; Fibrous constituents of ——. [*Average dimensions of wood pulp fibres*]. C. Beadle and H. P. Stevens. Paper-Maker, 1908, **34**, 8a—8c.

The authors put on record the following measurements of the dimensions of the fibres found in chemical wood pulps of different descriptions. Each value represents the mean of at least 40 observations, and the records show, first the average lengths of the fibres as they actually exist in the commercial half-stuffs, and secondly the average lengths of those fibres only which were entire.

Description of pulp.	Dimensions of fibres			
	in total pulp.		entire fibres only.	
	Length. mm.	Breadth. mm.	Length. mm.	Breadth. mm.
Hemlock, British Columbian	2·05	0·039	2·91	0·038
Spruce, British Columbian	2·74	0·043	3·24	0·046
Balsam, ,, ,,	2·72	0·045	3·30	0·049
Very strong sulphite pulp	2·37	0·035	2·80	0·036
Poplar	0·94	0·024	0·93	0·025
Pine (soda pulp)	2·51	0·031	2·81	0·030
Sulphite pulp	2·10	0·037	2·77	0·035
Sulphite ,,	1·91	0·038	2·67	0·030
Sulphite ,,	2·45	0·037	2·68	0·035
Sulphite ,,	2·19	0·039	2·51	0·035
Unbleached German sulphite pulp	2·77	0·045	2·81	0·038
Strong sulphite pulp	2·62	0·043	2·80	0·036
Swedish strong soda pulp	2·68	0·037	2·62	0·030
German bleached pulp	1·93	0·037	2·45	0·032

—J. F. B.

Patents.

Straw; Process of making paper-pulp from ——. L. K. Böhm, Jersey City, N.J. U.S. Pat. 875,315, Dec. 31, 1907.

Half-stuff is prepared from straw by the action of fixed alkalis; the product is treated with a solution of oxalic acid and agitated until the fibre is completely impregnated with the acid. It is then bleached by a solution of magnesium hypochlorite, thereby forming magnesium oxalate, and the bleached half-stuff is reduced to fine pulp and made into paper.—J. F. B.

Fibrous plants and their direct conversion into paper pulp; Process for the disintegration of ——. R. Kron. Fr. Pat. 381,462, Sept. 2, 1907.

The fibrous plants are boiled with water or treated with moist steam under pressure without the aid of any powerfully caustic chemical reagent, the pressure being raised during the digestion in such a way that the formic and other acids developed from the plant-substance act on the intercellular substance and facilitate the reduction of the stems to paper-pulp. The plants are not chopped up or prepared before digestion, but are stacked lengthwise in cylindrical wagons which are run into the digester. There is no circulation of liquor during the digestion, and if the pulp has to be bleached subsequently, the temperature must be kept as low as possible consistent with the production of the organic acids.—J. F. B.

Viscose and similar viscous substances; Process of filtering ——. C. A. Ernst and G. O. Hamlin, Lansdowne, Pa., Assignors to S. W. Petitt, Philadelphia, Pa. U.S. Pat. 876,901, Jan. 14, 1908.

The fibres of a fibrous filtering body are forced into close contact with each other and held substantially immovable with respect to each other by subjection to external pressure, and the viscose or similar substance is then forced through the filtering body under pressure less than that to which the said body is subjected.
—T. H. P.

Celluloid without camphor; Manufacture of ——. C. Gillet, sen. Fr. Pat. 382,270, Dec. 3, 1906.

The object of this invention is to replace the camphor used in the manufacture of celluloid by a mixture of rosin and castor oil in proportions varied according to the final product desired.—F. Shdn.

Waste sulphite liquor disinfectant. U.S. Pat. 877,414. *See* XVIII*C*.

Films for photography, etc. Addition to Fr. Pat. 379,421. *See* XXI.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

Cinchona alkaloids. VIII. Constitution of cinchonine. P. Rabe. Ber., 1908, **41**, 62—70.

The base, $C_{19}H_{20}ON_2$, described in a former paper (this J., 1907, 1158) and obtained by the oxidation of cinchonine, is now styled cinchoninone, as it has the properties of a ketone. The oxime of cinchoninone, $C_{19}H_{21}ON_3$, was prepared by the action of hydroxylamine hydrochloride and sodium hydroxide. It does not crystallise, but forms a slightly yellow, amorphous powder, which melts between 105° and 110° C. The methiodide of cinchoninoneoxime, $C_{19}H_{21}ON_3,CH_3I$, is an amorphous yellow powder, which begins to decompose at 145°—150° C., and blackens at about 200° C. Cinchoninone dissolves in alkalis with a deep coloration. Cinchoninone dissolved in benzene was treated with benzoyl chloride, when the hydrochloride of the benzoyl compound of the enol form of the ketone separated. The benzene solution on concentration gave benzoylcinchoninone, $C_{26}H_{24}O_2N_2$. which crystallises from light petroleum in white needles melting at 131° C., and is very easily saponified by hydroxyl-containing solvents. It is undoubtedly the derivative of the enol form, as it is neutral to litmus, and the hydrochloride is rapidly hydrolysed in aqueous solution. The methiodide of this benzoyl compound, $C_{26}H_{24}O_2N_2,CH_3I$, is prepared by acting upon cinchoninone methiodide with sodium hydroxide and benzoyl chloride; it forms a reddish-yellow powder when treated with ether, and is very easily decomposed. Cinchonine can be obtained from cinchoninone by reduction with sodium and alcohol, or with iron filings and acetic acid. Cinchoninone was dissolved in a solution of sodium in alcohol and treated with amyl nitrite at a low temperature. After standing overnight, the liquid was treated with water and an excess of alkali. This was followed by extraction with ether to remove the alcohols, and the liquid was saturated with carbon dioxide and shaken with ether for the second time. The ether from the second extraction left behind an oil which became solid, and proved to be α′-oximino-β-vinyl-chinuclidine, or the oxime of β-vinyl-α′-chinuclidone, $C_9H_{14}ON_2$. This oximino compound crystallises from ether and light petroleum in white needles, from ethyl acetate in short, well-formed colourless prisms, and melts at 146—147° C. It is easily soluble in water, alcohol, and benzene, is volatile with steam, sublimes below its melting point, and does not reduce Fehling's solution. The methiodide, $C_9H_{14}ON_2,CH_3I$, crystallises from methyl alcohol in groups of white feathery crystals, and melts at 224° C. The oxime was boiled with 20 per cent. hydrochloric acid for three hours, then treated with amyl nitrite and evaporated. The principal product was the hydrochloride of meroquinine ethyl ester which melts at 155—156° C. and not at 165° C. as stated by Kœnigs (this J., 1906, 825). This production of meroquinine is regarded by the author as strong evidence in support of the formula for cinchonine suggested in a previous paper (this J., 1907, 944), the constitution of meroquinine being well established.—F. Shdn.

Amygdalin. L. Rosenthaler. Arch. Pharm., 1907, **245**, 684—685.

The statement of Fischer that amygdalin might be a derivative of maltose or a diglucose of similar structure, has become regarded as an established fact by the authors of certain text-books. As dextrose is formed when amygdalin is acted upon by emulsin, this enzyme should resolve maltose into dextrose in accordance with the construction put upon Fischer's statement. The author found that the optical rotation of an aqueous solution of maltose containing emulsin remained unchanged for 8 days. The osazone of the sugar formed by the action of emulsin upon amygdalin melted at 204° C., and contained 16·20—16·29 per cent. of nitrogen, whereas the osazone of maltose contains only 10·76 per cent. of nitrogen. These facts shew that amygdalin is not a maltoside.—F. Shdn.

Verbenalin, a new glucoside from Verbena officinalis. L. Bourdier. J. Pharm. Chim., 1908, **27**, 49—57, 101—111. (See this J., 1907, 1292.)

Verbenalin, $C_{17}H_{25}O_{10}$, was isolated in the following manner:—The fresh flowering tops of the herb were plunged into boiling 90 per cent. alcohol containing a little calcium carbonate in suspension, and boiled under a reflux condenser for 20 minutes. After cooling, the herb was disintegrated, and again extracted with boiling 90 per cent. alcohol. The mixed alcoholic extracts were distilled, in the presence of calcium carbonate, and the soft residue extracted several times with boiling ethyl acetate saturated with water. The mixed ethyl acetate extracts were distilled to dryness, and the residue taken up with distilled water, After filtration. the solution was shaken with ether, until no more colouring matter was removed. The ether washings were rejected and the aqueous portion distilled *in vacuo* to a soft extract. This was then extracted by successive boilings with anhydrous ethyl acetate; on cooling the solution, the glucoside crystallised out, and was purified by recrystallisation from 95 per cent. alcohol, and finally, from anhydrous ethyl acetate. It forms colourless odourless needles, with a bitter taste; m.pt. 181·5° C.; $\alpha_D = -180{\cdot}5°$. It exerts a powerful reducing action on Fehling's solution, differing in this respect from all the other known glucosides which are hydrolysed by emulsin. It is soluble in water and in most solvents, except ether and chloroform; in these two it is quite insoluble. It forms with phenylhydrazine, in the cold, a crystalline compound in minute red sphærocrystals; and with hydroxylamine, a crystalline compound, decomposing at about 155° C., without melting. Verbenalin is slowly hydrolysed by boiling dilute sulphuric acid. With emulsin, the products of hydrolysis are dextrose and a body which is, apparently, a phenol. Verbenalin is not poisonous. It is accompanied, in the plant, by sucrose and by the ferments, invertin and emulsin.—J. O. B.

Poison sumach (*poison dogwood, poison elder, etc.*; *Rhus vernix, L.*). A. B. Stevens and L. E. Warren. Amer. J. Pharm., 1907, **79**, 499—522.

THE authors have investigated the resinous exudation from the American plant, *Rhus vernix, L.*, most of the work being carried out on the product collected in October. Four medium-sized trees yielded, on the average, 8·09 grms. of the exudation, the latter being collected from horizontal cuts 5—10 cm. long and 5 mm. deep. The exudation would probably be useful as a substitute for Japanese lac. It has the sp. gr. 0·997 at 20°/20° C., and reacts faintly acid to litmus. Its poisonous properties are destroyed by prolonged heating with water. The composition of four different samples of the exudation showed the following variations:—"Crude resin" (soluble in alcohol), 75·89—84·33; insoluble in alcohol, 5·17—6·13; insoluble in alcohol, soluble in water, 3·37—4·39; insoluble in alcohol, insoluble in water, 1·70—1·94; water (by difference), 9·97—18·93 per cent. The portion insoluble in alcohol, but soluble in water was obtained in the form of a white powder resembling gum acacia in appearance. It exhibits a very strong enzymatic action; it colours freshly-prepared guaiacum tincture deep blue, becomes purple-blue with naphthol, and red in 30 minutes with guaiacol. An aqueous solution of the gum-enzyme caused no transformation of starch into reducing sugar in 96 hours at 40° C. An emulsion of the gum-enzyme, water, and the resin separated from the exudation, darkened on standing just as the exudation itself did. An aqueous solution of the gum-enzyme becomes inactive on boiling. The purified gum when boiled for 8 hours with 2 per cent. sulphuric acid, yields an uncrystallisable, unfermentable, dextro-rotatory sugar, which reduces Fehling's solution, but has no action on Barfoed's cupric acetate solution. The purified gum contains a considerable quantity of nitrogen, which cannot be removed by repeated re-precipitation with alcohol. The portion of the exudation insoluble both in alcohol and in water contains gummy and mucilaginous substances; it has a chocolate-brown colour, is odourless, tasteless, and non-poisonous, and colours guaiacum solution blue; it contains a considerable quantity of nitrogen. The portion of the exudation soluble in alcohol is a dark amber-coloured, oily, non-volatile liquid of sp. gr. 0·9888 at 25°/25° C. It has a weak acid reaction, is very poisonous, and has the characteristic not unpleasant odour of the exudation; it produces a grease spot on paper, and is soluble in the usual solvents for resins and oils. It is neither an alkaloid nor a glucoside. In chloroform solution, it unites with bromine or iodine, with evolution of hydrobromic or hydriodic acid, forming a hard, black, lustrous lac. The "crude resin" is not completely soluble in methyl alcohol or petroleum benzine (b. pt. below 50° C.). The portion (15·5 per cent.) insoluble in benzine is a reddish-brown, semi-solid mass, which on drying *in vacuo* over sulphuric acid, becomes very sticky, resinous and stiff; sp. gr., 1·05167 at 25°/25° C. It is not poisonous, and on keeping at the ordinary temperature gradually becomes hard. When heated to 110° C., it becomes hard and remarkably difficult to pulverise, and insoluble in all solvents, whereas in the undried condition it is soluble in alcohol, chloroform, and glacial acetic acid and partially soluble in ether and methyl alcohol. When boiled with alcoholic potash it yields a brownish-black soap soluble in water and a brownish-black mass insoluble in water, but no glycerol; the saponification value varies from 286·7 to 344·2. The portion (79·5 per cent.) of the resin soluble in benzine is a clear amber-coloured, non-volatile liquid, sp. gr. 0·9693 at 25°/25° C., soluble in most organic solvents. It is optically inactive and very poisonous. When treated with alkali it darkens and yields a brownish-black soluble soap; its saponification value varies from 238·7 to 321·4. It has no drying properties. With methyl-magnesium iodide in Grignard's reaction it yields methane, which points to the presence of hydroxyl groups. It contains no alkyloxy groups, sulphur or halogens.

The fruits of the plant, freed from the kernels, contain about 20 per cent. of fat; the kernels amount to 75·5 per cent. of the whole fruit. The crude fat is a hard, greenish-white mass with a slight characteristic odour, and a faint, somewhat tallow-like taste. It has the sp. gr. 0·9749 at 25°/25° C., and is insoluble in cold, but slightly soluble in hot alcohol. After recrystallisation it melts at 43·5—45·5° C., and has the saponification value, 236·7—237·4, and iodine value, 3·39. In the mother liquors there remains a brownish-yellow liquid fat. The kernels contain 0·85 per cent. of a light yellow, odourless and tasteless non-poisonous oil having the saponification value, 267·7, and iodine value, 130. No poisonous constituents could be detected in the ripe fruits.—A. S.

Plants yielding odoriferous substances; Chemical studies on the growth of ——. *Successive conditions of the plant-substances during the normal development of a perennial plant.* Roure-Bertrand fils. Wiss. u. ind. Ber. von Roure-Bertrand fils, 1907, **6**, 3—14. Chem. Zentr., 1908, **1**, 476—477.

THE experiments were carried out with the wormwood plant. During the development of the plant the alteration of the content of soluble substances is least in the case of the dry substance of the leaves. So soon as a certain stage of development is attained, then, contrary to what was observed in the case of an annual plant, the dry substance of the stems and of the root becomes richer in soluble organic substances than the dry substance of the leaves. At the time of flowering, the reverse becomes the case, but the original condition of affairs soon returns at least so far as the root and leaves are concerned. The proportion of soluble inorganic substances is greatest in the dry substance of the leaves, just as in the case of an annual plant, but diminishes as growth proceeds. In an annual plant, the root and stems in all the stages of growth are formed from the least soluble organic substances; in the wormwood plant, on the other hand, the organic substance of the root is relatively soluble, and indeed in winter, is more soluble than the organic substance of any other organ of the plant. This fact indicates a migration of the plant constituents to the root, similar to that previously observed with respect to the essential oil. Apparently, this accumulation of soluble substances in the root is characteristic of perennial plants. Generally in all of the organs of the plant, up to the beginning of the flowering period, the organic substance becomes more soluble as growth proceeds, but as soon as the flowering begins, the solubility uniformly diminishes in all organs with the exception of the root. In the latter there is first a decrease of solubility, but an increase soon becomes perceptible again. At the beginning of the period of flowering, the organic substance of the flower-stalks shows the greatest solubility. It is concluded that in a perennial plant, the soluble organic substances migrate from the leaves to the flower-stalks, but on the approach of winter, migration proceeds also towards the root. —A. S.

Essential oils. Roure-Bertrand fils. Wiss. u. ind. Ber. von Roure-Bertrand fils, 1907, **6**, 15—32. Chem. Zentr., 1908, **1**, 464—465.

Sandalwood oil from Port-au-Prince.—The yield of oil from the plant is 3·8 per cent. The oil has the sp. gr. 0·9799 at 15° C., $[\alpha]_D = +47^\circ 4'$; it is soluble in 3 vols. of 70 per cent. alcohol, and contains 0·4 per cent. of esters (as linalyl acetate) and 44·1 per cent. of total alcohols (as linalool). Its odour resembles that of cedar-wood oil. *Oil from linaloe seeds.*—The oil has the sp. gr. 0·8883 at 15° C., $[\alpha]_D = +1^\circ 30'$, and after acetylation, $-3^\circ 12'$; saponification value, 29·2, and after acetylation, 164·5.

It is soluble in 1·5 vols. of 70 per cent. alcohol, and contains 10·2 per cent. of esters (as linalyl acetate) and 51·6 per cent. of total alcohols (as linalool). The chief fraction of the oil on distillation has a decided odour of linalool. *Distillation of lavender.*—The authors confirm the statement of Schimmel and Co. that distillation with steam gives a higher yield of oil and a higher content of esters in the oil than distillation with water over direct fire. *Oil from Grasse sage.*—The authors warn against judging of the genuine character of essential oils from the results of chemical examination alone, and in this connection quote the following results obtained with oil distilled by themselves from sage cultivated in Grasse. Sp. gr. 0·915—0·916 at 15° C., $[\alpha]_D = +6°8'$ to $+6°27'$; saponification value, 13·4, and after acetylation, 53·7; insoluble in 10 vols. of 80 per cent. alcohol, soluble in 1 vol. of 85 per cent. alcohol; the solution becomes turbid on addition of more alcohol. *Oil from Tetranthera polyanthra, Var. citrata Nees.*—(1). Oil from the bark. Sp. gr. 0·8673 at 15° C., $[\alpha]_D = +20°30'$, and after acetylation, $+8°46'$; saponification value after acetylation, 252·3. The oil is soluble in 2 vols. of 75 per cent. alcohol, but the solution becomes opalescent on addition of more alcohol; it is miscible with 80 per cent. alcohol in all proportions. It contains 8 per cent. of citral, 10 per cent. of citronellal, 56·5 per cent. of alcohols, $C_{10}H_{18}O$, and 2·4 per cent. of esters. (2). Oil from the leaves. Sp. gr. 0·9013 at 15° C., $[\alpha]_D = -12°30'$, and after acetylation, $-4°20'$; saponification value after acetylation, 104·7. The oil is soluble in 1·5 vols. of 75 per cent. alcohol, but the solution becomes turbid on addition of more alcohol. It contains 6 per cent. of citral, 21·2 per cent. of cineol, and 31·3 per cent. of alcohols, $C_{10}H_{18}O$. (3). Oil from the fruits. Sp. gr. 0·8872 at 15° C., $[\alpha]_D = +12°44'$, and after acetylation, $+10°14'$; saponification value after acetylation, 172·5. The oil dissolves in 4 vols. of 70 per cent. alcohol, but the solution becomes turbid on addition of more alcohol; it is miscible in all proportions with 75 per cent. alcohol, yielding a faintly opalescent solution. It contains 64 per cent. of citral, 19·4 per cent. of alcohols, $C_{10}H_{18}O$, and 2 per cent. of esters. *Oil from Magnolia Kobus, D.C.* (See following abstract).—A. S.

Magnolia Kobus D.C.; Essential oil of ——. E. Charabot and G. Laloue. Compt. rend., 1908, **146**, 183—185.

The essential oil of *Magnolia Kobus* D.C. (Kobushi) was obtained by distilling the branches of a Japanese tree. The oil had the following constants: $\alpha_D = -1°20'$ in a 100 mm. tube; sp. gr. 0·9432 at 15° C. It was soluble in one volume of 90 per cent. alcohol, an opalescence being produced by the addition of 3 volumes of alcohol. Besides anethol, the principal constituent, the oil contains about 15 per cent. of citral.—F. Shdn.

Lemon oil; Adulterated ——. E. J. Parry. Chem. and Drugg., 1908, **72**, 275.

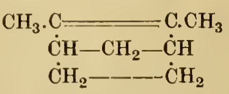
The author draws attention to the presence on the market of very large quantities of lemon oil adulterated with a considerable quantity of petroleum and also probably with lemon terpenes. The adulterated oil is very insoluble in absolute alcohol. Four typical samples showed the following results:—

	Sp. gr. at 15° C.	Optical rotation.	Refractive index.	Citral. Per cent.
1	0·8590	+37°	1·4620	1·8
2	0·8595	+35°	1·4595	1·7
3	0·8585	+29°	1·4600	1·5
4	0·8590	+33°	1·4616	1·6

After distilling off *in vacuo* about 50 per cent. of the oil, the residue was heated on the water-bath, and then treated with hot sulphuric acid. The uncharred substance was found to consist of a hydrocarbon oil having the refractive index, 1·4480.—A. S.

Essential oils. Derivatives and constitution of santene. F. W. Semmler and K. Bartelt. Ber., 1908, **41**, 125—130.

Norcamphor (this J., 1907, 1253) was treated with benzaldehyde and sodium in alcohol at a low temperature. In this way the benzylidene compound of π-norcamphor, $C_{16}H_{18}O$, was produced, boiling at 182°—184° C. at 10 mm., having the sp. gr. 1·041 at 20° C., and $n_D = 1·57516$. The benzylidene compound on oxidation with permanganate yielded π-norcamphoric acid, $C_9H_{14}O_4$, which melts at 170°—171° C. after crystallising from water; the dimethyl ester and the anhydride were prepared and are described. π-Norcamphoroxime boils at 116°—120° C. at 9 mm., has the sp. gr. 1·012 at 20° C., and $n_D = 1·49856$. π-Norbornylamine, $C_9H_{17}N$, obtained by the reduction of the oxime, boils at 69° C. at 10 mm., has the sp. gr. 0·9613 at 20° C., and $n_D = 1·47642$; the picrate melts at 208° C., the oxalate at 280° C., and the hydrochloride at 272° C. When the oxime is boiled with 25 per cent. sulphuric acid, π-norcampholenic nitrile, $C_9H_{13}N$, is produced, boiling at 82°—83° C. at 9 mm., and with the sp. gr. 0·950 at 20° C., and $n_D = 1·47200$. On hydrolysis, this yields π-norcampholenic acid, $C_9H_{14}O_2$, boiling at 132°—134° C. at 10 mm., and with the sp. gr. 1·014 at 20° C., and $n_D = 1·47936$. Norborneol was treated in light petroleum with phosphorus pentachloride, when a chloride was obtained, boiling at 72°—73° C. at 10 mm., and with the sp. gr. 1·010 at 20° C., and $n_D = 1·48422$; it solidifies and then has the melting point 59°—61° C. The hydrochloric acid was removed from this substance by means of alcoholic potassium hydroxide, when norcamphene, C_9H_{14}, was obtained, boiling at 33—35° C. at 10 mm. and with the sp. gr. 0·8677 at 18° C., and $n_D = 1·46658$. From its constants and oxidation products, norcamphene was shewn to be identical with santene (this J., 1907, 1292). When santene is heated with formic acid, π-norbornyl formate is produced, boiling at 82°—84° C. at 9 mm., and with the sp. gr. 1·010 at 20° C., and $n_D = 1·46559$; it is optically inactive. Except for the optical activity, this formate is identical with that obtained by the authors from teresantalic acid and formic acid (this J., 1907, 1253). On hydrolysis, the formate yields π-norborneol, boiling at 86°—88° C. at 9 mm. Aschan's santenol (this J., 1908, 89) is most probably identical with π-norborneol. The authors conclude that another formula is possible for santene:—



$$\begin{array}{lcl} CH_3.C & = & C.CH_3 \\ \dot{C}H & -CH_2- & \dot{C}H \\ \dot{C}H_2 & \text{———} & \dot{C}H_2 \end{array}$$

The name π-norcamphor is used to indicate that this substance contains one methyl group less than camphor, and has no dimethylated carbon atom.—F. Shdn.

Cardamine amara L.; Essential oil of ——. M. Kuntze. Arch. Pharm, 1907, **245**, 657—659.

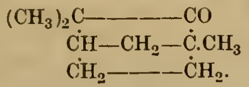
The oil obtained from a quantity of the root of *Cardamine amara L.* was shaken with alcoholic ammonia and then heated. The greater portion of the alcohol was then distilled off and the clear liquid treated with water. This solution on spontaneous evaporation left two kinds of crystals. The larger quantity of these was in the form of colourless leaflets and needles. This substance proved to be secondary *d*-butylthiourea, melting at 136° C. and having $[\alpha]_D = +19·96°$ at 20° C. in absolute alcohol. The other crystalline substance formed rosettes, melted at 159° C. and was optically inactive. It is possibly identical with benzylthiourea. 13·5 kilos. of the fresh root only yielded 2 grms. of impure thiourea.—F. Shdn.

Cineol (eucalyptol) in eucalyptus oils; Determination of ——. O. Wiegand and M. Lehmann. Chem.-Zeit., 1908, **32**, 109—110.

The authors find that the following method for the determination of cineol gives good results with eucalyptus oils containing other oxygenated substances besides cineol. 100 c.c. of the oil are distilled in a flask with three bulbs in the neck at the rate of about one drop per second. The amount of cineol in the fraction distilling between 170° and 190° C. is then determined by the method described in Schimmel's report (this J., 1908, 90).—F. SHDN.

Fenchone; Confirmation of the constitution of ——. L. Bouveault and Levallois. Compt. rend., 1908, **146**, 180—183.

THE authors describe experiments which they consider to definitely establish the constitution of fenchone as determined by Semmler (this J., 1906, 826), whose formula is as follows:—



$$\begin{array}{l}(CH_3)_2C\text{————————}CO\\ \qquad CH—CH_2—C.CH_3\\ \qquad CH_2\text{—————}CH_2.\end{array}$$

—F. SHDN.

Turpentine (pinene); Action of ozone upon oil of ——. C. Harries and H Neresheimer. Ber., 1908, **41**, 38—42.

PINENE (boiling point 50° C. at 15 mm., and $a_D = +9°$ in a 10 mm. tube at 19° C.) was dissolved in carbon tetrachloride and subjected to the action of ozone. A solid and a fluid ozonide were formed, the former being produced in smaller amount. The solid pinene ozonide (pinene perozonide) forms small elastic clusters, possessing an ill-defined crystalline structure, and is insoluble in the usual organic solvents. Analyses give results nearer to the formula $C_{10}H_{16}O_4$ than to $C_{10}H_{16}O_3$. The action of ozone upon pinene and cyclohexene are similar (Ber., 1906, **39**, 2847). When heated on platinum foil, the ozonide explodes, though not violently. When boiled with water it slowly decomposes, and hydrogen peroxide makes its appearance. It decomposes at 80°—85° C. When decomposed with water, it yields pinonic acid. The oily pinene ozonide, $C_{10}H_{16}O_3$, can be separated from the solid compound, by its solubility in carbon tetrachloride or ether. It has the sp. gr. 1·310 at 20°/4° C., and $[a]_D = +11° 40'$ in chloroform at 20° C. On decomposition, either by boiling with water, by heating with potassium hydroxide, or by distilling *in vacuo*, it yields optically active, oily pinonic acid, and possibly pinonic aldehyde.—F. SHDN.

Tannic acid in toxicological investigations. P. Biginelli. Gaz. chim. ital., 1907, **37**, II., 506—520.

ANHYDROUS tannic acid is more soluble in cold ether than in water. When it is heated with ether in a Soxhlet apparatus, and the excess of ether quickly removed, a syrupy addition-compound, $C_{14}H_{10}O_9,2C_4H_{10}O$, is left, which on exposure to the air, loses ether and takes up 2 mols. of water, forming ordinary tannic acid, $C_{14}H_{10}O_9,2H_2O$. With pure anhydrous ether, anhydrous tannic acid forms the compound, $C_{14}H_{10}O_9,3C_4H_{10}O$, which also gradually decomposes on exposure to air. Ordinary tannin or its aqueous solution when treated with ether forms the compound, $C_{14}H_{10}O_9,5C_4H_{10}O,6H_2O$ (see Pelouze, Ann. Chim. Phys., **54**, 337; **56**, 303; and Sisley, Bull. Soc. Chim., **9**, 757). Tannic acid also forms compounds with alcohol, *viz.*, with strong alcohol, $C_{14}H_{10}O_9,2C_2H_5OH$, and with absolute alcohol, $C_{14}H_{10}O_9,3C_2H_5OH$.

An aqueous 1 per cent. solution of tannic acid is not precipitated by nitric acid of less than 20 per cent. strength, by sulphuric acid of less than 10 per cent., or by hydrochloric acid of less than 5 per cent. strength. The compounds of tannic acid with mineral acids are flesh-coloured flocculent substances, insoluble in excess of the precipitant, but soluble in distilled water. The compound obtained with sulphuric acid has, approximately, the composition, $C_{14}H_{10}O_9,H_2SO_4,12H_2O$, and that with hydrochloric acid, $(C_{14}H_{10}O_9)_3,2HCl,20H_2O$.

The alkaloids, cinchonine, quinidine, cinchonidine, strychnine, brucine, cocaine, papaverine, solanine, narcotine, etc., behave in an analogous manner to quinine (this J., 1908, 138) towards tannic acid. With the aqueous solution of the addition-compound of hydrochloric acid and tannin, quinine hydrochloride forms pseudo-tannates, *e.g.*, the compounds,

$$(C_{20}H_{24}O_2N_2.2HCl)_2,5C_{14}H_{10}O_9,13H_2O \text{ and}$$
$$C_{20}H_{24}O_2N_2,2HCl.5C_{14}H_{10}O_9,xH_2O$$

previously described (*loc. cit.*). When using tannic acid as a test-reagent for alkaloids, care must be taken to have an excess of acid present.—A. S.

l-Arabinose; Preparation of —— *from mercuric gluconate. Conversion of a-hydroxy-acids into aldehydes.* M. Guerbet. Compt. rend., 1908, **146**, 132—135.

THE author has described a general reaction for the conversion of the mercuric salts of *a*-hydroxy-acids into aldehydes by boiling with water for several hours. The reaction is illustrated by the case of mercuric lactate, which yields mercurous lactate, lactic acid, acetaldehyde and carbon dioxide, thus:

$$2(C_3H_5O_3)_2Hg = (C_3H_5O_3)_2Hg_2 + C_3H_6O_3 + C_2H_4O + CO_2.$$

Similarly, formaldehyde is obtained by the decomposition of mercuric glycolate, and glyoxal from mercuric tartrate. In the above cases, owing to the relative insolubility of the mercury salts, it is necessary to boil for a very long time. The reaction may, however, be advantageously employed for the preparation of arabinose from mercuric gluconate. The time of ebullition required in this case is only 4 hours and the yield is double that indicated by the general equation because the mercurous gluconate formed itself undergoes a similar decomposition with formation of metallic mercury and a further quantity of arabinose. For the preparation of arabinose, 100 grms. of calcium gluconate are dissolved in 200 c.c. of water, treated with the equivalent quantity of oxalic acid and filtered. An excess of yellow mercuric oxide is added, the liquid is warmed gently and filtered. It is then boiled for 4 hours under a reflux condenser and filtered; the residual mercury is removed by sulphuretted hydrogen. The gluconic acid is neutralised by chalk, the solution is evaporated to a syrup, the latter is triturated with 200 c.c. of 95 per cent. alcohol, and the arabinose is extracted by 90 per cent. alcohol. By recovering and re-treating the calcium gluconate, the yield of arabinose from the above quantity may be raised to about 24 grms.—J. F. B.

Double chlorides of dimercuriammonium and ammonium; Decomposition by water of the ——. H. Gaudechon. Compt. rend., 1908, **146**, 177—180.

THE author has examined the dissociation in water of mercuric ammonium chloride, NHg_2Cl,NH_4Cl, and mercuric diammonium chloride, $NHg_2Cl,3NH_4Cl$. The former decomposes in water according to the equation: $NHg_2Cl,NH_4Cl \text{ sol.} + H_2O \rightleftarrows NHg_2Cl,H_2O \text{ sol.} + NH_4Cl$. For a given temperature there is a constant concentration of ammonium chloride. The second substance decomposes in a similar way: $NHg_2Cl,3NH_4Cl \text{ sol.} \rightleftarrows NHg_2Cl,NH_4Cl \text{ sol.} + 2NH_4Cl$. This reaction is limited by the concentration of ammonium chloride in the solution. Both substances behave as true double salts at the ordinary temperature. At the temperature of boiling water, the group NHg_2 tends to disrupt, and the double chlorides yield ammonia, mercuric chloride and mercuric oxide.—F. SHDN.

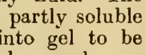
Colloidal sodium chloride. C. Paal and G. Kühn. Ber., 1908, **41**, 51—57. (See this J., 1906, 1066.)

THE ethyl ester of sodium-ethyl-malonic acid and ethylchloroacetate interact in benzene solution or in ether, to give yellow or orange-yellow opalescent milky solutions from which petroleum ether precipitates the organosol, which is soluble in benzene and in absolute ether when freshly precipitated, but becomes insoluble after drying *in vacuo*, forming a faintly yellow coloured amorphous gel containing 64 per cent. of sodium chloride as well as an excess of sodium present in the form of the sodium salt of an organic acid. The addition-product, $C_{13}H_{22}O_6.NaCl$, assumed by Michael to be formed in the milky liquid, would contain but 17·6 per cent. of sodium chloride. When the heating in the above reaction is prolonged and the liquid subsequently poured into another vessel, a liquid gel remains in contact with the glass; whilst the solution is separated on filtering into gel and benzene solution. Such a state midway between the liquid organosol and the gelatinous organogel is termed a liquid gel and it is akin to the behaviour of many plant fluids and rubber species, the apparent aqueous solutions of which are separable on filtration into their constituents. Very stable sodium chloride organosols are obtained by the interaction of chloroacetone and of ω-chloroacetophenone with the ethyl ester of sodium-ethyl-malonic acid. In benzene solution the sol remains in colloidal solution; from ether it separates as a finely divided orange precipitate which in the absence of moisture can be preserved under ether a considerable time without alteration, but is rapidly converted into the gel containing 44 per cent. of sodium chloride when dried. By the interaction of sulphuryl chloride with the ethyl ester of sodium-ethyl-malonic acid in benzene, a viscous, yellow solution of the organosol is first formed which rapidly becomes colourless and of a thinner consistence and shows all the properties of a liquid gel.—E. F. A.

Colloidal sodium bromide and iodide. C. Paal and G. Kühn. Ber., 1908, **41**, 58—61. (See this J., 1906, 1066, and preceding abstract.)

THE ethyl ester of sodium-ethyl-malonic acid reacts with ethyl bromoacetate or with phenacylbromide in benzene or absolute ethereal solution to form sodium bromide sols. In benzene the orange yellow opalescent liquid gives a precipitate of the sol with petroleum ether which soon passes over into the amorphous yellow gel. In ethereal solution the sparingly soluble sol separates as a fine precipitate, which is at first completely soluble in benzene but gradually passes over into the gel. These gels are not jelly-like but when magnified are seen to consist of aggregates of amorphous transparent balls. The sodium bromide sols are less stable than those derived from sodium chloride. The supposed crystalline sodium iodide compounds (*loc. cit.*) are now found when magnified to be colloids. Ethyl-β-iodopropionate and the ethyl ester of sodium-ethyl-malonic acid interact in the cold to form a yellowish-white milky fluid. The sol precipitated by petroleum ether is only partly soluble in benzene, showing the transformation into gel to be very rapid. The amorphous gel is colourless and contains as much as 88 per cent. of sodium iodide.—E. F. A.

Carbon suboxide. O. Diels and P. Blumberg. Ber., 1908, **41**, 82—86. (See this J., 1906, 500.)

CARBON suboxide is now prepared by the following method whereby 3 grms. are obtained from 40 grms. of malonic acid. 20 grms. of very carefully dried malonic acid are intimately mixed with 40 grms. of sea sand, the mixture again dried and shaken with 200 grms. of phosphorus pentoxide; the whole is then rapidly transferred to a large distillation flask connected to a large drying tower full of calcined lime and distilled as before (*loc. cit.*). This tower not only retains the acetic acid formed but also enables carbon dioxide to be almost entirely separated from the carbon suboxide, which when so obtained, free from acetic acid and carbon dioxide, is by no means so unstable as at first supposed. Use has been made of the possession of pure carbon suboxide to determine accurately the molecular refraction and dispersion. These were found to be 16·6 and 0·74 respectively, values which are in close agreement with those calculated on the assumption of the formula $CO:C:CO$ originally proposed by the authors and which render very improbable the alternative formula,  $\mathrm{C}\left\langle\begin{matrix}\mathrm{C}\\ \mathrm{CO}\end{matrix}\right\rangle\mathrm{O}$, proposed by Michael.—E. F. A.

Charcoal; Decolorising action of ——. L. Rosenthaler. *See* XXIV.

PATENTS.

Alkylphenolic ethers [codeine, etc.] from compounds containing phenolic groups (OH); Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 3068, Feb. 7, 1907.

SEE U.S. Pat. 863,792 of 1907; this J., 1907, 1029.—T. F. B.

Colloidal elements; Process for the peptisation of ——. H. Kuzel, Baden, Austria. Eng. Pat. 6109, March 13, 1907. Under Int. Conv., April 27, 1906.

SEE Addition of March 8, 1907, to Fr. Pat. 371,799 of 1906; this J., 1907, 1029.—T. F. B.

Stramonium, belladonna, grindelia, lobelia and similar drugs used in the treatment of asthma; Process to convert the products of combustion of —— *into a suitable form for medical use.* R. E. Ritsert, Frankfurt on Maine, Germany. Eng. Pat. 7097, March 25, 1907.

THE smoke produced by the combustion of the drugs is collected by means of an aspirator and introduced into a fluid mixture, which may subsequently be divided into exact doses and inhaled after being brought into a finely divided state, preferably by means of a spraying apparatus. Special claim is made for the use of a mixture in equal parts of alcohol and glycerin for the absorption of the smoke.—C. A. M.

1-*Phenyl*-2.3-*dimethyl*-4-*sulphamino*-5-*pyrazolone and its salts; Process for the production of* ——. E. Scheitlin, Altsletten, Switzerland. Eng. Pat. 12,889, June 4, 1907. Under Int. Conv., Feb. 13, 1907.

SEE Fr. Pat. 378,486 of 1907; this J., 1907, 1109.—T. F. B.

Pyrimidine derivative. L. Weber, Darmstadt, Germany. Reissue No. 12,745, dated Jan. 28, 1908, of U.S. Pat. 848,791, April 2, 1907.

SEE Fr. Pat. 346,188 of 1904; this J., 1905, 151.—T. F. B.

Formates; Process of making ——. C. Ellis, White Plains, N.Y., and K. P. McElroy, Washington, D.C. U.S. Pat. 875,055, Dec. 31, 1907.

A BASIC mineral substance which is practically insoluble in water, *e.g.*, calcium carbonate, is suspended in water and treated at a high temperature and under high pressure with carbon monoxide or producer gas.—J. F. B.

Formates; Preparation of ——. Usines des Moulins, Soc. Anon. Fr. Pat. 382,001, Sept. 19, 1907. Under Int. Conv., Sept. 10, 1907.

FORMATES can be prepared by the action of carbon monoxide on a metallic oxide, which is hydrated in the presence of the carbon monoxide itself, so that the heat of hydration helps in the reaction. For instance, calcium formate can be made by passing moist carbon monoxide over unslaked lime, heated to 100° C. under pressure.
—F. SHDN.

Camphor from camphene, isoborneol and other camphor-producing substances; Method of producing ——. C. Glaser, Baltimore, Md. U.S. Pat. 875,062, Dec. 31, 1907.

ISOBORNEOL is suspended in a solution of a chloride of an alkali metal, an electric current is passed through the mixture, and the camphor which is produced is separated.—J. F. B.

Sulphur; Process of making chlorides of ——. C. E. Acker, Niagara Falls, N.Y., Assignor to M. Stine, New York. U.S. Pat. 875,231, Dec. 31, 1907.

SULPHUR is dissolved in sulphur chloride and the solution is transferred to a reaction chamber in which it is sprayed through an atmosphere containing chlorine, the heat developed by the reaction being withdrawn. The product is then returned to the dissolving chamber where it is made to take up more sulphur and the cycle of operations is repeated.—J. F. B.

Carbon tetrachloride; Refining ——. C. E. Acker, Niagara Falls, N.Y., Assignor to M. Stine, New York. U.S. Pat. 875,232, Dec. 31, 1907.

IMPURE carbon tetrachloride is refined by treating it with an aqueous solution of a "reagent containing the radical of hypochlorous acid" at a temperature of 35° C. until the impurity is destroyed and distilling off the pure carbon tetrachloride from the product.—J. F. B.

Sulphoacetic acid and its salts; Process for the preparation of ——. O. Stillich. Ger. Pat. 185,183, May 21, 1904.

Monochloracetic acid is treated with an alkali sulphite, and sulphurous acid is expelled from the reaction-product by boiling with mineral acids or by oxidation. This method of expelling the sulphurous acid is possible, as, contrary to statements in the literature, sulphoacetic acid is not decomposed on boiling with water, but is very stable.—A. S.

Chlorhydrins [aryl or aralkylchlorpropanols]; Process for the preparation of ——. J. D. Riedel A.-G. Ger. Pat. 183,361, June 19, 1904.

Chlorhydrins of the general formula, $CH_2(OH).CHR.CH_2Cl$, where R is an alkyl or aralkyl group, are obtained by the action of aryl or aralkyl organo-magnesium compounds on epichlorhydrin.—A. S.

9.12-*Diketostearic acid; Process for the preparation of* ——. A. G. Goldsobel. Ger. Pat. 180,926, Oct. 12, 1904.

Ricinostearolic acid is dissolved in concentrated sulphuric acid, and the resulting 9.12-ketohydroxystearic acid is oxidised to 9.12-diketostearic acid.—A. S.

Dialkylbromacetamides; Process for the preparation of —— *from dialkylcyanacetic acids.* P. Hoering and F. Baum. Ger. Pat. 186,739, June 22, 1905.

Dialkylcyanacetic acids are converted by heating, *e.g.*, by repeated slow distillation, into the corresponding dialkylacetonitriles; the latter are treated with bromine, and the resulting dialkylbromacetonitriles are transformed into dialkylbromacetamides by means of concentrated sulphuric acid.—A. S.

Oxalic acid; Process for the preparation of —— *by oxidation of sugar with nitric acid.* A. Naumann, L. Moeser, and E. Lindenbaum. Ger. Pat. 183,022, Aug. 18, 1905.

In the oxidation of sucrose to oxalic acid by means of nitric acid, claim is made for the use of vanadium compounds as oxygen-carriers. It is stated that by using 0·001—0·002 grm. of vanadium pentoxide per grm. of sucrose, the reaction proceeds at the ordinary temperature, a higher yield of oxalic acid is obtained, and no intermediate products are formed.—A. S.

Thioglycollic acid; Process for the preparation of —— *from chloracetic acid.* Kalle und Co. Ger. Pat. 180,875, Oct. 27, 1905.

Salts of chloracetic acid are treated with alkali or alkaline-earth polysulphides, and the reaction-products are subjected to the action of reducing agents.—A. S.

Tetranitromethane; Process for the preparation of ——. C. Claessen. Ger. Pat. 184,229, Nov. 5, 1905.

Aromatic hydrocarbons or their nitro-derivatives are heated with a mixture of strong nitric acid and concentrated or fuming sulphuric acid, and the gaseous or volatile reaction-products are treated in the usual manner for the separation of substances insoluble in water and the isolation of tetranitromethane. It is stated that a yield of 50 per cent. of tetranitromethane on the weight of raw material is obtained.—A. S.

Formaldehyde (especially in the form of paraformaldehyde) and methyl formate; Process for the preparation of ——. M. Goldschmidt. Ger. Pat. 183,856, July 7, 1906.

The process consists in: (1), heating tin formate; or (2), passing formic acid vapour over moderately heated tin oxide or hydroxide. The decomposition of the tin formate begins at about 180° C. The volatile reaction products—formaldehyde and methyl formate—are condensed.—A. S.

Aluminium compounds; Process for the preparation of solutions of ——. R. Reiss. Ger. Pat. 189,959, Dec. 20, 1906.

Acid extracts of substances of *e.g.*, medicinal value (prepared with acetic, formic, or lactic acid, &c.) are partially or completely neutralised with aluminium hydroxide, or are first treated with aluminium sulphate and then with calcium carbonate.—A. S.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Agar-agar in emulsion making. W. F. Cooper and W. H. Nuttall. Phot. J., 1908, 48, 11—25.

A one per cent. solution of agar-agar may be used for making emulsions for photographic plates and papers. It is prepared by boiling the previously soaked agar with water, straining through fabric, and filtering through paper. Such solutions are clear and colourless, and can be boiled and evaporated without losing their setting properties. A solution of agar has a viscosity about eight times as great as that of a gelatin solution of the same strength; this property enables films of agar to be prepared much thinner than gelatin films. Citric acid can be added to agar emulsions without greatly decreasing their viscosity, hence it forms a suitable preservative. Neither gold chloride, nor platinic chloride, nor silver chloride gives any reaction with agar solution. Agar emulsions set very rapidly, hence they must be dried at a high temperature; an apparatus is described for drying such emulsions at temperatures up to 84° C. An account is given of other properties of agar solutions. (See also this J., 1905, 152, 291 and 1126; 1908, 140.)—T. F. B.

Pyrogallol solutions; Alteration and preservation of ——. A. and L. Lumière and A. Seyewetz. Bull. Soc. Franç. Phot., 1908, 23, 531—533.

Both aqueous and alcoholic solutions of pyrogallol can be preserved indefinitely by the addition of small quantities of sodium bisulphite. From 1 to 2 c.c. of the commercial bisulphite solution is sufficient for one litre of pyrogallol solution, according to the strength of the latter, (*e.g.*, from 3 to 50 per cent.). Aqueous solutions of pyrogallol become coloured more rapidly in contact with air than when in closely stoppered vessels, but the reverse is the case with alcoholic solutions, though to a much less degree.—T. F. B.

Patents.

Colour photography; Sensitive plate for ——. A. and L. Lumière, Lyon, France. U.S. Pat. 877,351, Jan. 21, 1908.

See Eng. Pat. 9100 of 1906; this J., 1906, 867.—T. F. B.

Photographic fixing bath. Act.-Ges. f. Anilinfabr. Fr. Pat. 381,682, Nov. 16, 1906.

See Eng. Pat. 25,869 of 1906; this J., 1908, 38.—T. F. B.

Plates, films, papers, etc., for the photographic reproduction of colours; Manufacture of ——. D. Rouilly. Fr. Pat. 382,012, Nov. 26, 1906.

A sensitive emulsion, rich in salts sensitive to the action of light, is spread very thinly on a transparent or opaque reflecting surface: when these plates, etc., have been exposed to coloured light, developed, and fixed, the colours are apparent when viewed by reflected light.
—T. F. B.

Films for photography and other purposes; Manufacture of ——. Soc. Anon. de Cellulose-Coton pour Poudre Blanche de Guerre et Celluloid. Addition dated Aug. 24, 1907, to Fr. Pat. 379,421, June 29, 1907.

Phenol can be used in place of benzoic acid in preparing caseïn films as described in the original patent (this J., 1907, 1255). In addition to the product being of use for photographic purposes, it can serve as a substitute for celluloid; for this, it is melted and formed into sheets or moulded in the same way as celluloid.—T. F. B.

Films with gelatin base for cinematographic and photographic purposes; Manufacture of non-inflammable ——. L. Labbe and V. Pauthonier. Fr. Pat. 381,637, Sept. 7, 1907.

Waxed paper is coated with collodion and a film of gelatin is applied to it. One half of the resulting composite film is washed with water to remove the alcohol and ether from the collodion, when it is fixed to the other part of the film and the whole hardened with formaldehyde. The complete film is then passed through an aqueous solution of albumin and glycerin (which produces a coating only on the washed side of the film), dried, and coated with a sensitive emulsion.—T. F. B.

XXII.—EXPLOSIVES, MATCHES, &c.

Explosion; Circumstances attending an ——, *which occurred in the Press house, at the factory of Messrs. Kynoch Ltd., at Worsboro' Dale, near Barnsley, Yorkshire, on Dec.* 12, 1907. By Major A. Cooper-Key, H.M. Inspector of Explosives.

The explosion, by which two men lost their lives, originated in the press-house (1300 lb. of powder), and was communicated, doubtless by burning *débris*, to the corning-house (1400 lb. of powder), situated about 70 yards to leeward. The explosion occurred just after recommencing work at the end of the dinner interval. According to the usual practice the first operation would be to start the engine and raise the press-table for the preliminary squeeze at 3 cwts., and, having regard to the pace at which the table moved, it was quite impossible that anything approaching the full pressure of 10 cwts. could have been reached at the time of the accident, unless the usual routine had been changed and there was no evidence to show that this was the case. The probabilities were, in fact, largely in favour of the view that not even the full 3 cwts. of preliminary pressure had been attained. In these circumstances it is almost inconceivable that a breakage of any part of the press could take place and thus cause an explosion. Ample precautions were also taken to ensure that no foreign matter was present in the ingredients of the powder. The Inspector considers that the probable cause of the explosion was a spark from the factory chimney situated about 150 yards from the press-house. The wind was blowing directly from the chimney to the press-house. The door of the latter was open and faced directly towards the shaft. The furnace was actually in course of being stoked at the moment the explosion occurred and there was no "spark-catcher" fitted to this particular chimney.

Major Cooper-Key summarises his views as follows:—"Although there is no means of ascertaining definitely the cause of the accident under report, yet, on the assumption that the usual routine of work was being followed, there does not appear to be any explanation presenting any degree of probability other than that offered by the exceptional chain of circumstances connected with the factory chimney shaft on the day in question; although the presence between the press-plates of a small particle of grit or other foreign substance of a nature liable to cause a spark, by fracture or otherwise, when subjected to pressure is always possible."—G. W. McD.

Smokeless powder; Smoke from so-called ——. H. Rebenstorff. Z. ges. Schiess- und Sprengstoffw., 1908, **3**, 45—47.

On exploding a small quantity of guncotton or smokeless powder in a glass flask, a distinct cloud is visible in the flask. The presence of a considerable amount of moisture is indicated by using a gelatin hygroscope. If a piece of moistened filter-paper is held in the flask, and moved about in it, an increase in the cloud effect is observed following the motion of the paper. The author considers that the small amount of smoke observed in firing smokeless powders is due to the oxides of nitrogen produced on explosion facilitating the condensation of moisture on the dust particles in the atmosphere. A reduction in the quantity of acidic compounds in the products of combustion should in the author's opinion, reduce the amount of smoke. A description is given of an apparatus by which the relative amounts of smoke produced on explosion may be observed.—G. W. McD.

Patents.

Explosives; Manufacture of ——. M. A. G. Himalaya, London. Eng. Pat. 3199, Feb. 8, 1907.

See Fr. Pat. 374,932 of 1907; this J., 1907, 840.—T. F. B.

Nitroglycerin; Process for accelerating the separation of —— *in manufacturing the same.* J. F. Lehmann. Fr. Pat. 382,051, Aug. 21, 1907.

See Eng. Pat. 18,597 of 1907; this J., 1907, 1296.—T.F.B.

XXIII.—ANALYTICAL CHEMISTRY.

APPARATUS.

Patents.

Filtering device for laboratory work. J. Hudig, Groninghen, Holland. Eng. Pat. 21,279, Sept. 25, 1907.

The flask, or other vessel containing the liquid to be filtered is held in a frame which is mounted so that it can be rotated on a horizontal shaft. A glass rod is held against the mouth of the flask by a wire clamp, and the funnel and the vessel to receive the filtrate are placed in front of, and below the shaft. An adjustable screw spindle engages with a worm-wheel attached to the flask-frame so that on rotating the spindle, by means of a head-piece, the flask is slowly tilted to any desired extent. When it is desired to agitate the contents of the vessel, a clamp fixing the spindle is loosened and the latter on receiving a backward and forward motion acts as a rack on the worm-wheel, and the flask is shaken. Several frames are fixed on the same horizontal shaft so that several filtrations can be conducted at the same time.
—W. H. C.

Filtering apparatus for laboratories. J. Hudig. Fr. Pat. 382,219, Sept. 25, 1907.

See Eng. Pat. 21,279 of 1907; preceding.—T. F. B.

Calorimeters. C. Féry, Paris. Eng Pat. 23,996, Oct. 30, 1907. Under Int. Conv., Nov. 26, 1906.

See Fr. Pat. 373.230 of 1906; this J., 1907, 718.—T. F. B.

INORGANIC—QUALITATIVE.

Molybdenum; New colour test for ——. W. Bettel. Chem. News, 1908, **97**, 40.

The solution to be tested is evaporated nearly to dryness, cooled, rendered faintly ammoniacal, and a 5 per cent. solution of hydrogen peroxide added. If molybdates be present, an intense reddish-brown colour results, due presumably to the formation of a permolybdate. This colour is discharged by excess of alkali, or large excess of ammonia; partly discharged by dilution, and disappears on standing, with evolution of oxygen. On account of the instability of permolybdates, this method is unsuited to accurate quantitative work.—J. W. G.

INORGANIC—QUANTITATIVE.

Ferro-chromes containing high percentages of carbon; Analysis of ——. A. Caflin and F. Dhuique-Mayer. *See* X.

Iron in copper alloys; Colorimetric method for the determination of small percentages of ——. A. W. Gregory. *See* X.

Tin [in alloys]; Volumetric determination of —— *by means of potassium bichromate.* H. Reynolds. *See* X.

Red lead; Examination of ——. J. F. Sacher. *See* XIIIA.

Antimony sulphide; Analysis of "golden"——. F. Jacobsohn. *See* XIII*C*.

Soils; Determination of the acidity of ——. H. Süchting. *See* XV.

Carbon [*in soils*]; *Determination of ——.* I. Pouget and D. Chouchak. *See* XV.

ORGANIC—QUALITATIVE.

Flour; Detection of bleaching agents in ——. E. J. Watkins. *See* XVIII*A*.

ORGANIC—QUANTITATIVE.

Carbon bisulphide in benzene; Determination of ——. J. Bay. *See* III.

Dyestuffs; Volumetric determination of basic —— by means of acid dyestuffs. L. Pelet and Garuti. *See* IV.

Bleaching [*of cotton*]; *Determination of the degree of ——.* C. G. Schwalbe. *See* V.

Oakwood extract; Analysis of —— according to the new official method. J. Jedlicka. *See* XIV.

Wines; Polarimetric examination of red —— and determination of reducing sugars therein. G. Guérin. *See* XVII.

Butter-fat; Determination of the "caprylic acid value" of ——. R. K. Dons. *See* XVIII*A*.

"*Crude fibre*" [*in cacao, etc.*]; *Determination of —— and separation of cellulose, lignin, and cutin in the product.* J. König. *See* XVIII*A*.

Cineol [*eucalyptol*] *in eucalyptus oils; Determination of ——.* O. Wiegand and M. Lehmann. *See* XX.

XXIV.—SCIENTIFIC & TECHNICAL NOTES.

Charcoal; Decolorising action of ——. L. Rosenthaler. Arch. Pharm., 1907, **245**, 686—689.

This paper is a reply to the criticisms expressed recently by Glassner and Suida (this J., 1907, 1195) upon the work of the author and Türk on the adsorptive properties of charcoals (this J., 1906, 1172). The author shows by the action of animal, plant, and flesh charcoals on solutions of caffeine and dextrose that the adsorption is greater for a more dilute solution. Blood charcoal was shown to be still capable of oxidising guaiaconic acid after adsorbing such dyestuffs as Eosin and Ponceau R.R. After adsorbing indigosulphonic acid, Aniline Black or Chrysoidin, the effect on guaiaconic acid was slight. But when oxygen is passed through an aqueous solution of Aniline Black or indigosulphonic acid containing blood charcoal no decolorisation takes place. Cyanuric acid and melamine give no precipitates with picric, tannic, and indigosulphonic acids, nor with codeine and caffeine. The adsorptive power of melam for picric or indigosulphonic acids was shown to be less than that of animal charcoal. The author concludes that the decolorisation and adsorption phenomena associated with animal charcoal are physical processes, modified by reactions which can take place between constituents of the charcoal, and the adsorbed substances.—F. Shdn.

Silica and alumina; Catalytic power of ——. J. B. Senderens. Compt. rend., 1908, **146**, 125—127.

The catalytic action of silica on alcohols (this J., 1907, 715), depends on the temperature to which the silica has been heated. Precipitated silica, dehydrated by calcination at a moderate temperature, reacts on ethyl alcohol at 280° C., and yields ethylene corresponding to 99·5 per cent. of the total gas evolved; but if calcined at a higher temperature and for a longer time, it acts on the alcohol only at 340°—390° C., and then yields a considerable percentage of hydrogen. Powdered hyaline quartz acts still less readily on alcohol, and yields a larger proportion of hydrogen; and the same quartz, heated for 6 hours at the highest temperature of a muffle furnace, acts on alcohol only at 480° C., and 95·2 per cent. of the gaseous product is hydrogen. Alumina, prepared by heat or by precipitation from ammonium alum or aluminium sulphate, behaves like precipitated silica.
—J. T. D.

Peroxydases; Mineral salts which play the part of ——. J. Wolff. Compt. rend., 1908, **146**, 142—144.

With a dilute solution of an old, oxidised tincture of guaïacum small quantities of ferrous sulphate produce a blue coloration. The colour is very intense with 1 mgrm. of the iron salt per litre, and is still discernible at a dilution of 6 parts per million. No colour is developed in solutions of fresh tincture unless hydrogen peroxide be added, in which case the delicacy of the test is still greater. Minute traces of mineral acids inhibit the reaction. Ferric sulphate will produce the same coloration with fresh tincture of guaïacum, but ceases to give a coloration if its solution has been previously boiled. Small quantities of ferrous, ferric or copper sulphates will oxidise and decolorise dilute solutions of certain dyestuffs, such as methyl orange, methylene blue and fuchsin. Ferrous sulphate does this at the ordinary temperature, ferric sulphate at 50° C., and copper sulphate at 100° C.; manganous sulphate has no appreciable action. The concentration of the salt necessary to produce this result is 1—2 mgrms. of anhydrous ferrous sulphate in 10 c.c. Traces of the same salts, in presence of very small quantities of hydrogen peroxide, will rapidly oxidise and liquefy starch paste at a temperature of 70° C.; copper sulphate is the most active in this respect. The liquefaction takes place most readily when the liquid is nearly neutral to methyl orange.—J. F. B.

Chlorophyll; VI. Crystallised chlorophyll. Richard Willstätter and Max Benz. Annalen, 358, 267—287.

The authors confirm the results of J. Borodin [Bot. Zeit. **40**, 608 (1882)] and N. A. Monteverde [Acta Horti Petropolitani 13, 9, 123 (1893)] and give an improved method for obtaining the crystallised chlorophyll quite pure.

The method consists in extracting the dried leaves of the *Galeopsis* plant with 96 per cent. alcohol in presence of powdered chalk, from which the extract is filtered. Ether is then added to the filtrate and alcohol washings, and just enough water, containing sodium chloride in solution, to separate the alcohol and ether. The ethereal solution being now freed from plant acids is then shaken with talc to separate the colourless slimy substances, present in the form of an emulsion which ultimately prevents crystallisation.

From 1.5 kilo. of *Galeopsis* a yield of 3 grms. of crystallised chlorophyll is obtained.

The crystals possess no melting point, since on heating they decompose with intumescence.

They have a faintly alkaline reaction, and are easily soluble in alcohol, acetone, and methyl alcohol but with some difficulty in ether. The analysis of this crystalline chlorophyll gave results corresponding to the formula: $C_{38}H_{42}O_7N_4Mg$.

Six absorption-bands were observed in the spectrum of the alcoholic solution.—W. S.

New Books.

Chemiker-Kalender, 1908. Ein Hilfsbuch für Chemiker, Physiker, Mineralogen, Industrielle, Pharmazeuten, Hüttenmänner u.s.w. Von Dr. Rudolf Biedermann. 29ster Jahrgang. In zwei Theilen. Verlag von Julius Springer, Monbijouplatz 3, Berlin. 1908. Price 4 Mark.

Part I.—Arranged as a pocket-book, strongly bound in water-proof cloth. It contains almanack for 1908, with also a table of the more frequently used atomic weights and their multiples. The general text refers principally to matters of purely chemical interest. I. Atomic and molecular weights. II. Different properties of chemical substances. III. Gas and vapour densities. Specific gravities. (1) Alkalis. (2) Acids. (3) Salts. (4) Alcohols, &c. IV. Solubility. V. Analysis. VI. Volumetric analysis. VII. Electrochemical analysis. VIII. Gas analysis. IX. Spectrum analysis. The matter in these various groups is chiefly composed of tables. A notebook calendar with blank pages is arranged for the different days of the year. The subject matter, exclusive of the calendar and the blank pages for Notes, fills 380 pages.

Part II.—This supplement volume is of similar size to the pocket-book, but is unbound, and is more directly concerned with Chemical Technology. It contains tables relating to:—I. Physics and physical chemistry. II. Mineralogy. III. Technical-chemical analysis and investigation. Besides the tabulated matter, however, there are concise descriptive paragraphs of introductory character, with descriptions of analytical methods. The subdivisions are the following:—(1) Water. (2) Assaying. (3) Fuels. (4) Sulphuric acid. (5) Alkali. (6) Bleaching powder. (7) Nitre and explosives. (8) Ceramics. (9) Glass. (10) Mortar and cement. (11) Illuminants. (12) Starch and sugar. (13) Fermentation industries. (14) Fats and oils. (15) Tanning agents. (16) Textile fibres and paper. (17) Photography. (18) Dyestuffs, colours and pigments. (19) Physiological chemical analysis. Appendix with various recipes, etc. The subject matter fills 556 pages.

Laboratoriumsbuch für den Metallhüttenchemiker. Von Dipl.-Ing. H. Nissenson und Dr. W. Pohl. Verlag von Wilhelm Knapp, Halle a. S. 1907. Price 3 Mark.

8vo volume, containing 86 pages of subject matter, and a table of contents. The following metals are considered and described, each under approximately the following heads:—(1) Chemical behaviour, and qualitative methods of distinguishing. (2) Methods of determination. (3) Separation from metals of similar group. (4) More commonly occurring alloys, slags, minerals, etc., and methods of determination. I. Aluminium. II. Antimony. III. Arsenic. IV. Lead. V. Chromium. VI. Gold. VII. Cadmium. VIII. Copper. IX. Manganese. X. Molybdenum. XI. Nickel. XII. Platinum. XIII. Mercury. XIV. Silver. XV. Thorium. XVI. Uranium. XVII. Tungsten. XVIII. Zinc. XIX. Tin.

Detection of the Common Food Adulterants. By Edwin M. Bruce, Indiana State Normal School. Archibald Constable & Co., Ltd., 10, Orange Street, Leicester Square, London, W.C. 1907. Price 5s. net.

8vo volume, containing 69 pages of subject matter, and indexes of authors, tests, and subjects. The methods described refer to the following articles of food:—I. Dairy products. II. Meats and eggs. III. Cereal products. IV. Leavening materials. V. Canned and bottled vegetables. VI. Fruits and fruit products. VII. Flavouring extracts. VIII. Saccharine products. IX. Spices. X. Vinegar. XI. Fats and oils. XII. Beverages.

Dairy Laboratory Guide. By Charles W. Melick, Professor of Dairy Husbandry, Maryland Agric. Expt. Station. Archibald Constable & Co., Ltd., 10, Orange Street, Leicester Square, London, W.C. 1907. Price 5s. net.

8vo volume, containing 129 pages of subject matter, with 52 illustrations and a table of contents. The subjects and methods treated of are arranged as follows:—I. Laboratory apparatus for use. II. Cream separators. III. Separation of cream. IV. Use of Babcock tester. V. Use of lactometer. VI. Testing acidity of milk. VII. Pasteurisation. VIII. Starter making. IX. Curd test. X. Cream ripening. XI. Cream grading. XII. Churning. XIII. Determination of water content of butter. XIV. Determination of casein, ash, and salt, in butter. XV. Cheese making. XVI. Gouda cheese. XVII. Cottage cheese. XVIII. Ice cream. XIX. Dairy bacteriology. XX. Milk paint. XXI. Tests for preservatives. XXII. Test for oleomargarine. XXIII. Repairing creamery machinery. XXIV. Modification of milk for infants and invalids. XXV. Standardization of milk. XXVI. Condensing milk, milk paste, dried milk, milk sugar. XXVII. Junket, papanized cheese paste. XXVIII. Atimidcaseose, milk shake, buttermilk high ball, buttermilk pop, koumiss, buttermilk, moose, dried milk cocktail. XXIX. Milk preparations. XXX. Solid milk; soap, etc. XXXI. Disinfectants. XXXII. Mechanical refrigeration, etc.

Graphite, its properties, occurrence, refining, and uses. Fritz Cirkel. Dept. of Mines, Ottawa.

8vo volume of 289 pages, followed by an index. After an introduction, the matter is arranged as follows: 1. History and properties of graphite. 2. Occurrence of graphite. 3. Origin of graphite. 4. Composition of graphite ores. 5. Qualities of graphite for commercial purposes. 6. Determination of the value of graphite. 7. Statistics of production, exports, imports, and prices. 8. Dressing and refining of graphite. 9. Uses of graphite. The book contains 21 plates and diagrams.

Colonial Import Duties, 1907. Return relating to the Rates of Import Duties levied upon the Principal and other Articles Imported into the British Colonies, Possessions, and Protectorates. [Cd. 3708.] Wyman & Sons, Fetter Lane, London, E.C. Price 2s. 9d.

This Return shows the duties in force, so far as notified to the Board of Trade, at the date of preparation of the Return, viz.: December, 1907.

Foreign Import Duties, 1907. [Cd. 3859.] Wyman & Sons, Fetter Lane, London, E.C. Price 3s.

This return contains detailed statements of the rates of Customs duty leviable on the principal articles of British trade on importation from the United Kingdom into European countries, Egypt, the United States, China, Japan, Persia and Mexico. The present issue embodies alterations which took place in the Tariffs of Belgium, France, Spain, Italy, Switzerland, Roumania, Turkey and Greece during 1907. Particulars as to the duties levied in Servia are included for the first time, and the return now contains information as to all European Tariffs, so far as the principal articles of trade are concerned, except those of Finland and Montenegro.

Patent List.

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

Applications.

1975. Ralph and Cranford. Treatment and mixing of solids, liquids, and gases. Jan. 29.

2029. Tavernier. Separation of gases of different densities. Jan. 29.

2165. Jäger. Filtering and apparatus therefor. [Addition to No. 20,677 of 1907.]* Jan. 30.

2361. Bennett. Distilling apparatus. Feb. 3.

2479. Nichols. *See under* X.

2528. Von Radlowski. Burning process in rotary furnaces.* Feb. 4.

2613. Jacob and others. Introducing gases into vessels filled with liquid. [Ger. Appl., Oct. 4, 1907.]* Feb. 5.

2690. Ogle. Apparatus for removing liquid from solid material. Feb. 6.

2702. Fairbrother (Moller and Pfeifer). Drying apparatus.* Feb. 6.

2815. Ogle (Cockburn). Apparatus for removing liquids from solids. Feb. 7.

3010. Haddan (Warren). Rotary kilns. Feb. 10.

3290. Tiemann. Filters. [Ger. Appl., March 27, 1907.]* Feb. 13.

3394. Boult (Schmatolla). Reverberatory and like furnaces. Feb. 14.

Complete Specifications Accepted.

2148 (1907). Mecredy and Hawes. Obtaining dry products from liquids and semi-liquids. Feb. 5.

7073 (1907). Hubbard. Filtering gases. Feb. 5.

10,447 (1907). Berkovits and Kridlo. Filter presses. Feb. 5.

13.058 (1907). Lübecker Apparatebau. Vaporising liquids. Feb. 5.

13.569 (1907). Fitzpatrick (Leslie). Automatic filtering machine. Feb. 5.

14.981 (1907). Candy. Filtering apparatus. Feb. 12.

22,095 (1907). Eschelmann, Harmuth, and Ges. der Tentelew'schen Chem. Fabr. Apparatus for absorbing gases and vapours, especially sulphuric anhydride vapour. Feb. 19.

26,984 (1907). Stock. Vacuum-jacketed vessels. Feb. 12.

II.—FUEL, GAS, AND LIGHT.

Applications.

1852. Lake (Akt.-Ges. f. Selasbeleuchtung). Manufacture of mantles for incandescent lamps.* Jan. 27.

1853. Watkins. Composition for fuel. Jan. 27.

1909. Lymn. Gas producers. Jan. 28.

1917. Smith and Harmes. Incombustible incandescent fuel. Jan. 28.

2145. Koppers. Gas furnaces or coke ovens. [Addition to No. 28,811 of 1904.]* Jan. 30.

2240. British Cerofirm Co. (Cerofirm Ges.). Production of incandescent mantles. Jan. 31.

2496. Hellstern and Vincent. Manufacture of gas. Feb. 4.

2527. Epstein. Generating gases for fuel, etc. Feb. 4.

2550. Richter. Regenerative coking ovens.* Feb. 5.

2572. Weickert. Mantles for incandescent gas lighting.* Feb. 5.

2609. Kelly and Lowry-Corry. Manufacture of fuel.* Feb. 5.

2655. Vivian, Davies, and Grote. Manufacture of artificial fuel. Feb. 6.

2700. Wynne. Improvement of liquid fuels. Feb. 6.

2720. Cie. du Gaz de Lyon. Treatment of gaseous fuel. [Fr. Appl., March 1, 1907.]* Feb. 6.

2735. Wilson. Production of gaseous power fluids. Feb. 7.

2741. Craig. Manufacture of air-gas. Feb. 7.

2874. Hill and Westwood. Apparatus for making gas. Feb. 8.

3189. Hadlow. Treatment of coal for the production of artificial fuel. Feb. 13.

3462. Morton. Producer gas plants.* Feb. 15.

Complete Specifications Accepted.

24,232 (1906). British Thomson-Houston Co. (Allgem. Elektricitäts Ges.). Manufacture of incandescing bodies for electric lamps. Feb. 5.

2226 (1907). Verey and Downes. Manufacture of peat fuel. Feb. 5.

2676 (1907). Felten und Guilleaume Lahmeyer A.-G. Apparatus for making water gas. Feb. 5.

3098 (1907). Wilton. Coke ovens. Feb. 12.

3689 (1907). Tully. Manufacture of gas. Feb. 19.

3911 (1907). Wilton. Manufacture of producer gas or suction gas. Feb. 19.

4364 (1907). British Thomson-Houston Co. (General Electric Co.). Incandescing bodies for electric lamps. Feb. 5.

7454 (1907). Hughes. Gas producers. Feb. 12.

12,141 (1907). Ling. Preparation for consuming smoke and economising fuel. Feb. 5.

13,668 (1907). Wahlen and Caro. Utilising waste coal and coke. Feb. 19.

13,669 (1907). Caro. Utilising waste coal. Feb. 19.

21,808 (1907). Sheldon. Manufacture of gas and coke. Feb. 12.

22,746 (1907). Siemens und Halske A.-G. Manufacture of incandescence filaments for electric lamps. Feb. 12.

26,032 (1907). Vass. Gas production. Feb. 12.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

Application.

2648. Baker. Enriching hydrocarbons. Feb. 6.

Complete Specifications Accepted.

1970 (1907). Parker. Treatment of pitch. Feb. 5.

3063 (1907). Marriott. Substitute for natural bitumen. Feb. 12.

6878 (1907). Ganz and Faller. Distillation of illuminating petroleum. Feb. 19.

25,152 (1907). Henderson. Apparatus for treating paraffin wax. Feb. 19.

IV.—COLOURING MATTERS AND DYESTUFFS.

Applications.

1822. Newton (Bayer und Co.). Manufacture of anthracene derivatives. Jan. 27.

1835. Bloxam (Act.-Ges. f. Anilinfabr.). Manufacture of phenoxazine derivatives. Jan. 27.

1840. Johnson (Badische Anilin und Soda Fabrik). Manufacture of colouring matters of the anthracene series. Jan. 27.

2306. Durand, Huguenin, et Cie. Manufacture of a gallocyanine dyestuff. [Addition to No. 1334 of 1908. Ger. Appl., Feb. 14, 1907.]* Feb. 1.

2683. Bloxam (Act.-Ges. f. Anilinfabr.). Manufacture of yellow azo dyestuffs. Feb. 6.

2721. Ransford (Cassella und Co.). Manufacture of polyazo dyestuffs. Feb. 6.

2865. Bloxam (Act.-Ges. f. Anilinfabr.). Manufacture of Bordeaux-red sulphurised dyestuffs. Feb. 8.

2957. Bloxam (Act.-Ges. f. Anilinfabr.). Manufacture of a violet sulphurised dyestuff. Feb. 10.

2958. Bloxam (Act.-Ges. f. Anilinfabr.). Manufacture of a red disazo dyestuff. Feb. 10.

3155. Johnson (Badische Anilin und Soda Fabrik). Manufacture of dithiosalicylic acid compounds. Feb. 12.

3156. Johnson (Badische Anilin und Soda Fabrik). Manufacture of colouring matters of the anthracene series. [Addition to No. 10,770 of 1907.] Feb. 12.

3373. Ellis (Chem. Fabr. vorm. Sandoz). Manufacture of yellow dyes suitable for wool. Feb. 14.

3502. Lake (Chem. Fabr. Griesheim-Elektron). Manufacture of *o*-oxymonoazo dyestuffs.* Feb. 15.

Complete Specifications Accepted.

2568 (1907). Read Holliday and Sons, and others. *See under* V.

2767 (1907). Bloxam (Act.-Ges. f. Anilinfabr.). Manufacture of colouring matters of the safranine series. Feb. 12.

3167 (1907). Read Holliday and Sons, Turner, and Dean. Dyestuffs for direct dyeing on cotton, etc. Feb. 5.

13,176 (1907). Imbert. Production of aromatic glycin derivatives. Feb. 19.

13,406 (1907). Bloxam (Act.-Ges. f. Anilinfabr.). Manufacture of dyestuffs of the safranine series. Feb. 19.

18,816 (1907). Kur. *See under* V.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

Applications.

1937. Erler. Multicolour printing machine for textiles, etc. Jan. 28.

1989. Crabtree and Howard. Colour dyeing or printing machine for cops, cheeses, bobbins, etc. Jan. 29.

1997. Ashworth. Sizing textile and other fabrics.* Jan. 29.

2178. Castle. Material for use in textile manufactures. Jan. 31.

2642. Miller. Protecting parts of textiles from the action of dyes or bleaching agents Feb. 6.

2814. Morford. Application of soluble cellulose derivatives to fabrics. Feb. 7.

2876. Venter. Purifying soda lye after the mercerisation process. [Ger. Appl., Oct. 14, 1907.]* Feb. 8.

Complete Specifications Accepted.

2568 (1907). Read Holliday and Sons, Turner, and Dean. Preparation and use of direct cotton dyestuffs for dyeing. Feb. 5.

2998 (1907). Lilienfeld. Production of silk-like effects on fabrics and paper. Feb. 12.

3114 (1907). Corron. Charging dye vats. Feb. 12.

3184 (1907). Spivey. Treatment of textile fibres or materials by electrolysis. Feb. 19.

3209 (1907). Howorth (Spiegler und Soehne). Dyeing and bleaching rolled up spun yarns in the pack system. Feb. 5.

3609 (1907). Newton (Bayer und Co.). Production of colour effects on mixed cotton and wool goods with sulphur dyestuffs. Feb. 5.

4251 (1907). Silverwood and Taylor. Mercerising and bleaching cotton yarns and fabrics. Feb. 12.

4528 (1907). Bousfield (Heberlein und Co.). Mercerising vegetable fibres or textile materials. Feb. 19.

7224 (1907). Ashwell, and Ashwell and Co. Machinery for dyeing hanks. Feb. 19.

14,665 (1907). Lake (Soc. Gén. de la Soie Artif. Linkmeyer). Apparatus for making artificial silk threads. Feb. 19.

18,816 (1907). Kur. Preparation of dyestuff solutions in paste form for printing or dyeing. Feb. 19.

22,347 (1907). Hanitzsch. *See under* XIX.

23,795 (1907). Schmid and Schmid. Degumming silk. Feb. 12.

VI.—COLOURING WOOD, PAPER, LEATHER, &c.

Complete Specification Accepted.

12,256 (1907). Reinhold and Palm. Composition for dyeing leather. Feb. 19.

VII.—ACIDS, ALKALIS, AND SALTS.

Applications.

1841. Johnson (Badische Anilin und Soda Fabrik). Manufacture of cyanides and cyanamides. Jan. 27.

1842. Johnson (Badische Anilin und Soda Fabrik). Production of titanium nitrogen compounds. Jan. 27.

2382. Kaesmacher. Separation and concentration of acids.* Feb. 3.

2399. Koppers. Producing ammonium sulphate from gases. Feb. 3.

2414. Johnson (Badische Anilin und Soda Fabrik). Manufacture of compounds containing nitrogen. Feb. 3.

2555. Anselm and Ashworth. Stable reducing agent. Feb. 5.

2719. Feld. Obtaining sulphur from sulphur dioxide and hydrogen sulphide. [Ger. Appl., March 6, 1907.]* Feb. 6.

2876. Venter. *See under* V.

2974. Elworthy. Apparatus for generating ozone. [Ger. Appl., July 31, 1907.]* Feb. 10.

3039. Hargreaves. Manufacture of sulphate of soda. Feb. 11.

3428. Dyes (Hempel). Manufacture of formic acid. Feb. 15.

3429. Dyes (Hempel). Manufacture of oxalates. Feb. 15.

Complete Specifications Accepted.

25,442 (1906). New Salt Synd., Ltd., and Tee. Purification of rock salt. Feb. 19.

1844 (1907). Benker. Manufacture of sulphuric acid and sodium sulphate from sodium bisulphate. Feb. 5.

2133 (1907). Johnson (Badische Anilin und Soda Fabrik). Manufacture of barium cyanide and barium oxide. Feb. 5.

3494 (1907). Gans. Alumino-silicates or artificial zeolites.

8164 (1907). Hellsing. Recovering sulphur from gases containing sulphuretted hydrogen. Feb. 5.

20,652 (1907). Hartenstein. Manufacture of calcium carbide. Feb. 12.

22,035 (1907). Ges. der Tentelew'schen Chem. Fabr., and others. *See under* I.

VIII.—GLASS, POTTERY, AND ENAMELS.

Applications.

1935. Monin. Substitute for kaolin. Jan. 28.

2231. Vincart-Mouzin. Tunnel kiln for baking potter.* Jan. 31.

2396. Handcock and Dykes. Drying china clay. Feb. 3.

3485. Keppeler and Spangenberg. Treatment of clay, kaolin, or ceramic masses. Feb. 15.

Complete Specifications Accepted.

8268 (1907). Koenig. Glass furnaces. Feb. 19.

13,533 (1907). Twyford and Moore. Gas fired pottery kilns and ovens. Feb. 5.

24,979 (1907). Imray (Window Glass Machine Co.). Apparatus for drawing glass. Feb. 19.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Applications.

1854. Boucherie. Injection of woods. [Fr. Appl., Jan. 28. 1907.]* Jan. 27.

1922. Baekeland. Impregnation of wood and other fibrous or cellular materials.* Jan. 28.

2405. Bamber. Treatment of blast furnace slag. Feb. 3.

3011. Haddan (Warren). Manufacture of cement. Feb. 10.

3255. Hadlington and Webster. Regenerative gas-fired kilns for burning bricks, tiles, &c. Feb. 13.

3400. Harnett. Manufacture of tiles. Feb. 14.

Complete Specifications Accepted.

2605 (1907). Charles. Manufacture of artificial stone and building materials. Feb. 5.

2605A (1907). Charles. Manufacture of artificial stone. Feb. 5.

3372 (1907). Wade and Vaughn. Manufacture of artificial lumber. Feb. 19.

3916 (1907). Woodard and Thomlinson. Fireproof, sound-resisting building composition. Feb. 19.

10,243 (1907). Schleuning. Artificial stone-like substance. Feb. 12.

13,811 (1907). Assoc. Portland Cement Manufrs., Ltd., and Butchard. Manufacture of concrete. Feb. 19.

X.—METALLURGY.

Applications.

1860. Dreaper. Treatment of metals or alloys. Jan. 28.

1952. Howard and Hadley. Treating gases and fumes from spelter furnaces, etc. Jan. 28.

2025. Von Schmidt. Detinning and dezincing process. Jan. 29.

2160. Simpson and Oviatt. Reduction of metallic oxides. Jan. 30.
2243. Cowper-Coles. Treatment of copper precipitate. Jan. 31.
2322. Brandenburg. Removing tin from tin-plate waste, &c.* Feb. 1.
2479. Nichols. Separating liquid and solid components of slimes, ore pulp, &c. Feb. 4.
2595. Hodgkinson. Production of metals, alloys, phosphor metals, and phosphor alloys. Feb. 5.
2678. Herrenschmidt. Separating metalloids from their compounds. [Fr. Appl., Feb. 7, 1907.]* Feb. 6.
2686. Bowley. Treating iron or steel to prevent oxidation. Feb. 6.
2908. Mason. Smelting iron sands and other ores. Feb. 10.
2959. Bowley. Treatment of iron and steel articles to prevent oxidation or rust. Feb. 10.
2971. Carrick. Treatment of pyritic copper and nickel ores.* Feb. 10.
3173. Hiorth. Treatment of steel. [Appl. in Norway, Feb. 16, 1907.]* Feb. 12.
3224. Gutensohn. Treatment of complex lead zinc sulphide ores. Feb. 13.
3480. Westman. Reduction of arsenical ores.* Feb. 15.

Complete Specifications Accepted.

25,574 (1906). Holdsworth. Treatment of poor sulphide ores. Feb. 19.
3557 (1907). Aston. Recovering gold, silver, and like dust from washings or liquids. Feb. 19.
3598 (1907). Senior and Wincott. Converting or cementation furnaces. Feb. 5.
10,525 (1907). Harbord. Drying air blast for metallurgical purposes. Feb. 12.
19,696 (1907). Cowper-Coles. Annealing and galvanising or tinning metal plates. Feb. 5.
22,522 (1907). Brayshaw. Furnaces for hardening high-speed steel. Feb. 5.
23,060 (1907). De Laval. Extraction of iron and apparatus therefor. Feb. 5.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

Applications.

1877. Govan. Electrolysis of liquids. Jan. 28.
2728. Van Raden and Co., Robinson, and Metz. Electrodes for secondary batteries. [Addition to No. 21,719 of 1906.] Feb. 6.
3160. Cowper-Coles. Cathodes for use in electrodeposition of metals. Feb. 12.
3504. Wenger. Precipitation of electrolytic copper in form of sheets or cylinders by iron or other metals. [Fr. Appl., Sept. 9, 1907.]* Feb. 15.

Complete Specifications Accepted.

3000 and 3000A (1907). Boult (Elektricitäts Akt.-Ges. vorm. Schuckert und Co.). Electrolytic apparatus. Feb. 12.
3914 (1907). Reynolds. Electric furnaces. Feb. 19.
3982 (1907). Cowper-Coles. Vessels for containing fused salts during electrolysis. Feb. 19.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

Applications.

1907. Corner. Manufacture of detergent scouring soaps. Jan. 28.
1941. Nordström. Apparatus for purifying waste oils. Jan. 28.
2501. Schou. Manufacture of soap. Feb. 4.

Complete Specifications Accepted.

15,900 (1907). Verein. Chem. Werke. Manufacture of bleached soap. Feb. 5.
17,976 (1907). Pirsch. Manufacture of emulsions. Feb. 5.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(A.)—Pigments, Paints.

Application.

2644. Knowles and Kidner. Distempers and water paints.* Feb. 6.

(B.)—Resins, Varnishes.

Application.

2909. Nairn. Manufacture of linoleum. Feb. 10.

(C.)—India-Rubber.

Applications.

2155. Campbell and Douglas. Substitute for india-rubber or leather. Jan. 30.
2787. Norzagaray. Treatment of rubber. Feb. 7.

XIV.—TANNING, LEATHER, GLUE, SIZE, &c.

Application.

2155. Campbell and Douglas. *See under* XIIIC.

Complete Specifications Accepted.

11,134 (1907). Chain. Machine for treating hides, skins, and leather. Feb. 12.
12,256 (1907). Reinhold and Palm. *See under* VI.
18,769 (1907). Smith, and Buffalo Leather Co. Apparatus for treating skins, &c. Feb. 5.

XV.—MANURES, &c.

Complete Specification Accepted.

2796 (1907). Dickson and Alder. Manufacture of superphosphates and other fertilisers. Feb. 5.

XVI.—SUGAR, STARCH, GUM, &c.

Applications.

3081. Heinemann. Converting carbohydrates into hydrocarbons. Feb. 11.
3467. Tiemann. Apparatus for producing uniform circulation of the crystallised material or massecuite in boiling pans, vacuum apparatus, &c. [Ger. Appl., Aug. 16, 1907.]* Feb. 15.

Complete Specifications Accepted.

26,871 (1906). Newton-Clare. Apparatus for the manufacture of sugar. Feb. 5.
10,196 (1907). Macfarlane. Apparatus for treating sugar in the centrifugal drying machine. Feb. 19.
11,799 (1907). Duryea. Manufacture of maltose. Feb. 5.
11,800 (1907). Duryea. Manufacture of glucose. Feb. 5.
11,802 (1907). Duryea. Refining syrups. Feb. 5.

XVII.—BREWING, WINES, SPIRITS, &c.

Applications.

1884. Breker. Brewing processes. [Ger. Appl., Jan. 29, 1907.]* Jan. 28.
3166. Humphrey. Desiccating yeast. Feb. 12.

Complete Specifications Accepted.

3421 (1907). Schmied. Manufacture of brewers' pitch. Feb. 5.
12,544 (1907). Boult (Heuser and Brain). Preparation of grains for malting. Feb. 5.

XVIII.—FOODS; SANITATION, WATER PURIFICATION; AND DISINFECTANTS.

(A.)—Foods.

Application.

2035. Wimmer. Treatment of coffee. [Fr. Appl., Jan. 29, 1907.]* Jan. 29.

(*B.*)—Sanitation; Water Purification.

Applications.

2077. Reisert. Clarifying water.* Jan. 29.

3124. Ashton. Apparatus for drying sewage, sludge, &c. Feb. 12.

3357. Vogelsang. Purification and filtration of water and foul liquids.* Feb. 14.

Complete Specifications Accepted.

6220 (1907). Wilson. Purification of water. Feb. 12.

13,522 (1907). Harris. Purifying liquids. Feb. 5.

(*C.*)—Disinfectants.

Application.

2427. Evans-Jackson (Perolin Fabrik P. Brick). Preparation of a disinfectant from formaldehyde and essential oils. Feb. 3.

Complete Specification Accepted.

10,128 (1907). Gasparini. Disinfecting process and apparatus. Feb. 19.

XIX.—PAPER, PASTEBOARD, &c.

Applications.

2026A and B (1907). Wetter (Knoll und Co.). Manufacture of cellulose esters from cellulose or transformation products resembling cellulose. [Ger. Appl., Jan. 26, 1907.]* Feb. 12.

2767. Owens. Bleaching and separating the fibres of wood pulp. Feb. 7.

2794. Crumière. Eliminating copper from coagulated cellulose. [Fr. Appl., March 16, 1907.]* Feb. 7.

2814. Morford. *See under* V.

3374. Marino. Process for obtaining soluble cellulose. Feb. 14.

Complete Specifications Accepted.

2998 (1907). Lilienfeld. *See under* V.

22,347 (1907). Hanitzsch. Apparatus for spraying fluid on paper, textiles, &c. Feb. 5.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

Applications.

1921. Baekeland. Insoluble condensation products of phenols and formaldehyde.* Jan. 28.

1936. Leemans. Preparation of acetates of borneol and isoborneol. [Belg. Appl., Feb. 11, 1907.]* Jan. 28.

2023. Wellcome and Barger. Manufacture of cyclic carbonates of halogen derivatives of ethyl and propyl 3.4-dihydroxybenzene. Jan. 29.

2152. Trivelli. Obtaining radio-active bodies from uranium or thorium or their compounds.* Jan. 30.

2684. Bloxam (Act.-Ges. f. Anilinfabr.). Manufacture of pyrogallol. Feb. 6.

3081. Heinemann. *See under* XVI.

Complete Specifications Accepted.

2520 (1907). Bedford and Williams. Reduction of organic substances. Feb. 5.

13,411 (1907). Johnson (Chem. Fabr. Griesheim-Elektron). Manufacture of acetylene tetrachloride. Feb. 19.

22,129 (1907). Chem. Fabr. von Heyden. Manufacture of isobornyl esters. Feb. 12.

25,817 (1907). Bachmann. Production of a dioxynaphthylmethane preparation soluble in water. Feb. 12.

27,117 (1907). Meister, Lucius, und Brüning. Manufacture of aromatic ethanolamines. Feb. 5.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Application.

3415. Morgan. Photographic printing papers. Feb. 15.

Complete Specifications Accepted.

2155 (1907). Cooper. Photographic printing-out papers. Feb. 5.

13,736 (1907). De Ruiter. Photographic emulsions and printing paper. Feb. 5.

XXII.—EXPLOSIVES, MATCHES, &c.

Applications.

1953. Williams. Matches. Jan. 28.

2232. Nathan and Robertson. Explosives.* Jan. 31.

2509. Claessen. Manufacture of weather-proof blasting explosives.* Feb. 4.

2704. Buckpitt and Taylor. Explosives. Feb. 6.

3221. Gartenmeister. Making readily inflammable phosphorus compounds and kindling or priming compositions.* Feb. 13.

Complete Specifications Accepted.

4439 (1907). Himalaya. Manufacture of explosives. Feb. 19.

7837 (1907). Ceipek. Manufacture of a safety explosive. Feb. 12.

8537 (1907). Hann and Greaves. Rendering explosives safer when used in coal mines. Feb. 12.

16,492 (1907). Wadsworth. Treatment of gelatinised nitrocellulose explosives. Feb. 12.

20,931 (1907). Himalaya. Manufacture of explosives. Feb. 19.

26,261 (1907). Winand. Manufacture of explosives. Feb. 12.

XXIII.—GENERAL ANALYTICAL CHEMISTRY.

Applications.

2314. Philipp. Determining the calorific value of gases. Feb. 1.

2914. Arndt. Air pyrometer. [Ger. Appl., Feb. 9, 1907.]* Feb. 10.

Complete Specification Accepted.

22,995 (1907). Szczepanik. Colorimeters. Feb. 12.

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Official Notice.

ANNUAL GENERAL MEETING.

The Annual General Meeting will be held in Newcastle-on-Tyne on Wednesday, July 22nd. Full particulars will appear later.

Canadian Section.

At a meeting of the Section held at Toronto, on January 16th, a paper was read by Mr. A. McGill, of Ottawa, on the subject of Food Standards.

London Section.

Meeting held at Burlington House, on Monday, January 6th, 1908.

DR. J. LEWKOWITSCH IN THE CHAIR.

THE KEEPING POWER OF FEHLING'S SOLUTION, AND THE VOLUMETRIC PROCESS OF DETERMINING REDUCING SUGARS WITH IT.

BY FRANCIS WATTS, C.M.G., D.SC., F.I.C., AND H. A. TEMPANY, B.SC., F.I.C.

Read by the Hon. Secretary of the Section.

The modification of Fehling's solution employed in this laboratory is that of Violette, which differs from most other modifications in containing a larger proportion of alkali. This we have found the most advantageous for general use, and it is that employed in the laboratory of the Bureau of Chemistry of the United States Department of Agriculture. (See Wiley, "Principles and Practice of Agricultural Analysis," Vol. 3, p. 129, 1897 ed.) This, like other modifications of Fehling's solution, is generally kept as two separate fluids, *i.e.*, the copper sulphate in one solution and the Rochelle salt and sodium hydroxide in the other, equal portions of the two fluids being mixed as required.

From observations extending over a considerable number of years, we have found that if Violette's solution is kept in the dark, and especially if air is not allowed to have access to the surface of the liquid, it will keep, ready mixed, without serious deterioration for long periods of time, even under the conditions of a tropical laboratory. This is shown by the following results. A large quantity (about fourteen litres) of Violette's solution was prepared in February, 1905, for use during the coming sugar campaign. This was standardised against invert sugar, and it was found that 10 c.c. of the solution was completely reduced by 0·0453 grm. of invert sugar. This solution, in accordance with our practice, was kept in the dark and withdrawn for use as wanted. In March, 1906, there was still a quantity (about 3½ litres) unused, and accordingly this was re-standardised against invert sugar: two determinations were made, one of the contents of an unopened Winchester quart, and the other of the entire quantity of solution after bulking. It was found that 10 c.c. of the solution was, in both cases, reduced by 0·0446 grm. of invert sugar. This indicates so small a falling off in the invert sugar equivalent of the solution in thirteen months as to be negligible in practice, where the solution is re-standardised from time to time. In May, 1906, a quantity of the solution was prepared, and its reducing sugar equivalent determined by titration against a standard solution of invert sugar. Three separate portions of this solution were put up, in duplicate, in the following way:—1. Bottle full of solution. 2. Bottle half full of solution. 3. Bottle half full of solution, the surface of the solution being covered with kerosene. One set of these bottles was kept on the laboratory shelves exposed to the action of light, the other set was rigorously shielded from exposure to it, the bottles being covered with brown paper and kept in one of the laboratory cupboards. In July, 1907, *i.e.* after an interval of fourteen months, these bottles were reopened and the invert sugar equivalent of the solution re-determined, with the following results:—

Original invert sugar equivalent of 10 *c.c. of the solution*= 0·0437 *grm.*

	After 14 months' keeping in daylight 10 c.c. = grm. of invert.	After 14 months' keeping in the dark 10 c.c. = grm. of invert.
Bottle 1........	0·0397	0·0442
2........	0·0387	0·0428
3........	0·0412	0·0442

These clearly show that in fourteen months the solution kept in the dark has in all cases undergone little or no change; on the other hand, the same solution kept exposed to the action of light for the same length of time has undergone an appreciable amount of decomposition. Keeping the surface of the liquid protected from the free access of air also appears to have an appreciable effect in retarding decomposition. The influence of air and light in the case of the samples exposed to it was further shown by the amount of precipitate thrown down from the solution, which was quite appreciably in the case of the samples in the light, but almost nil in the case of those kept in the dark. The precipitate appeared to consist partly of cuprous oxide and partly of material derived from the action of the alkali on the glass of the containing bottle. The action of Fehling's solution on glass has already been pointed out by Jovitschitch (Zeits. Deutsch. Rüben Zucker Ind., 1897, 868—869; this J., 1897, 1046).

The above results demonstrate that Violette's modification of Fehling's solution may be kept ready mixed without fear of deterioration if light and air are not allowed to have access to it. It may be mentioned that H. Pellet, in a paper presented to the International Commission for Uniform Methods of Sugar Analysis, at its Session, August, 1906, briefly noted the fact that Violette's modification of Fehling's solution will keep, ready mixed, for some time.

At the present time the volumetric process of estimating reducing sugars by means of Fehling's solution is very largely condemned. On the continent of Europe its use has been generally superseded, in accurate analytical work, by the gravimetric method; but in sugar-house control work, &c., it still holds undisputed sway by reason of its greater rapidity and ease of determination, combined with the fact that extreme accuracy and refinements of method are unnecessary in work of this description. The chief arguments that have been brought to bear against the volumetric process are, briefly, as follows:—1. The uncertainty of the end point of the reaction. 2. The continual alteration of the bulk of the solution during the performance of the test. 3. The uncertainty of the correction to be applied for the reducing action of any sucrose that may be present in solution. Various methods for determining the end point of the reaction have been used, one that has found wide application being the filtering tube of Wiley and Knorr (Wiley's "Principles and Practice of Agricultural Analysis," Vol. 3, p. 130, 1897).

In this laboratory, we used for several years small plaster of Paris slabs, half an inch square and one eighth inch thick, as filters, with very good results. The determination was proceeded with in the usual manner until the blue colour was nearly discharged. A drop of the boiling solution was transferred to one of these slabs, a thin film of plaster was then removed from the top of the slab by means of a penknife, carrying the cuprous oxide that had been in suspension with it, the whole of this having been deposited on the surface of the slab. A drop of a solution of potassium ferrocyanide acidified with acetic acid was placed on the white plaster at the place where the cuprous oxide had been removed, the formation of a brown stain indicating the presence of unreduced copper in solution. This method was found easy to manipulate and very sensitive, 0·12 c.c. of Fehling's solution in 35 c.c. of solution, reacting quite distinctly. In performing the test it is necessary that the layer of plaster removed should be as thin as possible, but at the same time all the cuprous oxide must be taken with it. This process has been subsequently modified by the substitution for the plaster of Paris squares of small pads constructed from filter paper in the following manner: A sheet of specially toughened filter paper forms the top layer (Carl Schleicher and Schull's No. 975 answers admirably); this is placed upon two sheets of filter paper of a rough, fairly open type (such as C. S. and S. No 597). These layers of filter paper are then cut into squares of about 1 sq. cm. A drop of the liquid to be tested is dropped on the hardened filter paper and allowed to soak through the three layers; the two upper layers of filter paper, containing all the precipitated cuprous oxide, are rejected, and the spot of liquid on the lower one is tested for unreduced copper with ferrocyanide and acetic acid. It very occasionally happens that it is somewhat difficult to determine the end point satisfactorily by the above method, by reason of the fact that the cuprous oxide is precipitated in such form that it will pass through the filter pad, and, dissolving in the acidified ferrocyanide, give a reaction. In our experience this only occurs with very impure juices and syrups containing relatively large amounts of organic non-sugar. The effect can usually be overcome by using two thicknesses of toughened paper. Probably the addition of kieselguhr to the Fehling's solution when performing the determination, would entirely remove this objection. (See H. Kial. Pharm. Centralb., **35**, 411.)

Where special accuracy is desired in performing the titration, it is our practice to minimise the error due to the expansion of the solution contained in the burette, owing to heating by radiation and convection from the sand bath, by the attachment of a narrow tube of glass, about 10 cm. in length to the nozzle of the burette; this tube is bent almost at right angles to the vertical, the extreme end being bent down again, and along it the sugar solution is conveyed from the burette and delivered into the beaker; the burette is thus very largely screened from direct heating effect, and the error due to expansion is minimised. We find that it is easily possible for two independent operators working on the same sample to obtain results agreeing to within 0·1 c.c.

The second objection to the volumetric process quoted above, namely, that of the continual alteration of the bulk of the solution during the performance of the determination, is to a large extent met by the fact that it is necessary to have the reducing sugar content of the solution under examination confined within narrow limits (*i.e.* 0·3—0·8 grm. of sugar per 100 c.c.). Under these conditions the actual amount of dilution experienced in different determinations does not vary very largely, and the error introduced thereby becomes an approximately constant quantity; allowance is also made for it in the actual process of standardisation of the solution, which is performed in an exactly identical manner with an ordinary determination.

The third point, namely, that of the reducing action of sucrose itself on Fehling's solution, has recently been emphasised by Alexander Watt in a report presented to the International Commission for Uniform Methods of Sugar Analysis in 1906. (See Internat. Sugar J., 8, 502 *et seq.*). In the gravimetric process, as carried out in Germany, allowance is made for the reducing action of sucrose by means of Meissl and Hiller's well-known formula and tables; no such allowance is made for this effect in the case of the volumetric process as commonly carried out. Watt is of opinion that in the volumetric process this effect may give rise to errors amounting, in some cases, to as much as 150 per cent. of the total reducing sugars present in the sample when this is less than 1 per cent.

In order to investigate the magnitude of the effect liable to occur owing to the reducing action of sucrose, a series of determinations was made by the volumetric process in which solutions containing a fixed quantity of invert sugar but increasingly large amounts of sucrose were titrated against 10 c.c. of Fehling's solution diluted with an equal bulk of distilled water. The following are the results:—

No.	Sucrose per 100 c.c. of solution.	Solution required for titration.	Apparent invert sugar per 100 c.c.
	grms.	c.c.	grms.
1	—	8·35	0·53
2	4·0	8·15	0·54
3	8·0	7·9	0·56
4	12·0	7·8	0·57
5	16·0	7·6	0·58
6	20·0	7·5	0·60

From these results we see that the presence of 4 per cent. of sucrose occasions on the average an effect equivalent to 0·013 grm. of invert sugar, or 1 grm. of sucrose dissolved in 100 c.c. of water possesses reducing power equal to 0·0033 grm. of invert sugar dissolved in the same volume of water, under the conditions of the volumetric process.

The average raw muscovado sugar met with in these islands contains from 85 to 92 per cent. of sucrose and 2 to 5 per cent. of reducing sugar calculated as invert. The effect of the sucrose on the reducing sugar content, as determined by the volumetric process, in the case of such a sugar containing 90 per cent. of sucrose and 3 per cent. of invert sugar would, according to the above results, be that the reducing sugar would be returned as 0·3 per cent. too high, an error of 10 per cent. on the total reducing sugar contained in the sample. It is therefore clear that due allowance should be made for the influence of sucrose in determinations by the volumetric method. This allowance for sucrose can either be made by the method suggested by Watt, namely, the standardisation of the solution by means of a solution containing sucrose and glucose in the proportions commonly met with in practice, or, better, by the application of a correction factor determined as above for the invert sugar equivalent of 1 grm. of sucrose, by means of which the amount of reduction due to the sucrose in any sample can be calculated and allowed for from a knowledge of the sucrose content as determined. According to the above quoted results, we find that, for the conditions which we advocate, this correction factor is, 1 grm. of sucrose is equal in reducing power to 0·0033 grm. of invert sugar.

Before concluding we would direct attention to one other point, namely, whether the determination is to be performed on the untreated sugar solution, or juice, or on the solution after clarification with basic lead acetate. Watt, in his report, mentions this point, and states that it is the practice among English chemists to carry out the test on the untreated sugar solution by the volumetric process, whereas on the continent of Europe it is customary to determine reducing sugars on the lead-clarified solution by the gravimetric method. Watt is of opinion that this difference in methods is insufficient to account for differences that have been observed between the results that have been obtained by British and Continental operators, when working on identical samples, and attributes these differences to failure to take account of the reducing action of sucrose, on the part of British analysts. At the same time, there appears reason to believe that copper-reducing bodies may be removed from solution by the process of clarification with basic lead acetate (Watts and Tempany, this J., 1908, 57). If this is so, it would still further tend to magnify the amount of reducing sugar returned in the analyses of British operators.

It is difficult to say whether it is preferable to perform the determination on the untreated or the lead-clarified solution; it may be urged that any reducing substance removed by lead acetate is not a reducing sugar, also that the cuprous oxide is precipitated in a form much easier to handle from a clarified solution than from one that has received no treatment. On the other hand, it may be pointed out that if, as is frequently the case, a considerable excess of lead is employed to effect clarification, unless great care is exercised to effect its complete removal from the clarified solution, it is liable to give rise to large errors in Fehling determinations performed with the clarified solutions. In the past it has always been our practice to carry out the volumetric determination on the untreated solution in accordance with British practice.

In conclusion we would state that it is not our intention to suggest that such a high degree of accuracy is obtainable by means of the volumetric process as with the gravimetric methods. In our opinion, however, very material improvements can be effected in it on the lines we have indicated so as to render it sufficiently accurate for all ordinary technical analytical purposes, but where great accuracy is desired the preference should undoubtedly be given to the gravimetric method.

Discussion.

Mr. A. R. **Ling** said that the use of acidified ferrocyanide solution as indicator, in conjunction with folded filter paper, was well known. He had come to the conclusion that ferrocyanide solution in any form was not sufficiently sensitive, and had given it up in favour of the indicator, ferrous thiocyanate, which was described in a paper read by Mr. Rendle and himself before the Society of Public Analysts in 1905 (this J., 1905, 753), and which the authors had not referred to, possibly because they had not seen it. In that paper it was shown that the titration of solutions of invert sugar, dextrose, and maltose could be carried out with ease to 0·1 c.c., a degree of delicacy which could never be obtained when ferrocyanide was used as an indicator. He presumed that the authors in giving a constant for the influence of cane sugar were only dealing with mixtures containing very small proportions of invert sugar and large proportions of cane sugar.

Mr. A. C. **Chapman**, referring to the filter paper method recommended by the authors for applying the ferrocyanide test, said he was rather surprised that no reference had been made to the thiocyanate (sulphocyanide) indicator; he felt that sugar chemists generally were very much indebted to Mr. Ling for having brought this indicator to their notice, since it was certainly much superior to the ferrocyanide, and had done a great deal to increase the accuracy of the volumetric method.

Mr. E. G. **Hooper** said he thought that no sugar chemist was likely to need to keep Fehling's solution for 14 months. From his experience of many years' working with this solution, he found that within a period of 3 or 4 weeks there was no appreciable variation, the solution, of course, being kept in a shaded place. The method of applying the indicator referred to appeared unnecessarily elaborate. His own practice had been to fold a Swedish paper thrice, drop the solution on the upper side, and apply the test to the under portion which, on unfolding the paper, occupied the middle of the filter; he had found that perfectly satisfactory. He should have been inclined to expect—though he had no experience of anything beyond English summer temperatures—that Fehling's solution would deteriorate more rapidly—he referred of course to the complete, mixed solution—in a hot climate than in cool regions, but if such deterioration were found to be serious, there seemed to be no great advantage in the mixed solution, and the remedy was of course to be found in keeping the copper solution and the alkaline solution apart, only mixing when actually required.

Dr. E. **Divers** said that it was well known that Fehling's solution in the dark kept well for a long time, and that it soon altered in a strong light. It was not the best practice to test the filtrate after passing very little of it through several folds of paper, because of adsorption of copper salt by cellulose.

Mr. J. L. **Baker** said he should like to make it clear that the authors were not in the habit of keeping their alkaline tartrate and copper sulphate solutions mixed for 14 months, but this was an experiment to show what change would take place if the mixed solution was kept for that unusual period. He could imagine, however, that for chemists who were working under great pressure during a sugar campaign, it would be a very decided advantage if they could prepare a large quantity of mixed solution ready for testing. Anyone who had worked in sugar factories would appreciate the force of that remark.

Mr. **Grant Hooper** said he had made up to 10 litres at a time, and kept them over 3 weeks without any appreciable change.

Meeting held at Burlington House on Monday, February 3, 1908.

DR. J. LEWKOWITSCH IN THE CHAIR.

NITROGLYCERINE AND ITS MANUFACTURE.

BY LT.-COL. SIR F. L. NATHAN, R.A., AND W. RINTOUL, F.I.C.

The Memoirs of the Royal Academy of Science of Turin, published on Feb. 21, 1847, contains a paper by Professor Ascanio Sobrero, entitled "Concerning some new explosive compounds obtained by means of the action of nitric acid on organic vegetable substances." The first portion of the paper summarises the work published by him in the previous year on nitromannite, &c., and he then proceeds as follows:—"The oxidability of glycerine is very great; nitric acid reacts violently upon it and produces oxalic acid, although it would seem probable that this is only the ultimate degree of oxidation to which it attains through intermediate stages corresponding to more complicated substances. However that may be, when concentrated nitric acid, or a mixture of two volumes of sulphuric acid at 66° B., and one volume of nitric acid at 43° B., is added to glycerine concentrated to the consistency of a thick syrup, oxidation takes place immediately and tumultuously, producing copious nitrous fumes. I have had no opportunity of studying the products of this oxidation. If, however, instead of pouring the acid mixture into the glycerine, the operation is reversed, taking the precaution of keeping the acids in a freezing mixture at a temperature several degrees below zero, a different reaction occurs. The glycerine dissolves when it comes in contact with the acids, the solution being facilitated by shaking the containing vessel. When solution has been effected, the liquid is quickly poured into distilled water at ordinary temperature, and immediately a considerable quantity of liquid drops are precipitated at the bottom of the vessel. These drops unite and form a layer, which, if undisturbed, separates completely from the water. These drops constitute the new substance whose properties I am about to describe, and which I will call piroglycerine." Sobrero found that piroglycerine possessed "detonating power to a high degree," but no use was made of it as an explosive for many years after its discovery by him.

It has been stated that mines or torpedoes charged with nitroglycerine were employed during the Crimean War to protect the water approaches to the fortress of Cronstadt, and that their supposed existence deterred the British fleet from entering the harbour. There does not appear, however, to be any accounts of these mines having produced explosive effects.

In 1863, Alfred Nobel introduced piroglycerine, which he called nitroglycerine, as a blasting agent, in Norway. It was first of all employed in the liquid state and was exploded by means of small charges of gunpowder, or detonated by means of percussion caps containing fulminate of mercury (Eng. Pat. 1813 of July 20, 1864). Its use now spread rapidly, but many accidents occurred with it, and, in consequence, its employment was prohibited by many governments. To render liquid nitroglycerine safe for purposes of transport, Nobel dissolved it in various solvents, but in order to use it, it had to be separated from these solvents, so that nitroglycerine treated in this way was not a success.

Pure nitroglycerine freezes easily at about 8° C., and in the frozen condition it is much safer to transport. This property was made use of in America by G. M. Mowbray, who, in 1868, erected a factory for the manufacture of nitroglycerine for use in the construction of the Hoosac tunnel, Massachusetts. Large quantities of nitroglycerine were made at this factory, and successfully employed in the blasting operations in connection with this tunnel, and other works. It was transported all over America in a frozen condition without apparently any serious accidents, and the use of frozen nitroglycerine was continued in America for many years.

Meanwhile Nobel, after a long series of experiments, commencing probably about 1863, when he took out a patent for mixing nitroglycerine with ordinary gunpowder, sodium nitrate, or a mixture of carbon and sulphur (Eng. Pat. 2359 of Sept. 24, 1863), succeeded in finding a substance which would absorb very large quantities of nitroglycerine, and in this way he got rid of the difficulties and dangers incidental on the use of liquid nitroglycerine. The material he employed was kieselguhr, an infusorial earth, and to the product he gave the name of "dynamite" (Eng. Pat. 1345 of May 7, 1867). Nobel eventually succeeded in replacing the kieselguhr by an explosive absorbent, and in 1875 he patented "blasting gelatine," the most powerful form of which consists of 93 parts by weight of nitroglycerine, and 7 parts by weight of soluble nitrated cellulose (gelatinised) (Eng. Pat. 4179 of Dec. 2, 1875).

Both dynamite and blasting gelatine are explosives suitable only for blasting or disruptive purposes. By considerably reducing the proportion of nitroglycerine whilst increasing that of the soluble nitrated cellulose, Nobel produced an explosive for propulsive purposes; this he patented in 1888 under the name of "ballistite" (Eng. Pat. 1471 of Jan. 31, 1888). Meanwhile, the Explosives Committee in England were working on the production of a smokeless propellant in which nitroglycerine was combined with guncotton or insoluble nitrocellulose, in place of the soluble nitrocellulose used by Nobel, and in 1890 they patented "cordite" (Eng. Pat. 11,664 of May 24, 1890).

Nitroglycerine is now used as a constituent of a large number of both disruptive and propulsive explosives.

Early Manufacture.—In the early days of the manufacture of nitroglycerine, only small quantities were produced at one operation, and the apparatus employed was of the simplest description. It consisted usually of a pot of cast iron, china, or lead, in which the nitration was carried out. The pot contained the mixed acids and was stood in an outer vessel full of cold water. The glycerine was poured very slowly from another vessel into the mixed acids, and whilst it was running in the contents of the nitrating pot were kept well stirred by hand. When all the glycerine had been added, the nitroglycerine formed was allowed to settle out from the waste acid in a separating funnel and then run into water and washed. The washing was generally very imperfect, and the nitroglycerine so made was obviously not suitable for prolonged storage. The quantity of nitroglycerine produced in one operation only amounted to, say, 100 grms., and when fairly large quantities came to be required, the number and size of nitrating pots was increased, mechanical arrangements for regulating the inflow of glycerine and for agitation during nitration were introduced, and greater care was taken in the preparation of the nitrating acids and in purifying the nitroglycerine.

The most successful, probably, of the early factories for the manufacture of nitroglycerine on a commercial scale, was the one at North Adams, Mass., erected by G. M. Mowbray in 1868. Compressed air was used for thoroughly mixing the acids and removing nitrous fumes. The nitrating vessels were stone pitchers to the number of 116, they stood in wooden troughs filled with ice-cold water, or ice and salt. The charge of mixed acid was 17 lb. The glycerine, contained in glass jars placed at a higher level, syphoned over drop by drop into the mixed acid, and the contents of the nitrating vessel were kept agitated during the inflow of the glycerine by means of compressed air led in through a glass tube. The nitration lasted 1½ to 2 hours. Temperatures were taken frequently during nitration, and if a rise took place or nitrous fumes were given off, the inflow of glycerine was reduced, and hand stirring resorted to. On the completion of the nitration the charges were poured into a large tank of water at a temperature of 70° F., a batch consisting of about 450 lb. After a preliminary washing in this tank the nitroglycerine was run off into a wooden swinging tub, in which it was washed five times, three times with plain water and twice with soda, a current of air working through it at the same time. The washing water was run into large tubs in which any nitroglycerine settling out from it was retained. After washing, the nitroglycerine was transferred to earthenware jars holding 60 lb. each. The jars stood for 72 hours in tanks of water warmed to 70° F., any impurities rising to the surface as scum being skimmed off. The purified nitroglycerine was poured into tin cans lined with paraffin and holding 56 lb. each, and then frozen in the tins, in which condition it was always stored and transported. This process, now 40 years old, resembles in many of its essential features, the process now in use.

With the introduction of dynamite towards the end of the Sixties, the manufacture of nitroglycerine was again taken up on a large scale, and the apparatus almost universally employed was constructed on very similar lines to that more or less in general use at the present day. The nitrating vessel was a large cylindrical lead tank with an outer wood casing, between it and the lead tank cold water circulated and it contained lead coils through which cold water ran. Agitation was effected by means of compressed air, led in through lead pipes, and in the earlier plant mechanical agitation was also employed. Glycerine was run in from a tank placed above the nitrating vessel, the inflow being controlled by means of a cock. A glass pipe led away from the cover for carrying off and observing the fumes, and the temperature during nitration was watched by the aid of a thermometer passing into the liquid through a hole in the cover of the nitrator. Below the nitrator, a large tank containing water was provided, into which the charge could be run in the event of overheating. In this apparatus several hundred pounds of glycerine were nitrated in one operation. On completion of nitration, the whole of the charge of waste acids and nitroglycerine was run slowly into a large tank of water, agitation being kept up in the tank with wooden paddles, operated by hand or mechanically. The nitroglycerine finally was allowed to separate out to the bottom of the tank, and was drawn off into smaller vats and washed several times with soda solution and water until perfectly neutral. This system entailed the loss of all the waste acids, if the inflow of the charge was not carefully controlled, dangerous heating was liable to occur, and in any case there was a large development of nitrous fumes. For these reasons this system was abandoned, towards the end of the Seventies, and the separating tank introduced. This tank is of lead and usually completely enclosed; it will be described in more detail later. The charge was run into it through a cock at the bottom of the nitrator, and nitroglycerine being lighter than the waste acid it separated out on the top of it and was then transferred to the washing tank where it was washed, as already described. When all the nitroglycerine had been drawn off, the waste acids were run away to lead tanks in another house.

The above descriptions are necessarily brief, but time does not permit of our entering into full details, or of describing the somewhat numerous differences in apparatus and processes of manufacture, which existed in the early days of the production of nitroglycerine. These are dealt with fully in "The Manufacture of Explosives" by Mr. O. Guttmann.

The relative proportions and strengths of nitric and sulphuric acids, and the proportion of mixed acid to the glycerine, have varied from time to time, and in different factories. Sobrero in his laboratory used two volumes of sulphuric acid of 1·842 sp. gr. to one volume of nitric acid of 1·424 sp. gr., and to this mixture he added half a volume of glycerine. This proportion of acids was employed in the early days of large scale manufacture, and the proportion of glycerine to mixed acid varied from one-sixth to one-eighth. The more modern practice is to use a mixture of 3 parts by weight of nitric acid of 1·5 sp. gr. and 5 parts of sulphuric acid of 1·842 sp. gr., and to nitrate one part by weight of glycerine in every 8 parts of this mixture; the proportion of glycerine to mixed acid varies somewhat according to the strength of the acids.

Theoretically, 100 parts of glycerine should produce 246·74 parts of nitroglycerine, but for several reasons this yield is never reached in practical manufacture. In the early processes a yield of somewhat under 200 per cent. was all that was obtained. In more modern factories yields between 200 per cent. and 210 per cent. were obtained, the higher figure being considered very good. The average yield at the Royal Gunpowder Factory over a series of eight years was 214¼ per cent. With the introduction of the improved plant, to be described later, a material increase of yield was obtained, the average for two years being 220·18 per cent.

With nitrating acid of the composition given above, and with commercially pure glycerine the reaction of nitration is practically quantitative. It is free from side reactions such as the oxidation of the glycerine radical, referred to in the opening sentences of Sobrero's original paper, as occurring under certain conditions. If we assume for the moment that there is no mechanical loss and that the waste acid does not contain any nitroglycerine, the operation may be stated in the form of an equation thus:—

Nitrating Acid.

$$\underset{100}{C_3H_5(OH)_3} + \left\{\begin{array}{lr} H_2SO_4 & 480.0 \\ HNO_3 & 273.0 \\ H_2O & 47.0 \end{array}\right\} =$$

$$\underline{}\;800.0$$

Waste Acid.

$$\underset{246.7}{C_3H_5(NO_3)_3} + \left\{\begin{array}{lr} H_2SO_4 & 480.0 \\ HNO_3 & 67.6 \\ H_2O & 105.7 \end{array}\right\}$$

$$\underline{}\;653.3$$

There are thus present in the nitrating acid 47 parts of water which appear again in the waste acid and perform no useful function. It occurred to us that, as Nordhausen sulphuric acid can now be readily obtained at reasonable prices, it might be used to remove this water. We therefore calculated this 47 parts of water to its equivalent in waste acid, and deducted the figures thus obtained from both sides of the equation. As a result, we arrived at an equation giving the composition of a nitrating acid free from water and its ratio to glycerine required to produce a waste acid of the same composition as above. This equation is:—

Nitrating Acid.

$$\underset{100}{C_3H_5(OH)_3} + \left\{\begin{array}{lr} H_2SO_4 & 266.6 \\ HNO_3 & 242.9 \end{array}\right\} =$$

$$\underline{}\;509.5$$

Waste Acid.

$$\underset{246.7}{C_3H_5(NO_3)_3} + \left\{\begin{array}{lr} H_2SO_4 & 266.6 \\ HNO_3 & 37.5 \\ H_2O & 5\ .7 \end{array}\right\}$$

$$\underline{}\;362.8$$

By using a nitrating acid free from water, it is therefore possible to reduce the quantity of waste acid produced per 100 parts of glycerine from 653·3 to 362·8, a saving of 290·5 parts. Experiments have shown, and it has been confirmed by observations on the manufacturing scale, that waste acid of the above composition absorbs 3·7 per cent. of its weight of nitroglycerine. There should therefore be obtained an increase of 10·75 per cent. in the yield of nitroglycerine if this mixed acid were adopted.

Neither theoretical considerations nor the result of experiment suggests that this anhydrous mixture would be in any way more dangerous to use than acid containing four or five per cent. of water, but in all manufactures, and in the manufacture of explosives particularly, any alteration in a process should be carried out with the utmost caution and, where possible, gradually. We did not therefore proceed at once to the use of acid free from water, but used such a strength of Nordhausen acid as would reduce the ratio of acid to glycerine from 8 to 1, to 6·13 to 1.

The manufacturing results obtained during a period of nearly two years show the increased yield that we anticipated, *viz.*, from 220 per cent. to rather over 229 per cent., and therefore prove the above reasoning sound.

In addition to the obvious economy of an increased yield, the new mixture has further advantages, inasmuch as the capacity of any given plant is greatly increased, and there is less loss of nitric and sulphuric acids through the reduction in the quantity of waste acid to be denitrated and recovered.

Having succeeded in reducing the quantity of nitroglycerine absorbed by the waste acid by adjusting the composition of the charge so that less waste acid was produced, we turned our attention to the composition of the waste acid itself. We were not aware that any thorough investigation of the absorptive properties of this acid had been published, and thought it possible that such an investigation might afford useful information.

Our earliest experiments on this point gave quite unexpected results. We were aware of the fact that the addition of water to waste acid of the usual composition caused the absorption of any globules of nitroglycerine that might be present, but we were surprised to find that if nitrating acid containing sulphuric and nitric acids in the old 5 : 3 proportion and no free water, were used, this absorption no longer took place. On the contrary, on adding a small quantity of water to the waste acid from this nitration, a further formation and separation of nitroglycerine occurred. Obviously, therefore, beyond a certain point, the less water a waste acid contains, the more nitroglycerine will it absorb.

In order to determine the nature of the curve representing the absorption of nitroglycerine in waste acid, we decided to prepare synthetical mixtures of varying composition and determine their absorptive powers. The acid mixtures to be tested were made up as follows:—Pure sulphuric and nitric acids were prepared containing exactly 100 per cent. of H_2SO_4 and HNO_3 respectively. The required proportions of these acids and of water were accurately weighed and mixed under conditions precluding any loss of nitric acid or the formation of nitrous acid. This procedure was found to be more reliable than adjustment by analysis. The method of determining the absorptive power of an acid was as follows:—100 c.c. of the acid mixture to be tested was introduced into a flask of 200 c.c. capacity, having a long narrow neck, and provided with a tubulure and stopcock at the bottom. A known weight of nitroglycerine was then added—usually about one grm. more than it was expected would be required to saturate the acid. The flask was placed in a thermostat fixed on a rocking apparatus, so that the contents of the flask could be well shaken while being maintained at any desired temperature. When saturation was considered to be complete, agitation was stopped, and the flask allowed to remain at rest in the thermostat until all the nitroglycerine had risen to the surface, leaving the acid below perfectly clear. The flask was removed and placed for a few moments in water at 19° C. If saturation were complete, a slight opalescence at once formed, but disappeared on again raising the temperature to 20° C. The clear acid layer was now run off by means of the stopcock at the bottom of the flask, the nitroglycerine being left behind in contact with only a few tenths of a gram of acid. 50 c.c. of cold water was quickly added to the flask with shaking. The dissolved acid was neutralised by addition of sodium carbonate solution and the nitroglycerine dissolved out by shaking with ether. The ethereal solution was afterwards washed, dried and distilled, and the remaining nitroglycerine weighed after desiccation. To ascertain if the nitroglycerine recovered in this way had undergone any change by agitation with the acid, its nitrogen content was frequently determined, but was not found to be altered. That concordant and reliable results can be obtained by this method will be seen from the following experiments on the time of agitation necessary for complete saturation :—

Time of agitation.	Nitroglycerine absorbed.
Hours.	Per cent.
5	3·23
8	3·25
15	3·22

While discussing the question of the absorption of nitroglycerine by synthetical waste acid, it is convenient to consider also the condition in which the absorbed nitroglycerine exists in the acid. When nitroglycerine is shaken with a mixture of sulphuric acid, nitric acid, and water, at least two phenomena are brought into play before equilibrium is established. Nitroglycerine at first dissolves in the acid without chemical change, but as soon as solution has begun, a secondary reaction sets in, which results in the decomposition of a portion of the dissolved nitroglycerine. This secondary decomposition is, we consider, due to an interaction between sulphuric acid and nitroglycerine, and results in the formation of sulphoglycerine and nitric acid. A further examination of this decomposition reveals the fact that it is incomplete even in presence of a large excess of sulphuric acid. When the solution has been allowed to stand until no further change takes place, that is, until equilibrium has been established, nitroglycerine, sulphuric acid, sulphoglycerine and nitric acid still exist in it. We have here, therefore, a case of a balanced or reversible reaction. Assuming trisulphoglycerine to be the only ester formed, the reaction may be expressed thus :—

$$C_3H_5(ONO_2)_3+3H_2SO_4C_3H_5\rightleftharpoons(SO_4H)_3+3HNO_3,$$

but it is in reality of a much more complex nature, owing to the formation of a lower nitroglycerine, sulphoglycerine, and possibly of mixed esters.

In order to make quite certain that this interpretation of the observed facts was the correct one, we carried the investigation somewhat further. According to the now well established theory of reversible reactions, the addition to the system of excess of one of the active substances causes a displacement of the equilibrium away from the side of the equation on which that substance appears. Consequently, if this is a reversible reaction, the addition of sulphuric acid to a solution in a state of equilibrium should cause a further formation of sulphoglycerine and nitric acid, while the addition of nitric acid should conversely cause re-nitration and the formation of sulphuric acid. Both of these experiments were tried, and the displacement of the equilibrium in the direction required by theory was found to occur. Without quoting unnecessary figures on this point, it will be sufficient for our present purpose to refer to Diagrams Nos. 1 and 2. From the curves representing the ratio existing between dissolved and decomposed nitroglycerine, it will be seen that the presence of increasing quantities of sulphuric acid tends to increase the proportion of nitroglycerine decomposed ; that is to say it causes the formation of sulphoglycerine. Whereas an increase in the nitric acid content of the acid causes renitration or formation of nitroglycerine. In Diagram 3, the similar curves indicate the influence of equal increase of concentration of the nitric and sulphuric acids on the reaction. It will be seen that in this series, the influence of the latter increases at a greater rate than that of the former. Further, if this is a case of homogeneous equilibrium, from whichever side of the equation the reaction be started, the final state will be the same. Again, we find that the reaction in question proceeds according to the requirements of theory. Two experiments may be cited :—

(*a*) 3·8 per cent. of nitroglycerine was added to an acid mixture of similar composition to waste acid.

(*b*) Glycerine equal to the above 3·8 per cent. of nitroglycerine was dissolved in sulphuric acid and added to an acid mixture of such proportions that the masses of the reacting radicles present were the same as at (a) although differently combined.

Both mixtures were maintained at a temperature of 15° C., until equilibrium was established, and the quantity of nitroglycerine existing in solution determined with the following results :—

	(*a*)	(*b*)
	Per cent.	Per cent.
Nitroglycerine in solution	1·90	1·87
Decomposed nitroglycerine (by difference)	1·90	1·93

From the above evidence it is clear that the decomposition of nitroglycerine which occurs in waste acids is a reversible reaction and follows, in all respects, the laws governing such changes.

The method adopted for the determination of the ratio of what we may call potential nitroglycerine, to nitroglycerine existing as such in solution in an acid, depends on the fact that chloroform readily removes the latter without directly affecting the former and without being itself attacked by the acids. The removal of the dissolved nitroglycerine by the chloroform however, necessarily affects the equilibrium above referred to, with the result that re-nitration sets in and proceeds until a fresh equilibrium is established. For this reason it is necessary to use a relatively large volume of chloroform and to carry out the extraction in the most expeditious manner possible. Even with these precautions, however, the results obtained are not accurate. There is, however, a balancing of errors, as on the one hand nitroglycerine is formed during the period of extraction however short—the velocity of reaction of re-nitration being greatest during its first period ; on the other hand, one extraction, even with a large volume of solvent, will not remove the whole of the nitroglycerine in solution. The results obtained by this method are, therefore, probably fairly accurate.

Waste acid contains three principal ingredients, sulphuric acid, nitric acid and water. Three series of experiments were therefore designed to show in what manner and to what extent each ingredient influenced the proportion of nitroglycerine required to saturate the acid. Thus :—

Series I Ratio $\frac{H_2O}{HNO_3}$ = a constant (1·1) ; sulphuric acid the variant.

Series II Ratio $\frac{H_2SO_4}{H_2O}$ = a constant (5·8); nitric acid the variant.

Series III Ratio $\frac{H_2SO_4}{HNO_3}$ = a constant (10·4) ; water the variant.

The results of these three series of experiments are given in Diagrams 1, 2 and 3. It will be seen that in the experiments where sulphuric acid was the variant, a portion of the curves are represented in shaded lines. This indicates that, on attempting to saturate acids in this zone, oxidation of the glycerine radicle occurred and the results were vitiated. In these cases special precautions were taken, and the reaction was never uncontrollable, but it is clear that no acid of a composition in or near this zone should be allowed to come in contact with nitroglycerine in a manufacturing operation. In this connection, the action of sulphuric acid of various strengths on nitroglycerine was examined, with the results shown on Diagram 4. Again, it will be seen that a danger zone exists, namely, with sulphuric acid containing between 50 and 85 per cent. of H_2SO_4. As regards nitric acid of various strengths, up to 45 per cent. HNO_3 no action was found, but above this oxidation occurred. The upper limit of this zone

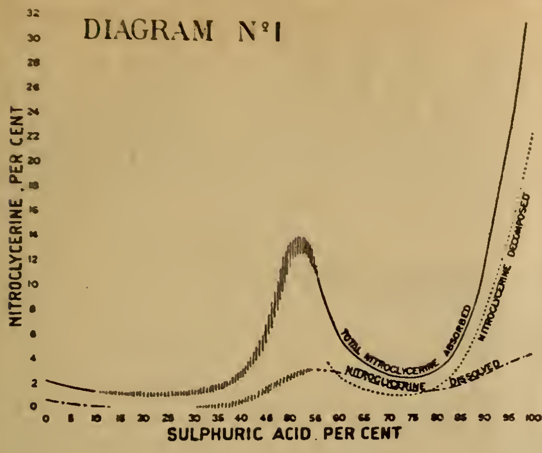


DIAGRAM N°1

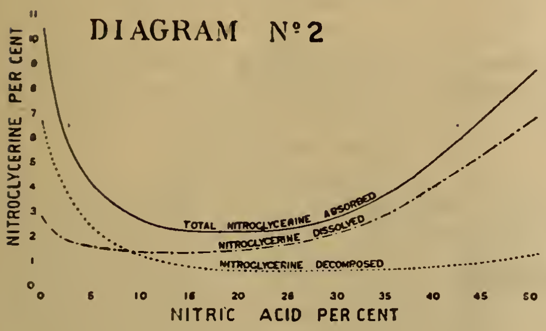


DIAGRAM N°2

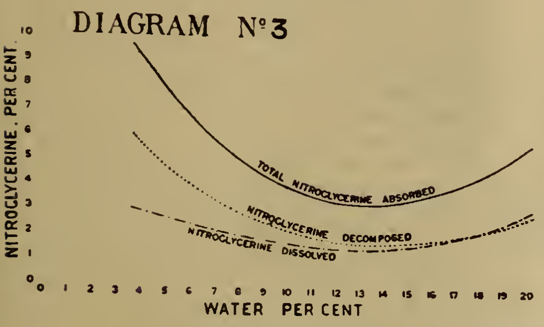


DIAGRAM N°3

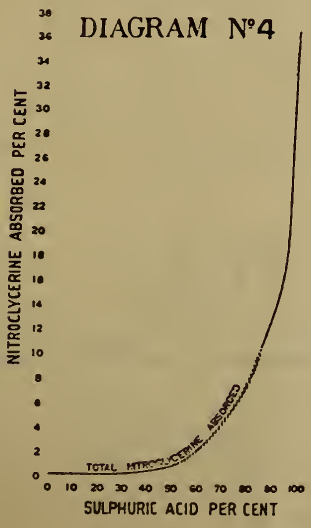


DIAGRAM N°4

of decomposition is below 90 per cent. of HNO_3, but it was not considered necessary to investigate this point too closely, owing to the danger of turbulent or even explosive reaction. It was, however, proved that nitroglycerine is miscible in all proportions with nitric acid containing 100 per cent. HNO_3, and such a solution containing 10 per cent. of nitroglycerine can be raised to a high temperature without decomposition taking place.

Returning to Diagrams 1, 2, and 3, it will be seen that in the case of each variant there occurs a point of minimum absorption of nitroglycerine, and in all three cases this minimum is lower than the absorption shown by ordinary waste acid. It was therefore probable that the present composition of waste acid could be improved on and we were confronted with the problem of how to select from an infinite number of possible mixtures, the one which would be the most economical from the manufacturers' point of view. The time at our disposal this evening does not permit us to give an account of the results so far obtained. The investigation of this point has proved long and intricate, and is, even now, incomplete as regards some of the factors of minor importance.

Mixed acid.—Having determined on theoretical grounds an acid mixture of suitable composition, which, whilst producing a waste acid of the usual strength, would at the same time allow of a much smaller proportion of acid to glycerine being employed than heretofore, we decided to use for the production of this mixture a Nordhausen acid offering no difficulties in use. An acid containing 20 per cent. of SO_3 is liquid at all ordinary temperatures. Supplies of this acid were accordingly obtained, and it has given no trouble of any kind. The acid is supplied to the factory in iron drums, containing about half a ton each; the drums are stored in the open, and are emptied into a steel egg of about 3,000 lb. capacity, and the acid blown from it into the mixing tanks. The mixing tanks are large, cylindrical, steel plate tanks, raised a few feet from the ground. The tanks, of which two are in use, have a capacity of about 60 tons of mixed acid. In the cover is an inlet cock for the sulphuric acid, and a lead inlet pipe extending to the bottom of the tank, for the admission of nitric acid. Two lead pipes also pass through the cover down to and along the bottom of the tank, for supplying compressed air. The nitric acid made by the Valentiner process, which produces an acid very free from nitrous acid, is first of all run into the tank. The sulphuric acid is then blown in slowly from the egg. During the time that the sulphuric acid is being added, air agitation is maintained in the tank. An earthenware fume pipe leads from the cover of the tank to a battery of Guttmann ball towers, so that the fumes arising from the mixing are condensed. By using such large tanks a more uniform acid mixture is obtained, and with two tanks it is possible, whilst acid from one is being used, to fill the other some days before it is required; this allows any solid impurities to settle out, with the result that a very clear nitrating acid is obtained. This is a point of much importance, as our experience has proved that the time required for the nitroglycerine to separate from the waste acid is influenced by the clearness of the nitrating acid. A dirty nitrating acid very much prolongs the separation of the nitroglycerine. Another advantage of these large mixings, prepared some time before they are required for use, is that they can be analysed, and should the mixture not be correct, it can be accurately adjusted by the addition of either sulphuric or nitric acid, as may be required. The mixed acid when required for use is drawn off into a steel tank, and blown into a cylindrical steel vessel in the charge house, at a higher level than the apparatus in the nitrating house. This steel vessel resembles a vertical egg in construction. The top is provided with a small aluminium dome with a fume pipe leading up through the roof, so that there are no fumes escaping into the charge house. The acid supply pipe is led in through the aluminium dome, and terminates in a swan neck, the open end of which coincides with the level of the charge required. A gauge glass is fixed to the aluminium hood. The gauge is watched whilst the acid is flowing in, and when the acid level in the gauge glass is slightly above the charge level, the air pressure on the mixing tank egg is released. The supply pipe acts as a syphon, drawing off any surplus acid, and thus automatically adjusting the volume of the charge. This arrangement ensures an absolutely correct charge of nitrating acid without any of the trouble, inconvenience, and possibility of errors of weighing.

Glycerine.—Glycerine from various sources of supply is used, and to ensure uniformity throughout manufacture, the different glycerines in stock at any one time are blended proportionately to the stock quantities. The blending takes place in iron tanks of a capacity of about 10 tons. One blend of glycerine corresponds to one mixing of nitrating acid. The glycerine is rendered sufficiently fluid by heating, to enable it to be blown from a steel egg into a galvanised iron tank in the charge house. This tank is provided with coils permitting of the glycerine being either cooled or heated, as required. The glycerine is run from this tank into the glycerine tank in the nitrating house; this latter tank is provided

DIAGRAM NO 5

R.G.P.F. NITRATING HOUSE PLANT.

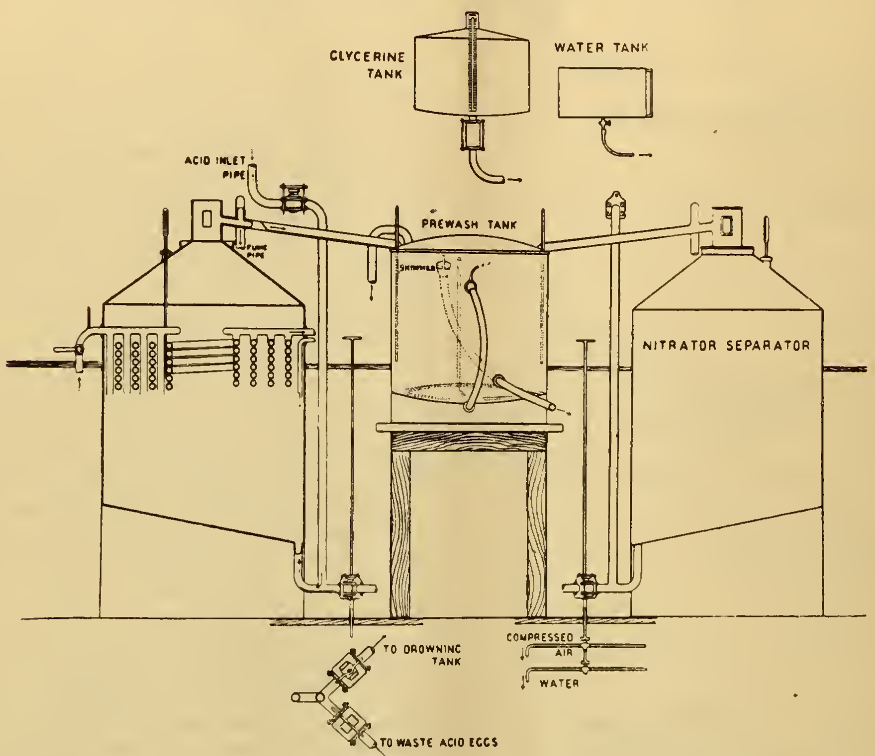
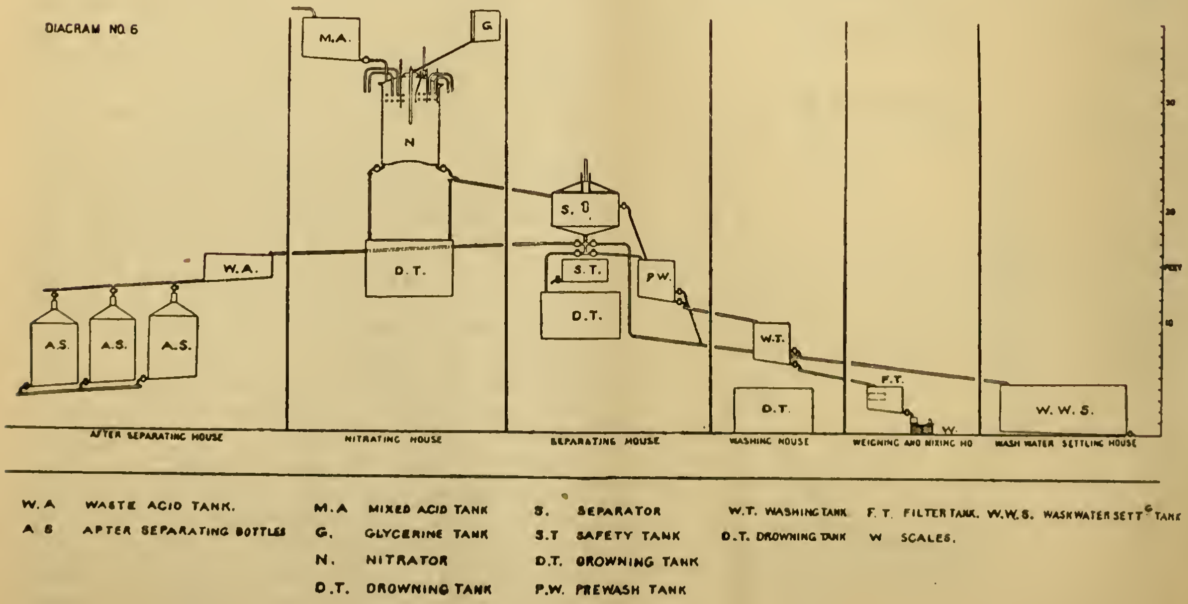


DIAGRAM NO. 6



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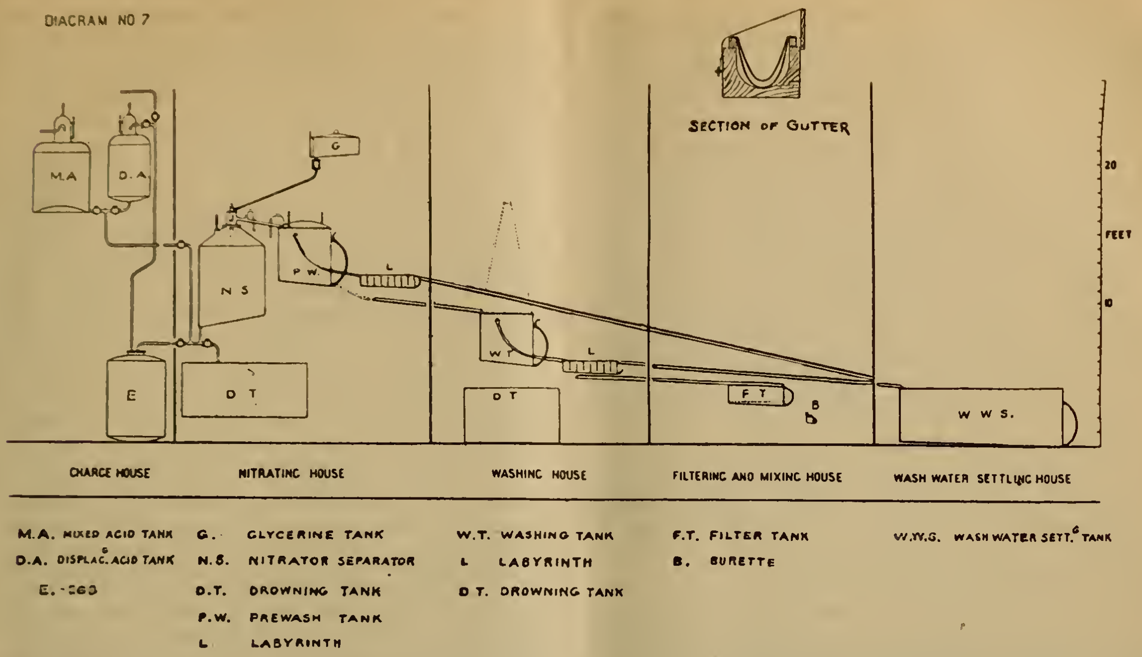

with a gauge glass so arranged as to allow of accurate measurements of the charge. In the case of the glycerine, as in the case of the acid, and for the same reasons, the charge is measured, not weighed.

Nitration.—We have already referred to the nitrating plant used by Nobel for the production of nitroglycerine on the large scale, for the manufacture of dynamite, when the latter explosive was introduced. This plant, with but few modifications, was universally used until recently for the production of nitroglycerine. We propose to describe this plant, as erected at the Royal Gunpowder Factory, in 1890, and to compare it against the plant now in use there, as well as at other factories in this country and abroad. These plants are shown on diagrams Nos. 6 and 7.

The old pattern nitrating apparatus was a large lead tank, cylindrical in shape with a convex bottom; inside were coils, through which cold water circulated and pipes for the supply of compressed air were led down to and round the bottom of the apparatus. The top of the tank was closed by a dome cover of lead, cemented on, and provided with glass inspection windows. The air pipes, the pipe conveying the acid, and the water inlet and outlet pipes, all passed through holes in the cover; in the centre of the cover was a manlid with an acid lute, and in the centre of that again was a hole for the insertion of the glycerine injector. This hole was closed by a loose lead plug when the injector was removed. A fume pipe fitted with a glass cylinder, to allow the colour of the fumes to be seen, was also fixed in the cover. The bottom of the tank was provided with two earthenware cocks. Both cocks were available for drowning the charge; whilst one of them was used for running the contents of the nitrator into the separating tank through a movable lead bend.

The nitrating acid having been run into the nitrator, the glycerine injector was introduced through the hole in the manlid, and the glycerine sprayed by means of air pressure under the surface of the acid. During nitration cold water was allowed to circulate through the coils, and the contents of the nitrator were kept agitated by means of compressed air. The inflow of glycerine was regulated so as to keep the temperature of the charge at or below 22° C. When all the glycerine had been added, the injector was removed, the charge cooled down to about 15° C., and then run off into the separator.

Separation.—The separator was a square lead tank; the bottom sloped downwards from all four sides to a central hole fitted with a vertical glass cylinder. A horizontal pipe with branches in four directions was secured to this cylinder, each branch was provided with an earthenware cock. Under the separator was a lead-lined wooden tank, for the purpose of catching the contents of the separator, should the glass cylinder break from any cause. The separator was provided with a skeleton frame cover, filled in with glass, the sides sloping up to a fume pipe, for carrying off the fumes; air pipes were led into the separator through the cover. On one side of the separator was a glass inspection window, on another side was an earthenware cock, situated about 4″ below the surface of the nitroglycerine, when it had separated from the acid. When the separation was complete, the bulk of the nitroglycerine was run off through the earthenware cock in the side of the separator into the preliminary washing tank. The waste acid was then run away through one of the branches on the bottom pipe, to the "after-separating house." As soon as the rest of the nitroglycerine was seen coming down into the glass cylinder, the earthenware cock leading to the after-separating house was closed, and the one leading to the pre-wash tank was opened, and the remainder of the nitroglycerine run into this tank. Of the other two cocks at the bottom of the separator, one was used for running any thick sludge to the "wash-water settling house," the other was connected to the "drowning tank."

In some factories, instead of a closed separator, an open lead-lined tank was, and is still, used. The nitroglycerine, as it separates from the waste acid, is removed from the tank by hand, by means of a metal skimmer, and transferred little by little to the preliminary washing tank.

In the apparatus just described, it will be noticed that there are several earthenware cocks, in fact, earthenware cocks were until comparatively recently a feature of all the plant employed in the manufacture of nitroglycerine. These cocks have always been regarded as a source of danger, owing to the possibility of friction being set up between the body of the cock and the key, when the latter was manipulated, should any foreign gritty substance be present. Where nitroglycerine only had to be run out of a vessel, it had been found possible to do away with the use of earthenware cocks, in a manner which will be referred to presently, but the same system could not be applied where acids or acid nitroglycerine had to be dealt with. We had at the Royal Gunpowder Factory done away with the use of earthenware cocks in all the plant subsequent to the separator, but they existed as late as 1901 in the nitrating apparatus, and in the separator. In January of that year, the danger incidental to the use of earthenware cocks was brought home to us in a forcible manner. Shortly after the charge had been run out of the nitrating apparatus, an explosion occurred in one of the earthenware cocks leading to the drowning tank. The cock was not being used at the moment the explosion occurred, and the explosion was therefore probably due to the lodgement in a depression of the key, of a trace of acid nitroglycerine. If the apparatus had contained the charge, a serious accident must inevitably have occurred. This accident emphasised the necessity of doing away with the earthenware cocks still remaining in our plant, through which nitroglycerine passed, and the idea occurred to us that this would be accomplished if we could remove the nitroglycerine, which on the completion of nitration separates out on the surface of the acid, from the top of the apparatus, instead of from the bottom. The simplest way to effect this was, if possible, to raise the whole of the contents of the apparatus, so that the nitroglycerine should flow over a suitable arrangement in the cover, and run by gravity into the pre-wash tank. The best method for raising the level of the separated nitroglycerine was to introduce some inert liquid below the nitroglycerine, and the liquid obviously most suitable for the purpose was waste acid from a previous charge. Waste acid was the liquid we selected, and the form of apparatus eventually adopted to carry out this principle is shown in diagram 5. The construction and method of working this apparatus we will now describe.

The "nitrator-separator," as we prefer to call it, consists of a cylindrical lead vessel with a bottom sloping in one direction, and containing cooling coils and air pipes, the number depending upon the size of the vessel. The cooling coils enter and leave the vessel through its sides, just below the surface of the nitrating acid, as do also the air pipes. The cooling water is led in and led out again through one main pipe controlled by a single cock, the coils themselves branch away from this main pipe inside the vessel. The supports for the coils are of lead and are formed by loading up between the turns; this arrangement obviates the use of lead covered iron supports, and entirely does away with interstices in which nitroglycerine or sulphate can lodge. The cover is conical, and is burnt on to the cylindrical portion. The cover terminates in a cylinder of small diameter open at the top and provided with glass inspection windows; the only other fitting in the cover is a gland through which the thermometer passes. A pipe is fixed in one side of the cylinder, from which another pipe branches, for carrying away the fumes. A suction is produced in this pipe by means of an air jet. Beyond this fume pipe, the pipe from the cylinder opens out into a gutter leading into the pre-wash tank. The pipe for conveying the nitrating acid as well as the waste acid for displacement, enters the apparatus at the bottom. The pipe is carried vertically downwards below the level of the bottom of the apparatus, and then rises again into it; the object of this arrangement is to prevent the possibility of nitroglycerine getting into the acid supply pipe. There are two branches on this pipe, each with an earthenware cock; one branch leads into the drowning tank, the other to the waste acid egg. The drowning cock is controlled by means of a long rod terminating in a handle, situated on the operating platform. By turning this handle through a quarter of a circle, the drowning cock is opened, and allows the whole of the contents of the nitrator-separator to discharge into the drowning tank. Attached to the key of the drowning cock are two other cocks, one on the drowning tank compressed air pipe, the other on the water supply pipe, so that by turning the handle, not only is the drowning cock opened, but the drowning tank compressed air supply is turned on, and water is also admitted to the drowning tank. The drowning tank is always kept full of water, and is provided with an overflow, so that the water is being continually renewed during the drowning of the charge. This drowning arrangement has the advantage of simplicity, and the continual supply of cold water keeps down the temperature due to the mixing of a large volume of acid with the water, and also allows of a smaller drowning tank for any given charge.

The waste acid from the previous charge having been run out of the vessel, the cock on the nitrating acid tank is opened, and the acid allowed to run into the nitrator-separator by opening the cock on the acid supply pipe. As soon as the acid has all run in, the cock on the nitrating acid tank is closed, as well as the cock on the acid supply pipe. The nitrating acid having been brought to the desired temperature by means of the cooling coils, the injector is inserted through the open top of the apparatus, and the nitration commenced. The temperature of the cooling water which flows through the coils, is regulated so that the total time of nitration for any given charge is kept constant within fairly narrow limits, both summer and winter. To enable this to be done the water is refrigerated when necessary. The advantages of using refrigerated water are, that nitration is completed in a reasonable time, loss of nitric acid due to volatilisation is reduced to a minimum, and the time of nitration being constant, enables the whole of the operations in the factory to be carried out systematically. The volatilised nitric acid is carried away to a Guttmann condensing tower, provided with a liquid circulating arrangement; this allows of a complete condensation of the fumes, and the recovery of about 18 lb. of nitric acid of a sp. gr. of 1·320 per ton of nitroglycerine produced. When nitration is completed the injector is removed and the nitroglycerine allowed to separate for a few minutes. The cock leading from the displacement waste acid tank is then opened, and waste acid is allowed to enter the apparatus at the bottom, by opening the cock in the acid supply pipe. The rate of inflow of displacing acid can be regulated with the utmost nicety, so as to allow of the nitroglycerine as it separates flowing over through the gutter into the pre-wash tank. The dividing line between the clear nitroglycerine and the acid is watched through the inspection windows.

The advantages of separating the nitroglycerine in the nitrator-separator are, that the nitroglycerine is removed from the acid as quickly as it separates, the cooling coils, which did not exist in the old form of separator, are a great safeguard against any undue rise in temperature, which could only be dealt with formerly by drowning the charge; and any flocculent matter separating from the charge is distributed throughout the whole bulk of the nitroglycerine, instead of accumulating, as formerly, as a thick sludge between the nitroglycerine and the waste acid. When the separation is complete, a clear line of demarkation between the nitroglycerine and the waste acid appears in the inspection windows.

The nitrator-separator is left full of waste acid until it is required for the nitration of another charge. The result of this is that no part of the interior of the apparatus is exposed to acid fumes, and its durability is increased to a very remarkable extent. In the old form of apparatus, where this could not be done, and where the coils entered through the cover, it was necessary to remove the cover and the coils as often as once in every three months, to repair them. The new pattern apparatus was in use for 2½ years without being opened up. After that period it was considered desirable to remove the cover for inspection. The whole of the interior of the apparatus, as well as the cooling coils and the air pipes, were found to be as good as new, and no repairs of any kind were necessary. As a precaution, the cooling coils are tested every week, before commencing work, by air pressure; any leak would be at once detected by the escape of air through the waste acid.

Preliminary washing.—The old pattern of pre-wash tank was fitted with two earthenware cocks, the upper one for running off the washing waters, the lower one for running off the nitroglycerine to the washing house. The air pipe for agitating the charge during pre-washing operations was laid loosely on the bottom; another was led into the bottom faucit down the inside of the tank; the tank was open at the top.

The pre-wash tank now in use has no cocks. It has a fixed lead cover with an opening covered with a small rubber flap. There is a fume pipe in the cover, for removing the fumes. The washing waters are run off through a skimmer of pure rubber, in the form of a tube, the top expands into a funnel provided with a loop handle, also of rubber. By means of this handle, the operator depresses the skimmer gradually, and allows the wash-water, as it separates, to flow over the edge of the funnel and away down the tube. The skimmer delivers into a labyrinth where the bulk of the nitroglycerine contained in the wash water separates out. This nitroglycerine is drawn off into a rubber bucket, and returned to the pre-wash tank. The bottom faucit has secured to it a rubber tube. During the pre-washing this tube is in position on a perforated plug, into which compressed air is led; this ensures the nitroglycerine in the rubber tube being pre-washed along with the rest of the charge. The air pipe in the pre-wash tank, instead of being laid loose inside, is burnt on to the under-side of the bottom. The air holes are pierced through the bottom, and are bushed with ebonite plugs, to prevent wear. The advantages of this form of air pipe are, that it entirely removes the risk of any friction between the air pipe and the bottom of the tank which might be set up by vibration due to escaping air when the pipe is loose, it gives a perfectly flat surface on which no sulphate or other solid impurities can lodge, and it facilitates the cleaning out of the tank between the charges. The pre-washing is effected by means of water, soda solution being used for the last pre-washing to render the nitroglycerine alkaline before it is run down into the washing house. When the charge is ready for sending down to the washing house, the end of the rubber running off pipe is slipped off its plug and placed on a fixed nozzle on the end of the gutter leading to the washing house. No clamp of any sort is used on this pipe, either to cut off or to regulate the outflow of nitroglycerine; hand pressure is sufficient for both these purposes. The gutter connecting the pre-wash tank to the washing house tank, passes through the open, and to prevent freezing of the nitroglycerine during the cold weather, it is provided with an outer jacket. (See Diagram 7.) Warm water is circulated between the gutter and the jacket when the external temperature renders this necessary. In order to have a gutter with a perfectly smooth even surface, the old system of lap-jointing has been replaced by a butt jointed gutter, scraped smooth on the inside. This pattern of gutter has been in use for years, and has shown no signs of developing cracks or unevenness, which were of not unfrequent occurrence in the case of lap-jointed gutters. The gutter instead of being covered with √-shaped heavy wooden covers, is protected by means of a canvas covering fixed along one edge and laced down on the other, so as to enable it to turn back readily for cleaning purposes. After a charge has been run down, the gutter is wiped along its whole length with a flannel in the direction of the washing house, to remove all traces of nitroglycerine.

Washing.—The old washing tank was usually a wooden tank lined with lead and provided with cocks, one at the bottom for running off the nitroglycerine, and one or more skimming cocks at different levels. An alternative arrangement for running off the wash-water was a skimmer, a saucer-shaped vessel attached to a rubber pipe, which led out through the side of the tank to the wash-water gutter. The early form of skimmer was of lead and was supported by means of a rope and counter weight. Later patterns were made of lighter material, for example, sheet brass covered with rubber cloth. The use of the skimmer got rid of the earthenware cocks for running off the wash-water, but the objectionable bottom cock for running off the nitroglycerine remained. The pattern of tank now in use at the Royal Gunpowder Factory is made of heavy lead without any wood casing. It has no cocks. The air pipe is an underneath one on the same lines as the one in the pre-wash tank, but the wear of the air holes is so slight that it has not been found necessary to bush them with ebonite. The skimmer has no saucer-shaped top to it, it is entirely of rubber and exactly similar to the one in use at the pre-wash tank. The nitroglycerine is run off through a rubber tube in the same way as it is run off from the pre-wash tank. The wash-waters are run through a labyrinth. The nitroglycerine is carried by a water-jacketted gutter to the filtering and mixing house. The drowning arrangements are on the same lines as those of the nitrating house. The washing tank is provided with a hood of rubber cloth with a funnel, also of rubber cloth, passing out through a hole in the roof. An air-jet is inserted in the funnel, and all fumes are removed from the house. To enable the operator to know how much washing waters to add and when they have been removed, an inch scale is marked down the inside of the tank. This arrangement obviates the use of a loose measuring rod.

Just prior to running down the charge of nitroglycerine from the pre-wash tank, some warm soda solution is sent down the gutter from the nitrating house. This is immediately followed by the charge of nitroglycerine, and the charge of nitroglycerine is itself immediately followed by some more warm soda solution. Purification of the nitroglycerine in the washing tank is effected by washing it with warm weak soda solution, agitation of the contents of the tank being kept up all the time by the means of compressed air. To remove the sodium carbonate as far as possible, the last two washings, at least, are carried out with warm water.

The water available at the Royal Gunpowder Factory is very hard, and in course of time the interior of the washing tank showed a tendency to become coated with an extremely hard deposit consisting chiefly of carbonate of lime. To prevent the formation of this very objectionable scale, the practice now is to soften the water and to filter it very carefully before use. The softening and filtering processes are applied to all washing water used in the manufacture of nitroglycerine, and the softened and filtered water, as well as the soda solution at the proper temperature, are supplied to all the houses from main supply tanks in the charge house. This arrangement does away with the making up of soda solutions and the heating of water in any of the houses themselves.

An important feature in connection with the washing operation is the design of the washing tank, as affecting the total depth of liquid it contains. The greater the depth, the longer is the time the nitroglycerine takes to separate from the washing waters. Two series of experiments on this point have been carried out at different times. The depth of liquid was varied, the proportion of nitroglycerine to washing water remaining constant. In one case the total depth of liquid was 27¼ inches, in the other 18½ inches. With the greater depth of liquid the mean time of separation of the first washings of a number of charges was 34½ minutes in the first series, and 28½ in the second; with the lesser depth of liquid the mean time of separation of the first washings of a number of charges was 10 minutes in the first series, and 9½ minutes in the second.

Filtration.—The filtration of the nitroglycerine is generally carried out in the washing house in a lead lined wood tank. This tank is provided with a cover in which a cylinder, open at both ends, is placed; the bottom of the cylinder is closed by means of a wire gauze attached to a solid metal ring, and this supports a flannel bag filled with salt. The nitroglycerine runs through the salt filter into the body of the tank, moisture being absorbed by the salt and any flocculent matter being retained on the bag. The nitroglycerine is run out of the tank through an earthware cock into some suitable vessel placed on scales for weighing the charge. The cylinder, the wire gauze with ring, and the bag of salt, were all of necessity removable, and at the end of the day's work, or oftener if necessary, the salt bag had to be renewed, and the salt dissolved in warm water to recover any nitroglycerine it might contain.

The filter tank at the Royal Gunpowder Factory is a plain lead tank with a fixed false bottom of perforated lead, a layer of sponges sewn up in flannel is laid on the false bottom. The nitroglycerine is run on to the surface of the sponge bags, through which it filters. The sponges retain the moisture and any flocculent matter. As often as is necessary the sponges are removed and wrung by hand, to free them from water and any nitroglycerine. For drawing off the nitroglycerine the usual rubber tube is employed. Instead of using a movable vessel on scales, the nitroglycerine is run into a fixed burette of lead provided at the top with a very narrow orifice, to allow of accurate measurement. The requisite charge, measured in this way, is emptied out of the burette, through a rubber tube, into rubber-lined canvas bags containing the weighed charge of guncotton. It will be seen that this pattern of filter tank, burette, and rubber bag, do away with all movable apparatus, tending to very much greater safety in the manipulation of the pure nitroglycerine. The substitution of the sponge filter for the salt filter, reduces the amount of sodium in the finished explosive, which is not without its effect on the luminosity of its flame.

The charge is sampled from the filter tank. The sample is taken in small guttapercha bottles about the middle of the running off of the charge, precautions being taken to obtain an absolutely fair sample.

The heat-test is the most important test to which nitroglycerine is subjected. Experiments carried out some time ago demonstrated that the heat-test was very much influenced by the percentage of sodium carbonate retained in the finished nitroglycerine. These experiments were very instructive, and the following is a brief resumé of the results :—

	Heat test at 180° F.	
	I.	II.
	mins.	mins.
Nitroglycerine—		
From filter tank	88	70
After drying in desiccator (sodium carbonate retained)	57	66
After washing with distilled water and drying in desiccator	—	20
After thorough filtration through paper	21	18

To obtain true results, therefore, the sample should be thoroughly freed from sodium carbonate before heat-testing. Nitroglycerine is also tested for moisture, alkalinity and nitrogen content.

Wash-waters.—All the waters used for washing nitroglycerine and plant, are run down lead gutters into a large wooden tank in the wash-water settling house, the contents of the tank being kept agitated by means of compressed air. At the end of the day's work, the air is shut off, and any nitroglycerine present is allowed to settle out, and is drawn off through the usual rubber pipe into buckets and returned to the preliminary washing tank in the nitrating house. At the end of the week the mud, consisting mostly of sulphates holding a certain proportion of nitroglycerine, is removed from the wash-water settling tank to flannel filters suspended over a small lead washing tank. The nitroglycerine is washed out of the mud by means of hot water and soda solution. This treatment has the advantages of removing nitroglycerine, rendering the mud alkaline and converting the sulphates originally present into carbonates ; the mud in this condition is much less likely to decompose. Analyses have shown as much as 80 per cent. of lead sulphate in the mud as removed from the wash-water settling tank, practically the whole of which is converted into lead carbonate by the alkaline treatment. The mud is subsequently wrung in flannel to remove the last traces of nitroglycerine and then mixed with paraffin and burnt.

Since the adoption of labyrinths in the nitrating and washing houses for passing the wash-water through, the quantity of nitroglycerine which finds its way down to the wash-water settling tank has been very materially reduced. Formerly, the quantity of nitroglycerine recovered from the wash-water settling tank amounted to about 4½ per cent. of the nitroglycerine manufactured. The percentage now is about 1½. The better settling now given to the nitrating acid, and the use of softened water have materially reduced the amount of mud. Whereas formerly the mud amounted to about half per cent. of the nitroglycerine, it is now only one quarter per cent.

After-separation.—The after-separating house contained large lead vessels with conical tops provided with a small glass separation cylinder in the centre. The small quantities of nitroglycerine settling out from the waste acid were removed from time to time by means of a metal skimmer, and drowned in a small washing tank full of water. Apart from the fact that decompositions of the acid nitroglycerine occasionally took place, this house was an expensive one to instal and maintain, and required constant supervision as long as any waste acid was present in it. The quantity of nitroglycerine that was recovered was incommensurate with the labour required and the cost of maintaining the installation.

The after-separating house has for some time ceased to exist at the Royal Gunpowder Factory. To enable us to dispense with this house, we made use of the fact that the addition of water to the waste acid not only prevented the formation of more nitroglycerine, but absorbed any nitroglycerine existing as such in a fine state of division in the waste acid. In the original experiments it was ascertained that at the normal working temperature of the factory, *viz.*, from 10° C., to 15° C., the addition of 2 per cent. of water sufficed to prevent the separation of nitroglycerine from the waste acid on storage. An accident with a drum of nitroglycerine waste acid, which occurred at an acid factory in January, 1906, led to further experiments being carried out by us on this point. Waste acids from actual nitrations were operated upon. These were kept at various temperatures for considerable periods without and with an addition of 2 per cent. and 5 per cent. of water. The results showed that when any nitroglycerine did separate from the acids, the quantity separated varied inversely with the temperature of storage, that 2 per cent. of water did not entirely prevent the separation of nitroglycerine below 10° C., and that with 5 per cent. of water no nitroglycerine separated, even when the acids were kept at a temperature of 0° C. Experiments carried out at the same time, in which nitroglycerine was actually added to waste acids containing different percentages of added water at the same, and at different, temperatures, brought out the fact that the absorptive power of the acids increased with the increasing percentages of water, and with rise of temperature. These latter experiments explained the cause of the phenomena observed in the manufacturing experiments referred to above.

The study of the influence of the addition of water to waste acid led to the method of dealing with waste acid by after-separation in a special house being abandoned in favour of a simpler and less expensive method. The waste acid is now allowed to remain in the nitrator-separator until it is required for another nitration, any nitroglycerine separating in the interval being displaced in the usual way into the pre-wash tank. This further separation of the nitroglycerine is promoted by cooling down the waste acid. When the nitrator is to be emptied, every trace of nitroglycerine is removed from the surface of the acid ; the quantity of waste acid required for the displacement of a subsequent charge is then run out of the nitrator into an egg, and blown into the displacing acid tank in the charge house. To the remainder of the waste acid in the nitrator, 2 per cent. of water is added, the contents of the nitrator, meanwhile, being strongly agitated by means of compressed air. The waste acid is then sent into an egg and blown over to a tank in the denitrating house. As a further precaution against a possible separation of nitroglycerine, all waste acid is kept at a temperature of about 15° C.

The plant and the systems of manufacture we have described in detail, are shown diagrammatically on diagrams No. 6 and No. 7. Diagram No. 6 exhibits a factory typical of many in this country and abroad. Diagram No. 7 is a diagram of the nitroglycerine plant of the Royal Gunpowder Factory and of some other English and foreign works. The plants shown on the diagrams are both for the nitration of a charge of 1320 lb. of glycerine. The Royal Gunpowder Factory diagram No. 7 differs from the factory shown on diagram No. 6 in the following main points :—

1. Reduced total elevation 16 ft., against 33½ ft., measuring from the top of the nitrator to the bottom of the wash water settling tank.

2. Less total ground area. The simplest way to

estimate this is to take the number of the gutters, connecting house to house. In diagram 6 plant there are 5 such gutters, in diagram 7 plant only 3, so that the respective ground areas are as 5 to 3. For a 5,000 lb. limit of nitroglycerine the length of each connecting gutter measured from outside to outside of any two houses, must be, according to the Home Office distances, 51 yards.

3. Omission of the separating house.
4. Omission of the after-separating house.
5. Fewer pieces of apparatus. For nitrating and separating there are 5 vessels in diagram 6 plant and 2 in diagram 7 plant; for diagram 6 plant there is also the addition of the after-separating house apparatus.
6. Abolition of all cocks, except those for acid to and from the nitrator-separator.
7. Measuring acids, glycerine, and nitroglycerine, instead of weighing them.
8. Introduction of labyrinths for all washing waters.
9. Simplification of plant generally.

The Royal Gunpowder Factory plant tends to increased safety in manufacture for the following reasons:—

1. The absence of earthenware cocks removes the risks attendant on their use. These risks are, friction due to the presence of some foreign substance, jamming due to nitroglycerine freezing or through want of lubrication, and decomposition of acid nitroglycerine lodging in them.
2. The removal of the nitroglycerine from contact with the acid as it separates out from it.
3. The presence of the cooling coils during separation in the nitrator-separator.
4. In factories where nitration and separation are carried out in separate houses, the undesirable operation of running the mixture of acids and nitroglycerine down a more or less exposed gutter is avoided.

It is important to note from the point of view of risk to personnel, that for any given output, fewer men are required for working diagram 7 plant than for working diagram 6 plant, and the whole of the former plant being enclosed and provided with arrangements for carrying off both acid and nitroglycerine fumes, the men work under much more healthy and pleasant conditions. In addition to the increased yield, amounting to at least 15 per cent., there are many other economical advantages which it is unnecessary to enumerate.

We wish in conclusion to refer to a matter we consider of paramount importance in connection with the safe manufacture of nitroglycerine, and that is the absolute necessity of entirely dispensing with the use of any heavy or hard loose tools and implements in the houses. The abolition of all such articles has been a guiding principle with us in designing and perfecting the plant which we have described, and that we have succeeded in accomplishing this will be evident from an inspection of the list of tools and implements allowed in the various houses.

The lists of authorised articles are termed " Use lists," and the use lists for the various houses are as follows:—

Articles.	Nitrating house.	Washing house.	Washwater settling house.	Filtering and mixing house.
Bags, rubber	—	—	—	1
Bottles, guttapercha	—	—	—	12
Buckets, rubber...	3	6	6	—
Covers, bucket, guttapercha	—	6	6	—
Flannels..........	4	3	2	2
Gauntlets, rubber .	1	—	—	—
Gauntlets, leather	—	—	—	2
Overshoes, rubber	4	3	2	—
Socks	—	—	—	2
Thermometers	3	3	2	—

The list for any one house is posted upon a board near the entrance of that house. This board also shows the quantity of explosives and the number of men allowed in the house in accordance with the usual practice in explosives factories as required by His Majesty's Inspectors of Explosives.

Some of the more recent accidents which have occurred in nitroglycerine manufacture have been attributed to the dropping or fall, or knocking over of some heavy tool or implement, and in view of the fact that we have proved that the presence of any such articles in houses used for the manufacture of nitroglycerine is absolutely unnecessary, we venture to hope that it will not be long before His Majesty's Inspectors of Explosives will require that tools and implements likely to cause an accident shall be excluded altogether from the houses, and that " use lists " shall be affixed to every house in the same way that " limits " of explosives and men now are.

We are indebted to the Master General of the Ordnance for permission to publish this paper.

Discussion.

The **Chairman** mentioned the difficulties which in the early days attended the use of glycerin prepared from soap lyes in the manufacture of nitroglycerin. Frequently there was a separation of flocculent matter, sometimes honeycombing the whole mass of the nitroglycerin. The authors had mentioned impure acid as causing this abnormality; but in his own experiments chemically pure acid was always used. He could mention several substances which, added in minute quantities to the glycerin, would produce the separation of flocculent matter. Moreover, this flocculent matter was not only confined to soap lye glycerin. He should therefore like to ask whether the authors could throw any further light upon the cause of this separation. He noticed that they had got over the difficulty in a very ingenious manner by floating it off. Regarding the reaction of the sulpho-esters of glycerol, some light might be thrown on the equation by the fact that on trying to prepare glycerides from glycerine sulphate with fatty acids, only mono- and di-glycerides, and not tri-glycerides were obtained.

Mr. H. F. **Donaldson** referred to the great advantages which accrued from every effort to eliminate danger in hazardous operations which attached to such things as cocks in the nitroglycerin apparatus, and to the exclusion of all but absolutely necessary movable appliances in houses devoted to this manufacture. The paper contained valuable information on the chemical side of the question, as it certainly did on the safety of *personnel.*

Lt.-Col. Sir **Hilaro Barlow** said the point of greatest interest to him in connection with any paper on explosives was that of safety. All who had to do with the British workman would know the extraordinary importance of making, if possible, every safety appliance in a factory automatic; *e.g.*, they would grasp the importance of getting rid of stop-cocks for nitroglycerin and using instead an india-rubber pipe. He might also refer to the necessity of preventing every sort of movable apparatus, especially things of weight, being in the workshops, and having everything that was possible fastened to the walls so that they could not be moved. Sir Frederick Nathan had reduced that to a fine art. Unfortunately, in his own department he had a large number of tools, gauges, etc., which could not be so fastened, but it was desirable that such arrangements as had been suggested should be made as far as possible.

Prof. R. **Meldola** thought that the investigation of the flocculent matter referred to in the paper as well as by the Chairman might throw some light on the course of chemical events. It might be due to the glycerin; and he asked whether it was used as it came from the makers; or, did it go through any process of purification? That seemed to be one of the independent variables they had not heard much about. He presumed that the quality of the commercial glycerin varied according to source, and it might introduce fluctuating elements which would have to be reckoned with.

Mr. W. F. **Reid** said not only had the improved arrangements introduced by the authors resulted in a reduction of risk to the work-people, but this had been attended with great economy. They knew that a yield of nitroglycerin of from 214 to 216 per cent. used to be considered very good, whereas they had now got to 229 per cent. or over.

The separation of nitroglycerin from the waste acids was first done by the Boutmy-Faucher process. Sulpho-glycerin was made by mixing glycerin with sulphuric acid, during which operation a certain amount of heat was liberated; and it was supposed that when this sulpho-glycerin was nitrated there would be a smaller evolution of heat and consequently less danger; but as a matter of fact the reverse was the case. There was such a slow separation of nitroglycerin from the waste acids that they frequently fired, and consequently the process had to be abandoned. The scum which formed between the nitroglycerin and the acids after nitrating was really a collection of vesicles; and when this was filtered through sand, a very small quantity of impurity was obtained in which he had found fatty acids, iron, and lead, but in what particular form they existed, and why they formed that particular vesicular structure between the two layers of liquid, it was difficult to say. He would be interested to hear from the authors whether they now frequently came across glycerin which caused trouble in nitration or separation. He believed that now the manufacturers of glycerin knew what was required so well that they produced an article much more regular in quality and safer than it used to be.

He had recently tested a number of glycerins of various origins, by nitrating in vacuum vessels, in order to measure the amount of heat produced, and had obtained some rather curious results; but he had not been able exactly to find out the particular bodies which produced these different results between glycerins which by the ordinary tests showed no difference whatever though there was a great difference in nitrating. In distilling glycerin no doubt some fatty acids passed over which were of the same boiling point, and when these were nitrated they were not so easily purified, and might produce unexpected results. With regard to the separation, in this plant he thought a most ingenious method had been devised for raising the whole body of liquid instead of skimming off or separating in a separating funnel. Many years ago he tried a method which worked very well, but he abandoned it for reasons partly connected with the safety of the work-people, and partly from difficulty in the mechanical arrangements; he lowered a vessel of lead into the liquid thus causing the latter to rise and the top layer flowed over a lip at the side. Possibly some modifications of that process might be utilised if there was any reason why fresh acid should not be added; but as this was usually not the case the method described that evening was one which ought to be adopted in every factory. He should like to ask with regard to the drowning arrangements whether the drowning tap had been often used, and whether there was a sufficiently rapid emptying of the charge to prevent over-heating.

Softening the water also eliminated a great danger. Sometimes guncotton or collodion cotton did not pass the heat test; this was no doubt often owing to the water used in the manufacture. As to the question of sodium carbonate in the nitroglycerin, Sir Frederick Nathan made a very pertinent remark with regard to its action on the flame, although he understood a certain percentage was considered necessary for it to pass the heat test.

Major COOPER-KEY said that, although they did not call on manufacturers to have "Use lists" hung up in all the buildings on account of the expense, they would be exceedingly glad if they did do so, and he hoped the suggestion thrown out that evening might lead to their general adoption. Although the Home Office Inspectors did not insist on their being posted up, they acted in the spirit of the regulation by refusing to allow any article, either hard or heavy, to be present in any shed containing nitroglycerin.

Mr. R. B. POLLITT said he gathered that the authors considered that they could take the use of eight parts of mixed acid, and a yield of 216 per cent., as representing modern practice, for the purpose of comparing the latter, with Waltham Abbey practice, but he thought it was too high a ratio and too low a yield to take. He knew from practical experience, and no doubt many others knew it also, that it was quite possible to work with seven, or seven and a quarter, parts of mixed acid of ordinary composition, containing about 5 per cent. of water, to one part of glycerin and to obtain an average yield of well over 220 per cent. With regard to keeping the nitrating acid free from suspended mechanical impurities, it was surprising what a difference it made, not only in the rate and sharpness of the primary separation, but also in the amount of nitroglycerin that found its way to the secondary separators, and waste-water tanks. It was not difficult to prepare nitrating acid practically free from any suspended impurities, and the advantages gained much more than counterbalanced the slight extra cost involved. Working in the method referred to, and at a suitable temperature, secondary separators can practically be dispensed with, without adding water to the waste acid, and the amount of nitroglycerin-bearing "mud" collecting in the waste-water tanks is greatly reduced. The authors stated that they keep the temperature of nitration practically the same, winter and summer, but did not, he thought, say what it was, and it would be interesting to have the information. His own experience was that the temperature of nitration should be kept as low as it could be without risk of any of the nitroglycerin freezing on the coils.

Dr. R. MESSEL referred to his attempts, about 30 years ago, to introduce the use of fuming sulphuric acid in the explosive industry, partly for strengthening the mixed and waste acids, partly for obtaining an increase in the yield of trinitrocellulose, then the chief desideratum in the manufacture of guncotton. A real demand for this acid did not spring up, however, until the manufacture of nitroglycerin came more to the fore and it was shown that its use resulted in a not inconsiderable increase in the yield of nitroglycerin.

Mr. H. DE MOSENTHAL thought that it would not be right to leave the impression that private factories did not work as advantageously as the Royal Gunpowder Factory at Waltham Abbey with regard to yields. As a matter of fact private factories obtained yields quite as good, if not better. The use of fuming sulphuric acid in the manufacture of nitroglycerin was introduced in Great Britain, France, Germany, Italy, Austro-Hungary, Russia, the United States, and South Africa several years prior to its introduction at Waltham Abbey.

Mr. OSCAR GUTTMANN said the labyrinth had been devised by Mr. Alarik Liedbeck some 40 years ago, and he supplied improved drawings of it to Waltham Abbey. The sponge filter was used in the Boutmy-Faucher process, and illustrated in his book, and a similar one had been described in 1847. At the factory at Paulilles, a sponge used for wiping up nitroglycerin from the washing tank, on being left in the open air, fired, and since that time its use had been abandoned, therefore a sponge filter should be carefully attended to.

The CHAIRMAN said nitroglycerin manufacturers were at first only too prone to blame the glycerin. They rightly refused anything that did not comply with their requirements, but the glycerin makers had successfully fulfilled all their demands. It should, however, be pointed out that the nitroglycerin makers showed by their own specifications some curious notions as to possible impurities in glycerin. Thus they specified that glycerin must not curdle on passing nitrous acid through it, their idea evidently being that glycerin always contained oleic acid. This specification was still in vogue. In reality glycerin was nowadays delivered of such purity that it was the last thing the nitroglycerin makers could blame.

Sir F. NATHAN, in reply, said the point which had been most frequently referred to in the discussion was the presence of flocculent matter in nitroglycerin. What it was, Mr. Reid had described, but how to prevent it, and why it occurred with some glycerins and not with others, were questions which although they had been worked upon for a considerable time, had not yet been satisfactorily solved. He was inclined to think however that it was not the difficulty it used to be. Dynamite glycerin manufacturers probably knew their business better than they did, and they certainly produced a glycerin which did not give so much trouble from this cause as it used to do. Again there was no doubt that now that, instead of its accumulating as a layer between the nitroglycerin and the waste acid as it did in the old form of separator; it came up and was removed with the nitroglycerin during the separation in the new form of nitrator-separator; it gave no trouble. It no doubt resulted from the presence in the glycerin of resinous substances, fatty acids and organic impurities, but ordinary chemical tests on glycerin as delivered in bulk failed to detect more of these substances in one sample than in others. The Chairman had asked if they knew anything about di-nitroglycerin, and tetra-nitroglycerin; he could only say they had devoted themselves entirely to tri-nitroglycerin, and so far had not done any work on either of those other forms. Di-nitroglycerin might have a future in connection with explosives, and several patents had been taken out recently for its preparation and use, but as he had no experience with regard to it he hesitated to express any opinion. It appeared to him, however, that there would be some difficulty in getting pure dinitroglycerin free from other nitroglycerines. He was happy to say, in reply to Mr. Reid, that during his sixteen years at Waltham Abbey they had never had occasion to drown a charge, but they did know that their arrangements would meet the case if unfortunately it became necessary. They had tested them, and knew that the rate of drowning was fairly rapid, and they had the additional advantage that cold water was being added to the drowning tank along with the nitroglycerin and acid. As regards the average proportion of acid to glycerin being in practice 7 or 7½ to 1, their information rather tended to support the figure they had quoted of 8 to 1, which they believed was the figure used recently in most factories in this country, and in Germany. The glycerin before being used was submitted to all the usual chemical tests and to the nitration test, and that was not a laboratory one, because experience showed that laboratory nitration tests were fallacious as a guide to what would happen in manufacture. From every consignment of glycerin they received a drum was selected at haphazard and nitrated on the manufacturing scale, and only if it was satisfactory did they accept the consignment. For a long time now it had not been necessary to reject any consignment owing to its failing to pass this test. With regard to the labyrinth referred to by Mr. Guttmann, they had not been able to name the authors of all their improvements. The idea of the labyrinth was certainly suggested by Mr. Guttmann many years ago, though not perhaps for quite the same purpose for which it was now used at Waltham Abbey. Mr. Guttmann suggested that the labyrinth should take the place of the wash water settling tank and supplied a drawing of it as used at Hayle. They had rather extended the principle and put labyrinths in after every vessel from which washing waters were run, so as to trap as much nitroglycerin as possible before it got down to the wash water settling house. He was glad to say they had not had any signs of any failure with the sponge filter.

Mr. W. Rintoul said a paper by H. Lemaître on the analysis of nitroglycerin waste acid (Monit. Scient., Dec., 1907), had recently come to his notice, in which it was suggested that the nitroglycerin present could be determined by extraction with chloroform. From the curves given in the paper, it would be seen that the result so obtained would be about 50 per cent. too low. Lemaître assumed that all the glycerin in the waste acid existed as a nitroglycerin in solution, whereas they had shown that this was not the case. The fall of the heat test of nitroglycerin on repeated filtration was probably due to the fact that the first traces of decomposition products were absorbed by the moisture and sodium carbonate present. Whatever the cause, the fact remained that, if nitroglycerin showing a high heat test was repeatedly filtered through paper, there heat test in all such cases fell, and in so regular a manner as to suggest that the heat test of pure nitroglycerin, carried out under standard conditions, was really constant, and that it was impossible to get pure nitroglycerin to stand a prolonged test.

Manchester Section.

Meeting held at Manchester on Friday, February 7th, 1908.

DR. J. F. THORPE IN THE CHAIR.

SOME APPLICATIONS OF THE "CLARIFICATION TEST" TO SEWAGE AND EFFLUENTS.

BY GILBERT JOHN FOWLER, D.SC., F.I.C., SAM EVANS, B.SC. (TECH.), AND ARTHUR CHADWICK ODDIE.

Introduction.—In a paper read before this Society in May, 1905,(1) attention was drawn to the importance of determining the proportion of the suspended matter in sewage and effluents which is present in the colloidal state, or in a state of fine division or emulsion, as this constitutes potential solid matter which has to be ultimately dealt with. Reference was made to previous work on the subject (2) and a number of results were given, obtained by submitting samples of sewage from various sources and of sewage and septic tank effluent, to dialysis in parchment cylinders. The importance of the subject has been since fully recognised, and numerous papers (3) have appeared dealing with various aspects of the question.

The object of the present paper is to record a number of results which have been obtained by precipitation of the colloidal and finely suspended matters by means of basic ferric acetate, a method originally suggested by Rübner, (4) and mentioned by Fowler and Ardern in the paper already referred to, (5) which, for the sake of brevity, is here spoken of as the "clarification test." This method has been found to yield as instructive results as the method of dialysis, while it occupies much less time, and probably, in consequence, is less liable to error.

Clarification test.—The method adopted is as follows:—To 200 c.c. of the sample in a conical flask are added 2 c.c. of a 5 per cent. solution of sodium acetate and 2 c.c. of 10 per cent. ferric ammonium alum solution, the whole shaken and placed over a Bunsen burner. Immediately the liquid begins to boil the flame is turned down and the liquid kept just on the boil for two minutes. It is then removed, cooled under the tap, and filtered, introducing as little of the precipitate on to the paper as possible. In this way a clear filtrate is obtained which, therefore, may be taken for practical purposes to contain only substances in "true" solution. The filtrate is then analysed and the results compared with those obtained before clarification.

The precise period and method of boiling were chosen after a number of trials as being those which allowed no more liquid to be evaporated than was equal to the volume of the reagents added, the concentration of the sample is thus unaffected by the clarification. A number of blank experiments showed that, at any rate in dealing with sewage and effluents, the errors introduced by the addition of reagents and by the use of ordinary filter paper were inappreciable, especially as the chief value of the test lies in its use as a rapid method of comparing a number of samples, any small error therefore being common to all.

The exact method of estimating the amount of oxidisable matter present in the unclarified and clarified sample is a matter of more importance. It was at first thought that boiling with acid permanganate and titrating with oxalic acid, generally known as the Kubel method, would result in a saving of time. A number of experiments varying the proportion of reagents to sample, time of boiling, &c., showed that, if concordant results were to be obtained, the amount of permanganate used must be carefully proportioned to the amount of oxidisable matter present, and consequently time is occupied in preliminary estimations of this proportion. The ordinary 4 hours' test was finally chosen as being the most satisfactory determination for the purpose. At the same time, it is possible if the utmost rapidity is important, to obtain useful comparative results if shorter periods are taken for the action of the permanganate, *e.g.*, 1 hour or even 3 minutes. In all cases if appreciable quantities of nitrites are present in solution, these must be allowed for by heating the clarified solution with acid and urea, redetermining the oxygen absorbed, and correcting accordingly. Further information as to the nature of the organic matter in solution and suspension is afforded by the determination of the albuminoid ammonia or Kjeldhal nitrogen before and after clarification. This is especially valuable where sulphides are likely to be present, as these are either oxidised or precipitated by the hydrated oxide of iron, and therefore are not included in the estimation of crystalloids, but may, on the contrary, be included in the unclarified samples as colloids.

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(1) G. J. Fowler and E. Ardern, "Suspended Matter in Sewage and Effluents" (this J., 1905, 483).

(2) Manchester Corporation Rivers Committee, Annual Report for Year ending March, 1901, pp. 40—41.

O. Kröhnke and W. Biltz, Hygien. Rundschau, 1904, 9. Ber., 1904, 1745. (This J. 1904, 619.)

(3) A. S. Jones and W. O. Travis, Proc. Inst. Civil Eng., 1905—1906, Paper No. 3599. F. R. O'Shaughnessy and H. W. Kinnersley, this J., 1906, 719. J. H. Johnston, J. Roy. Sanitary Inst., 1906, 548. J. W. Ellms and J. F. Snell, Zeits. angew. Chem., 1906, 35. W. Biltz and O. Kröhnke, Cer. Ing., 1907, 350. (This J. 1907, 711.) W. O. Travis, Contract J., Dec. 11 and 18, 1907.

(4) M. Rübner, "Das Städtische Sielwasser und seine Beziehung zur Flussverunreinigung," Archiv. für Hygiene, 14.

(5) *Loc. cit*

Comparison of dialysis and clarification method.—It was of interest, in the first place, to determine how far the results given by the clarification test were comparable with those given by dialysis. A number of comparative analyses were therefore made by the clarification and dialysis method, both at the Davyhulme works, where much trade effluent is present in the sewage, and at the Withington works, which receives only domestic sewage. The method used for dialysis was the same as described in Fowler and Ardern's paper (6) In all cases, unless specially stated, the samples were examined after 2 hours' settlement. This procedure is, of course, quite empirical, but for practical purposes it is sufficient to distinguish between those matters which settle readily and are consequently eliminated after 2 hours' standing, and those which still remain in suspension, whether of a strictly colloidal character or not. As a matter of fact, as Zsigmondy (7) has pointed out, no absolute distinction can be drawn between substances in suspension, in colloidal solution, and in crystalloidal solution.

In the following and other tables the figures given, unless otherwise stated, are those representing the oxygen absorption, or the albuminoid ammonia due either to colloids or crystalloids, these figures being calculated as follows:

In the case of the clarification method:—X = oxygen absorbed in 4 hours by *unclarified* sample; and y = that absorbed by the *clarified* sample; then $x - y$ = oxygen absorbed by the *colloids* and y = that absorbed by the *crystalloids.*

In the case of the dialysis method:—X = oxygen absorbed in 4 hours by liquid *outside* dialyser; and y = that absorbed by liquid *inside* dialyser; then $x - y$ = oxygen absorbed by the *colloids*, and $2y$ = that absorbed by the *crystalloids.*

The figures throughout are in parts per 100,000.

TABLE I.

Comparative dialysis and clarification tests (average results.)

Sample.	Clarification Test.					Dialysis.			
	4 Hours' oxygen absorption.		Ammoniacal nitrogen.	Albuminoid nitrogen.		4 Hours' oxygen absorption.		Albuminoid nitrogen.	
	Crystalloids.	Colloids.		Crystalloids.	Colloids.	Crystalloids.	Colloids.	Crystalloids.	Colloids.
Sewage, Withington Works (average 5 samples) ..	1·26	3·95	2·16	0·09	0·11	1·38	2·19	0·08	0·19
Sewage, Davyhulme Works	5·14	3·10	—	—	—	4·42	3·32	—	—
Effluent from septic tanks, Davyhulme Works ...	4·87	2·69	—	—	—	3·94	2·69	—	—

An examination of the table shows that although the oxygen absorption figures by the two methods, dialysis and clarification, are not identical, yet the relation between the samples as regards matters in true solution and in fine suspension respectively is of the same order in both cases. It will be seen, however, that if a sample contains a large proportion of "colloids" the dialysis method tends to give rather low oxygen absorbed figures for these. On the other hand, if the proportion of "crystalloids" is large, lower results for these are given by the dialysis than by the clarification method. This is to be expected in view of the fact that the dilution necessary for dialysis and the time required for equilibrium to be set up is likely to have a greater proportionate effect on whichever class of oxidisable matter is present in greater amount. This supposition is upon the whole confirmed by the results recorded in Table II. The samples were tested at once, after 24 hours standing alone, and after 24 hours standing after mixing with an equal volume of water. The figures for Davyhulme sewage are the average of seven analyses, which, owing to the presence of trade-effluents, &c., showed considerable variation among themselves.

TABLE II.

To show effect on various samples of standing in presence of air before and after dilution, to compare with dialysis experiment.

January, 1908.	4 Hours' oxygen absorption.					
	Original sample.		Original sample after standing 24 hours in contact with air.		Mixture of 1 vol. sample and 1 vol. water after standing 24 hours in contact with air.	
	Crystalloids.	Colloids.	Crystalloids.	Colloids.	Crystalloids.*	Colloids.*
Sewage, Withington	0·63	1·80	0·60	1·60	0·29	0·72
Tank effluent.....................	0·77	1·74	0·56	1·63	0·27	0·79
Primary filtrate	0·40	0·67	0·34	0·65	0·20	0·29
Secondary filtrate	0·34	0·36	0·24	0·40	0·17	0·14
Sewage, Davyhulme	5·20	3·64	4·71	3·65	2·70	1·64

* Figures in these columns to be doubled for comparison with the other results.

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(6) *Loc. cit.*

(7) "Zur Erkenntniss der Colloide," Fischer, Jena.

In the case of the Withington sewage samples some comparative determinations of albuminoid nitrogen are given in Table I. These agree well as regards the matters in true solution, but show considerable variation in respect to the colloidal matters. In presence of suspended matter it is, however, well known that the albuminoid nitrogen figure is somewhat indeterminate.

Experiment re-aeration of contact beds.—An interesting application of the clarification test was afforded in an experiment done at the Withington works to determine some of the conditions of effective aeration of contact beds. This inquiry arose in connection with certain experiments with reference to the working of automatic gear, where it was necessary to reduce the capacity of certain of the second contact beds by holding up the effluent within them to the depth of about 9 inches by means of a weir board at the exit. It was thought not unlikely that this might exert a prejudicial effect on the aeration of the bed, and consequently on the purification effected by it. The opportunity was therefore taken of carefully testing the point, and the results of the clarification test are given in the following table. They bring out quite clearly the superior results obtained when the bed is allowed to empty itself completely. The appearance of the samples confirmed the results of the analyses in showing that defective aeration increased the amount of colloidal matter present. The inference appeared to be that a certain amount of circulation of air must take place through the exit valves, and consequently these should be kept open during a period of rest and the bed allowed to drain freely.

TABLE III.

Aeration of contact beds.—Secondary bed No. 3, without weir board : completely emptied. Secondary bed No. 4, with weir board : about 9 inches of water held in bed.

Average filtrate, Nov. 12 to 15, 1906.	4 Hours' oxygen absorption.		Albuminoid nitrogen.	
	Crystalloids.	Colloids.	Crystalloids.	Colloids.
Secondary bed, No. 3	0·60	0·04	·025	·015
Secondary bed, No. 4	0·70	0·20	·025	·045

SYSTEMATIC APPLICATION OF THE CLARIFICATION TEST AT DAVYHULME.

The foregoing results and other investigations with widely varying sewages to be recorded later led to the adoption of the "clarification test" as a routine method at the Davyhulme works, and the following tables give the result of determinations continued during the last 6 months of 1907. Average figures only are given for each month.

TABLE IV.

Clarification test (Davyhulme Works). 4 hours' oxygen absorption test. Results in parts per 100,000.

Source of sample.	Original sample I.	After 2 hours' settlement unclarified. II.	Heavy suspended matter. I.—II.	Clarified sample "crystalloids." III.	Fine suspended matter "colloids." II.—III.
July and August.					
Raw sewage	8·73	6·13	2·60	3·44	2·69
Effluent from septic tanks	6·79	6·03	0·76	3·17	2·86
Effluent from primary contact beds—					
Series I.	3·17	2·86	0·31	1·77	1·09
Series II.	2·36	1·91	0·45	1·11	0·80
Series III.	3·33	3·07	0·26	1·77	1·30
Effluent from secondary bed	0·91	0·91	nil.	0·49	0·42
September.					
Raw sewage	11·44	8·07	3·37	5·33	2·74
Effluent from septic tanks	8·57	7·60	0·97	4·74	2·86
Effluent from primary contact beds—					
Series I.	3·87	3·56	0·31	2·53	1·03
Series II.	2·94	2·69	0·25	1·70	0·99
Series III.	4·09	3·77	0·32	2·36	1·41
Effluent from secondary bed	1·03	1·00	0·03	0·59	0·41
October.					
Raw sewage	11·11	8·10	3·01	5·31	2·79
Effluent from septic tanks	8·12	7·27	0·86	4·87	2·40
Effluent from primary contact beds—					
Series I.	3·61	3·24	0·37	2·13	1·11
Series II.	2·83	2·51	0·32	1·50	1·01
Series III.	4·14	3·89	0·25	2·43	1·46
Effluent from secondary bed	0·96	0·96	nil.	0·59	0·37
November.					
Raw sewage	11·43	8·31	3·12	5·20	3·11
Effluent from septic tanks	8·13	7·52	0·60	4·94	2·59
Effluent from primary contact beds—					
Series I.	4·20	3·83	0·37	2·74	1·09
Series II.	3·43	3·10	0·33	2·10	1·00
Series III.	4·27	4·07	0·20	2·59	1·48
Effluent from secondary bed	1·27	1·21	0·06	0·73	0·48
December.					
Raw sewage	11·84	8·31	3·53	5·20	3·11
Effluent from septic tanks	8·65	7·70	0·95	5·03	2·67
Effluent from primary contact beds—					
Series I.	4·16	3·80	0·36	2·57	1·23
Series II.	3·49	3·09	0·40	2·60	0·93
Series III.	5·10	4·73	0·37	2·51	2·22
Effluent from secondary bed	1·51	1·41	0·10	0·97	0·44

A study of these tables reveals several points of interest.

Sewage and septic tanks.—In the first place, it will be seen that during the warmer months of July, August, and September there is a greater proportion of colloidal matter in the effluent from the septic tanks than in the raw sewage, whereas during the last 3 months the reverse is the case. The lower figures for the total oxidisable matters in the sewage in July and August are due entirely to the less proportion of oxidisable matter in solution. This is partly accounted for by the lessened production of certain trade effluents (mainly ammonia-recovery liquor) during this period, and partly by the greater rainfall. The figure for the total oxidisable matter in September is, however, almost identical with those of the following months. Consequently, it would appear that the increase in the colloidal matter in the effluent over that in the sewage during the first 3 months must be due almost entirely to the higher temperature, and consequently greater fermentative activity of the tanks. It is a curious fact that, although the sewage was certainly more dilute in July and August than in September, the oxygen absorption due to colloids is the same in both cases. This is confirmed by experiments quoted later, which suggest that on mixing solid sewage matter with increasing quantities of water a proportionately greater quantity of colloids are disseminated through the liquid. In time of rain the lighter organic solids are also probably more thoroughly separated from the heavier mineral matters. The substances in true solution are apparently merely diluted. There is a distinct reduction in the oxygen absorbed by crystalloidal substances in the tank effluent as compared with the raw sewage, especially during the warmer months. As there is almost always an increase in ammoniacal nitrogen after the sewage has passed through the septic tanks, the decrease in the oxygen absorption figures would indicate the breaking up of nitrogenous compounds into substances absorbing less oxygen. This receives confirmation from experiments with Withington sewage to be quoted later, and also is in harmony with results obtained some years ago in the laboratory at Davyhulme, (8) where a distinct decrease in the actual weight of dissolved organic matter originally present in the sewage, as determined by evaporation, was found to take place in the septic tank.

While it is hardly conceivable that substances in true crystalloidal solution can become converted into the colloid condition in the septic tank, yet these results certainly do not favour the view that any large proportion of the solid matters in the sewage are, in the strict sense, dissolved in the septic tank under the conditions at Davyhulme. The disappearance of undissolved organic matter would appear to be chiefly accounted for by its escape in the form of colloids and as gas. At higher temperatures or longer periods of fermentation, evidence will be brought forward to show that with domestic sewage at any rate true solution of organic matter does take place.

Contact beds.—Turning to the purification effected by the bacteria beds, a point which comes out quite clearly is the better purification effected by the beds of Series II. over those of Series I. and III., and of Series I. over Series III. This is no doubt due to the progress of washing operations, the beds on Series II. having all been completely renewed with washed material by the beginning of the year, and an increasing number of beds in Series I. in the course of the six months in question. The superiority of the washed beds shows itself in the earlier months more in the capacity of oxidising the dissolved matter, but later rather in the reduction in the oxygen absorbed by the colloidal matter. The lessened oxidation of dissolved matter may be due in part to the greater activity of nitrification in the warmer months. At the same time, it must be remembered that the actual quantity of nitrates emerging in the effluent from contact beds is the balance left over after a certain amount has been taken up in oxidising organic matter during the period of contact. The character of the dissolved matter in the septic tank effluent in the two periods may also affect nitrification, apart from the actual temperature of the liquid as it passes on to the beds. Probably, however, the increased rate of working the beds on Series II. during the later months is the chief factor in causing a greater proportion of dissolved matter to pass through unoxidised. (9)

The figures for colloids indicate that retention, oxidation, and granulation of colloidal matter is probably a process largely independent of nitrification; other researches have, in fact, shown that the oxidation of retained organic matter is due in part to the activity of worms and other higher organisms. These latter are unable to live in any portion of a bed which is permanently water-logged. Any undigested colloids will also tend to re-dissolve in the effluent. Further, the power of "absorption" exerted by the gelatinous film has been shown by the experiments of Dunbar (10) to be reduced rapidly in absence of adequate aeration. All these factors will tend to increase the proportion of colloids in the effluent from a badly aerated bed. On the other hand, if a bed is well aerated the colloids continue to be retained or oxidised, even when the oxidation of dissolved matter is diminished.

With regard to the secondary bed, the larger amount of oxygen absorbed by the crystalloidal matter during the later months is obviously conditioned by the amount present in the primary effluents. The colloidal matter is practically independent of the amount in the primary filtrate.

The above results indicate how the "clarification test" may serve as a routine method for controlling the work of septic tanks and contact beds.

It may find equally useful application in the control of percolating filters. The following examples are taken from a number of results obtained in the course of experiments in the purification of latrine effluents on fine-grained percolating filters. The sewage under treatment

TABLE V.—*Treatment of latrine tank effluent on fine-grained percolating filter.*

Tank effluent.			Filter effluent.			
Oxygen absorption, 4 hours.		Ammoniacal nitrogen.	Oxygen absorption, 4 hours.*		Ammoniacal nitrogen.	Nitrous and nitric nitrogen.
Crystalloids.	Colloids.		Crystalloids.	Colloids.		
·99	2·26	—	1·12	·27	1·04	3·48
·96	1·45	4·72	0·36	·36	1·68	2·37
1·28	1·20	5·08	0·88	nil.	1·33	2·60

* Figures corrected for nitrites. The samples were not allowed to settle before analysis, but the amount of sedimentary matter was practically negligible.

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(8) Annual Report of the Manchester Rivers Committee, 1901, p. 37.

(9) *Quantities dealt with by bacteria beds—Series II. and Secondary bed. (Gallons per cubic yard per day.)*

Series II.		Secondary bed.	
July and August....	110	July and August....	180
September	100	September	160
October	125	October	140
November	125	November	180
December	160	December	180

(10) Zur Beurtheilung der biologischen Abwasserreinigungsmethoden. Ges. Eng., 1903, Nos. 33 and 34.

was mainly derived from a rice-eating population in the tropics. They are of interest as showing that even when excellent nitrification of the ammonia was being effected the work of the filter largely consisted in removal of the colloidal and suspended matters in the tank effluent. These matters are evidently much more affected than those in solution other than the ammonia.

How far the difference between the oxidisable colloidal matter in the effluent from the tank and the filter respectively indicates a mere retention of this matter by the filter, or how far it indicates actual oxidation, can only be determined after a filter has been at work a considerable time. General experience points to the fact that considerable retention does take place, and that the oxidation of this retained matter proceeds much more slowly than the nitrification change. The rapid increase of colloidal matter in the effluent if the aeration of a bed is impeded is one evidence of this storage. The "clarification test" gives a rapid measure of the quantity of this retained oxidisable matter which has to be dealt with.

It is of interest to note that the drop in the oxidisable matters in solution after filtration is less on the whole than is given by the Davyhulme contact beds. This may be due partly to the fact that the character of the dissolved matters are such that they do not cause reduction of nitrates or denitrification changes to the same extent as those present in the Davyhulme tank effluent. This is likely to be the fact, owing to the much more complete hydrolysis taking place at the high temperature of the experiment than is the case in the Davyhulme tanks. It is obvious that the clarification test will afford a simple means of determining how much of the organic matter passing away from coarse-grained percolating filters is in the colloidal and therefore incompletely oxidised condition. Recent experiments by the Massachusetts State Board of Health (11) on the mechanical filtration, after coagulation by chemicals, of effluents from open percolating filters would indicate that the amount of colloidal matter present in these effluents is appreciable.

FURTHER INVESTIGATION OF THE ANAEROBIC DECOMPOSITION OF SEWAGE.

Effect of varying periods of time.—As the anaerobic decomposition of albuminoid organic matter consists in the progressive resolution into substances of a colloidal and finally crystalloidal character, it appeared likely that the clarification test would afford a useful means of determining how far these changes go on in the septic tank, and possibly of throwing some light on the question of so-called "over-septicisation," which involves the practical issue of the right size of septic tanks. A series of experiments was carried out in the following manner at the Withington sewage works, where only domestic sewage is dealt with. A sample of sewage after settlement was divided among a number of bottles, which were completely filled, and allowed to stand for varying periods of time, after which a portion was carefully decanted off and taken for analysis. A similar series was made up, only half filling the bottles, and thus allowing the sample to stand the presence of air. The results of the analysis are given in Table VI. with a note as to the proportion of hydrogen-sulphide present. The figures are somewhat indeterminate, owing to the uncertainty as to the effect of the proportion of soluble sulphide on the oxygen absorption test, but taken together they indicate pretty clearly that little advantage and certainly a greater liability to nuisance is incurred by constructing tanks of a capacity greater than sufficient to hold one day's flow. In presence of air the oxidisable matter, both colloidal and in solution, is certainly reduced to a greater extent than under anaerobic conditions, the ammoniacal nitrogen is also less, but the albuminoid nitrogen does not appear to be affected to the same extent.

TABLE VI.—*Effect of varying periods of time on anaerobic decomposition.*

Series I.—Analyses of samples of raw sewage after settlement.

Time standing at the temperature of laboratory	4 Hours' oxygen absorption.				Ammoniacal nitrogen.		Albuminoid nitrogen.				Sulphide in absence of air.
	In absence of air.		In presence of air.		In absence of air.	In presence of air.	In absence of air.		In presence of air.		
	Crystalloids.	Colloids.	Crystalloids.	Colloids.			Crystalloids.	Colloids.	Crystalloids.	Colloids.	
0	1·83	2·97	—	—	2·93	—	·11	·19	—	—	trace
24 hours	1·80	2·54	1·23	2·88	3·05	2·94	·09	·13	·08	·17	trace
48 ,, ...	1·43	2·80	1·11	2·38	2·52	2·23	·06	·14	·08	·19	fair
120 ,, ...	1·80	3·51	1·31	1·52	2·71	2·47	·03	·11	·05	·14	large

Series II.—Analyses of samples of raw sewage after shaking.

Time standing at the temperature of laboratory	4 Hours' oxygen absorption.				Ammoniacal nitrogen.		Albuminoid nitrogen.				Sulphide in absence of air.
	In absence of air.		In presence of air.		In absence of air.	In presence of air.	In absence of air.		In presence of air.		
	Crystalloids.	Total undissolved matter.	Crystalloids.	Total undissolved matter.			Crystalloids.	Total undissolved matter.	Crystalloids.	Total undissolved matter.	
0..................	3·66	7·20	—	—	5·52	—	·27	·80	—	—	nil
18 hours	1·71	8·12	1·60	9·60	5·88	5 64	·19	·64	·16	·88	trace
24 ,, ...	1·71	8·00	1·43	9·08	5·64	5·18	·11	·69	·11	·74	fair
42 ,, ...	1·71	7·72	1·31	8·79	6·58	6·00	·13	·72	·11	·93	v. fair
66 ,, ...	1·77	8·29	1·43	9·57	6·23	5·88	·08	·82	·08	·85	v. good
90 ,, ...	1·83	8·86	1·49	10·21	6·23	5·76	·07	·56	·07	·65	large
114 ,, ...	1·94	9·55	1·60	8·80	6·82	6·00	·08	·59	·08	·87	large

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(11) State Board of Health, Massachusetts, Annual Report, 1906, p. 283.

A second series of experiments, where the samples were analysed after shaking, thus including the settled solids in the precipitated matter, led to pretty much the same conclusion. The decrease in oxidisable matter in solution under anaerobic conditions, which was noted in the case of the Davyhulme observations is here emphasised.

Additional anaerobic treatment of effluent from septic tanks.—An interesting application of the clarification test was afforded in the case of an installation where a considerable extent of anaerobic contact bed, which remained constantly full of liquid, had been provided between the septic tank proper and the aerobic percolating filters. Average samples were carefully taken before and after this anaerobic bed and tested by the clarification method, 1 hour being allowed for the oxygen absorption in this case, and the samples being allowed to settle before analysis. The following results were obtained :—

	Oxygen absorption, 1 hour.	
	Colloids.	Crystalloids.
Before anaerobic tank............	1·00	1·00
After anaerobic tank	1·05	0·95

These figures reveal, therefore, practically no difference, and complete analyses showed that the weight of actual solids in solution was practically identical in the two cases, and consequently that the only effect of the anaerobic beds was to retain a certain quantity of the suspended solids escaping from the septic tank. In this case the septic tank alone held nearly two days' flow and the anaerobic bed provided another 12 hours' storage. Much less provision than this would have been sufficient for a mere mechanical straining, which was all apparently that the bed was effecting. The bearing of the results of the clarification test on the economical design of works is thus apparent.

Effect of dilution on rate of change under anaerobic conditions.—An important and difficult point to decide in the design of works, especially of anaerobic tanks, is the right proportion between the concentration of the sewage and the holding capacity of the tank. It is generally considered that 24 hours' storage is enough for practical purposes, and this general rough and ready estimate is probably sufficiently correct in a large number of cases. It is evident, however, that 24 hours' storage for a sewage of, say, 5 gallons per head concentration means a much less tank capacity per head of population than if a 24 hours' storage is to be given to a volume of sewage amounting to, say, 40 gallons per head from the same population. The same amount of organic matter, however, passes through both tanks. Of this the heavier portion will settle out in a few hours in both cases, and its fermentation continues over a long period of time. The question is really confined to the matters in colloidal and crystalloidal solution, and it is important to find out what effect dilution has upon their course of change. On general principles it would be expected that within limits enzymic hydrolysis would be more rapid and complete the more dilute the solution.

Much work remains to be done in this direction in connection with the various fermentations occurring in the anaerobic tank. The following experiments show the results obtained in two cases by the application of the clarification test. In the first case a sample of crude sewage (5 gallons per head strength) in a very fresh state from a rice-eating population, was diluted in varying proportions with tap-water and the mixtures allowed to stand 24 hours and then analysed, the whole of the solids, however, were included in the portion tested before clarification. The figures for the ammoniacal and albuminoid nitrogen are also given.

Table VII.—*Effect of dilution on rate of anaerobic change.*

Series I.

Ratio of volume of sample to volume of tap-water.	Nitrogen.		Oxygen absorption, 4 hours.	
	Ammoniacal.	Albuminoid.	Total suspended solids, including colloids.	Crystalloids.
1 : 1	1·07	2·36	7·94	2·71
1 : 3	0·79	1·23	3·09	2·39
1 : 5	0·61	0·61	1·79	2·01
1 : 7	0·36	0·41	0·93	1·77

Series II.

	Colloids.	[Crystalloids.
Original sample.	2·64	2·26
1 : 1	2·04	1·43
1 : 3	1·73	1·11
1 : 7	1·30	0·83

These figures show very clearly the greater conversion of complex nitrogenous matters into simpler forms, the albuminoid figures decrease in much greater proportion than the dilution, while the ammoniacal nitrogen is proportionately increased. Corresponding with this there is a very considerable increase in the oxygen absorption due to crystalloids, and a corresponding decrease in the amount absorbed by the insoluble matters. There is clear evidence here of true solution of organic colloidal matter, and this solution evidently takes place more rapidly the more dilute the solution. These results are confirmed by experiments in this country, the experimental conditions being somewhat modified. The sewage contained a thick sediment of fæcal matter ; this was shaken up thoroughly on dilution, but even when 7 volumes of tap water were added to 1 of sewage much sediment remained. The samples were incubated for 7 days at 26° C., and the supernatant liquid carefully decanted off and the oxygen absorbed in 1 hour determined before and after clarification.

Table VII. Series II., shows the progressive increase in colloids and crystalloids, with increase of dilution, the figures being much greater than they would have been had simple dilution taken place.

The fact that considerable evolution of hydrogen sulphide took place hardly affects the conclusion that the rate of decomposition increases with the dilution, as in any event any oxygen absorbed by the hydrogen sulphide would only affect the figure due to colloids, and if the rate of decomposition were equal throughout should be proportionately less with the greater dilution. Moreover, the total sulphur in European sewage of 5 gallons per head strength has been found by one of us not to exceed 4 parts per 100,000.(12) Still, some portion of the increase in the oxygen apparently absorbed by the colloids may be due to hydrogen sulphide, and no doubt a purely mechanical disintegration of heavy solids into colloidal matter takes place on dilution as mentioned earlier in connection with Davyhulme sewage. The results, however, bear out the general conclusion that when sewage ferments under anaerobic conditions some proportion of the heavy solids assume the colloidal condition, and the colloids progressively are converted into complex crystalloidal compounds, and these suffer further change in composition with final production of simple ammonia derivatives. The relative rate at which these various changes take place will depend on the character of the sewage, the temperature, and the dilution. Much further work is needed before these points can be worked out in detail. Thus examination by the clarification test of a sample of Withington sewage after incubation at about 26° C. for 4 days and after standing for the same time at laboratory temperature shows a greater amount of colloids and of crystalloids in the incubated sample.

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(12) Fowler "Treatment of Sewage under Tropical Conditions," International Congress of Hygiene and Demography, Berlin, Sept., 1907.

TABLE VIII.—*Effect of temperature on anaerobic changes.—Raw sewage, Withington.*

Temperature conditions.	Oxygen absorption.				Chlorine.	Hydrogen Sulphide.
	4 hours.		3 minutes.			
	Crystalloids.	Colloids.	Crystalloids.	Colloids.		
Incubated at 26° C.	·91	1·38	·46	·45	3·6	Fair amount
Laboratory temperature	·69	1·08	·29	·45	3·6	trace

FURTHER STUDY OF THE CHANGES TAKING PLACE IN SEWAGE UNDER AEROBIC CONDITIONS.

It becomes now of interest to endeavour to follow the changes taking place under aerobic conditions of various kinds and certain observations may be quoted in reference to preliminary aerobic treatment in contact beds of very open structure.

The following table (Table IX.) shows the average effect of such treatment on native sewage (10 gallons per head dilution) in the tropics. The sewage was taken in an almost absolutely fresh condition. Unfortunately no distinction was made between heavy solids and colloidal matters, the oxygen absorbed by both of these being given in one column. As a matter of fact with a 10 gallon dilution most of the oxidisable matter was obviously colloidal. There is a slight decrease in the oxygen absorbed by the insoluble and colloidal matters, and a slight increase in the amount absorbed by the crystalloids. On passing the liquid on to a fine contact bed a great decrease takes place in both. With a concentration of 5 gallons per head, later experiments showed that a greater difference was exhibited in the total purification effected by the open contact bed.

TABLE IX.—*Preliminary aerobic treatment (tropical conditions).*

Description of sample.	Oxygen absorption, 4 hours.	
	Crystalloids.	Colloids.
Raw sewage	2·77	6·69
Preliminary aerobic contact bed	3·19	6·19
Secondary ditto	0·90	2·51

The following observations were made in the course of an investigation of Mr. Dibdin's slate bed process at Devizes, High Wycombe, and Coombe Malden. At Devizes the sewage is highly offensive and concentrated, at High Wycombe it is very dilute, and at Coombe Malden the sewage is of average strength, and the object of the test in the latter case was to compare the effect of the slate bed with chemical treatment. The oyxgen absorption figures were in this investigation determined by the Kubel method, the amount of permanganate used being roughly proportional to the oxidisable matter present. The colloids were not determined separately from the total suspended matters except in the case of Devizes where the figures for colloids are given in brackets. The results obtained were as follows:—

TABLE X.

Preliminary aerobic treatment (English conditions) (Kubel test).

	Oxygen absorbed (Kubel pest) by	
	Total suspended solids.	Crystalloids.
Devizes—		
Crude sewage	36·3 (6·3)	16·7
Slate-bed effluent	21·1 (9·6)	15·4
Fine-bed	3·5	8·5
High Wycombe—		
Sewage	13·5	5·5
Slate-bed effluent	3·6	6·9
Coombe Malden—		
Effluent from chemical treatment	5·00	1·0
Slate-bed	3·60	0·8

Both under tropical and European conditions the main effect of holding the sewage in contact with such surfaces for an hour or two appears to be retention of the heavier suspended solids which are subsequently slowly oxidised. The effect on the remaining colloidal and crystalloidal substances is much less marked and will depend to some extent no doubt on dilution and temperature. It is worthy of remark, however, that the effluents after preliminary aerobic treatment are more quickly nitrified on mixing with aerated tap-water than is untreated sewage.

Changes accompanying nitrification in solutions of organic matter.—The clarification test may be usefully employed in studying the changes taking place when mixtures of nitrogenous organic matter and aerated tap-water are kept under conditions favouring nitrification. It thus supplements the methods of examination so successfully used by Adeney in his classical researches.(13) It may find a specially useful application in studying the conditions of successful treatment of complex trade-effluents.

The following results were obtained in the course of an investigation into the treatment of woolcombers' refuse and the effect of the presence or absence of free sulphuric acid on the decomposition of the organic matter present. The following solutions were made up:—*Solution* 1*a*. 50 c.c sample 1, 5 c.c. nitrifying solution, 945 c.c. tap-water (free acid present). *Solution* 1*b*. The same mixture neutralised with excess of magnesium carbonate. *Solution* 2*a*. 50 c.c. sample 2, 5 c.c. nitrifying solution, 945 c.c. tap-water (free acid present). *Solution* 2*b*. The same mixture neutralised with excess of magnesium carbonate. (The nitrifying solution was made by dissolving 0·25 grm. of urea in 1 litre of water, with the addition of 1 c.c. of sewage effluent, a small piece of filter paper moistened with fermenting urine, and a little magnesium carbonate. A good development of nitrites had taken place in the solution when used as above.) Solutions 1*a*, 1*b*, 2*a*, and 2*b* were transferred to Winchester bottles (which were thus more than half full of air), placed in the incubator at 26° C., and kept under observation for a considerable time (Sept. 9—Oct. 17, 1907) being well shaken at intervals. They were then examined by the clarification test, the 4 hours' oxygen absorption being used as a measure of the changes which had taken place. The following figures were obtained after deducting the oxygen absorbed by the nitrites in the neutralised samples:—

TABLE XI.

Effect of neutralisation on aerobic changes.

	Oxygen absorbed, 4 hours.	
	Total insoluble matters, including colloids.	Crystalloids.
1*a* (acid)	1·53	0·61
1*b* (neutral)	1·31	0·94
2*a* (acid)	1·00	0·61
2*b* (neutral)	1·27	1·40

These figures point to a greater breaking down and solutionising of organic matter in the case of the neutralised samples, and thus indicate that neutralisation is advisable at some stage of the purification process.

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(13) Trans. Royal Dublin Soc., 1897; Proc. Royal Irish Academy, 1905.

Amount and character of crystalloidal and colloidal matter.—It is fully realised that the mere determination of the oxygen absorbed, though of evident value as a comparative test, does not give much information as to the actual composition or quantity of the oxidisable matters present in the different conditions, and much further research of a more detailed character is needed for a full interpretation of results. Some preliminary work has been done in this direction. Thus a number of determinations of the amount of grease present in Withington sewage have been made by extracting the basic ferric acetate precipitate with ether. The results as given in the following table do not show any special correspondence between the amount of ether extract and the other analytical figures.

Table XII.—*Application of clarification test to determination of amount of "ether extract" in Withington sewage.* (*Parts per* 100,000.)

Oxygen absorption, 3 minutes' test.		Albuminoid nitrogen.		Ammoniacal nitrogen.	Chlorine.	Ether extract.
Total precipitated matter.	Crystalloids.	Total precipitated matter.	Crystalloids.			
3·08	3·26	0·37	0·11	3·05	7·7	8
3·56	1·31	0·32	0·16	3·53	8·0	42
4·57	1·49	0·30	0·09	2·82	7·7	11
4·29	1·77	0·20	0·08	2·35	7·4	35
4·57	1·60	0·24	0·11	2·70	8·3	26
4·74	1·09	0·36	0·13	3·18	7·7	20

It is intended to pursue the investigation of the precipitated matter, determining, for example, the total carbon and nitrogen present, if possible, after separating fatty substances and cellulose. Further examination of the amount and nature of the crystalloidal substances and their rate of oxidation needs to be made; in fact, ample materials exist for prolonged research.

Conclusions.—The present paper, however, is intended to be suggestive rather than final. The results recorded have, at any rate, emphasised the complexity of the problem with which the sewage chemist has to deal. They have shown that the oxidisable matters in sewage are present in three states, as heavy suspended matter, as colloidal matter, and as crystalloidal matter. The rate and character of change in each of these states respectively has been shown to differ and to depend on varying factors.

For a full understanding of the process, the conditions of purification of each class of matter should be worked out separately. This evidently requires prolonged research of a refined character.

At the same time, when used as an ordinary routine method, the "clarification test" has been shown to be capable of affording the sewage works chemist, in a rapid and simple way, a deeper insight into the changes taking place in the course of the processes he is called upon to supervise. It is hoped, therefore, that it may be more generally adopted, when the accumulated observations of a number of workers should supply a valuable control upon the more detailed work of the research laboratory.

The thanks of the authors are due to the Rivers Committee of the Manchester Corporation for their ready permission to publish the results obtained at the Davyhulme and Withington works, and to Mr. Edward Ardern, Resident Chemist at Davyhulme, for valuable help and criticism during the preparation of the paper.

The experiments relating to the treatment of sewage under tropical conditions were done in connection with work described in a paper on the subject read before the International Congress for Hygiene and Demography at Berlin, in September, 1907. The remaining observations were made by one of us at the Public Health Laboratories of the University of Manchester, where every facility was afforded for the carrying on of such work

Discussion.

The **Chairman** said that some time ago, in conjunction with Mr. Ogden, the manager of the Davyhulme works, he had made experiments with regard to sewage clarification by filtration processes. He could not say whether they got rid of the colloids, but he should think not. He thought Dr. Fowler's method, in addition to being simple, was accurate. He believed it was due to the soluble colloids that the effluent, although not putrefactive itself, possessed putrefactive power when mixed with other waters which contained bacteria. He looked upon this question as one for the organic chemist more than the sewage chemist to deal with. When they considered the great number of known compounds and the different methods adopted for their production, he thought it should be possible at the present time to attack these problems with some hope of success. With regard to the proteins, this was a problem which could not be solved by one man. Science had become so specialised that it would have to be collaborated work of the chemist, the physiologist, and the bacteriologist.

Mr. H. L. **Terry** said that the clarification test would doubtless be employed when better known, in conjunction with the oxygen absorption test, by those who had sewage works under their control. Dr. Fowler had not suggested that the reagent could be employed on the large scale with a view to further reduce the objectionable colloidal matters existing in varying amounts in sewage effluents. He was specially interested in the figures given in the effluent from a percolating filter, showing as they did the conjunction of low colloidal matter and high nitrates. His experience with certain types of sprinkler filters was that with effluents containing nitric nitrogen varying from one to three grains per gallon, there was no subsequent decomposition. High nitrates seemed to indicate a low content of colloidal matters, and, consequently, the advantage of the sprinkler filter over the contact bed.

Mr. **Barnes** said that a more rapid method for estimating the oxygen absorbed was by using chromic acid and sulphuric acid, whereby he could quickly obtain very good results and a more complete oxidation of the organic matter than by the usual four hours' permanganate test. Moreover, certain organic substances which gave practically no results with the permanganate test gave almost theoretical results with the chromic acid test. He also found it possible by making use of the two tests to tell whether the sewage effluent was polluted with starch or gelatin, or whether it was mainly of an albuminoid character. He should like Dr. Fowler's opinion on these matters.

Dr. F. W. **Skirrow** said it has been shown by Biltz and Khrönke that the colloids in sewage had a negative polarity when suspended in water, and it had also been shown that two colloids of opposite polarity mutually precipitated one another, even in absence of electrolytes, but in order to effect this precipitation it was essential that the concentration of the colloids should be kept within certain limits, and if the concentration of the added colloid was outside these limits no precipitation was effected. Biltz and Khrönke stated that in the precipitation of the negative colloids in sewage by ferric salts the active agent, in all probability, was the positively charged colloidal ferric hydroxide present owing to the hydrolysis of the salt. Had Dr. Fowler found it necessary to carefully regulate the concentration and amount of the basic ferric acetate added in order to effect the maximum precipitation? Biltz and Khrönke attempted to explain the bacteriological treatment of sewage by the attraction of oppositely charged colloids. The bacteria formed a gelatinous layer on the material of the bed and this layer then acted mechanically on the colloids contained in the sewage forming a so-called "absorption compound." The further oxidation of the absorbed colloid then took place quite independently by the oxygen of the air or by enzyme action. If this explanation were correct, Dr. Fowler's method was of still greater value, as the laboratory test really reproduced what was taking place on the bacteria bed, the active agent in this case being the positively charged colloidal ferric hydroxide in place of the gelatinous product of bacterial action.

Mr. E. **Ardern**, as a result of considerable experience with the clarification test at Davyhulme, was able to confirm the authors' opinions in regard to its usefulness in amplifying the information gained by the usual routine analytical methods employed in the examination of sewage and sewage effluents. The results given in Table I. showed that the oxygen absorption due to crystalloids in the case of the sewage at Davyhulme was considerably greater than that due to colloids, while in the case of Withington, it was only one-third of that due to colloids. The difference in character of the two sewages was thus readily shown. The clarification test also afforded useful information in connection with the supervision of sewage purification works. Once a definite standard of working had been established for a given works, by results obtained from filter beds of known efficiency, it was possible with some degree of accuracy to ascertain by means of the tests whether any individual filter bed was in a satisfactory condition or not. Considerable care would, however, have to be exercised in the interpretation of the results obtained. Further information was required as to the relation of the amount of oxygen absorbed from permanganate by the colloidal matter to its actual weight and character. The determination of the total amount of colloidal matters (by examination of the matter precipitated by ferric acetate) appearing in the various stages of the purification process, and investigation as to the exact nature of these matters, would doubtless yield interesting information regarding the actual purification changes. Mr. Barnes had referred to the results obtained by oxidation with chromic acid as compared with those given with acidified permanganate. Under suitable conditions it was possible to obtain, by means of concentrated chromic acid, complete oxidation of the carbonaceous products present and consequent estimation of the percentage of organic carbon. In many cases this moist combustion method was very useful, especially where a combustion furnace was not available.

Dr. **Fowler**, in reply, said his chief reason for reading the paper was to bring this test into general use, so that others might collect information which would be mutually helpful. The chairman had referred to the experiment of filtration through porous porcelain. He thought Dr. Thorpe was the first to work on these lines. He remembered how Dr. Thorpe filtered some sewage through a porous pot and found that the filtered liquid was very slightly putrefactive. Undoubtedly the colloidal matter was the more polluting and would be more rapidly oxidised on mixture with the stream, and afterwards they did not cause any very serious trouble by deposit. As a matter of fact, the Davyhulme effluents, if filtered through paper, were non-putrefactive. The most serious problem centred round the removal of the colloidal matters. He fully agreed with the chairman as to the necessity of the collaboration of many workers in the purely scientific investigation of these matters and he was also particularly anxious to obtain information from the works managers, who had ordinary routine knowledge of analytical methods, which would be of great value in the scientific working out of the subject. Mr. Terry referred to the absence of colloids if nitrates were present. He (Dr. Fowler) thought that was not always the case, and referred to the Massachusetts experiments to show that such colloids were present. He was particularly anxious to obtain more information as to the character of effluents from open percolating filters. He had shown that in a fine-grain filter the colloids were removed. Whether they were removed or oxidised remained to be seen. As explained by Dr. Skirrow, the removal in the first instance was largely physical. The theory of Khrönke and Biltz threw further light on the absorption theory of Dunbar. When sewage is placed in connection with clinkers, there was no doubt that the colloids were largely removed from solution. They were not oxidised in the time taken for them to pass through the filter. The rate of oxidation depended on a variety of factors. The idea of the precipitation of the colloids by electrical means had been present in his mind for some time. Some years ago Mr. Ogden found, on experimenting, that purification was effected. He thought it was largely due to the polarising of the colloidal matter. They had tried a number of experiments, but had not obtained very good results. It was not possible with the action of the weak current to bring about any great change without a considerable extension of surface. With regard to Dr. Skirrow's reference to the proportion of ferric salts to be added, they had never had any difficulty in getting an absolutely clear solution, having always an excess of ferric salt present. The permanganate test was purely experimental. It afforded a rapid means of comparison, but it is necessary to investigate much more fully, and no doubt the chromic acid method mentioned by Mr. Barnes would be extremely useful in that respect. They could differentiate between the final cellulose, but it was very difficult to oxidise such compounds as certain derivatives of humic acid. In their further investigations they would certainly bear in mind the relative effect of these reagents. They began to collect these precipitates with a view to their complete oxidation by chromic acid owing to this differential action, but gave up the method and went on with the combustion process; that work was still in progress and further work was in contemplation.

Obituary.

F. J. SMALE.

The death of F. J. Smale, Ph.D., of Toronto, has deprived the Canadian Section of the Society of an exceedingly valuable member. He was born Sept. 26th, 1871, was educated in the public school and Collegiate Institute of Lindsay, graduated into Toronto University in 1889, won a fellowship in 1892 given for capacity in scientific research, and then proceeded to Leipsic, where he took the Ph.D. degree. On his return from Leipsic, he was at once elected a lecturer in Chemistry in the Toronto University. At the end of three years he resigned this post, to devote himself to business life. He served on the Committee of the Canadian Section of this Society as an ordinary member in 1902, became vice-chairman in 1903, and was chairman during 1904 and 1905. In 1906 he was elected an ordinary member of the Council of this Society. Smale was a man of high character, and greatly esteemed both in social and scientific circles. He died after a brief illness on Jan. 3rd, 1908.

Journal and Patent Literature.

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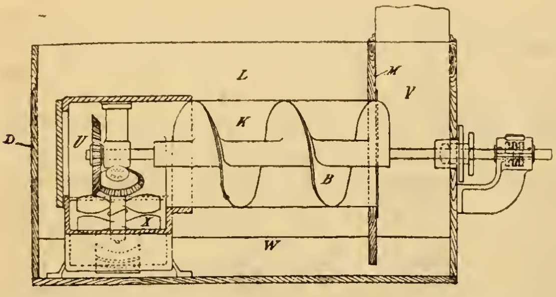
I.— PLANT, APPARATUS, AND MACHINERY.

Patents.

Smoke and gases ; Apparatus for treating ——. F. W. Allan, Buffalo, N.Y. Eng. Pat. 1363, Jan. 18, 1907.



The apparatus consists of a casing, D, divided into two compartments, V and L, by the partition, M, which does not extend quite to the bottom of the vessel in order that the water, W, may circulate freely. The smoke is drawn from the boiler by a fan and is delivered into the compartment, V, from which it is drawn, along with some water, by the helical blade, B, into the cylinder, K, and delivered into the inverted V-shaped casting, U, connected to the other end of K. Here it is thoroughly mixed with the washing fluid by the agitators, X, which are rotated in the legs of the V-shaped casting, U, and the washed gas escapes below the level of the water, W, into the compartment, L.—W. H. C.

Dry products from liquids and semi-liquids ; Obtaining ——. J. Mecredy and D. M. A. G. Hawes, London. Eng. Pat. 2148, Jan. 28, 1907.

The liquid, or semi-liquid, is first beaten into a froth in a whisking chamber and the froth is then spread by a suitable device as a thin layer on a travelling belt or apron. It is conveyed by the belt through a drying chamber and the dried product is scraped off the belt as it leaves the chamber.—W. H. C.

Evaporator. F. Sawyer, Brighton, Mich. U.S. Pat. 877,665, Jan. 28, 1908.

The evaporator outlet is connected to a reservoir in which a float is arranged, which, by means of a lever operates the outlet valve. The valve is automatically opened when the specific gravity of the evaporated liquid rises above, and closed when it falls below, a certain predetermined point.—W. H. C.

Desiccating apparatus. H. Paucksch, Landsberg on the Warthe, Germany. U.S. Pat. 879,060, Feb. 11, 1908.

See Fr. Pat. 375,063 of 1907 ; this J., 1907, 860.—T. F. B.

Gas furnaces. C. H. Thompson, Stourbridge. Eng. Pat. 7506, March 28, 1907.

In gas-heated muffle furnaces having one or more producers arranged at one side of the furnace, two sets of air inlets are provided. One set is situated near the point where the gas enters, and the other near the point at which it leaves the furnace. By suitably adjusting the amount of air entering at these points, the combustion can be so regulated that the whole of the muffle is uniformly heated.—W. H. C.

Furnaces and kilns ; Method of heating continuous ——. A. Fichet and R. Heurtey, Paris. Eng. Pat. 15,174, July 1, 1907.

The kiln is heated by a number of small gas flames which burn from rows of jets placed in metallic tubes arranged transversely to the kiln, along its entire length. The supply to each jet-tube can be regulated separately and the kiln is consequently easily and efficiently heated to a uniform temperature.—W. H. C.

Filter presses. B. Berkovits, Budafok, Hungary, and V. Kridlo, Prague, Bohemia. Eng. Pat. 10,447, May 4, 1907.

See Fr. Pat. 378,312 of 1907 ; this J., 1907, 1129.—T. F. B.

Vaporising [evaporating] liquids ; Method of ——. Lübecker Apparatebau-Ges. m. b. H., and C. H. Köhn, Lübeck, Germany. Eng. Pat. 13,058, June 5, 1907.

See Fr. Pat. 378,513 of 1907 ; this J., 1907, 1128.—T. F. B.

Filtering machine ; Automatic ——. H. D. Fitzpatrick, Glasgow. From H. M. Leslie, Masikuppam, India, Eng. Pat. 13,569, June 12, 1907.

A number of flat filter boxes, or trays, are arranged in a circle around a reaction-wheel which forms a central rotating distributor. The pulp to be filtered is fed into a hopper at the top of the wheel, which, as it rotates fills tray after tray with pulp. Vacuum is applied to the interior of the trays and draws off the liquid, and when a sufficiently thick cake has formed, the supply of pulp is stopped and wash-liquor is delivered on to the surface of the cake from another arm of the central rotating distributor. When washing is finished, the supply of wash-water is stopped, and the cake is drained dry by the vacuum, after which the vacuum is shut off and the filter tray reversed. Compressed air is then admitted and the cake of residue is blown off the filter into a receptacle placed below. All these operations follow one another automatically, the duration of each being regulated by the speed at which the distributor rotates. The shutting and opening of the vacuum and compressed-air valves and the reversing of the filter trays are performed by levers attached to tappets which are operated by arms projecting from the central distributor and coming into action as it rotates.—W. H. C.

Filter elements ; Covering for ——. Filter- und Brautechnische Maschinenfabrik A.-G. vorm. L. A. Enzinger. Fr. Pat. 382,328, Sept. 13, 1907.

See Eng. Pat. 20,375 of 1907 ; this J., 1908, 66.—T. F. B.

Emulsions ; Method of making ——. O. Pirsch, Brussels. Eng. Pat. 17,976, Aug. 7, 1907. Under Int. Conv., Aug. 8, 1906.

See Fr. Pat. 375,594 of 1907 ; this J., 1907, 1000.—T. F. B.

Drying air, gases, and the like ; Device for ——. O. Tonzimsky, Lobositz, Bohemia. Eng. Pat. 19,539, Aug. 31, 1907.

The air to be dried is passed through a cylinder in which another perforated cylinder of smaller diameter, but of the same length and filled with calcium chloride, or other suitable drying agent is disposed centrally. At the lowest point of the under side of the outer cylinder is an opening covered by a perforated plate which communicates with another cylinder placed below. As the calcium chloride dissolves owing to its abstraction of water from the air, the solution drains into the lower cylinder, from which it is removed from time to time. —W. H. C.

Gases ; Separation of ——. J. Dewar, Cambridge. U.S. Pat. 879,129, Feb. 11, 1908.

See Eng. Pat. 13,638 of 1904 ; this J., 1905, 793.—T. F. B.

II.—FUEL, GAS, AND LIGHT.

Benzene in illuminating gas ; Determination of ——. L. M. Dennis and E. S. McCarthy. J. Amer. Chem. Soc., 1908, **30**, 233—247.

An ammoniacal solution of nickel cyanide quantitatively absorbs benzene from mixtures containing benzene and air and from coal gas. A solution of 25 grms. of potassium cyanide in 40 c.c. of water is added to a solution of 50 grms. of nickel sulphate crystals in 75 c.c. of water. 125 c.c. of ammonia (sp. gr. 0·91) are added, the mixture shaken, and cooled to 0° C. to precipitate the potassium sulphate. The clear liquid is poured off and a solution of 18 grms. of citric acid crystals in 10 c.c. of water added. After standing at 0° C. for 10 minutes the liquid is decanted, and transferred to a Hempel pipette, of which the upper bulb is filled with broken glass. After the gas to be analysed has been passed in and out several times, it must be transferred to a similar pipette containing dilute sulphuric acid to remove ammonia The nickel cyanide solution prepared as above does not absorb measurable amounts of ethylene or other constituents of ordinary coal gas, except those which can be absorbed by potassium hydroxide solution. The authors find that the method suggested by Morton (this J., 1907, 40), where benzene is absorbed by sulphuric acid of sp. gr. 1·84, does not give constant results with the same or varying conditions. The acid absorbs both ethylene and benzene, and presents difficulties in manipulation.—F. Shdn.

Coal gas ; Effect of —— on the corrosion of wrought iron pipe buried in the earth. W. L. Dudley. *See* X.

Hydrocarbons ; Explosive combustion of ——. W. A. Bone. Royal Inst. Lecture, Feb. 28, 1908.

An exhaustive study of the slow combustions of methane, ethane, ethylene and acetylene at temperatures between 250° and 400° C., has afforded evidence decidedly in favour of the hydroxylation theory, with the proviso however, that the oxygen was decidedly active, and no evidence of any real discontinuity between the chemical phenomena of ordinary inflammation and those of detonation. The higher temperatures and more violent conditions of detonation or explosive combustion were responsible for the more complete breaking down of unsaturated hydrocarbons and a greater "unburning" of steam by carbon, but there was probably no difference as regards the mode in which the hydrocarbon was attacked by the oxygen in the two cases. The experiments demonstrated a point to which the lecturer attached great significance—viz., the greater affinities of hydrocarbons as compared with either hydrogen or carbon, for oxygen. Methane might be excepted here so far as high temperatures were concerned, though between 300° and 400° C. even methane was oxidised more readily than hydrogen.

Patents.

Petroleum, petroleum spirit, alcohol and other liquids to be used for lighting, motive power, or other purposes ; Treatment of ——. E. Beugniot. Fr. Pat. 381,827, Nov. 21, 1906.

The process consists in saturating the liquid with a gas such as oxygen, acetylene, coal gas, etc., in a closed vessel at the ordinary temperature and at atmospheric or a higher pressure. The product burns more readily, with increased effect, and renders the working of an engine more regular.—A. T. L.

Peat blocks or peat fuel ; Manufacture of —— and apparatus therefor. J. C. Verey, Athy, Ireland, and L. Downes, London. Eng. Pat. 2226, Jan. 29, 1907.

Peat is formed into a perforated or tubular mass by being forced through a tapering nozzle, which is provided along the greater part of its length with an inner rod or stem, which forms the perforation. The nozzle and stem also act as electrodes for a current, by the action of which, the moisture is driven from the centre of the mass of peat towards the inner surface of the nozzle, where it acts as a lubricant for the mass. Suitable apertures, inclined at an acute angle to the direction in which the mass of peat is moving, may be provided in the wall of the nozzle, for the escape of moisture. The production of peat fuel blocks of hollow or pipe-like form, by cutting off suitable lengths of the mass extruded from the nozzle, is also claimed.—W. C. H.

Coking or distilling coal for the manufacture of coke and production of gas. S. B. Sheldon. Buffalo, U.S.A. Eng. Pat. 21,808, Oct. 2, 1907. Under Int. Conv., Oct. 2, 1906.

See U.S. Pats. 847,614 and 855,069 of 1907 ; this J., 1907, 519, 676.—T. F. B.

Furnace with a battery of four or more retorts for coking peat, lignite, and wood. Oberbayerische Kokswerke und Fabr. chem. Prod. Act.-Ges. Fr. Pat. 382,742, Oct. 10, 1907. Under Int. Conv., Oct. 20, 1906.

The vertical retorts are of rectangular cross-section, the width being reduced at the middle of the longer sides so as to divide each retort into two vertical chambers. Gas is drawn off from each side of the retorts and to ensure uniformity, the outlets which are further from the exhauster are situated at a higher level in the retorts. The heating flues between adjacent retorts contain heat-storing materials to prevent irregular heating.
—A. T. L.

Suction gas-producers. F. de Prez Crassier. Fr. Pat. 382,470, Oct. 2, 1907.

The invention relates to detail improvements in suction gas-producers of the type in which an annular chamber around the upper part of the producer forms the vaporiser. To facilitate cleaning, the outer casing of the vaporiser is in two semi-cylindrical parts and the top is closed by an annular cover which can be removed without breaking gas-joints. Air is drawn in through the starting fan and passes around the gas-outlet pipe before entering the vaporiser, the chimney-pipe being arranged so that the waste gases pre-heat the air whilst the producer is being started. The fuel rests on a rotatable table mounted in a ball-bearing which can be raised or lowered to vary the annular air passage between the table and the plate which carries the refractory lining. The inner edge of this plate is curved under to form an open trough to which water is supplied. The vertical cylindrical scrubber is formed in sections, each having two grids and a door so that the contents (coke, wood shavings, etc.) can be renewed in part if desired. To prevent objectionable odours, the water from the scrubber is delivered beneath a layer of oil in the overflow tank, and passes away through a dip pipe pierced at its highest point to prevent siphoning.—A. T. L.

Combustible gas from carbonaceous materials ; Apparatus for making ——. C. H. Rider. Fr. Pat. 382,828, Oct. 4, 1907.

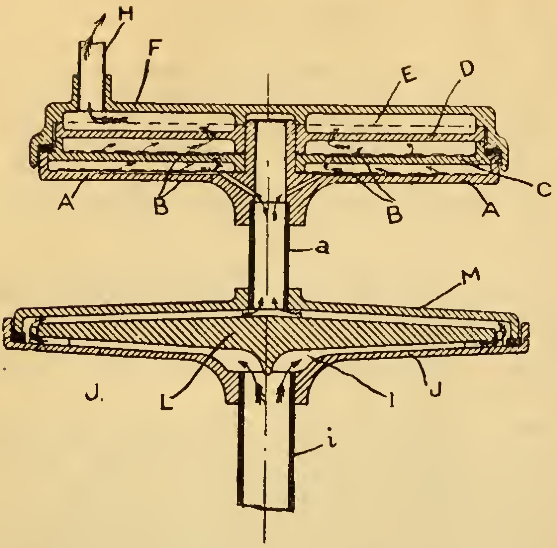
See Eng. Pat. 21,078 of 1907 ; this J., 1908, 67.—T. F. B.

Gas ; Process for the manufacture of —— by distilling coal in vertical retorts. M. Hempel. Ger. Pat. 177,869, March 14, 1906.

In order to allow of the free escape of the gas from the charge in the retorts, a hollow cylinder, with side openings throughout its length, and composed of the material to be distilled, is introduced into the retort with each fresh charge. This cylinder may be built up of superimposed sections prepared by methods such as are used in the manufacture of coal briquettes.—A. S.

Filtering gases. W. S. Hubbard, Leicester. Eng. Pat. 7073, March 25, 1907.

The gas to be filtered enters the apparatus through the pipe, *i*, and passes first through the condenser, 1,



formed of two concave dishes, J, M, and the doubly convex disc, L. Owing to the large surface of this condenser, the moisture is condensed and drains away through the pipe, *i*. The dry gas passes from I, by the pipe, *a*, to the filter, as shown by the arrows. The filter consists of a series of superposed dishes, A, C, D, in which are placed slotted plates covered with "towelling," or other suitable filtering medium, B. The gas passes from chamber to chamber till it reaches the compartment, F, where it receives a final filtration through cloth, or paper, E, and then passes to the exit pipe, H. The coarse filtering material, B, lies quite loosely on the plates and as it becomes choked it is lifted more and more by the pressure of the gas and continually exposes a fresh filtering surface.—W. H. C.

Mantles for incandescence burners; Process for impregnating ——. Soc. Franç. de Chaleur et Lumière. Fr. Pat. 381,660, Sept. 9, 1907.

The mantles are placed in a closed glass or porcelain vessel, and the vessel is exhausted to remove all air from the pores of the material. The impregnating solution is then drawn in, and finally air is admitted, the solution allowed to run back and the mantles removed. The reservoir for the solution may itself be a closed vessel which can be exhausted to withdraw all air from the solution before use. Both vessels may be enclosed in vacuous metal chambers to relieve them of the atmospheric pressure.—A. T. L.

Incandescence mantles. G. L. Courtot. Fr. Pat. 381,727, Sept. 11, 1907.

The finished mantles after treatment with collodion, are strengthened by forming upon them a simple design with a suitable composition so as to leave a supporting framework when the mantle is burnt off. For example, an upright mantle may be painted with a band at the head and another near the base, the two bands being joined by narrow vertical lines, thickly covered with the composition. A suitable composition consists of 100 grms. of distilled water, 40 drops of gum tragacanth, 100 grms. of talc, and 40 drops of potassium silicate.—A. T. L.

Mantles; Refractory and indestructible filament for incandescence ——. R. Laigle. Fr. Pat. 382,749, Oct. 11, 1907.

The filament is formed from a plastic mixture of rare earths with an oxide of lower melting point and an agglomerant, and is heated to the melting point of the oxide or above it. A suitable mixture consists of:—alumina (precipitated by ammonia), 3; beryllium oxide, 2; silica or aluminium silicate, 1; thorium oxide, 92·8; cerium oxide, 1·2 per cent.—A. T. L.

Filaments for lighting and heating by gas or by electricity in the open air; Process and apparatus for the continuous manufacture of ——. G. Michaud and E. Delasson. First Addition, dated Sept. 25, 1907, to Fr. Pat. 378,665, June 10, 1907 (this J., 1907, 1131).

Filaments prepared as in the principal patent are delivered by the press on to carborundum plates, cut at once to the required length, and carried by the plates through a drying chamber and through a muffle, also of carborundum, in the electric furnace. The press is of the multiple type and the plate carrying a number of parallel filaments is turned through a right angle to receive another set of parallel filaments, the whole forming a grid after being heated in the furnace. The plates and the muffle may be made from ferruginous magnesia, or from thoria, etc., instead of carborundum.—A. T. L.

Incandescing bodies in electric lamps; Process of manufacturing electric conductors suitable for use as ——. The British Thomson-Houston Co., Ltd., London. From The General Electric Co., Schenectady, N.Y. Eng. Pat. 5575, March 7, 1907.

Powdered refractory metals such as tungsten, molybdenum, titanium, etc., are mixed with cadmium amalgam and the mixture is formed into a wire, or filament. The wire is cut into suitable lengths and bent into shape, placed in layers in carbon boats and heated *in vacuo* in a glass vessel by an electrical resistance heater to about 215° C. for about 60 minutes. When the mercury has been volatilised, the filaments are withdrawn and heated individually *in vacuo* to a higher temperature by passing an electric current through them until the cadmium is also volatilised. The current is then increased so that the particles of tungsten, or other refractory metal are sintered together into a strong wire.—W. H. C.

Incandescent bodies for electric lamps; Process of manufacturing ——. A. Just and F. Hanaman, Budapest, Austria-Hungary. U.S. Pat. 878,463, Feb. 4, 1908.

See Addition of June 10, 1905, to Fr. Pat. 347,661 of 1904; this J., 1905, 1220.—T. F. B.

Ferrocyanogen compounds from gas purifying materials, etc. Ger. Pat. 188,902. *See* VII.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

Wood distillation in the United States. U.S. Forest Service Report. [T.R.]

Hardwood.—The amount of hardwood distilled at 86 plants in the United States in 1906 was 1,144,896 cords, valued at 3,716,423 dolls. The products consisted of charcoal, 45,657,721 bushels (value, 2,965,940 dolls.); crude alcohol, 7,871,494 gallons (2,676,191 dolls.); grey acetate of lime, 96,376,497 lb. (2,017,331 dolls.); brown acetate, 6,960,933 lb. (85,777 dolls.); tar and oils, 250,610 galls. (19,877 dolls.).

Pinewood.—33 plants reported the distillation of 50,234 cords of pine wood in 1906, of a value of 129,358 dollars, the products being charcoal, 791,887 bushels (44,381 dolls.); turpentine, 503,427 galls. (238,612 dolls.); tar, 648,120 galls. (64,368 dolls.); tar oils, 125,008 galls. (17,429 dolls.); pyroligneous acid, 305,000 galls. (15,380 dolls.).

The quantity, value, and average price of wood alcohol exported from the United States from 1902 to 1906 is as follows:—

Year.	Quantity, galls.	Value.	Average value per gall.
		$	$
1902	626,925	338,619	0·54
1903	833,629	452,892	0·54
1904	1,194,466	585,359	0·49
1905	1,097,451	603,385	0·55
1906	780,222	466,467	0·60

Galician crude petroleums ; Fuel values of some ——. M. Wielezynski. Petroleum, 1908, 3, 507—509.

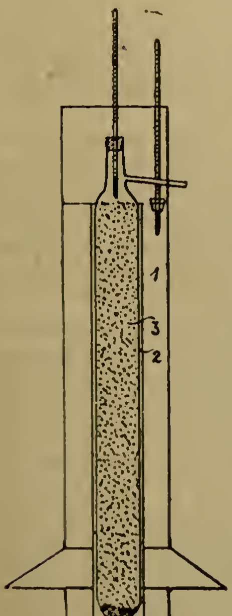
THE results of the determination of the calorific value and other characters of a number of Galician and other crude oils and petroleum products are shown in the following table :—

	Sp. gr. at 15° C.	Point of ignition.	Setting point.	Viscosity.	H.	C.	O.	Calorific value.*
					Per cent.			
		° C.	° C.					
Crude oil from Urycz	0·878	<10	<−12	1·87 at 15° C.	14·06	84·94	1·00	11,092
Masut from Urycz crude oil .	0·933	115	<−12	34·7 at 15° 4·44 at 50°	12·96	85·53	1·56	10,675
,, ,, ,, ,, ,,	0·940	129	<−10	83·3 at 15° 6·50 at 50°	12·09	86·75	1·16	10,623
Crude oil from Boryslaw	0·864	<10	+21	2·8 at 30°	14·73	83·47	1·80	11,064
Masut from Boryslaw	0·925	109	+35	—	13·27	85·23	1·50	10,845
" Blue oil " from Boryslaw .	0·892	135	—	—	14·24	82·18	3·68	10,653
Crude oil from Orow........	0·919	41	<−12	5·74 at 15°	13·89	86·00	0·11	11,130
Masut from Orow	0·941 at 35° C.	139	8	—	12·98	87·02	—	10,942
Crude oil from Harklowa ...	0·898	14·5	<−12	3·90 at 15°	14·39	84·36	1·25	11,118
Masut from Harklowa.......	0·910 at 30° C.	141	<− 9	18·5 at 50°	12·54	86·56	0·90	10,749
Crude oil from Kosmacz	0·876	<10	<−12	2·6 at 15°	13·94	85·49	0·57	11,092
Masut from Kosmacz	—	35	+ 5	—	13·21	85·48	1·31	10,852
Fuel oil from M. Schönberg .	0·906	27	− 7	8·2 at 15° 2·0 at 50°	13·80	85·54	0·66	11,069
Crude oil from—								
Rymanow	0·878	<10	<−12	1·93 at 17·5°	14·13	84·00	1·87	10,994
Ropica ruska	0·8321	<10	<−12	1·11 at 17°	14·40	83·42	2·18	11,020
Mraznica	0·880	<10	<−12	2·52 at 15°	12·2	82·2	5·6	10,544
Potok	0·831	<10	<−12	1·20 at 15°	12·74	83·12	4·14	10,866
Stoboda rungurska	0·853	25	—	1·96 at 15°	15·5	81·6	2·9	11,733
Texas	0·925	—	—	—	13·69	84·17	S=2·00 O=0·14	11,604
Romani-Apscheron	—	—	—	—	14·25	85·58	0·17	11,207

* Calculated according to Mendelejeff's formula : $Q=81C+300H-26(O-S)$.

—A. S.

Dephlegmator ; New —— for the fractionation of petroleum. V. F. Herr. Chem.-Zeit., 1908, 32, 148—149.



THE dephlegmator described has proved very useful in the preparation of fractions of constant boiling point from petroleum, especially in cases where ordinary dephlegmators were unsatisfactory. The dephlegmator itself, 3, (see Fig.) is a glass cylinder, 300—1000 mm. long, filled with lead shot six of which weigh about 1 grm. The outer mantle of a Liebig's condenser with one of the side tubes sealed up is suitable for the purpose. The cylinder is covered with cotton-wool, filter-paper and asbestos to prevent loss of heat. When the dephlegmator is to be kept at above 130° C., it is enclosed in a copper heating jacket, 1, heated by means of four burners or otherwise, between which and the dephlegmator is a thin layer of air, 2, enclosed by an inner jacket. It is possible with this device to fractionate liquids at temperatures up to 330° C. When starting the distillation, it is best to first warm the outer air jacket, or to bring the liquid in the distilling flask only very slowly to the boiling point, as otherwise liquid is condensed in the dephlegmator and gradually fills the latter. When this happens, the distillation must be stopped, and the dephlegmator dried by blowing air through it.—A. S.

PATENTS.

Pitch ; Treatment of ——. T Parker, London. Eng. Pat. 1970, Jan. 25, 1907.

THE crude pitch is dissolved in a suitable solvent, for instance, the light oil obtained in the process of manufacturing the pitch. The free carbon is first separated from the solution in any suitable manner, and the latter is then treated with a water-absorbing agent, for example, barium or calcium oxide, or plaster of Paris. After separating the drying agent, the solution is distilled to recover the pitch. It is stated that pitch which has been treated as described is much more suitable for the preparation of varnishes than ordinary pitch.—W. H. C.

Phenol or its substitution products with the exception of homologues of phenol, and also hydroxyl derivatives of multi-nuclear hydrocarbons or sulphonic acids of aromatic hydrocarbons ; Process for rendering —— soluble in water. A. Friedlaender. Ger. Pat. 181,288, Sept. 21, 1905.

PHENOLS or other hydroxy compounds are mixed with sulphonic acids of aromatic hydrocarbons or their salts, preferably in presence of water. Phenols may be extracted from tar oils by adding to the latter a concentrated aqueous solution of a sulphonate of an aromatic hydrocarbon.—T. F. B.

Petroleum and volatile hydrocarbons ; Continuous rectification of ——. E. A. Barbet. First Addition, dated Dec. 1, 1906, to Fr. Pat. 322,265, June 7, 1902 (this J., 1903, 292).

THE invention relates to a simplified apparatus for separating by a continuous process four fractions boiling below 130° C., and a burning oil, and for " cracking " the heavy oil not distilled. The apparatus comprises a tubular heater with inclined grate for decomposing the heavy oils, a large boiler communicating with a fractionating column, and condensers and coolers for the products. The crude oil is admitted to the fractionating column some distance above the base, and three fractions are drawn off from the upper part of the column. The lightest product is obtained from the vapour not condensed in the column. Burning oil is drawn off below the inlet for crude oil, or from the boiler itself. The non-volatile residue passes to the tubular heater, and the resulting vapours are condensed and added to the crude oil.

—A. T. L.

Resins, resinous substances, mineral waxes, etc. Fr. Pat. 382,371. *See* XIII*B*.

IV.—COLOURING MATTERS AND DYESTUFFS.

αβ-Naphthazines; The two ——. O. Fischer and H. Straus. Ber., 1908, **41**, 397–400.

Benzeneazo-ββ-dinaphthylamine, and similar dyestuffs substituted in the benzene nucleus, are best prepared by combining the suitable diazo-solution with ββ-dinaphthylamine in pyridine solution. These azo-dyestuffs, when digested on the water-bath with glacial acetic and hydrochloric acids, furnish *sym-αβ*-naphthazine, m.pt. 243° C. A modification of the method of purifying *asym-αβ*-naphthazine, by crystallising the crude product from pyridine and separating the *sym*-compound by addition of hot water is also described. —J. C. C.

Dyestuffs; A method of identifying and valuing ——. J. W. Lovibond. J. Soc. Dyers and Col., 1908, **24**, 36-40.

The author shows how the tintometer can be applied to the analysis of dyestuffs by splitting them up into their constituent colour-parts and so arriving at a method of valuation by which those dyestuffs richest in the dominant colour-constituent are seen to be the purest. The paper is illustrated by charts of colour-analyses of Victoria Blue, Magenta and Fustic extract.—J. C. C.

Patents.

Direct cotton dyestuffs; Preparation and use of —— *for dyeing.* Read Holliday and Sons, J. Turner, and H. Dean, Huddersfield. Eng. Pat. 2568, Feb. 1, 1907.

See Fr. Pat. 375,476 of 1907; this J., 1907, 961.—T. F. B.

Colouring matters of the safranine series; Manufacture of ——. A. G. Bloxam, London. From Act.-Ges. f. Anilinfabr., Berlin. Eng. Pat. 2767, Feb. 4, 1907.

See Fr. Pat. 374,832 of 1907; this J., 1907, 865.—T. F. B.

Arylthioglycollic-o-carboxylic acids; Manufacture of ——. O. Imray, London. From Farbwerke vorm. Meister, Lucius und Brüning, Hoechst a/Main, Germany. Eng. Pat. 6930, Mar. 22, 1907.

Anthranilic acid or its substituted derivatives, is diazotised and the neutralised solution is run gradually at 0°—10° C. into a solution of sodium sulphide. A solution of sodium chloroacetate is now added and, finally, aqueous caustic soda. The whole is heated on the water bath until the reaction is complete, when phenylthioglycollic-*o*-carboxylic acid (or the corresponding substituted derivative) is precipitated by means of hydrochloric acid.—J. C. C.

Arylthioglycollic-o-carboxylic acids; Process of making ——. E. Bryk, Assignor to Farbwerke vorm. Meister Lucius, und Brüning, Höchst on the Maine, Germany. U.S. Pat. 877,702, Jan. 28, 1908.

See Eng. Pat. 6930 of 1907; preceding.—T. F. B.

Mercaptan derivatives of hydroxylated phenazines; Process for preparing ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 187,868, Jan. 20, 1904.

Mercaptan derivatives of phenazine are obtained by heating with sodium sulphide, hydroxylated azines which are halogen substituted in the nucleus containing the hydroxyl group, or those substituted in the azine nitrogen groups. The products are intended for use in preparing sulphide dyestuffs.—T. F. B.

Quinoline derivatives of the anthracene series; Process for preparing non-hydroxylated ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 189,234, Jan. 31, 1905.

Strongly basic quinoline derivatives of anthracene are obtained by condensing *α*-aminoanthraquinone or its derivatives which do not contain hydroxyl groups, with glycerol, sulphuric acid (about 66° B.), and an oxidising agent, such as nitrobenzenesulphonic acid. These compounds are not dyestuffs, but can be used in preparing basic anthracene dyestuffs.—T. F. B.

o-Hydroxymonoazo dyestuffs; Process for preparing ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 188,819, Jan. 27, 1906. Addition to Ger. Pat. 184,689, Sept. 28, 1905.

Diazo derivatives of nitro-*o*-aminophenols, which are also *p*-nitraniline derivatives, are combined with chromotrope acid in presence of an alkaline-earth hydroxide, or of zinc or magnesium hydroxide.—T. F. B.

Dyestuffs of the anthracene series; Process for preparing ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 188,605, March 18, 1906.

The compound obtained by the action of sodium sulphide on dinitroanthrarufindisulphonic acid, when reduced in acid solution, is converted into leuco-4.8-dithiol-1.5-dihydroxyanthraquinone: this is condensed with aromatic amines, and the product is sulphonated. The product obtained from *p*-toluidine, for example, dyes unmordanted wool fast, pure green shades.—T. F. B.

Azo dyestuffs. O. Günther and L. Hesse, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pats. 877,643 and 877,644, Jan. 28, 1908.

1 : 8-Aminonaphthol-3 : 6-disulphonic acid is diazotised and combined with: (1), *α*-naphthylamine, or (2), *p*-xylidine, and the products are diazotised and combined with 2-phenylamino-5-naphthol-7-sulphonic acid and 2-amino-5-naphthol-7-sulphonic acid respectively; the sodium salts of the resulting dyestuffs produce: (1), blue and (2), violet-red shades on cotton.—J. C. C.

Sulphide dyestuff; Production of a ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 382,412, Sept. 30, 1907. Under Int. Conv., March 13, 1907.

See U.S.Pat. 866,939 of 1907; this J., 1907, 1082.—T. F. B.

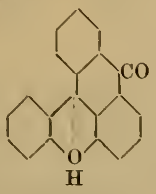
Mordant dyestuffs; Production of ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 382,920, Oct. 15, 1907. Under Int. Conv., Feb. 2, 1907.

New mordant dyestuffs giving bright red shades of a good fastness are obtained by condensing amino-*m*-hydroxybenzoylbenzoic acids (substituted in the amino group) or their homologues with oxyhydroquinone (hydroxyquinol) or its triacetyl derivative. If these red dyestuffs be treated with dehydrating agents, a molecule of water is split off and a new ring is formed, the products formed giving, on chromium mordants, green shades fast to washing and light.

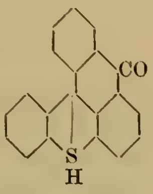
Example.—Mix intimately 313 kilos. of diethylamino-*m*-hydroxybenzoylbenzoic acid with 120 kilos. of hydroxyquinol, then introduce this mixture in small portions into 1200 kilos. of sulphuric acid of 168° T., stirring and taking care to keep the temperature below 50° C. The mass is kept at about 30° C. for 3 hours with constant stirring; it is then poured into water and the precipitated dyestuff collected on a filter. It is a red powder only slightly soluble in water but its alkali salts are easily soluble and dye chrome-mordanted wool in bright red shades. To produce the green dyestuff, 3 kilos. of the red dyestuff are added, a little at a time, to 12 kilos. of fuming sulphuric acid (10 per cent. SO_3). The mixture is heated on a water-bath until a sample mixed with water and rendered alkaline shows a pure bluish-green colour. The mass is then poured into ice water and the separated colour filtered off and dried. It dyes chrome-mordanted wool or cotton in bright green shades. In some cases the fuming acid causes a sulphonation of the dyestuffs besides the condensation, thus rendering them much more soluble without losing their valuable dyeing properties. —A. B. S.

Coeroxonium and coerthionium compounds; Process for preparing ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 186,882, Feb. 23, 1906.

α-ARYLETHERS or α-thio-aryl ethers of anthraquinone are treated with neutral or acid condensing (dehydrating) agents; if sulphuric acid is used, the reaction must be so regulated that no sulphonation of the original substance takes place. The new products have the following constitution:—



Coeroxonium.



Coerthionium.

—T. F. B.

Azo dyestuff and process of making same. P. Julius and E. Fussenegger, Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 879,053, Feb. 11, 1908.

SEE Eng. Pat. 5640 of 1907; this J., 1907, 818.—T. F. B.

Dyestuff [from dinitronaphthalene]; Process for preparing a brown ——. Badische Anilin und Soda Fabrik. Ger. Pat. 187,912, Sept. 26, 1906.

$\alpha_1\alpha_4$-DINITRONAPHTHALENE is heated, in presence of alkali, with not more than half its weight of dextrose and with an alkali or alkaline-earth sulphite or bisulphite. —T. F. B.

Sulphide dyestuffs; Manufacture of a black ——. Soc. Anon. des Mat. Col. et Prod. Chim. de Saint-Denis. Fr. Pat. 381,608, Nov. 14, 1906.

THE preparation of a black sulphide dyestuff by reacting with sodium polysulphides upon dinitrophenol, is described in Fr. Pats. 231,188 of 1893, 259,509 of 1894, and 267,343 of 1897, Eng. Pat. 19,831 of 1896, Ger. Pat. 127,835 of 1899 and Fr. Pat. 299,721 of 1900. By the process here described, it is possible to obtain by heating sodium dinitrophenate with sodium polysulphide a product of high concentration and free from impurity and of such a constitution that the dyestuff, when formed, is insoluble in the liquor and separates out. Upon filtering and washing, the dyestuff is obtained free from impurity and excess of the reagent. 33·5 kilos. of sodium dinitrophenate are dissolved in 80 litres of water. To the boiling solution, 30 kilos. of sulphur and 40 kilos. of sodium sulphide (62 per cent.), mixed with 40 litres of water, are added little by little and the mixture boiled, the temperature of ebullition being raised to 106—108° C. by the addition of salts of the alkalis. After boiling for 10—15 hours the melt is thrown into water, filtered and the residue well washed with water. Upon drying, the dyestuff is obtained as a black powder, insoluble in water, alcohol and strong sulphuric acid, but soluble in solutions of sodium sulphide. In the deep blue solution so obtained, cotton is dyed evenly, in deep blue-black shades.—F. M.

Gallocyanine dyestuffs; Manufacture of new derivatives of ——. Fabr. Prod. Chem. ci-dev. Sandoz. Fr. Pat. 382,335, Sept. 18, 1907.

NEW dyestuffs belonging to the gallocyanine group and soluble in water can be prepared by the following methods: (1), By partial reduction of a gallocyanine; (2), by partial oxidation of a leucogallocyanine; (3), by the action of a leucogallocyanine on a gallocyanine. Example I.:—One hundred parts of the gallocyanine derived from nitrosodimethylaniline and gallic acid are diluted to a thin paste with 500 parts of water and 50 parts of concentrated hydrochloric acid; 11 parts of zinc powder (85 per cent.), corresponding to a half molecule, are added to this paste, a little at a time, with constant stirring. The new gallocyanine soon enters into solution and at the end of one hour the small amount of insoluble matter remaining is filtered off and the colour precipitated from solution with common salt and dried at a low temperature. It forms a violet crystalline powder soluble in water. Example II.:—A solution of 3·4 kilos. of ammonium persulphate is added to a neutral solution of 10 kilos. of leucogallocyanine hydrochloride in 50 litres of water. Oxidation takes place immediately and the colour formed is precipitated with salt. The persulphate can be replaced by an equivalent amount (½ mol. of oxygen) of other oxidising agents. Example III.:—Ten kilos. of leucogallocyanine hydrochloride are made into a paste with 30 litres of water. 10 kilos. of gallocyanine hydrochloride are added, and the mass heated on the water-bath for several hours to 50° C. with constant stirring. The gallocyanine rapidly dissolves and a dark violet syrup, soluble in water, is obtained, which can be employed as such in printing. The colour can be isolated from its solution by precipitation with salt. By this last method mixed compounds can be obtained. Apparently a molecule of the gallocyanine combines chemically with a molecule of the leucogallocyanine giving rise to a quinhydrone derivative.—A. B. S.

Dyestuffs suitable for lakes, etc; Manufacture of ——. K. Merz. Fr. Pat. 382,191, Sept. 24, 1907. Under Int. Conv., Sept. 24, 1906.

IT has been found that the metallic salts of the dyestuffs obtained by combining 2.3-hydroxynaphthoic acid (m.p. 216° C.) with diazotised derivatives of anilinecarboxylic acids are insoluble in oils and may be employed as pigment colours. The dyestuffs obtained by these combinations are, in the form of pastes or in solution, mixed with solutions of metallic salts such as barium chloride, calcium chloride, lead nitrate, etc., and the mixture well agitated at a convenient temperature. When a pigment colour is desired, finely divided barium sulphate is most suitable for the substratum, but for a printing colour, aluminium hydroxide is to be recommended. These colours are insoluble in water, alcohol or oil, and possess good fastness to light.—F. M.

Sulphide dyestuffs dyeing black shades direct on cotton; Process for preparing ——. Kalle und Co. Ger. Pat. 186,860, Dec. 17, 1902.

THE dyestuffs obtained by combining the diazo derivatives of amines of low boiling point with o-nitrophenol, are melted with sulphur and sodium sulphide.—T. F. B.

o-Hydroxyazo dyestuffs; Process for preparing —— *which can be chromed.* Kalle und Co. Ger. Pat. 188,645, Aug. 31, 1904.

1.2-AMINONAPHTHOLSULPHONIC acids are suspended in a very small quantity of water, diazotised in presence of acetic acid, and combined with a concentrated solution of the sodium salt of β-naphthol in presence of sodium carbonate, at a temperature of about 40° C. Fast blue-black or violet-black shades are obtained by chroming these dyestuffs on the fibre.—T. F. B.

Dichloroanthraflavic acid; Process for preparing ——. R. Wedekind und Co. Ger. Pat. 187,685, Nov. 15, 1903.

NASCENT chlorine is allowed to act on an aqueous suspension of anthraflavic acid, in presence of a considerable quantity of sulphuric acid, at 120° C. (See also this J., 1907, 1216.)—T. F. B.

Aromatic amino-compounds; Extraction of —— *from reduced mixtures containing iron and ferrous oxide.* Chem. Fabr. Grünau, Landshoff und Meyer. Ger. Pat. 184,497, Dec. 8, 1905.

To increase the rapidity of extraction of amino-compounds from the mixtures containing them, after reduction with iron, the extraction is performed in an apparatus in which the perforated partition, on which the mixture rests, is strongly magnetised.—T. F. B.

Azo dyestuffs containing fatty acid groups which are present in fats; Process for preparing ——. N. Sulzberger. Ger. Pat. 188,909, April 25, 1906.

Fatty acid arylides are nitrated and the products reduced: the amino-fatty acid arylides thus obtained are diazotised and combined with phenols or amines. Such dyestuffs possess many properties of fatty compounds, and they are therefore useful for mixing with fats, or with oil of turpentine for painting, or with other dyestuffs which are insoluble in fats; they can also be used in the preparation of coloured soaps. Wool, silk, or cotton is dyed in shades fast to washing by solutions of the dyestuffs. Among the dyestuffs described are those derived from the anilides of stearic, oleic, and palmitic acids, and from palmitic acid β-naphthylamide.—T. F. B.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

Sisal hemp cultivation in India. H. H. Mann. Agric. J. of India, 1907, 2, 323—333.

It is stated that of all the Agaves, true sisal hemp (*Agave sisalana*) is the best variety for large plantations in India, but if a good fibre-extracting machine for this plant cannot be economically provided, then Mauritius hemp (*Furcræa gigantea*) may possibly be found more profitable in certain parts of North-East India. The author states that additional experience during the past three years has confirmed the conclusion at which he arrived in 1904, viz., (1) that in many parts of North-East India, sisal hemp fibre can be produced in competition with nearly all—if not with all—the countries and districts in which it has been tried; (2), that the quality of the fibre is as good as that of the American fibre; and (3), that it will be a number of years, at least, before there is likely to be any such slackening in the annual increase in the demand as to lead to serious over-production and so bring the price below a remunerative figure. The prices on the London market for sisal hemp and Manila hemp during the past eight years are shown in the following table:—

Year.	Sisal hemp.		Manila hemp.	
	June	Dec.	June	Dec.
	£	£	£	£
1900	39	30	39	31
1901	—	42	33	46½
1902	42	40	41½	37
1903	39	26	35	41
1904	35	36	36	42
1905	37	39	39	41½
1906	33	35	43	42½
1907	33½	—	38	—

—A. S.

Sisal hemp in German East Africa. Bull. Imp. Inst., 1907, 5, 425. [T.R.]

The approximate quantities and value of the sisal hemp exported from German East Africa since 1902 were as follows:—

Year.	Quantity.	Value.
	Tons.	£
1903	422	16,000
1904	765	28,300
1905	1,140	43,900
1906	1,836	66,000

During the first half of 1907 the exports from Tanga and Pangani amounted to about 1,321 tons of value £50,600.

Cotton in German East Africa. Bull. Imp. Inst., 1907, 5, 426. [T.R.]

The exports of cotton from German East Africa during the years 1900—1906 were as follows:—

Year.	Quantity.	Value.	Year.	Quantity.	Value.
	lb.	£ s.		lb.	£
1900	24	0 5	1904	414,850	6,250
1901	240	4 14	1905	416,270	9,930
1902	818	10 12	1906	415,930	9,050
1903	20,450	370 0			

A much larger quantity has been exported during 1907, as the industry has undergone great extension. Specimens of the cotton from Kilwa, Saadani and Mwanza were valued at the beginning of 1907 at about 11d. per lb.

Shoddy; Possible danger of spontaneous combustion of ——. W. H. Schramm. Z. angew. Chem., 1908, 21, 252—255.

Owing to the refusal by a large shipping company to accept consignments of shoddy except as deck cargo, comparative experiments were made as to the tendency of shoddy, raw cotton, and raw wool to ignite spontaneously, as the two last-named are shipped regularly as ordinary cargo. The experiments show that there is no greater danger of fire with shoddy than with raw cotton or wool, and that the former should be equally acceptable as the two latter as ordinary cargo.—A. S.

Indigo dyeing; Improvement in the copperas vat for ——. A. Binz and Th. Marx. Färber-Zeit., 1908, 19, 49.

The copperas-lime vat is unsatisfactory on account of the small and variable yield of dissolved indigo-white and the large amount of sediment. In a series of 16 experiments, in which vats were set with the proportions known to be actually employed in practice, the authors found the average percentage of Indigo brought into solution to be only 54·2, with a maximum of 68·2 and a minimum of 38·7. It is evident that, owing to some cause which cannot be controlled, a large proportion of the indigo-white remains in the sediment. By substituting caustic soda for lime, a much better yield is obtained but the objection arises that when dyeing yarn in hanks the hands of the workmen are attacked. This difficulty may be overcome by setting the stock-vat with caustic soda and adding a calcium salt, *e.g.*, acetate, to the dye-vat in sufficient amount to convert the whole of the sodium hydroxide into calcium hydroxide. A stock-vat was prepared with 3 parts (by weight) of Indigo (powder, B.A.S.F. or a corresponding amount of paste), 19·1 parts of ferrous sulphate, and 9·2 parts of solid caustic soda, made up with water to 350 parts by volume and kept for 1 hour at 50—60° C. The dye-vat contained 25 parts of calcium acetate previously dissolved in water; the stock-vat was poured in and the vat made up to 1000 parts. In six experiments the average percentage of the indigo used found in the clear vat-liquor was 76·9, with a maximum of 80·3 and minimum of 73·4; thus showing a considerable improvement in amount and regularity of yield. After the first setting, the vat may be corrected as required by addition of lime; this addition will not precipitate the indigo-white. A similar improvement might be adopted in the case of the zinc-lime vat.

—R. B. B.

Dyeing; A method of dry ——. F. J. Farrell and C. W. May. J. Soc. Dyers and Col., 1908, 24, 40—48.

The authors find that clear and level shades can be produced on textile fabrics by immersing them in a dyebath containing an alcoholic solution of an acid dyestuff mixed with petroleum benzine containing Grünwald and Stommel's saponine. The best results were obtained with the dyestuffs Acid Green extra conc, Acid Magenta, Acid Violet 10 B, Alizarin Sapphirol, Azo Rubin A, Croccin Scarlet B and 3B, Cyanole, Eosin extra, Fast Acid Violet A 2 R, Formyl Violet S 4 B and 10 B, Indian Yellow G and R, Metanil Yellow, Orange II, Patent Blue A, Phloxines and Rhodamine B. A strong solution

of the dyestuff is employed and a typical mixture consists of 10 c.c. of the alcoholic solution and 290 c.c. of benzine containing 10 grms. of saponine. It is essential that a small amount of water should be present (either in the saponine solution or the alcohol) but an excess is to be avoided, otherwise separation of the benzine occurs. After dyeing, the goods are rinsed in benzine to remove adhering dye solution but no further removal of dyestuff from the fibre is effected by the action of this agent.
—J. C. C.

Patents.

Artificial silk ; Manufacture of ——. A. Lecœur. Fr. Pat. 381,939, Nov. 24, 1906.

In the precipitation of cellulose from its solution in cuprammonium, the use of acids in the coagulating liquid tends to give products which are milky or opaque and not over strong. With alkalis the threads obtained are clear, supple and strong, but though suitable for the manufacture of thick threads, such baths cannot be used for the preparation of threads of a fine or even medium titre. The best results are obtained by using solutions of the bisulphates of the alkali metals, of such strength that coagulation is instantaneous and the ammonia and copper hydroxide completely neutralised. Upon leaving this first bath the threads traverse a second, more dilute one, and are finally obtained in a supple, elastic and strong condition.—F. M.

Artificial textile fibres from nitrated cotton ; Apparatus for the production of ——. Soc. Anon. des Plaques et Papiers Phot. A. Lumière et ses fils. Fr. Pat. 382,718, Dec. 14, 1906.

The collodion solution is forced under pressure through the usual capillary openings and then falls vertically through a tube open at both ends and lined with an absorbent material which is kept moist with alcohol so that the air in the tube is kept saturated with alcohol vapour. The collodion thread during its passage through this tube cannot dry and remains perfectly cylindrical. It then falls into the receiver which consists of a cylindrical vessel which can be revolved on its vertical axis and contains an inner sieve-like vessel which revolves with it. The receiver is filled with the coagulating liquid. The thread falls into the revolving sieve and is immediately coagulated and arranged in the shape of a truncated cone by the revolution of the receiver. When this sieve is full, it is removed from the receiver and replaced by an empty one. The sieve full of thread is immersed first in water to remove the solvent and then in the denitrating solution.—A. B. S.

Artificial silk threads and analogous artificial threads ; Process for making ——. P. Follet and G. Ditzler. Fr. Pat. 382,859, Oct. 14, 1907. Under Int. Conv., Oct. 16, 1906.

See Eng. Pat. 22,753 of 1907 ; this J., 1908, 19.—T. F. B.

Silk ; Degumming of ——. P. and J. Schmid, Basle, Switzerland. Eng. Pat. 23,795, Oct. 28, 1907. Under Int. Conv., Nov. 10, 1906.

See Fr. Pat. 381,402 of 1906 ; this J., 1908, 119.—T. F. B.

Plants or parts of plants ; Process for preparing dried —— *for bleaching and dyeing.* Kolbe und Pellmann. Ger. Pat. 187,827, Sept. 17, 1905.

The plants are treated for a considerable time with concentrated acetic acid, alone or with alcohol. This treatment removes the fatty substances from the plants without damaging them.—T. F. B.

Bleaching of textile materials. C. Jaloux. Fr. Pat. 382,144, Sept. 23, 1907.

Silk, wool, cotton, ramie, etc., are treated at any stage of their preparation by immersion in a bath containing : glycerin, 1 ; neutral sodium silicate, 2½ ; and barium peroxide, 2 per cent., with 10 litres of hydrogen peroxide per 100 kilos. of material to be treated, the bath being made up with sufficient water to ensure complete immersion of the goods. The temperature is maintained at 45° C. for about an hour, when the goods are removed and placed in a bath of dilute acid warmed to 35° C., in which they remain for half an hour and are then thoroughly rinsed.
—F. M.

Bleaching and dyeing of flax, hemp, etc. ; Process and apparatus for the ——. J. D. Quern. Fr. Pat. 381,783, Sept. 14, 1907. Under Int. Conv., Mar. 27, 1907.

The material to be treated is placed, in hank form, on a number of perforated trays, which fit one upon the other in a cistern which is covered with a double tray, this being perforated to ensure the even distribution of the liquors. The liquors are pumped into the tray from tanks let into the ground, and after percolating through the yarn, return to the tanks, or are run away through a four-way tap at the bottom of the cistern. The apparatus may be lined with lead or other resistant material and the trays may be filled outside the cistern and by means of a frame, filled in and removed therefrom as a whole, thus economising time. The yarn is boiled or wet out in the usual way and, the machine being filled, the bleaching liquor is circulated for about two hours, being strengthened as required. The material is then drained (or suction applied through the four-way tap) and rinsed, soured and washed. The yarn is not disturbed during these operations and remains open, and easily accessible in all parts to the liquors.—F. M.

Wool mordanting ; Process for ——. P. Rogers, Wollaston, Mass. U.S. Pat. 878,314, Feb. 4, 1908.

The wool is mordanted in a bath containing an alkali bichromate to which has been added an ammonium salt, so as to form ammonium bichromate.—A. B. S.

Sulphur dyestuffs on mixed cotton and wool goods ; Multi-coloured effects by dyeing with ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co. Elberfeld, Germany. Eng. Pat. 13,132, June 6, 1907.

Chromed or unchromed wool, treated with formaldehyde, loses its affinity for sulphide dyestuffs almost completely. Mixed fabrics of cotton and wool in which the wool has been thus treated either before or after weaving, may be dyed with sulphide dyestuffs and the wool will remain practically white. Subsequently the wool may be dyed with suitable dyestuffs, mordant or acid. During the dyeing of the cotton with sulphide dyestuffs, the strength of the wool is maintained by adding to the dyebath the sodium salts of organic acids, such as sodium lactate or formate. For example, the wool is treated at 60° C., with a 1 per cent. solution of formaldehyde and a 0·15 per cent. solution of potassium bichromate. It is then spun or interwoven with cotton and the fabric dyed in a bath containing per litre, 8 grms. of Katigen Black TW extra, 8 grms. of crystallised sodium sulphide, 5 grms. of calcined sodium carbonate, 30 grms. of common salt, and 26 c.c. of acid sodium lactate solution.

The goods are entered at 20—25° C. and dyed at this temperature for 1—1½ hours, rinsed in water and afterwards in a dilute solution of acetic acid. The wool may then be dyed with Anthracene Yellow C, Acid Anthracene Red 3B, Benzo Fast Red FC, Alkali Fast Green 3G, etc. (See also Levinstein, this J., 1908, 19.)
—F. M.

Dyeing and bleaching rolled-up spun yarns in the pack system. F. W. Howorth, London. From P. Spiegler und Soehne, Vienna. Eng. Pat. 3209, Feb. 8, 1907.

See Fr. Pat. 374,817 of 1907 ; this J., 1907, 870.—T. F. B.

Dyeing with sulphur colouring matters ; Production of bi- and multicoloured effects on mixed goods composed of cotton and wool by ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 3609, Feb. 13, 1907.

See Fr. Pat. 374,677 of 1907 ; this J., 1907, 870.—T. F. B.

Silk; Process of treating ——. E. P. L. Sisley, Lyon, France, Assignor to Soc. Anon. Coop. per la Stagionatura e l'Assaggio delle Sete ed Affini, Milan, Italy. U.S. Pat. 878,902, Feb. 11, 1908.

SEE Fr. Pat. 358,033 of 1905; this J., 1906, 262.—T. F. B.

Dyeing of dense fabrics or felts. S. von Kapff. Fr. Pat. 382,658, Oct. 7, 1907.

THE fabric is impregnated with the required mordant or colour and is then passed, at full width, through an aspirating apparatus by the aid of which the solution is sucked right through the fabric. The dyestuff or mordant is then fixed in the usual manner.—A. B. S.

Hank dyeing; Machine for ——. H. Ashwell and Co. Fr. Pat. 382,770, Oct. 11, 1907.

THE machine consists of a dye-vat above which is supported a framework carrying two parallel endless chains placed at a distance apart corresponding with the length of the yarn sticks. The latter fit into holes in the links of one chain whilst the other ends of the sticks slip into spring clips attached to the other chain, so that the sticks may be easily removed. When filled with yarn, the framework is lowered into the dye-vat and the endless chains are revolved so as to carry the yarn through the liquor from one end to the other, the yarn being then raised out of the bath and carried back to the other end by the endless chain.—A. B. S.

Dyeing the cotton in (half-wool) union fabrics with sulphide dyestuffs; Process for ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 188,699, Sept. 19, 1906.

BY adding silicates or phosphates to the sulphide dyestuff baths, the cotton fibres only will be dyed, whilst the wool fibres remain colourless; the latter can be subsequently dyed with acid dyestuffs.—T. F. B.

Dyed cotton; Process for "oiling" ——. E. Junginger. Ger. Pat. 188,595, April 2, 1905.

THE patent relates to the process of "oiling" dyed cotton or other vegetable fibres with an emulsion of a mixture of vegetable and animal fats and mineral oil in aqueous ammonia, and the improvement claimed consists in the addition of soluble compounds of the alkaline-earth metals or alkaline-earth hydroxides to the emulsion. The dyeing and "oiling" may be performed simultaneously in an alkaline bath, in which case, the alkaline-earth compounds may be added to the dye-bath after the addition of the ammoniacal emulsion.—A. S.

Spraying fluids upon paper, textile fabrics or other surfaces; Apparatus for ——. C. A. Hanitzsch, Manchester. Eng. Pat. 22,347, Oct. 10, 1907.

THE fluid to be applied is contained in a vertical cylinder, which is connected at the top with a supply of compressed air and contains a thin tube. This tube protrudes through the top of the cylinder and is then bent twice at right angles. A spraying device is attached to the end of the tube outside the cylinder, while the other end reaches almost to the bottom of the cylinder and meets a needle. By means of a lever and spindle, this needle can be made to wholly or partly close the orifice of the tube and in this way regulate the flow of liquor up the tube. When the air pressure is applied, the liquor is forced up the tube and through the spraying device; and by means of a valve in the pipe connecting the compressed air with the cylinder, the air pressure can be shut off or exhausted. The machine is designed for use by hand.—S. H. H.

Discharge effects on textile fibres or fabrics. G. W. Johnson, London. From Kalle und Co., Biebrich, Germany. Eng. Pat. 1549, Jan. 21, 1907.

DISCHARGE effects are obtained upon materials which have been dyed with colouring matters belonging to the Thioindigo Red or indigo groups, by printing upon these a hydrosulphite paste and steaming. The excess of hydrosulphite is then removed by rinsing in weak acid or air-free water, and the material is afterwards passed through a bath of boiling, dilute alkali. It is necessary that the passage through the air-free water or acid should follow the steaming so soon, that the leuco-compound cannot become oxidised on the fibre, otherwise the discharge effect is not obtained.—F. M.

Discharges on dyed textile fibres; Production of ——. Badische Anilin und Soda Fabrik. Fr. Pat. 382,884, Oct. 14, 1907. Under Int. Conv., April 9, 1907.

THE nitrogen compounds of formaldehyde sulphoxylate or hydrosulphite which are obtained by the action of ammonia on these compounds, give excellent discharging effects if they are applied together with an ammonium salt and also with a salt of a volatile organic acid such as sodium acetate or formate. Example:—Dissolve 200 grms. of nitrilomethylenesulphoxalate of sodium $N(CH_2OSONa)_3$, 50 grms. of ammonium chloride and 50 grms. of sodium acetate in 200 grms. of water and thicken with 500 grms. of gum water (1 : 1). Print this paste on the fabric to be discharged, dry and steam, free from air, for 3—3½ minutes in a Mather-Platt. After steaming, rinse and soap if required. Coloured discharges may be obtained by adding to the printing pastes colours which are not affected by the discharging agent. —A. B. S.

Discharging azo ground colours with aldehyde or ketone compounds of hydrosulphites or sulphoxylates. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 188,700, Aug. 25, 1906.

DISCHARGES on fabrics dyed with azo dyestuffs are obtained by adding to the hydrosulphite or sulphoxylate discharge paste, such triphenylmethane or pyronine dyestuffs as have a sulphonic or carboxylic group in an aromatic nucleus in the *o*-position to the methane carbon atom.—T. F. B.

Drying fabrics or fibrous material; Apparatus for ——. A. N. Marr, Thorner. U.S. Pat. 877,938, Feb. 4, 1908.

SEE Eng. Pat. 19,508 of 1905; this J., 1906, 924.—T. F. B.

VII.—ACIDS, ALKALIS, AND SALTS, AND NON-METALLIC ELEMENTS.

Sicilian sulphur ores; Use of —— *in the manufacture of sulphuric acid.* G. Oddo. Chem.-Zeit., 1908, **32**, 145—146.

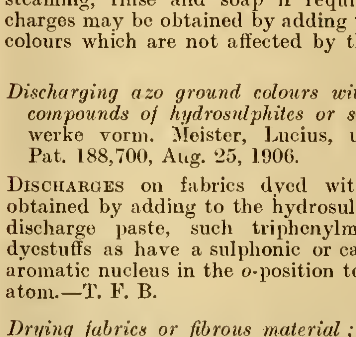


FIG. 1.

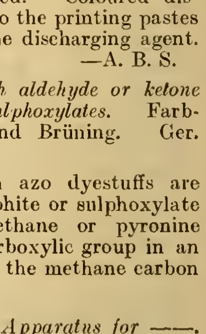


FIG. 2.

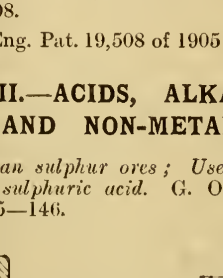


FIG. 3.

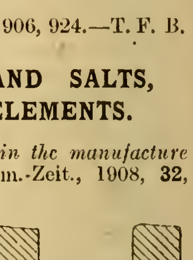


FIG. 4.

In order to overcome the difficulties experienced by the Sicilian sulphur industry in consequence of the flooding of the market with Louisianian sulphur, the author suggested to the Italian Minister for Agriculture, Industry and Trade that Sicilian sulphur ores should be put on the market directly as raw material for the manufacture of sulphuric acid. In this way Sicilian sulphur ores might compete with pyrites, which is not possible with free sulphur, the price of the latter being too high, owing to the heavy losses in the process of manufacture. Trials on the large scale with the sulphur ore on the one hand in a Malétra furnace connected with a chamber system, and on the other with a Herreshoff furnace connected with a contact apparatus, gave very satisfactory results. From 1 ton of the ore containing 31·75 per cent. of sulphur, there were obtained 1⅓ tons of chamber acid as compared with the theoretical yield of 1½ tons. After the furnaces had been slightly modified, the sulphur in the ores was almost completely burned, only 0·03 per cent. remaining in the residue; there was a loss of 1·75 per cent. with the Malétra furnace and 0·75 per cent. with the Herreshoff furnace, in the form of calcium sulphide or sulphate. Among the advantages of using sulphur ores are mentioned lower cost for labour or power in working the furnaces, purer gases and acid, and furnace residues which can be utilised directly as a fertiliser or for the manufacture of lime or cement, etc. The author estimates that the sulphur in Sicilian ores would compete against that of pyrites, even at a price 1½ times as great, and that such a price would be equivalent to a price of 90L. per 1000 kilos. for pure crystalline sulphur (1 Lira = 9·516 pence). Sicilian sulphur ores contain much more sulphur than has been generally stated. Of 31 of the more important ores, 21 contained over 30 per cent. of sulphur, and only one less than 20 per cent. For the efficient burning of sulphur ores, the author has designed two furnaces. Figs. 1 and 2, show a furnace for use with hand labour. The ore is burnt on the third hearth from the top, this hearth being provided with a chamber through which air circulates, in order to keep the temperature as low as possible and thus prevent decomposition of calcium carbonate and consequent loss of sulphur as calcium sulphide or sulphate. The two upper hearths assist in the complete combustion of the sulphur vapour and the settling of the entrained dust. The two lower hearths receive the ashes from the third hearth and serve to warm the incoming air. The furnace shown in Figs. 3 and 4, works in an exactly similar manner except that the charging, raking, etc., are performed mechanically. The sulphur is fed in through the hopper on to the third hearth from the top, which as in the other furnace is provided with an air chamber. The rakes are mounted on the central hollow shaft through which a current of air is passed. These furnaces have been patented, but in order to encourage the use of the Sicilian sulphur ore, the author is prepared to enter into agreements with manufacturers whereby the furnaces may be installed without any payment of royalty.—A. S.

Glover tower functions [sulphuric acid chamber process]; Division of the ——. H. Schmidl. Z. angew. Chem., 1908, **21**, 249—252.

In reply to criticisms by Schliebs (this J., 1905, 1301) and others, the author describes the way in which he has obtained, in practice, very satisfactory results with Niedenführ's system of working with a fan and two Glover towers (see Lüty, this J., 1905, 921).—A. S.

Hyponitrous acid; Decomposition of ——. E. Divers. Chem. Soc. Proc., 1908, **24**, 16—17.

By suddenly drenching dry silver hyponitrite or mercurous hyponitrite at a temperature but little below 30° C. with a mineral acid, not greatly diluted in the case of hydrochloric acid or sulphuric acid, and only sufficiently so in the case of nitric acid to avoid inducing its oxidising action, Rây and Gañguli (Chem. Soc. Trans., 1907, **91**, 1866) have obtained nitric acid and nitrogen as products of decomposition, in place of much of the nitrous oxide which was to be expected. This interesting observation throws much light on the nature of the decomposition of silver and mercury hyponitrites by heat. These authors, indeed, suggest that the presence of mineral acids has a "specific directive influence" in determining the form of the decomposition, but that is a notion without evident support. That sulphuric acid should be less effective in bringing about the decomposition is sufficiently accounted for by the fact that the comparative insolubility of silver and mercurous sulphates greatly impedes the action of this acid on the hyponitrites and the rise of temperature which attends it.

Through Rây and Gañguli's observations, we are at length in possession of much knowledge of what the products are when hyponitrous acid decomposes, without explosion, by the heat generated in liberating it from its salts. Since hyponitrous acid yields only nitric acid and nitrogen (water and nitrous oxide being here negligible), whilst silver hyponitrite or mercurous hyponitrite yields, besides these, much nitric oxide and some nitrous acid or nitric peroxide, we can now see that production of the latter substances is due to the unstable oxidised silver or mercury. Writing hyponitrous acid as H_2O,N_2O, and its silver salt as Ag_2O,N_2O, we see that $5N_2O$ become $4N_2+N_2O_5$, the water remaining unchanged in the former case, whereas the silver oxide in the latter case is reduced to metal, whilst its oxygen becomes active. Hence we obtain the two equations: $5H_2O_2N_2=4H_2O+4N_2+2HNO_3$, and $3Ag_2O_2N_2=4Ag+2N_2+2AgNO_3$.

Similarly, the production of nitric oxide and peroxide is referable to the reducibility of oxidised silver or mercury, and could only come from hyponitrous acid through a highly improbable cumulative resolution of nitrous oxide.

Ammonium nitrite; [Decomposition of ——]. J. Meyer and E. Trutzer. Z. Elektrochem., 1908, **14**, 69—76.

Solid ammonium nitrite is found to dissociate slowly into ammonia and nitrous acid, which decomposes into nitric oxide and other products, and these decomposition products, being retained by the salt more obstinately than is the ammonia, impart to it a yellow colour, the salt being snow white when quite pure. The quantity of impurity increases with the age of the product and causes the more rapid decomposition of the salt into nitrogen and water, when in aqueous solution. The freshly prepared pure salt dissolves in water without decomposition, nitrogen being very slowly evolved at 60° C., and a really neutral aqueous solution would probably be quite stable; but, when 3 months old, the salt dissolves with the vigorous evolution of nitrogen. The solid salt explodes on gentle heating. Biltz and Gahl (Z. Elektrochem., 1905, **11**, 409) found the velocity of reaction to be represented equally well by equations of reactions of the first and second order, and, using van t' Hoff's method of comparing the velocities at two concentrations, found the reaction to be really bimolecular. They supposed the reacting substances to be ammonium nitrite and a comparatively insignificant proportional amount of nitrous acid produced by hydrolysis, the reaction being therefore "cryptobimolecular." The present authors show, however, by experiments extending over a longer period, that the reaction is not bimolecular at all, but that the results are in accordance with a monomolecular reaction, catalytically hastened by a substance, of which the concentration is proportional to the initial concentration of the ammonium nitrite. The acids produced by the action of water on the absorbed oxides of nitrogen answer to these conditions and must therefore be regarded as catalysts. Colloidal platinum solution also increases the rate of decomposition of ammonium nitrite, but the presence of small quantities of alkalis retards it.—F. Sodn.

Sodium sulphite in the presence of sodium sulphate and sodium thiosulphate; Detection of ——. F. E. Weston and C. W. Jeffreys. Chem. News, 1908, **97**, 85.

The principle of this test for the detection of sodium sulphite in the presence of sodium sulphate and sodium thiosulphate, depends upon: (*a*), the insolubility in water of lead sulphate, lead thiosulphate and lead sulphite; and (*b*), the solubility of lead sulphate, and lead thiosulphate, and the insolubility of lead sulphite, in a solution of sodium thiosulphate. To 5 c.c. of a solution containing from 0·05 to 0·1 grm. of the mixed salts, a solution of lead nitrate or lead acetate is added till no further precipitate is produced. 5 to 6 c.c. of a solution of sodium thiosulphate containing 1 grm.-mol. of the crystallised salt per litre of solution are now added, well shaken and the insoluble precipitate of lead sulphite washed free of sodium thiosulphate. On addition of 3 to 4 c.c. of dilute sulphuric acid, the liberated sulphurous acid may be detected on the filter by the smell of sulphur dioxide or in the filtrate by the decolorisation of a solution of potassium permanganate.—W. S.

Barium percarbonate (*barium dioxide carbonate*). R. Wolffenstein and E. Peltner. Ber., 1908, **41**, 275—280.

Duprey (Compt. rend., **55**, 736) and Balard (Compt. rend., **55**, 738), in their investigations of the action of carbonic acid on barium peroxide, used a large excess of the acid and obtained as end products of the reaction, barium carbonate and hydrogen peroxide. The present authors, using barium dioxide containing 30 per cent. of water and cooled to 0—5° C., pass in carbon dioxide until two successive weighings show no gain in weight. Under these conditions, in which the mixture remains alkaline instead of acid throughout, a light yellow product is obtained which is decomposed by heating or on standing. In presence of weak acids, such as carbonic acid, etc., this barium dioxide carbonate is almost instantly decomposed with liberation of hydrogen peroxide. The action of carbon dioxide on barium peroxide proceeds therefore in two stages, the barium percarbonate formed at first afterwards breaking up into barium carbonate and hydrogen peroxide.—W. S.

Percarbonates; Contribution to the knowledge of ——. R. Wolffenstein and E. Peltner. Ber., 1908, **41**, 280—297.

The authors have prepared and studied the following percarbonates: Sodium dioxide carbonate, Na_2CO_4; sodium dioxide bicarbonate, $Na_2C_2O_6$; sodium trioxide carbonate, Na_2CO_5; and sodium trioxide bicarbonate, $NaHCO_4$. For the preparation of sodium dioxide carbonate, 38 grms. of 92 per cent. sodium peroxide were mixed with 50 grms. of broken ice in an open vessel surrounded by a freezing mixture. A stream of carbon dioxide was led in while the mass was stirred with a glass rod, 38 grms. of sodium peroxide being then further added gradually. The current of carbon dioxide was continued until 44 grms. had been absorbed. The temperature of the reaction was not allowed to rise above 0° C. A table is given showing how the reaction and the purity of the product varies with the water present in the sodium peroxide hydrate.

Weight used of:		CO_2 absorbed.	C.c. of N/10 $KMnO_4$ decolorised by 0·02 grm. of the product.	
Na_2O_2	Ice.		Found.	Calculated.
grms.	grms.	grms.		
7·8	16·2	4·4	11·7	13·0
78	100	44	14·8	16·6
7·8	8	4·6	17·5	18·0
78	50	44	21·1	21·4
78	50	44	21·0	21·4

This non-crystallisable product was purified and prepared for analysis by washing with alcohol and ether. The analysis was carried out by determining in one sample the active oxygen by titrating with N/10 potassium permanganate solution. The water and secondary carbonic acid were determined by weighing out a sample of the substance in a platinum boat and heating the whole in a bayonet tube connected with a calcium chloride tube and a carbon dioxide absorption apparatus. The primary carbonic acid and sodium oxide were determined by the usual methods in the ash. In a perfectly dry state this product gradually loses oxygen and within several months is completely decomposed.

Sodium dioxide bicarbonate was prepared either by saturating sodium dioxide carbonate with carbon dioxide or better by passing carbon dioxide into sodium dioxide hydrate until no further increase in weight occurred. It was found difficult to obtain pure products on account of their easy decomposition, even in presence of water, with evolution of oxygen, and also on account of the presence of small quantities of sodium dioxide carbonate and sodium bicarbonate.

Sodium trioxide bicarbonate was prepared by the action of carbon dioxide, gaseous or better still solid, on sodium trioxide hydrate NaO.OH at 0° C. Two sodium trioxide hydrates were prepared: one by Tafel's method (this J., 1894, 1195) by the action of finely powdered sodium peroxide on absolute alcohol, and a second by the action of a concentrated alcoholic solution of hydrogen peroxide on sodium alcoholate, whereby the product is directly precipitated. The sodium trioxide bicarbonate prepared from the sodium trioxide hydrate [sodium hydrogen peroxide] made according to the authors' method differed largely from that made according to Tafel's process in being much more stable in the dry state.

To prepare sodium trioxide carbonate, 18·75 grms. of sodium trioxide hydrate are mixed with 5·2 grms. of water and 6·8 grms. of carbon dioxide under similar conditions as before. The carbonate is again much less stable than the corresponding bicarbonate.—W. S.

Calcium cyanamide; Action of sulphuric acid on ——. T. Jona. Gaz. chim. ital., 1907, **37**, II., 558—562.

If calcium cyanamide be added gradually, with good stirring, to a mixture of 66 per cent. sulphuric acid with an equal volume of water, a very vigorous reaction sets in, with evolution of gas. After cooling, the reaction-product is treated with water at 80°—90° C., and the aqueous solution concentrated. Calcium sulphate separates out first, and then crystals of dicyanodiamidine sulphate, $(C_2H_6ON_4)_2,H_2SO_4,2H_2O$, contaminated with calcium sulphate and ammonium sulphate. The crystals after purification by recrystallisation from alcohol, lose their water when heated at 110° C., and soften at 193°—195° C. They are soluble in water and dilute acids, but insoluble in ether. By treating the aqueous solution with barium chloride, dicyanodiamidine chloride, $C_4H_{12}O_2N_8,2HCl,H_2O$, is obtained. After recrystallisation from alcohol this softens at 172°—174° C. It is easily soluble in ethyl, methyl, and amyl alcohols, but almost insoluble in ether, benzene and ligroïn (petroleum spirit).
—A. S.

Iron salts; Reducing and oxidising power of ——. E. Müller and F. Kapeller. Z. Elektrochem., 1908, **14**, 76—82.

The reducing power of solutions of ferrous salts may be materially increased by the introduction of fluorine-ions. For instance, copper sulphate is unaffected by ferrous sulphate in neutral or acid solution, but in the presence of potassium fluoride, cuprous oxide is precipitated from a neutral solution, and metallic copper is deposited if the solution is faintly acid. And again, ferrous salts are oxidised by iodine in a solution of potassium fluoride, whereas ferric salts, as a rule, oxidise potassium iodide quantitatively. This is probably due to the formation of complexes containing iron and fluorine, which remove the ferric-ions, and so raise the value of the ratio $Fe^{\cdot\cdot}$: $Fe^{\cdot\cdot\cdot}$, on which the reducing power of the solution depends (compare, H. C. Biddle, this J., 1901, 1217). According to theory, ferric-ions should more readily enter into a complex than ferrous-ions; it is unlikely, therefore, that the oxidising power of a ferric solution could be increased in a similar manner.
—F. Sodn.

Stannic acids. H. Kühl. Pharm. Zeit., 1908, **53**, 49. Chem. Zentr., 1908, **1**, 512—513.

The author examined stannic acid which had been prepared in two different ways: (1), by treating a hot aqueous solution of sodium stannate with the necessary quantity of dilute sulphuric acid, and washing the separated stannic acid by digestion with water, and then draining;

(2), treating sodium stannate with the requisite quantity of sulphuric acid, avoiding rise of temperature. The stannic acid prepared by method (1) is soluble in concentrated sulphuric acid; on heating the solution, a jelly-like apparently crystalline mass separates, which is not completely soluble in concentrated hydrochloric acid. After keeping for ten days in the form of a paste, the stannic acid is no longer completely soluble in cold concentrated sulphuric acid, a gelatinous residue being left, which, after removal of the sulphuric acid is not completely soluble in cold 40 per cent. hydrochloric acid. The freshly-prepared stannic acid is easily soluble in 5 per cent. hydrochloric acid, but if the solution be boiled for some time and then allowed to stand for 10 days, re-solution in 5 per cent. of hydrochloric acid can only be effected by prolonged heating. The stannic acid prepared by method (2) dissolves easily in concentrated sulphuric acid and can be volatilised almost completely from the solution without any separation taking place. On keeping the acid in the form of paste, its solubility in sulphuric acid is considerably diminished. The freshly-prepared acid is readily dissolved by 2 per cent. hydrochloric acid. —A. S.

PATENTS.

Hydrochloric acid; Process of purifying ——. L. B. Skinner, Denver, Colo. U.S. Pat. 875,558, Dec. 31, 1907.

COMMERCIAL hydrochloric acid is redistilled from boiling-flasks, the vapours being passed through a closed pot and then ascending a vertical tube, before condensation. In this process the acid is freed from ferric chloride and all impurities, except chlorine. A current of acetylene or other suitable gas, passed through the condensed acid, reduces the chlorine, and acid of the quality known as "chemically pure" is thus obtained.—F. SODN.

Sulphuric acid and neutral sulphate of soda; Manufacture of free —— *by treating bisulphate of soda.* U. F. Benker, Clichy, France. Eng. Pat. 1844, Jan. 24, 1907. Under Int. Conv., Nov. 22, 1906.

SEE Fr. Pat. 381,863 of 1907; following.—T. F. B.

Sulphuric acid; Manufacture of free —— *and of sodium sulphate, by treatment of sodium bisulphate.* F. Benker. Fr. Pat. 381,863, Nov. 22, 1906.

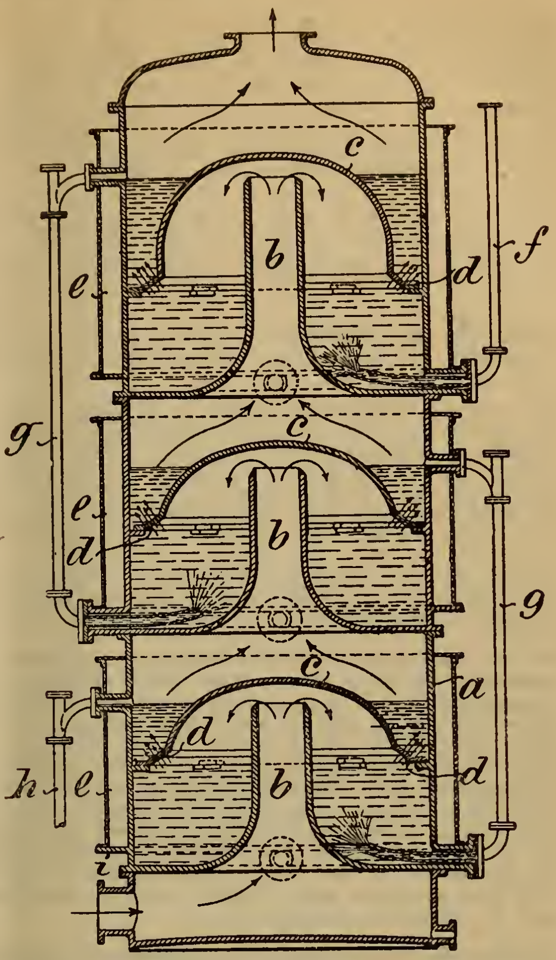
SODIUM bisulphate, or nitre cake, is mixed with fine sand, or with finely-divided silicates, or with other substances not attacked by the bisulphate, such as the anhydrous sulphate of sodium, potassium, or calcium, added in such proportion that the mass may not fuse when heated. Sulphuric acid may then be distilled from the mixture, leaving normal sodium sulphate behind, without the destruction of the apparatus which takes place when the bisulphate by itself is strongly heated.—E. S.

Alumina; Production of pure ——. A. D. A. Lambert. Fr. Pat. 382,347, Dec. 5, 1906.

AN aluminate is obtained by heating the mineral containing aluminium with the carbonate or oxide of one of the alkaline-earth metals, or of magnesium, in some excess. This is converted into sodium aluminate by treatment with a solution of sodium carbonate or sodium sulphate, the solution being added to the aqueous extract, when the aluminate, like that of barium, is soluble in water. The sodium aluminate solution, which is practically free from silica, is decomposed in the usual way by carbon dioxide, to give alumina and sodium carbonate. The advantages claimed are: (*a*), the freedom from silica of the alumina produced; (*b*), that sodium sulphate may replace the more expensive carbonate without an increase in the cost of fuel.—F. SODN.

Gases, especially sulphuric anhydride; Apparatus for absorbing ——. Ges. der Tentelewschen Chem. Fabr. Fr. Pat. 382,081, Sept. 11, 1907.

THE gas to be absorbed enters the absorbing chambers, *a, a, a,* placed vertically above one another, through the central pipes, *b, b, b,* as indicated by the arrows, and bubbles up through the absorbing liquid through the oblique perforations, *d, d, d,* in the hemispherical partitions, *c, c, c*; in so doing, it projects the liquid against the walls of the chambers, which are kept cool by means of a cooling agent in the jackets, *e, e, e.* The absorbing liquid enters the top chamber through the pipe, *f*, overflows into the lower chambers through the pipes, *g, g,* and finally leaves through the pipe, *h*.—A. G. L



Barium cyanide and barium oxide; Manufacture of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 2133, Jan. 28, 1907.

SEE Fr. Pat. 375,357 of 1907; this J., 1907, 924.—T. F. B.

Barium cyanide; Production of ——. K. Bosch and A. Mittasch, Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 879,030, Feb. 11, 1908.

SEE Fr. Pat. 370,420 of 1906; this J., 1907, 255.—T. F. B.

Cyanides, cyanamides, and nitrides; Manufacture of —— *by means of nitrogen and metal carbides.* G. Bredig and W. Fraenkel. Fr. Pat. 382,188, Sept. 24, 1907. Under Int. Conv., Aug. 28, 1907.

CALCIUM carbide, or other carbide, is heated with nitrogen under increased pressure. It is preferred to mix with the carbide so heated, a catalytic substance, such as certain salts or carbon powder, to further facilitate the reactions.—E. S.

Nitrogen compounds; Manufacture of —— *by means of carbides.* Cyanid-Gesellschaft. Fr. Pat. 382,743, Oct. 10, 1907. Under Int. Conv., Jan. 10, 1907.

WHEN the carbide of a metal belonging to the group of alkalis, alkaline-earths, or earths is heated in a current of nitrogen at one point, the reaction will propagate itself throughout the mass, if the necessary initial temperature is reached. The preliminary heating may be brought about electrically, or by passing heated nitrogen over the carbide, which also itself may be heated moderately, or by the addition of another constituent to the nitrogen or the carbide (*e.g.*, oxygen or aluminium powder), which shall, by reaction with some substance present, liberate the necessary heat.—F. Sodn.

Salt; Manufacture of ——. B. F. McTear. Fr. Pat. 382,598, Oct. 5, 1907. Under Int. Conv., Oct. 9, 1906.

See Eng. Pats. 22,327 and 22,327A of 1906; this J., 1907, 1279.—T. F. B.

Salts; Process of extracting —— from solutions. H. M. Crowther, Salt Lake City, Utah. U.S. Pat. 877,912, Feb. 4, 1908.

Solids are separated from solution by arranging a suitable absorbent material so as to touch the surface of the liquid. By capillary action a very large surface is thus exposed and evaporation much hastened. Reagents may also be associated with the absorbent material, so as to simultaneously bring about solution or precipitation. —F. Sodn.

Ammonium salts; Method and apparatus for producing —— in the cold. R. Fousset. Fr. Pat. 382,269, Nov. 16, 1906.

Waste or gas-liquors containing ammonia or ammonium salts, if necessary, after adding fixed alkalis, are "atomised" and in this condition allowed to fall down a vertical drum, in which they meet an ascending current of air, which carries the ammonia with it as gas. The charged air passes between zig-zag partitions, on which it deposits any spray, and then impinges against a rotating fan, which is kept supplied with dilute sulphuric acid. The solution of ammonium sulphate formed runs into a vat, in which crystals of ammonium sulphate are deposited, whilst the clear liquor overflows into a second vat, from which it is again pumped to the fan until the acid is exhausted.—A. G. L.

Metal sulphates; Obtaining —— by means of sulphides containing mono- or protosulphide of iron, by heating with alkali sulphides (or an alkali sulphate and carbon), followed by oxidation by exposure to the air. O. Meurer. Fr. Pat. 382,230, Sept. 26, 1907. Under Int. Conv., Oct. 19, 1906.

Sulphides containing iron protosulphide are heated with alkali sulphides (or alkali sulphates and carbon) at a moderate temperature, too low to render the iron oxides formed practically insoluble in dilute acid, the working process being checked by examination of samples drawn from the heated charge from time to time. After lixiviation of the product, the residue containing certain metal sulphides, and some unoxidised iron sulphide, is subjected to another oxidation to obtain oxides and sulphates. Ger. Pats. 120,822, of 1898; 135,182, of 1901, and 166,959 of 1904, are referred to. (Compare Fr. Pat. 347,970, of 1904; this J., 1905, 442.)—E. S.

Ferrocyanogen compounds from gas purifying material, cyanide sludge, and other products containing insoluble iron-cyanogen compounds by treatment with lime; Process for obtaining soluble ——. C. Petri. Ger. Pat. 188,902, Oct. 2, 1906.

The yield of soluble ferrocyanogen compounds from gas purifying material, etc., is said to be increased by 10 to 20 per cent. if the decomposition of the material with lime is carried out in presence of a reducing agent, *e.g.*, hydrogen sulphide or calcium sulphide.—T. F. B.

Tungsten dioxide; Process for producing ——. The Westinghouse Metal Filament Lamp Co., Ltd. Fr. Pat. 382,798, Aug. 19, 1907. Under Int. Conv., Nov. 23, 1906.

See Eng. Pat. 18,922 of 1907; this J., 1908, 22.—T. F. B.

Zinc oxide; Apparatus for producing ——. W. and H. Simm. Fr. Pat. 382,487, Oct. 2, 1907. Under Int. Conv., Oct. 3, 1906.

See Eng. Pat. 21,787 of 1906; this J., 1907, 1150.—T. F. B.

Zinc oxide; Preparation of —— from minerals containing zinc. L. Brunet. Fr. Pat. 382,759, Oct. 11, 1907.

The powdered mineral is agglomerated with resin and carbon or other combustible, in sufficient quantity to reduce all the zinc compounds present. When this mixture is burnt, the metal distils over and is oxidised by contact with an excess of air. Before passing to the condensing apparatus, the highly heated gases and fumes of zinc oxide are cooled, the heat being utilised for generating steam. Resin has the advantage of leaving no residue in the furnace and of increasing the temperature during burning.—F. Sodn.

Lime, cement, chemicals, etc.; Process and apparatus for burning and calcining —— in tubular rotary furnaces. C. de Radlowski. Fr. Pat. 382,491, Oct. 2, 1907.

See Eng. Pat. 26,150 of 1906; this J., 1908, 23.—T. F. B.

Hydrogen peroxide; Process for rendering —— stable by mixing with other substances. M. A. Queisser. Fr. Pat. 381,924, Sept. 16, 1907.

Starch, cooked, or in viscid solution, and with or without addition of such vegetable matters as gum arabic, etc., when added to hydrogen peroxide, not only impedes loss of oxygen, but is itself preserved from liability to become putrescent. Such mixtures, with addition of anhydrous calcium sulphate, may be used in the preparation of dentifrices, etc.—E. S.

Hydrogen peroxide; Manufacture of ——. C. A. F. Kahlbaum. Fr. Pat. 382,189, Sept. 24, 1907. Under Int. Conv., Oct. 20, 1906.

In the manufacture of hydrogen peroxide by bringing aqueous vapour, with or without air or gases, into contact with electric arcs, or bodies very highly heated, it is, under the present invention, prescribed that the aqueous vapour, etc., shall have a velocity of passage through the heated field of not less than 1 m. per second; or the electric field may be moved at such a rate against the gases. It thus follows that the cooling of the gases is so rapid that the hydrogen peroxide formed has not time to be decomposed before the water vapour charged with the same, condenses on cooled surfaces offered to it. The flames of burning hydrogen may be used instead of electrical methods of producing the required heat.—E. S.

Boron; Treatment [purification] of ——. The British Thomson-Houston Co., Ltd., London. From The General Electric Co., Schenectady, U.S.A. Eng. Pat. 1197, Jan. 16, 1907.

Impure boron, prepared by heating boric anhydride with magnesium, is partially purified by grinding the product with water or hydrochloric acid, and then decanting off the upper portion of the liquid, which is richer in impurities, before the matter in suspension has completely settled down. This process of "fractional decantation" is repeated until a product is obtained, which is less impure by several per cent. than was hitherto possible. The boron, which may still contain magnesium boride, boron hydride, boric anhydride, or a borate, is then compressed into the form of a stick or rod, and heated for several hours at 1200° C. in a vacuum electric resistance furnace, whereby all the above impurities are either dissociated or volatilised. Finally the pure boron, which conducts electricity, is melted down by heating it as anode in a vacuum arc in the presence of an inert gas, preferably hydrogen at a pressure of from 2½ to 15 cm. of mercury. Thus obtained, boron is a dense, solid substance, a relatively good conductor of electricity, and completely fusible without apparent vaporisation. It is consequently suitable for use in incandescent lamps and furnaces, either with or without the addition of a binding material.—O. R.

Sulphur from sulphuretted hydrogen and gases containing sulphuretted hydrogen; Method of recovering ——. G. H. Hellsing, Raback, Sweden. Eng. Pat. 8164, April 8, 1907.

See Fr. Pat. 376,534 of 1907; this J., 1907, 1009.—T. F. B.

Air; Separation of —— into its constituents. Soc. "L'Air Liquide" (Soc. anon. pour l'Etude et l'Exploitation des Proc. G. Claude). Fr. Pat. 381,866, Nov. 22, 1906.

Liquid air is systematically fractionated by making the vapour travelling upwards come into contact with freshly condensed drops of liquid air falling downwards. The air is liquefied by compressing and cooling it, and then passing it, about half-way up, into a long cylindrical vessel, the upper part of which is cooled by means of liquid oxygen, whilst the lower part is kept at a higher temperature by surrounding it with a vessel in which air enriched in oxygen is liquefied by compression. The liquid obtained in this outer vessel may also be allowed to fall through the inner vessel. Finally, liquid oxygen and gaseous nitrogen are obtained.

(See also this J., 1903, 288, 485, 365, 554, 796, 950, 1292, 1346; 1905, 969; 1906, 264.)—A. G. L.

Ammonia by fermentation, etc. Fr. Pat. 382,689. *See* XVII.

VIII.—GLASS, POTTERY, AND ENAMELS.

Glass; Some effects of sunlight on colourless ——. R. A. Gortner. Amer. Chem. J., 1908, **39**, 157—162.

Glass containing a relatively large percentage of manganese (0·2 per cent. or more) may show a violet coloration after exposure to sunlight for a period of one month or less, the degree of coloration being proportional to the manganese content. After exposure of less than a year, a violet coloration is apparent in most glasses containing only a small percentage of manganese, and becomes more pronounced when the time of exposure is increased. The production of a violet coloration in a glass by the action of sunlight furnishes a proof of the presence of manganese, but the reverse is not true, for some glasses containing manganese, *e.g.*, Jena Erlenmeyer glass, do not become coloured. "A background or subsoil" containing manganese has no influence on the coloration of glass lying upon it. The production of the violet coloration is accelerated by a violet background and retarded by brown and black backgrounds, whilst other colours such as yellow, blue and red appear to have no influence. —A. S.

Pottery; Testing of the raw materials for a whiteware ——. H. E. Ashley. Trans. Amer. Ceram. Soc., **9**, 57—62.

In testing clays, first the moisture is determined, next the amount of water required to make a slip and the residue left on the lawn. The slip is then cast into discs 100 mm. in diameter and 5 mm. thick, from which the shrinkage on drying and burning is determined as also the loss of weight in firing. Finally the piece is dipped in the glaze and put in the glost burn. For comparing the colours, a series of standards have been prepared, made from the whitest china clay blended with Tennessee ball clay. The face not in contact with the plaster mould is used for comparison. Similarly, ball clay biscuit standards are prepared, which have been burnt in the same glost fire. The flint is tested for fineness by passing through the lawn in the form of a slip and for colour by firing in a biscuit cup. The moisture is also determined. The felspar is tested for fineness, for fusibility by comparative fusion in the shape of cones, by fusion in a small cup, and for moisture. The plaster of Paris is tested for fineness and by plotting a time-temperature curve from observations of a thermometer in the setting plaster. The finished pottery is tested for crazing by chipping off the glaze in a few places and boiling in saturated salt water for 8 hours.

Fritted glazes. A study of variations of the oxygen ratio and the silica: boric acid molecular ratio. R. C. Purdy and H. B. Fox. Trans. Amer. Ceram. Soc., **9**, 94—187.

The ranges in the composition of whiteware glazes are discussed and the following variables introduced: oxygen ratio, 2·00 to 4·50; molecular ratio, silica to boric acid, from 1 : 0·25 to 1 : 0; alumina content 0·10 to 0·45 equivalent. The number of glazes made was 448. The body used was a whiteware body of the composition: ball clay 40 parts, china clay 40, Cornwall stone 20, flint 22·5. Five temperatures were employed, cones 0·10, 0·5, 1, 5, and 10. The results, giving the number of well matured glazes, were tabulated, and the composition areas were plotted. Some interesting facts were developed in regard to crazing. Additions of alumina rapidly decrease crazing at all oxygen ratios, and alumina is more potent in this respect than either silica or boric acid alone. Alumina cannot wholly counteract crazing unless the oxygen ratio is at least equal to 2·5. When alumina is less than 0·25 equivalent, fine-mesh crazing ensues for every oxygen ratio and nearly at every temperature. Alumina raises the firing point and the viscosity of the glaze when exceeding 0·25 equivalent, this being the most favourable alumina content. Boric acid increases the coefficient of expansion, thus causing crazing. The true function of boric acid is to counteract devitrification. Crazing also decreases as the oxygen ratio increases. Boric acid and alumina act alike in counteracting devitrification. For best results the ratio of boric acid to silica should not be lower than 0·13 : 1, irrespective of the oxygen or alumina content. The alumina should be equal to or more than 0·20 equivalent to obtain the best gloss and largest index of refraction. Opalescent effects can be obtained by supersaturating the glaze with silica at high oxygen ratios, at least of 1 : 4. The best opalescent glaze was produced with 0·20 equivalent of alumina, an oxygen ratio of 4·5 and silica-boric acid ratio of 1 : 0·25. A good commercial whiteware glaze quoted was: 0·064 K_2O, 0·192 Na_2O, 0·490 CaO, 0·250 PbO, 0·28 Al_2O_3, 2·81 SiO_2, 0·384 B_2O_3.

Patents.

Glass; Apparatus for melting and drawing ——. Window Glass Machine Co. Fr. Pat. 382,713, Oct. 9, 1907.

See U.S. Pat. 868,034 of 1907; this J., 1907, 1199.—T.F.B.

China-clay and like materials; Method of and apparatus for treating [grading] ——. W. J. Gee, London. Eng. Pat. 4155, Feb. 19, 1907.

The material is cut in the same way as ordinary potter's clay and mixed with water in suitable tanks. When the mixture has the desired consistency, it is introduced into a centrifugal machine, consisting of a cylinder which is capable of rapid rotation. Internally the cylinder is provided with vanes, which communicate the rotary motion to the contained liquid. Between the vanes, receptacles of suitable depth are fitted, which serve for the collection and subsequent removal of the deposits. The solids are deposited on the impervious, inner periphery of the cylinder, the coarsest and heaviest particles depositing near the inlet, and the product being of increasing fineness as the outlet is approached. The liquid flows away and is drawn off below or near the centre of the apparatus.—O. R.

Pottery and other kilns or ovens; Gas-fired ——. T. W. Twyford, Hanley, and T. C. Moore, Stoke-on-Trent. Eng. Pat. 13,533, June 11, 1907.

The general arrangement of these kilns is the same as that described in Eng. Pat. 18,769 of 1906 (this J., 1907, 762), but the outlets of the gas- and air-flues into the combustion spaces of the structure, are now so arranged that the delivery of gas under pressure into the combustion spaces, induces a positive draught in the air-flues. This may be effected by making the air-flues of larger internal dimensions than the gas-flues, and arranging the outlets of the gas-flues concentrically within the outlets of the larger air-flues, so that each pair of gas- and air-flues discharge into the bottom (or into the same side) of a combustion space, and each gas-outlet is surrounded by an annular air-outlet. A series of fire-clay blocks or slabs are arranged in the form of checker-work, above the top outlets of the combustion spaces which communicate with the floor flues and with the interior of the oven, to distribute the flame and products of combustion without checking the draught or impeding the action of the kiln.—W. C. H.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Clays; Pyro-chemical and physical behaviour of ——. R. C. Purdy and J. K. Moore. Trans. Amer. Ceram. Soc., 9, 203—319.

In this investigation the progress of vitrification of a number of second-grade fire-clays and paving-brick shales was observed by means of specific gravity and porosity determinations. For this purpose briquettes were made of the dimensions, 0·75 × 0·75 × 2·5 inches, which were dried and burnt at 10 temperatures varying from cone 010 to cone 9 in intervals of 2 cones. The sp. gr. of the briquettes was then determined by the suspension method, the test-pieces having been immersed in water under vacuum before weighing. The weights of the saturated briquettes were also obtained, thus making the porosity determinations possible. It was found that as the heat was raised, the sp. gr. decreased though at first with some clays, a slight increase in sp. gr. was observed. This decrease in sp. gr. was approximately parallel with the decrease in porosity, thus indicating that the rate of decrease in sp. gr. is proportional to the rate of vitrification. According to these determinations it seems then that the rate of decrease in sp. gr. is proportional to the rate of vitrification, and hence affords a valuable guide in determining the class of clays to which a certain material belongs and enables the operator to reject unsuitable clays.

Cements; Hydration of ——. C. Montemartini. L'Ind. Chimica, 1907, **7**, 321—327, 337—339. Chem. Zentr., 1908, **1**, 562—563. (See this J., 1907, 1239.)

If a current of dry carbon dioxide be passed over dry cement, no change is observed, but if the cement has been powdered and treated with water previously, it loses water and absorbs carbon dioxide. Air saturated with water vapour but free from carbon dioxide has no action on dry cement at 70°—75° C., but removes water from cement which has been previously powdered and treated with water. Moist carbon dioxide has no action on dry cement at temperatures up to 212° C., nor on powdered and moistened cement on temperatures above about 70° C. These results show that in the "weathering" of cements, the action of the water must precede that of the carbon dioxide. By the action of water vapour alone on powdered and moistened cement, the amount of firmly-bound water is increased.—A. S.

Patents.

Stone, artificial; Manufacture of — . A. Charles, Milan, Italy. Eng. Pats. 2605 and 2605a, Feb. 1, 1907. Under Int. Conv., March 1, 1906.

See Fr. Pat. 373,419 of 1907; this J., 1907, 692.—T. F. B.

Brick, etc.; Composition for ——, and process of making same. L. Houze, Assignor to R. H. Willey, A. Branquart, and C. F. Nicklaus, of Monterey, Cal. U.S. Pat. 875,662, Dec. 31, 1907.

The composition consists of 75 to 80 per cent. of a rock from Monterey county, California, and 25 to 20 per cent. of a plastic fireclay. The rock has the sp. gr. 1·85, and contains 65·48 parts of silica, 9·06 parts of alumina and iron oxide, 1·31 parts of magnesium oxide, 2·5 parts of chlorine, and 4·37 parts of sodium oxide, and loses 17·17 parts on ignition (water). The rock is pulverised, before or after calcination, mixed with fireclay and water, and the mass is moulded into the required shapes, which are then burnt. The products are said to be very light in weight, to offer great resistance to tension, compression, and very high temperatures, and to have a very low coefficient of expansion.—W. C. H.

Wood; Preservation of posts of —— placed in the soil. Himmelsbach Frères. Fr. Pat. 381,832, Aug. 20, 1907.

The wood to be treated is well dried, and immersed three times in hot tar containing phenol. It is next covered with a hot "asphalt" made by mixing tar-pitch and magnesian cement, and is finally covered with tarred pasteboard or similar material, the joints being made with the asphalt.—A. G. L.

Lime and carbonated cements; Continuous kiln for burning of, and methods of manufacture of ——. V. J. Poutet. Fr. Pat. 382,224, Sept. 24, 1907. Under Int. Conv., Sept. 29 and Nov. 14, 1906.

The hydraulic material is burnt in a vertical kiln consisting essentially of two compartments, the actual burning taking place in the upper one at a temperature of 900—1000° C., whilst in the lower compartment the burnt material is partially re-carbonated at about 600° C. by the waste gases from the upper compartment. For this purpose the two compartments may be continuously in communication with each other; the gases from the upper one being drawn downwards through the lower one to a flue leading to the chimney. Or else, the two compartments are closed to each other except when burnt material from the upper is allowed to fall into the lower one; in this case, the gases traverse a flue leading from the top of the upper compartment to the bottom of the lower one, then pass upwards through the burnt mass, and finally enter a flue leading to the chimney. In the first case, the air needed for the combustion of the fuel is drawn in at the top of the kiln; in the second case, through an opening near the bottom of the upper compartment.—A. G. L.

X.—METALS AND METALLURGY.

Iron alloys and metals of the steel industry. W. Venator. Stahl und Eisen, 1908, **28**, 49; 82; 149; 255.

A monograph or review of progress in the iron and steel industry in the direction indicated, in which descriptive reference is made to the following:—I. Spiegeleisen and ferromanganese. II. Ferrosilicon. III. Ferromanganese-silicon; silicospiegel. IV. Aluminium and ferro-aluminium. V. Ferrochrome. VI. Nickel; ferronickel; ferronickelchrome. VII. Ferrotungsten and tungsten. VIII. Ferromolybdenum. IX. Ferrovanadium. X. Ferrotitanium. XI. Ferrophosphor and phosphor-manganese. XII. Carborundum (silicon carbide). XIII. Metals prepared by the aluminothermic method.

Coal gas; Effect of —— on the corrosion of wrought iron pipe, buried in the earth. W. L. Dudley. J. Amer. Chem. Soc., 1908, **30**, 247—250.

Samples of earth were collected in Nashville, U.S.A., as representative of the different types in which wrought iron pipes are laid. The samples after analysis were placed in boxes of a cubic foot capacity, and clean iron pipes set in them. The earth was kept moist from time to time, and the pipes removed after 12 months. The pipes were cleaned with ammoniacal ammonium citrate and weighed in order to determine the amount of corrosion. The amount of the latter was found to depend on the amount of chlorides present in the earth. Another set of boxes was arranged so that half a cubic foot of coal gas was introduced into the earth daily for a period of 12 months. The effect of the coal gas was to retard in a marked degree the corrosion.—F. Shdn.

Metals; Action of finely divided —— on water. W. Van Rijn. Chem. Weekblad, 1908, **5**, 1—5. Chem. Zentr., 1908, **1**, 606.

Iron wire reacts with boiling water only if it has previously been exposed to moist air for a day or two. Ordinary iron powder, *ferrum redactum*, and "pyrophoric" iron are more active, the activity increasing in the order given.

The reaction is considerably accelerated by the presence of mercury. Metallic nickel obtained by reduction of the oxalate with hydrogen was not pyrophoric, but lead obtained in a similar manner showed a small rise of temperature on exposure to the air. Pyrophoric lead was obtained by the reduction of lead tartrate, the temperature being kept as low as possible. Finely-divided copper was obtained by reduction of copper oxide with hydrogen. These three metals had no preceptible action on water. Finely-divided aluminium reacts with water only in presence of mercury. Zinc dust causes the evolution of noticeable quantities of hydrogen from water even at the ordinary temperature; the reaction is not accelerated by the presence of mercury. Magnesium acts on water even in the form of sheet-metal and the reaction is greatly accelerated by the presence of mercury.—A. S.

Phosphorus in steel; Determination of ——. F. W. Hinrichsen. Mitt. aus dem königl. Materialprüfungsamt Gross-Lichterfelde West, 1907, **25**, 293—302.

The author's experiments with pure materials show that in the presence of arsenic, high results are obtained for phosphorus when the latter is weighed directly as the phospho-molybdic compound, even when the precipitation is performed cold.—A. G. L.

Tungsten and chromium in steel; Determination of ——. F. W. Hinrichsen. Mitt. aus dem königl. Materialprüfungsamt Gross-Lichterfelde West, 1907, **25**, 308—317.

When tungsten only is present, the author finds von Knorre's benzidine method (this J., 1905, 292) to give good results. In the presence of chromium also, however, the method suffers from the defect that a part of the chromium is precipitated together with the tungsten. In this case it is best to determine chromium in one portion of the steel iodometrically, tungsten being kept in solution during the titration by the addition of sodium phosphate. In another portion tungsten and chromium are determined together by Berzelius's method, as follows: Two grms. of the sample are oxidised by repeated evaporation with nitric acid. The residue is ignited and fused with 16 grms. of sodium peroxide. The melt is dissolved in water, the solution filtered through asbestos and the filtrate evaporated to about 150 c.c. The separated silica is filtered off on asbestos, and the filtrate made up to 250 c.c., 50 c.c. of the clear solution are acidified with nitric acid, and again make alkaline with ammonia, after which the solution is heated to boiling, and precipitated with mercurous nitrate. The washed precipitate is ignited, treated with hydrofluoric and sulphuric acids to remove silica, and weighed as $WO_3 + Cr_2O_3$.—A. G. L.

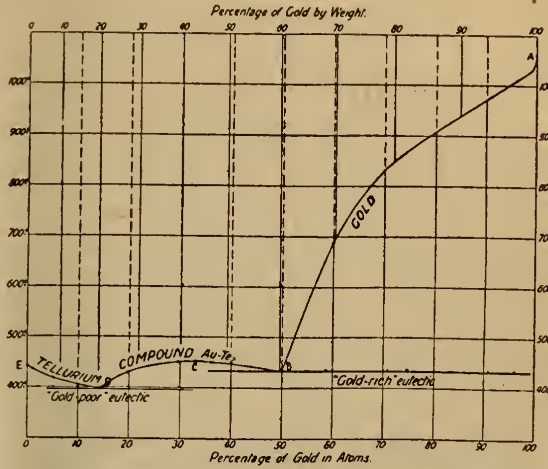
Cyanide process; Two deterrents to the dissolution of free gold in the ——. D. Simpson. Bull. Inst. Min. and Metall., 1908, No. 41.

The author finds that both oil and lime hinder the solution of gold by potassium cyanide solution (containing 0·05 to 0·15 per cent. of potassium cyanide). In one case, in which the treated sand contained 29 grains of gold per ton, it was washed with ether and hydrochloric acid, and again treated with cyanide, when the gold content was reduced to 13 grains per ton.—A. G. L.

[Gold] slimes; Method of settling ——, *as applied to their separation from solution in cyanide treatment.* H. G. Nichols. Bull. Inst. Min. and Metall., 1908, No. 41.

The author finds that settlement of slimes from cyanide treatment, is greatly facilitated if the solids are removed as soon as they deposit. This may be effected by inducing settlement in a vat provided with a trap at the bottom; below the trap an endless belt circulates, and continuously or intermittingly removes the deposited solids falling through the open trap. The belt may convey the solids to a second similar vat in which they are removed from the belt, treated with wash-water, and again allowed to settle as in the first vat. The process may also be made continuous by removing by means of upward suction through filtering screens an amount of liquid proportionate to the quantity of solids removed from the bottom of the vat. If two screens are used, one may be cleared from time to time from accumulated slimes by exerting a back-pressure, without interfering with the removal of liquid through the second screen.—A. G. L.

Gold and tellurium; Alloys of ——. T. K. Rose. Bull Inst. Min. and Metall., 1908, No. 41.



Solidification curves of mixtures of gold and tellurium.

When gold and tellurium are fused together in suitable proportions, a compound $AuTe_2$ or Au_2Te_4, containing 43·59 per cent. of gold, fusing at 452° C., and corresponding in composition to sylvanite or calaverite, is formed. Two eutectic mixtures are also produced, containing 60 and 20 per cent. of gold respectively, and corresponding to the formulæ, AuTe and $AuTe_6$, respectively. All the alloys of gold and tellurium are brittle, and all those containing less than 60 per cent. of gold fuse at temperatures between 397° and 452° C., consequently tellurium cannot be completely removed from such alloys by roasting. Gold containing only 2·4 per cent. of tellurium is of a pale brass colour, whilst the alloy, $AuTe_2$, is white or grey without any yellow tinge.—A. G. L.

Silver oxide; Reduction of —— *by hydrogen, and colloidal silver.* V. Kohlschütter. Z. elektrochem., 1908, **14**, 49—63.

Dried silver oxide and dry hydrogen can be kept in contact for a long time without chemical action taking place. In presence of very small quantities of water vapour, however, the oxide is reduced, the first product of the reaction being colloidal silver. Silver oxide in aqueous solution is also reduced by hydrogen with formation of colloidal silver. The reaction proceeds almost entirely at the surface of contact between the solution and the containing vessel, and the nature of the material of which the latter is composed influences not only the rate of reduction of the silver oxide, but also the colour of the resulting silver sol. This effect on the colour is not due to dissolved substance from the containing vessel. The colloidal solutions are very stable. They are coagulated by base metals in the order of Hardy's law of precipitation, according to which the coagulating power of metallic salts on electro-negative colloidal solutions is practically entirely dependent upon the cation and increases with the valency of the metal. Hydrogen in presence of platinised platinum has no action on the collodial silver, but effects the removal of all but slight traces of electrolytes from the sols. This method of purification in conjunction with the method of precipitating the sols with electrolytes permits of the detection of differences in the composition of the sols and of correlating such differences with their colour. The colorations imparted to beads of borax or microcosmic salt in qualitative analysis are due to colloidal silver. It is the formation of metals in the colloidal condition, also, which is the cause of the metal mist or fog observed in the electrolysis of fused salts. Silver sols are also formed by the reduction of silver oxide with carbon monoxide, but they are not so stable as those produced by reduction with hydrogen. Sols prepared by Bredig's method of cathodic disintegration contain silver oxide.—A. S.

Arsenic in ores; Rapid method for the determination of ——. H. E. Hooper. Bull. Inst. Min. and Metall., 1908, No. 41.

About 0·5 grm. of an ore containing 20 per cent. of arsenic is dissolved in 10—15 c.c. of a solution of potassium chlorate in nitric acid, the solution is evaporated to dryness, and the residue heated for a short time. The mass is then boiled with 10 c.c. of dilute ammonia solution; 25 c.c. of a 25 per cent. solution of sodium hydroxide are added, and the whole is boiled and filtered, the residue being then washed with hot water. The filtrate is evaporated to 50 c.c., if necessary, and neutralised with hydrochloric acid; 25 c.c. of concentrated hydrochloric acid are then further added, and the whole cooled. Potassium iodide is added, and the liberated iodine titrated with sodium thiosulphate solution standardised against copper or arsenious oxide. The ordinary metals do not interfere with the reaction. If antimony is present, the ore should be decomposed by fusion with sodium peroxide, the aqueous solution of the alkaline melt being treated as above.—A. G. L.

Tungstic acid in tungsten ores; Determination of ——. J. B. Ekeley and G. D. Kendall, jun. Western Assoc. Techn. Chem. and Metall., S. Dakota; Mining J., Feb. 22, 1908.

The principle of the method consists in dissolving the tungstic acid in a standardised solution of ethylamine and determining the excess of the latter by titrating with standard oxalic acid. One grm. of a poor ore or as little as 0·3 grm. of one containing over 40 per cent. of tungsten trioxide is decomposed by prolonged digestion with *aqua regia*, in the usual way, and the solution is diluted and decanted on to a filter, leaving as much of the tungstic acid and insoluble residue in the flask as possible. The precipitate is washed with a 5 per cent. solution of sodium chloride until the washings show no acidity when tested with phenolphthalein and a drop of ethylamine solution. The filter-paper is dropped into the flask and an excess of ethylamine solution (6 grms. of a 33·3 per cent. alcoholic solution of ethylamine per litre: 1 c.c. = about 0·005 grm. WO_3) is run in from a burette. The paper is then broken up by means of a glass rod and the flask closed with a rubber stopper to prevent evaporation while the tungstic acid is dissolving. When solution is complete, which must not be accelerated by warming, the excess of ethylamine is titrated back with a standard solution of oxalic acid (2·8 grms. per litre: standardised by permanganate), using phenolphthalein as an indicator, and the value of the ore calculated from the amount of ethylamine used in dissolving the tungstic acid. The authors give tabulated results showing that silica is not a disturbing element and that the results are practically identical with those yielded by the standard gravimetric method on which tungsten ores and compounds are sold. They however indicate that the presence of molybdenum may render the method unreliable.—F. R.

Iron vanadate; Technical analysis of ——. A. M. Wilson. Electrochem and Metall. Ind., 1907, 5, 495. Chem.-Zeit., 1908, 32, Rep. 73—74.

Vanadium, iron, silica, and loss on ignition may be determined in iron vanadate as follows:—0·3 grm. of the finely powdered vanadate is evaporated to dryness with 40 c.c. of dilute hydrochloric acid (1 : 3), the residue is boiled with 10 c.c. of concentrated hydrochloric acid, taken up with water, and the silica filtered off and volatilised with hydrofluoric acid. The filtrate, after addition of 4 c.c. of concentrated sulphuric acid, is evaporated until fumes of this acid appear, and is then cooled and taken up with 30 c.c. of water. This solution is oxidised with hydrogen peroxide, until a dark red colour appears, and is then carefully neutralised with concentrated caustic soda, until all the iron is precipitated. After boiling for some minutes, the liquid is diluted to 200 c.c., heated to boiling, and quickly filtered when the precipitate has settled. The colourless filtrate is acidified with sulphuric acid, boiled, and reduced with sulphur dioxide, the excess of which is driven off with a current of carbon dioxide. It is then titrated with potassium permanganate, until the colour no longer vanishes on boiling. Again it is reduced with sulphur dioxide, until the solution smells strongly of the gas, the excess is boiled off, and the liquid titrated with permanganate. The precipitated iron is dissolved in hot dilute sulphuric acid (1 : 5), 5—10 c.c. of strong hydrochloric acid and 3—5 grms. of zinc are added, the solution is shaken until colourless, the zinc dissolved with 10 c.c. of concentrated sulphuric acid, and the solution titrated with permanganate. To determine the loss on ignition (water and chlorine), heating is continued until no reaction is obtained with starch and potassium iodide. It is well, as a precaution, to ascertain that no vanadium is present in the precipitate and that no iron has passed into the filtrate.—F. Sodn.

Magnesium silicide. P. Lebeau and R. Bossuet. Compt. rend., 1908, **146**, 282—284.

A series of alloys containing increasing quantities of silicon have been metallographically examined. Those containing not more than 45 per cent. of silicon were prepared by heating fragments of magnesium with a mixture of magnesium filings and potassium fluosilicate. Those richer in silicon were obtained by fusing appropriate proportions of magnesium filings with crystalline silicon and a small quantity of potassium fluosilicate. The polished surface of two alloys containing 0·38 and 1·37 per cent. of silicon showed grains of magnesium in a eutectic. When more silicon is present, the well-crystallised silicide is formed and in alloys containing 6 or 8 per cent. of silicon, it is abundantly developed in a eutectic rich in magnesium. A 40 per cent. alloy is almost entirely composed of this compound, whilst the eutectic contains free silicon. Above 50 per cent. of silicon, crystals of silicon appear in the eutectic. Only one magnesium silicide appears to exist; to separate it from the excess of magnesium, aqueous liquids cannot be employed, but the magnesium may be removed as an organo-magnesium compound by treatment with ethyl iodide in presence of anhydrous ether, when the silicide, Mg_2Si, is obtained in brilliant octahedra. This decomposes slowly in water forming hydrogen but not silicon hydride. Hydrochloric acid attacks it energetically, forming hydrogen and spontaneously inflammable silicon hydrides. When heated in vacuum or in a current of hydrogen at 1200° C. it is completely dissociated. —E. F. A.

Copper mirror; Method of depositing copper on glass with formation of a ——. F. D. Chattaway. Royal Soc. Proc., 1908, 80a, 88—92.

A mixture of one part of freshly distilled phenylhydrazine and two parts of water is heated until the solution is clear, a warm saturated solution of cupric hydroxide in strong ammonia being then added. The cupric hydroxide is reduced to cuprous hydroxide with evolution of nitrogen. A hot 10 per cent. solution of potassium hydroxide is added to the solution until a slight precipitate of cuprous hydroxide is produced. By heating this liquid in contact with a well cleaned glass surface, metallic copper is deposited in a thin, perfectly reflecting film. The surface is washed after an hour or so with water, then with alcohol and ether, and is afterwards protected from the action of the air by a coating of a quick-drying varnish.—W. S.

Thermal conductivities of solids; Effects of temperature and pressure on the ——. *II. Effect of low temperatures on the thermal conductivities of pure metals and alloys.* H. Lees. Royal Soc. Proc, 1908, 80a, 143—145.

The thermal conductivities of metals and alloys were determined at temperatures ranging from 18° C. to the temperature of liquid air. A rod of the metal 7 or 8 cm. long and 0·6 cm. in diameter was placed in the axis of a copper tube of 2·7 cm. internal, 3·3 cm. external diameter and 9·5 cm. long, closed at the top. The lower end of the rod fitted into a copper disc which closed the lower end of the tube. The joints were smeared with olive oil to improve thermal contact, and heat supplied electrically by means of a current flowing through a fine "platinoid" wire wound on a short thin brass sleeve slipped on the upper end of the rod. The difference in temperatures of the rod between the heating coil and the point where the rod entered the disc was measured by means of two platinum thermometers, the wires being wound on two short thin brass sleeves capable of sliding along the rod. Thermal contact of the sleeves was improved by smearing with a little olive oil. The results are shown in the following table, together with some figures obtained by Jaeger and Diesselhorst at higher temperatures.

tated by the partial removal of sulphurous acid or by the addition of zinc oxide. The monosulphite of zinc is calcined to give zinc oxide. (See also Eng. Pat. 22,534 of 1906, this J., 1907, 1203.)—O. F. H.

Aluminium alloy. Fried. Krupp Aktienges., Essen, Germany. Eng. Pat. 16,726, July 22, 1907. Under Int. Conv., Nov. 28, 1906.

The alloy consists of 87 per cent. of aluminium, 8 per cent. of copper and 5 per cent. of tin.—O. F. H.

Aluminium alloy. Fried. Krupp Akt.-Ges. Fr. Pat. 382,423, Sept. 30, 1907. Under Int. Conv., Nov. 28, 1906.

See Eng. Pat. 16,726 of 1907 ; preceding.—T. F. B.

Substance.	Chemical and physical state.	From the present experiments.				Jäger and Diesselhorst's results :		
		At —160° C.	At —80° C.	At 0° C.	At +18° C.	At 18° C.	At 100° C.	Chemical and physical state.
Copper	pure soft drawn	1·075	0·960	0·924	0·916	0·918	0·908	pure
Silver	0·999 Ag	0·998	1·006	0·981	0·974	1·006	0·992	0·9998 Ag
Zinc	pure redistilled cast	0·278	0·269	0·269	0·268	0·265	0·262	pure cast
Cadmium	ditto	0·239	0·228	0·219	0·217	0·222	0·216	ditto
Aluminium	0·99 Al	0·514	0·493	0·502	0·504	0·480	0·492	0·99 Al
Tin	pure cast	0·192	0·173	0·160	0·157	0·155	0·145	pure wire
Lead	pure	0·092	0·085	0·084	0·083	0·083	0·082	pure
Iron	wrought	0·152	0·150	0·147	0·147	0·144	0·143	0·9955 Fe
Nickel	0·99 Ni	0·129	0·136	0·140	0·140	0·142	0·138	0·97 Ni
Steel	—	0·113	0·115	0·116	0·115	0·108	0·107	0·01 C.
Brass	—	0·181	0·223	0·254	0·260	—	—	—
German silver	—	0·043	0·049	0·056	0·059	—	—	—
Platinoid	—	0·042	0·047	0·058	0·060	—	—	—
Manganine	—	0·035	0·040	0·050	0·052	0·053	0·063	—
Lipowitz alloy	—	0·042	0·043	0·044	0·044	—	—	—

—W. S.

Alloys of metals ; Interaction of mercury with ——. J. W. Mallet. Royal Soc. Proc., 1908, **80**a, 83—87.

A tin-platinum alloy containing 45·26 per cent. of platinum and 54·74 per cent. of tin was mixed with five times its weight of mercury and shaken for several days. No sign of amalgamation could be detected. On addition however of a very little sodium, amalgamation took place at once. In the case of a silver-platinum alloy, however, the silver was found to partly bring about solution of the platinum by mercury ; whilst in an alloy of tin and copper (speculum metal) the readiness and extent with which each metal unites with mercury was found to be greatly diminished.—W. S.

Patents.

Steel or steel alloys ; Treatment of metals, such as ——, *in order to vary, improve or accentuate the qualities or character thereof.* W. F. L. Frith, London. From C. J. Grist, Johannesburg. Eng. Pat. 1259, Jan. 17, 1907.

Steel of low quality which has been hardened and tempered, is improved by immersing the part to be treated in mercury in an open vessel and passing an electric current at the "critical period" between 350° F. and 600° F.—O. F. H.

Copper ; Treatment of —— *for refining the same and for other purposes.* A. E. Pratt, Farnborough, Kent. Eng. Pat. 1699, Jan. 22, 1907.

Calcium in the metallic form or as a copper-calcium alloy is added to the copper in the refining furnace in order to reduce cuprous oxide and sulphide, and to eliminate dissolved gases. It is claimed that copper so refined may contain impurities which in ordinary conditions would render the metal worthless.—O. F. H.

Zinc from its sulphates ; Separation of ——. H. L. Sulman, London. Eng. Pat. 2058, Jan. 26, 1907.

Lime is added to solutions containing zinc sulphate in order to precipitate zinc oxide in admixture with calcium sulphate. This product is treated with a solution of sulphurous acid so as to obtain a solution of soluble bisulphite of zinc, and an insoluble monosulphite is precipi-

Alloys or mixtures of metals with purifying or seasoning elements ; Process of producing ——. A. J. Rossi, New York, Assignor to Titanium Alloy Manufacturing Co., New York. U.S. Pat. 877,518, Jan. 28, 1908.

In making alloys of titanium with another metal of higher specific gravity and lower melting point, a layer of molten slag containing titanium oxide is maintained as a covering on the surface of the bath during the fusion of the metals. —O. F. H.

Refractory oxides ; Process for the reduction of ——. K. A. Kühne, Assignor to Titan-Ges. m. b. H., Dresden, Germany. U.S. Pat. 878,210, Feb. 4, 1908.

See Addition of May 4, 1907, to Fr. Pat. 364,329 of 1906 ; this J., 1907, 1145.—T. F. B.

Slimes ; Process of treating ——. C. Butters, Berkeley, Cal. U.S. Pat. 879,080, Feb. 11, 1908.

See Eng. Pat. 20,979 of 1906 ; this J., 1907, 415.—T. F. B.

Metals from ores ; Wet process for the extraction of ——. H. Rosalt. Fr. Pat. 381,642, Nov. 15, 1906.

The ore, such as garnierite, is crushed as finely as possible with water, and treated with chlorine or hydrochloric acid in the presence of ozone. The soluble chlorides so formed are separated in a filter-press, and an emulsion of magnesia is added to the solution in order to successively precipitate the metals as hydroxides. The chlorine is obtained by the electrolysis of magnesium chloride, and the residue of magnesia is used to precipitate the metals, the final solution containing only magnesium chloride which is used in a fresh cycle of operations.—O. F. H.

Aluminium ; Solder for ——. G. Cazalas. Fr. Pat. 381,878, Sept. 10, 1907.

The solder is an alloy of 2 parts of tin, 1 part of antimony, and one part of zinc to which is added 10 per cent. of magnesium chloride. Soldering is done at a low temperature, using as flux a solution of naphthalene and camphor in alcohol.—O. F. H.

Plates and engravings ; Process and apparatus for the production of ——. E. Spitzer. Fr. Pat. 382,100, Sept. 20, 1907.

The strength of the etching bath is increased or decreased gradually, and continuously or intermittingly by adding the acid or other etching liquid of convenient strength from a reservoir. Means are provided for heating or cooling the liquid, and for agitating the bath when necessary.
—O. F. H.

Furnace ; Regenerative reverberatory ——. T. S. Blair, jun. Fr. Pat. 382,135, Sept. 21, 1907.

Claim is made for hollow metal, water-cooled arches and end walls of the gas passages in a regenerative furnace.
—O. F. H.

Blast-furnaces ; Method of charging ——. P. Thomas and M. Bojemski. Ger. Pat. 187,509, Feb. 14, 1906.

Above the furnace is a feed-hopper, divided by cross partitions into a number of separate compartments, and movable shoots are provided so that the charge materials can be introduced into the different compartments in the desired order. The bottom of the hopper is closed by a cone, and on lowering this, the charge falls into the furnace where it spreads out in uniform layers. Another method of charging consists in introducing intermittingly portions of the charges into the different compartments, in such manner that the different charge materials arrange themselves in the form of a spiral in the furnace.—A. S.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(*A.*)—ELECTRO-CHEMISTRY.

Nickel peroxide electrodes : Reply to J. Zedner. F. Foerster. Z. Elektrochem., 1908, **14**, 17—19.

Evidence is adduced to show that neither concentration polarisation nor the presence of occluded oxygen, which have been instanced by Zedner (this J., 1905, 1239 ; 1906, 765), suffices to explain the higher step in the discharge curve of nickel peroxide electrodes. The author emphasises his earlier conclusions (this J., 1907, 875) and contends that analytical evidence is forthcoming to establish the existence of an oxide, NiO_2, and to prove that the presence of a small quantity of this oxide is answerable for the first drop of 0·1 volt in the discharge.—R. S. H.

Silver and copper ; Electrolytic separation of ——. H. W. Gillet. *See* XXIII.

Copper ; Electrolytic determination of minute quantities of ——. E. E. Free. *See* XXIII.

Patents.

Cells ; Electrolytic ——. H. S. Hatfield, Hove, Sussex. Eng. Pat. 22,920, Oct. 17, 1906.

A compound is decomposed in an electrolytic cell by passing an electric current between two electrodes, and at one electrode an insulating substance is deposited ; the compound is re-formed by contact of the electrolyte with a reserve supply of the insulating substance, with which the electrolyte is also saturated. For use as an electrolytic meter, a solution of hydrobromic acid, saturated with bromine and in contact with a pool of liquid bromine, is used as the electrolyte, the liberated bromine being measured. Another form is described in which the chlorine, liberated from a solution of ferric chloride saturated with chlorine, is used as a measure of the current, the ferrous chloride formed being converted again into ferric chloride by contact with a reserve supply of chlorine gas. Forms of cells are also described for the purification of solids, liquids and gases, as, for example, the purification of sulphur by liberating it from a solution of sodium sulphide saturated with sulphur. In order to diminish the resistance of cells of this class, the electrodes may be placed adjacent to each other, and the electrolyte circulated over or through the material to be dissolved or purified. Thus in the case of a gas, the electrolyte passes through a porous electrode, and falls over baffle-plates in a chamber through which a stream of the impure gas is circulated. In order to re-saturate the electrolyte with a gas, the solubility of which varies considerably with the pressure, an arrangement is used whereby a head of electrolyte is maintained between the porous electrode and the chamber containing the gas. The pressure of the latter may thus be increased, so that the partial pressure of the gas to be dissolved from the mixture is equal to or greater than the pressure of the pure gas above the electrode.—B. N.

Electrolysing salts ; Method of ——. J. Whiting, Niagara Falls, N.Y. U.S. Pat. 877,537, Jan. 28, 1908.

An electric current is passed through the electrolyte, containing the salt to be electrolysed, to a mass of liquid metal beneath it, which is maintained at a practically constant level as the cathode for a period of time. The metal in then withdrawn, and replaced by a fresh mass. The metal withdrawn is freed from the material received during the electrolysis, and the purified metal is afterwards returned to the decomposing chamber. "The same angular relation between the adjacent surfaces of the electrodes" is maintained throughout the cycle of operations.—B. N.

Furnace ; Electric arc —— *with concentration of energy* L. Clerc and A. Minet. Fr. Pat. 382,437, Sept. 30, 1907.

The body and cover of the furnace are constructed of blocks of refractory material, enclosing a confined space of limited dimensions, and the adjustable electrodes of carbon pass horizontally through openings in the walls. After a short time, even with voltages and intensity of current relatively feeble, the enclosed space reaches a temperature approximating to that of the arc, and the latter attains a length equal to the total length of the confined space. By means of an adjustable support fixed to one of the columns supporting the furnace, a crucible may be raised through an opening in the base, in order to bring it into the arc when the desired length of the latter is obtained. A tube of refractory material, of cross-section equal to that of the crucible, may also be placed in position through an opening in the cover, any evolved vapours being condensed in the closed end of the tube which projects outside the furnace.—B. N.

Incandescing bodies, etc. Eng. Pat. 5575. *See* II.

Filaments for lighting, etc. Addition to Fr. Pat. 378,665. *See* II.

(*B.*)—ELECTRO-METALLURGY.

Patents.

Furnace ; Compound electrometallurgical ——. Soc. Anon. Electrométallurgique (Procédés P. Girod). Fr. Pat. 382,457, Dec. 7, 1906.

An ordinary metallurgical furnace for the production of steel, such as a Martin furnace, Bessemer converter, etc., is provided with electrodes, so that it may be operated, successively or simultaneously, for a non-electric refining of the metal, and an electric treatment for the finishing of the steel. Electrodes are introduced through the cover and the base of the furnace, and the upper electrodes may be withdrawn into an iron sheath, which can be closed below by a damper, thus completely removing the electrodes from the atmosphere of the furnace during the time they are not in use.—B. N.

Metals ; Electrolysis of ——. L. Hausmann. Fr. Pat. 382,536, April 27, 1907. Under Int. Conv., April 28, 1906.

Lead is deposited electrolytically on metals, such as iron, in order to protect the latter against oxidation, corrosion by sea water, etc. The current is brought to a point on the electrodes where it meets with the greatest resistance, or, in the case of an electrode which is a bad conductor, a plate of good conducting material is attached, in order to diffuse the current equally over the electrode. A further claim refers to electrolytically coating aluminium, the surface of which has been mechanically or chemically roughened, with another metal, by means of which the aluminium may be welded.—B. N.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

Cocoanut oil ; Proteins in ——. J. Freundlich. Chem. Rev. Fett- u. Harz-Ind., 1907, **14**, 302—305 ; 1908, **15**, 3—7.

The difficulties (frothing and "oily" flavour) frequently experienced in the manufacture of certain cocoanut oils into edible fats are commonly attributed to the presence of a larger proportion of proteins in these oils. The author, however, shows that this cannot be the cause ; for the amount of proteins in 10 different kinds of cocoanut oil, determined by Kjeldahl's method upon the crude fat and upon the residue left after removal of the bulk of the oil by means of alcohol and ether, ranged from 0·0 to 0·18 per cent. The emulsified layers formed in the manufacturing process were fractionated by treatment with dilute sulphuric acid into portions containing respectively only A, 1·54 to 2·85 per cent. ; and B, 0·04 to 0·21 per cent. of crude proteins. In the author's opinion the difficulties of working must be attributed to non-nitrogenous "extractives."—C. A. M.

Vegetable fats and mixtures used as substitutes for cacao butter in the manufacture of chocolate. O. Sachs. Chem. Rev. Fett- u. Harz-Ind., 1908, **15**, 9—10 ; 30—33.

The chief vegetable fats used as substitutes for cacao butter are dika fat, tankawang fat (Borneo tallow), and illipé fat, either alone or in admixture with the stearines obtained by the expression of cocoanut oil or palm nut oil. Commercial samples of hard cocoanut and palm nut stearines gave the following average values :—*Hard cocoanut "stearine"* :—m.pt., 29·3—29·5° ; solidification point, 26·5° C. ; sp. gr. at 100° C., 0·8700 ; saponification value, 252 ; Reichert-Meissl value, 3·4 ; iodine value, 4·01 to 4·51 ; m.pt. of fatty acids, 28·1° C. ; solidification point of fatty acids, 27·4 ; and mean molecular weight of fatty acids, 209. *Palm nut "stearine"* :—m. pt., 31·5—32° C. ; solidification point, 28° C. ; sp. gr. at 100° C., 0·8700 ; Reichert-Meissl value, 2·2 ; saponification value, 242 ; iodine value, 8 ; m.pt. of fatty acids, 28·5—29·5° C. ; solidification point of fatty acids, 28·5° C. ; and mean molecular weight of fatty acids, 211. A mixture of two-thirds of palm nut "stearine" with one-third of cocoanut "stearine" is stated to be a favourite substitute for cacao butter, whilst a mixture of 40 per cent. of Borneo tallow with 60 per cent. of cocoanut "stearine" has also given good results.—C. A. M.

Blackberry seed oil. R. Krzizan. Chem. Rev. Fett- u. Harz-Ind., 1908, **15**, 7—9, 29—30.

The seeds after being washed with cold petroleum spirit, crushed, and then extracted with the same solvent yielded 12·6 per cent. of a dark greenish-yellow oil with red fluorescence and having a characteristic odour. When exposed in a thin film upon glass, it dried in 2 to 3 days, and in Livache's test increased in weight by 6·87 per cent. in 3 days. It gave the following analytical values :—Sp. gr. 0·9256 ; acid value, 2·03 ; saponification value, 189·5 ; Reichert-Meissl value, 0·0 ; Hehner value, 96·3 ; iodine value, 147·8 ; unsaponifiable matter, 0·83 per cent. Fatty acids : Sp. gr. 0·9070 ; saponification value, 199·9 ; iodine value, 155·1 ; acetyl value (Lewkowitsch's distillation method), 13·9 ; and mean molecular weight, 280·9. Pure phytosterol (0·6 per cent.) was separated from the oil in crystalline needles (m. pt. 133° C.). The liquid fatty acids on oxidation with alkaline permanganate solution yielded dihydroxystearic acid corresponding to about 17 per cent. of oleic acid. The tetrahydroxystearic acid obtained melted at 161° C., instead of 173°—174° C. as found by Hazura and by Hehner and Mitchell. This supports Lewkowitsch's supposition of the probable occurrence of isomeric tetrahydroxystearic acids (*Chem. Technology, etc.* Vol. I., p. 126). The yield corresponded to about 80 per cent. of linolic acid in the liquid fatty acids, whilst the amount of hexahydroxystearic acids indicated the presence of about 1·5 per cent. of linolenic acid and 1·5 per cent. of isolinolenic acid. The solid fatty acids (about 4·7 per cent. of the oil) consisted, in the main, of palmitic acid. The drying capacity of the oil was slightly less than that of raspberry seed oil (this J., 1907, 1019). Neither oil gave Halphen's or Baudouin's colour reaction. —C. A. M.

Nsa-Sana seeds from Southern Nigeria. Bull. Imp. Inst., 1907, **5**, 369—370.

Nsa-Sana (*Ricinodendron africanum*) seeds contain 45·2 per cent. of a drying oil similar in character to tung oil (Chinese wood oil). The oil dries in a day on exposure to air at the atmospheric temperature, leaving a wax-like residue. It has the sp. gr. 0·9320 at 20° C., saponification value, 191·6 ; iodine value, 147·7 ; Hehner value, 95·2 ; solidifying point of fatty acids, 35·7° C. Apart from a possible use as a substitute for tung oil, Nsa-Sana oil would be worth about £18—20 per ton as a raw material for making soft soap. The "cake" left after extraction of the oil would be useful as a manure, but is not suitable as a cattle food owing to the nature of the oil and the probable presence of an alkaloid.—A. S.

Marmot fat ; Characters of ——. Gruebler. Z. Oesterr. Apoth.-Vereins, 1907, [52]; Schweiz. Woch. Chem. Pharm., 1908, **46**, 69—70.

Pure marmot fat is fluid, and after filtration at the ordinary temperature, remains liquid, only a small amount of white deposit being separated. In the cold, it solidifies to a mass of minute crystals. Its colour is golden yellow, becoming paler on long exposure to light ; its odour somewhat resembles that of cod-liver oil. It has very slight drying properties. Two specimens of genuine oil had the following characters :—Sp. gr. at 25°/25° C., 0·9179 and 0·9187 ; acid value, 3·14 and 5·94 ; saponification value, 198·68 and 195·57 ; iodine value, 106·7 and 111·46 ; butyro-refractometer reading at 40° C., 59·0 and 59·7 ; Reichert-Meissl value, 0·6 ; Hehner value, 95·79. The insoluble fatty acids of one of these oils had the following characters :—Solidifying point, 27·0° C. ; m. pt., 28·6° C. ; iodine value, 105·59 ; saponification value, 209·56 ; acetyl value, 40·34. Commercial marmot fat is subject to much adulteration or substitution. Wax, cod-liver oil, and lard are employed as adulterants ; and a mixture of sesame oil with tallow or lard is substituted for it. For pure, fresh fat, the iodine value should be between 100 and 120 ; the saponification value should not fall much below 195.—J. O. B.

Sunflower [Helianthus annus] in India ; The ——. D. Hooper. Agric. Ledger, 1907, [1], 1—11.

The author gives a review of experiments on the growth of the sunflower as an oil-yielding plant in India, and also of the production and uses of this plant in other countries. At present the economic production of the sunflower is confined almost exclusively to Russia, where it is an agricultural industry of considerable importance.—A. S.

Glycerol esters ; Theory of the hydrolysis of ——. R. Wegscheider. Monats. f. Chem., 1908, **29**, 83—134.

The author has made a comprehensive theoretical study of the question and states that if the hydrolysis of triglycerides proceeds by stages, then there are not three reactions only, but the whole of the seven possible ones to be taken into consideration, *viz.*, two reactions for the formation of the two isomeric diglycerides from the triglyceride, three for the formation of the two isomeric monoglycerides from the diglycerides, and two for the formation of the acid from the monoglycerides. From consideration of the problem along these lines, the author concludes that the hydrolysis of glycerol esters proceeds in stages with formation of all the possible reaction-products. If the whole course of the hydrolysis, of diglycerides as well as of triglyceride, as measured by the quantity of acid liberated, corresponds approximately with the course of an unimolecular reaction, and if the unimolecular hydrolytic constants of mono-, di- and triglycerides are approximately equal, then the following relations among the velocity constants of the individual reactions must approximately hold good. (1). The hydrolytic constants of the two monoglycerides must be equal. (2). The hydrolytic constant of the symmetrical diglyceride must be twice as large as that of the monoglyceride and equal to the sum of the two hydrolytic constants of the unsymmetrical diglyceride. (3). The sum of the two hydrolytic constants of the triglyceride must be three times as large as the hydrolytic constant of the monoglycerides. The assumptions made are valid in the case of hydrolysis in acid solution, but proof is still required in the case of hydrolysis in alkaline solution. Finally it is shown that the absence of measurable quantities of mono- and diglycerides in the hydrolysis of insoluble triglycerides in a heterogeneous system by aqueous solutions is to be expected, even if the hydrolysis proceeds by stages, and is therefore no proof against the correctness of this view. —A. S.

Linseed oil; "Alcoholysis" of ——. A. Haller. Compt. rend., 1908, **146**, 259—262.

The commercial samples of oil investigated had iodine values varying from 168 to 176 and saponification values from 185 to 191. Linseed oil is insoluble in methyl and ethyl alcohol, hence to facilitate esterification, benzene, carbon tetrachloride, acetone or ether was employed as solvent and the mixture boiled with alcohol containing 2·5 per cent. of hydrochloric acid. The esters were separated by fractional distillation and identified: in every case a small quantity of a solid residue remained. The methyl esters of palmitic, stearic, oleic, linolic, linolenic, isolinolenic and arachidic acids were obtained. Stearic acid, in appreciable quantities, and arachidic acid, of which only a very small proportion is present, were found in linseed oil for the first time. —E. F. A.

Tamarind seeds; Uses and composition of ——. D. Hooper. *See* XVIII*A*.

PATENTS.

Oils and the like; Apparatus for the chemical purification of ——. J. Fischer, Vienna. U.S. Pat. 878,370, Feb. 4, 1908.

See Fr. Pat. 355,465 of 1905; this J., 1905, 1166.—T. F. B.

Fats, oils, and the like; Process of extracting ——. E. Berliner, Moscow. U.S. Pat. 878,930, Feb. 11, 1908.

See Eng. Pat. 23,146 of 1907; this J., 1908, 168.—T. F. B.

Tallow and other fats; Apparatus for the odourless rendering of ——. G. Talbot. Fr. Pat. 382,745, Oct. 10, 1907.

The apparatus consists of an autoclave containing a perforated inner chamber into which are introduced the material to be rendered and sufficient water to cover it. The autoclave is heated above a suitable stove, and the pressure of the vapours developed drives the melted fat into an adjacent closed receptacle, containing water. The vapours produced in excess of this pressure, indicated by the manometer, are conducted by a pipe into the stove, whilst another pipe, also opening into the top of the stove, is provided for the vapours given off by the fat in process of cooling.—C. A. M.

Soap; Process for the manufacture of bleached ——. Verein. Chem. Werke A.-G., Charlottenburg, Germany. Eng. Pat. 15,900, July 10, 1907. Under Int. Conv., Aug. 11, 1906.

See Fr. Pat. 377,720 of 1907; this J., 1907, 1099.—T.F.B.

Soapy waters: Treatment of ——, and recovery of the fatty acids and materials employed. J. B. Ruinat. Fr. Pat. 382,555, Sept. 11, 1907.

The soapy water is treated direct with an acid and the fatty acids separated; or the soaps are first precipitated as insoluble salts (of calcium, etc.), the fatty acids recovered from the precipitate by the addition of a measured quantity of mineral acid, and the residues filtered to recover the materials employed, so as to leave a colourless, odourless, non-fermentable effluent.—C. A. M.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(*A.*)—PIGMENTS, PAINTS.

PATENTS.

Carbon-black; Apparatus for producing ——. A. D. Purtle and I. E. Rowland, Salem, W. Va. U.S. Pat. 877,596, Jan. 28, 1908.

A hydrocarbon, in the form of gas under pressure, is introduced into a closed tubular retort, through a gas-inlet pipe near to one end, the opposite end of the retort being closed by a hood the discharge pipe from which projects downwards, and is provided with a valve, beyond which it is connected with a valved conduit for permitting the escape of deposited carbon without admitting air to the retort. The latter is enclosed, with the exception of the ends, in a furnace, and a gas burner connected to the gas-supply pipe serves to heat the retort. The retort is of approximately the same diameter throughout, and a scraper, movable longitudinally, serves to remove the deposited carbon and convey it towards the discharge end.—B. N.

Lake [from azo dyestuff]; Red colour ——. K. König, Assignor to Farbwerke vorm. Meister, Lucius und Brüning, Höchst on the Maine, Germany. U.S. Pat. 878,964, Feb. 11, 1908.

See Fr. Pat. 373,115 of 1906; this J., 1907, 701.—T. F. B.

Dyestuffs suitable for lakes, etc. Fr. Pat. 382,191. *See* IV.

(*B.*)—RESINS, VARNISHES.

PATENTS.

Varnish and process for producing same. A. P. Bjerregaard, Mineola, N.Y., Assignor to C. and H. L. Calman, New York. U.S. Pat. 877,482, Jan. 28, 1908.

"Black damar" gum is dissolved in a suitable volatile hydrocarbon solvent at practically normal temperature and pressure, the quantity of solvent being in excess of that desired in the finished product. Insoluble impurities are then removed by refining, and finally the product is distilled to remove the excess of solvent.—B. N.

Resins, resinous substances, mineral waxes and other substances non-volatile with steam; Process for the extraction of ——. H. Köhler. Fr. Pat. 382,371, Sept. 27, 1907.

The materials are digested with melted naphthalene, which is afterwards separated from the residue, filtered, and distilled with steam to recover the naphthalene.—A. S.

Varnishes; Process for the filtration of ——. Internat. Elektra-Lack Werke, G. m. b. H., System Dr. Kronstein. Ger. Pat. 189,514, April 6, 1906.

The method consists in using as filtering material, common salt or hygroscopic salts such as magnesium chloride and calcium chloride, in a finely granular form, together with salts which exert a bleaching action on the varnish.—A. S.

Resinous substances; Process for obtaining —— for the preparation of varnishes, lacs, sealing-wax, and the like. G. Orloff. Ger. Pat. 191,011, June 14, 1906.

Oil of turpentine is treated with formaldehyde in the presence of sulphuric acid, the mixture is neutralised with ammonia, and after separating the ammonium sulphate, is heated with a further quantity of ammonia. The solid resinous reaction-product is soluble in light coal-tar oils and in ethyl acetate, giving solutions which yield quick-drying lacs of good elasticity.—A. S.

Horn and substances containing horn; Process for dissolving ——. S. Diener, Chem. Lab. und Versuchsstat. für Handel und Ind. Ger. Pat. 191,552, Oct. 27, 1905.

Horn or substances containing it are heated for a long time with fatty or resin acids or substances containing them at (1), a temperature of 300° C. at the ordinary pressure, or (2), under pressure at a temperature below that of decomposition. The solutions may be used in the preparation of varnishes, artists' colours, and insulating materials.—A. S.

Linoleum; Incombustible ——. Soc. del Linoleum. Fr. Pat. 382,279, May 27, 1907.

The claim is for the preparation of "linoleum Apyrofore," a product having the appearance and characters of linoleum, except that it burns only with difficulty and will not propagate fire. It is prepared by mixing in with the ordinary mass used for the preparation of linoleum, substances that will produce during the combustion of the linoleum a vitreous coating and an incombustible gas. Suitable substances are the alkali bicarbonates, carbonates of the alkaline-earths and of manganese, borates and boric acid, precipitated silica, and soap powder. The process may also be applied to other substances having somewhat similar properties to linoleum, *e.g.*, lincrusta, celluloid, pegamoid, etc. —A. S.

(*C.*)—INDIA-RUBBER, &c.

Para rubber from Mergui, Burma. Bull. Imp. Inst., 1907, 5, 371.

The sample of rubber from the Government plantation at Mergui consisted of two thin sheets of pale rubber, which compared favourably in composition and physical properties with Para rubber from Ceylon and the Federated Malay States. It contained: moisture, 0·5; caoutchouc, 95·2; resin, 1·6; protein, 2·4; ash, 0·3 per cent. It was valued at 5s. 6d. per lb. as against 5s. 2d. for South American Para rubber.—A. S.

Raw rubber; Mode of valuing ——. C. Beadle and H. P. Stevens. Chem. News, 1908, 97, 73—74.

The authors, while regarding vulcanisation tests as the most satisfactory method for the valuation of samples of raw rubber, emphasise the importance, when basing a valuation on the results of physical tests of the raw rubber itself, of reducing each sample to a standard physical condition before testing, by masticating under carefully standardised conditions, and otherwise treating samples in a uniform manner (compare this J., 1907, 1287).—E. W. L.

Patents.

Rubber; Process for the regeneration of ——. J. Dupont. Fr. Pat. 382,053, Nov. 28, 1906.

Waste vulcanised rubber is heated with terpin hydrate, the mixture is then treated with boiling water, and from the residue the regenerated caoutchouc is extracted by means of a suitable solvent such as commercial xylol. The terpin hydrate is recovered for use over again by cooling the hot aqueous wash-liquors.—A. S.

Rubber; Process for the regeneration of ——. Zühl und Eisemann. Ger. Pat. 188,574, Jan. 3, 1905.

The finely-divided rubber is heated, preferably at 110°—180° C., under pressure, with a soap solution to which may be added other substances such as aliphatic or aromatic hydrocarbons, oil of turpentine or the like, and salts capable of forming solutions which dissolve sulphur, such as alkali sulphides, alkali sulphites, etc. —A. S.

Caoutchouc and resin; Process and apparatus for the separation of —— *from latex, or from resinous products containing caoutchouc.* L. G. Worms and G. F. Flamant. Fr. Pat. 382,571, Oct. 4, 1907.

The solvent used consists of a mixture in suitable proportions of a liquid (petroleum spirit, carbon tetrachloride, or benzol) which dissolves readily both caoutchouc and resin, and a liquid (ethyl or methyl alcohol, or acetone) which dissolves resin but precipitates caoutchouc from its solutions. The solvent thus prepared is capable of easily penetrating the resinous mass containing the caoutchouc, but leaves the latter undissolved whilst readily dissolving out the resin. The resinous material containing the caoutchouc is treated with the solvent in a closed vessel, from which the solution of the resin flows to a jacketed still. The vapours of the solvent pass from the still through a rectifying column to a condenser. The condensed solvent passes through a coil in the rectifying column, where it is heated, and then back again to the extraction vessel. —A. S.

Elastic material, specially suitable for wheel tyres. L. C. G. Lesage. Fr. Pat. 382,272, Dec. 3, 1906.

100 parts of ossein are dissolved in 100 parts of glacial acetic acid to which has been added 2—5 parts of a cuprammonium solution. The solution is treated with 2—5 per cent. of a suitable coagulant, such as tannin, formaldehyde, alum, etc. The mass may then be mixed with a small proportion of a solution of rubber or gutta-percha, and is afterwards vulcanised. The solution of ossein may before treatment be mixed with a solution of gelatin in glycerin, and may also be treated with air or other gas under pressure according to the process described in Fr. Pat. 359,183 of 1905 (this J., 1906, 384). The product is useful as a rubber substitute.—A. S.

Elastic material for wheel tyres; Product intended for employment as ——. L. C. G. Lesage. Fr. Pat. 382,309, Dec. 4, 1906.

A solution of cellulose or one of its derivatives is mixed with an elastic material, preferably prepared from gelatin or ossein, and is thoroughly mixed and has compressed air forced into it as described in Fr. Pat. 359,183 of 1905 (this J., 1906, 384). The mixture may also be treated with other substances as described in Fr. Pat. 382,272 of 1906 (see preceding abstract). It is finally coagulated or solidified in any suitable manner.—A. S.

XIV.—TANNING, LEATHER, GLUE, SIZE.

Mangrove barks. Bull. Imp. Inst., 1907, 5, 344—352.

Analyses have been made of mangrove barks from British Honduras, British Guiana, West Africa, Portuguese East Africa, Seychelles, and India. Most of the specimens would be suitable only for local use, although some of them might also yield satisfactory extracts. The analyses of the specimens likely to be of value for export purposes are given in the following table:—

Botanical origin.	Source.	Moisture.	Ash.	Tannin.	Extractive matter (non-tannins).
		Per cent.	Per cent.	Per cent.	Per cent.
	Portuguese E. Africa—				
—	(1) Inner bark	13·22	3·47	39·8	10·6
—	Outer bark	12·69	2·04	8·97	5·93
—	(2) Whole bark	13·53	3·64	41·76	7·20
Bruguiera gymnorrhiza	Seychelles—				
	Bark from stems	11·75	4·32	45·04	10·66
	,, ,, branches	13·79	4·21	41·76	9·04
Pemphis acidula	Bark from stems	12·06	6·73	42·54	9·36

In the collection and preparation of mangrove barks for the market, it should be noted that old branches, stems and roots mostly yield richer bark than young branches, etc., and that where labour is cheap, it is generally advisable to remove the outer layers of bark. The stem bark is usually richer in tannin than the bark from the branches.—A. S.

Wattle or mimosa barks. Bull. Imp. Inst., 1907, **5**, 352—353.

Of six samples of wattle barks from Cape Colony, three proved to be of good quality and were valued at £6 10s. to £7 10s. per ton. Analyses of these barks gave the following results :—

Botanical origin.	Moisture.	Ash.	Tannin.	Extractive matter (non-tannins).
	Per cent.	Per cent.	Per cent.	Per cent.
Acacia pycnantha .	10·14	1·54	40·09	13·00
Acacia decurrens (1)	11·36	1·77	35·36	12·00
Acacia decurrens (2)	10·93	1·81	44·15	7·12

—A. S.

Leather ; Colour imparted to —— by different vegetable tanning materials. J. Paessler. Collegium, 1908, 48—51, 53—56.

The author points out that although leathers tanned with vegetable tanning materials are generally a brown colour, the exact shade differs considerably, ranging from a light yellow-brown to a dark red-brown. The demand for light-coloured leathers is referred to, and the desirability of this for leathers which are to be dyed, and especially where a light shade is required. The tendency of leathers tanned with some vegetable tanning materials to darken in colour and change in shade on exposure to light, is also pointed out, and hence the valuation of a tanning material by the colour it produces and the fastness of that colour to light. The author considers that it would be a considerable advantage if one could express this valuation numerically, and he attempts to do this by tanning small pieces of skin with the principal vegetable tanning materials, including both solid materials and extracts. Each tanning material is used without admixture with others, and the pieces of leather obtained are well washed, stretched on frames and dried in the dark. Each piece of leather is then cut into three parts ; one part is laid away in the dark, another is exposed for two months to diffused daylight in a room facing north, and the third is similarly exposed in the window of a room facing south where it receives direct sunlight. The colour of all these pieces is then measured by use of Lovibond's tintometer as adapted by Procter and Parker (this J., 1895, 123, 124) for this purpose. The results, which are the mean of many determinations are given in the following table :—

Leather.	Kept in the dark.			Exposed to diffused daylight.			Exposed to direct sunlight.		
Tanned with :	Red	Yellow.	Blue.	Red.	Yellow.	Blue.	Red.	Yellow.	Blue.
Oak bark	3·5	3·5	2·0	5·0	4·5	3·0	6·0	5·0	3·5
Pine bark	3·0	3·0	1·5	6·0	5·0	4·0	8·0	7·0	5·0
Mimosa bark	4·5	3·5	3·0	6·0	4·5	3·0	6·5	5·0	3·5
Mangrove bark	6·5	4·0	3·0	7·0	5·0	4·0	8·0	6·0	4·0
Mallet bark	4·5	4·5	2·0	7·0	6·0	3·0	7·0	5·5	3·5
Valonia	2·0	2·5	1·5	2·0	3·5	1·5	2·5	4·0	1·5
Trillo	3·0	3·0	2·5	3·5	3·5	2·5	3·5	4·5	2·5
Myrobalans	2·0	2·5	1·5	2·5	3·0	1·5	4·0	2·5	4·0
Divi divi	2·5	2·5	1·5	4·0	4·0	1·5	4·5	4·0	5·0
Algarobilla	1·5	2·5	0·5	2·0	3·0	0·5	2·5	3·0	1·0
Kroppern	2·0	2·5	1·0	2·0	3·0	1·0	2·5	3·5	1·0
Sumach	1·5	2·5	1·5	2·0	3·0	1·5	2·5	3·0	1·5
Quebracho wood	5·0	4·0	3·5	8·0	6·0	3·0	8·0	6·0	4·5
Pine extract	4·5	4·0	2·0	6·0	5·5	3·0	7·0	5·5	3·5
Oakwood extract	3·0	3·5	2·0	3·0	4·0	2·0	3·5	5·0	2·5
Chestnut extract	4·0	4·5	2·5	4·0	5·0	2·5	4·5	5·5	2·5
Quebracho extract, ord.	4·0	3·0	2·5	6·5	4·0	2·0	5·5	4·0	3·0
,, ,, decol.	4·5	3·5	1·5	7·0	5·0	3·0	8·0	5·0	3·5
,, ,, solubilised	2·5	2·0	0·5	5·0	4·0	2·5	4·5	3·5	2·0
Cube gambler	1·5	1·5	0·5	2·5	1·0	2·5	2·5	1·0	2·5
Sumach extract	1·5	0·5	1·5	2·0	0·5	1·5	1·5	0·5	2·0

In discussing the results the author points out that the most light coloured leathers are tanned with gambier, sumach, sumach extract and algarobilla, and that the darkest and reddest are tanned with mangrove bark. Great differences in shade also appear, and it is observed that the leathers tanned with sumach, sumach extract and gambier, are nearest the neutral tint and hence most suitable for leathers which are to be dyed light shades. With algarobilla the "yellow" content is prominent, whilst a neutral shade but darker, is given by myrobalans. Both diffused daylight and direct sunlight produce a darkening in colour in all cases, the effect of the latter being distinctly greater. At the same time the addition to the colour intensity and change in shade are somewhat different, for in many cases the "red" is especially developed. The effects of exposure to light are discussed by the author, and the materials classified according to their change in intensity and in shade. It is also suggested that the numerical expression of these facts, as given in the table, be used to guide the tanner in employing the different tanning materials for producing the required colours.—H. G. B.

Skins and leather ; Moisture contained in ——. P. Nicolardot. Bull. Soc. Chim., 1908, 3, 166—170.

Air-dried leather still contains a considerable amount of moisture, the exact quantity being slightly influenced by the humidity of the atmosphere. Shavings of such leathers, when placed over sulphuric acid in a closed vessel lose water, but at a gradually decreasing rate. By drying *in vacuo* or in an oven at 110° C., a limit is reached which is the same for both methods. Water estimated in this way is called "normal water." If the temperature of the stove be raised, more water will be estimated, but a fundamental change occurs in the constitution of the leather, which darkens, becomes brittle, and finally chars. This is due to the elimination of "water of combination." When exposed to the atmosphere again, leathers so treated re-absorb moisture with difficulty and irregularly, whilst if only dried at 110° C., or *in vacuo*, they return to their original condition. In the latter case also, the leather may be made to contain more water by soaking or by exposure to water vapour. This water, which is easily eliminated by drying in air, is termed "imbibed water," and is compared to the water in a sponge. The difficulties in determining the dividing line between "normal water" and "imbibed water" are pointed out, measurements of the forces of osmosis and capillarity being considered quite impracticable. The author, however, proposes to distinguish the normal and imbibed water by measurements of the tenacity of leathers, and results are given in which it is shown that if leathers are dried below their normal water content, an appreciable loss in tenacity is experienced, but that on exposure to air the tenacity increases again to its original value. On the other hand, if leathers are wet above their normal water content, *i.e.*, contain imbibed water, their tenacity is very rarely increased and often made less. The function of imbibed water is therefore merely one of weighting the leather, whereas the normal water is necessary to the leather to give the requisite tenacity. Leathers from which the normal water has been eliminated, such as those found in the tombs of Egypt, are therefore found to break easily. The author also discusses whether this necessary water is merely absorbed, or is " water of hydration " and held by other forces than those of osmosis and capillarity. He favours the latter view on the ground that a skin with its normal water content has less volume than the total volume of dry skin and " normal water " separately. Other evidence is that similar skins, from different neighbourhoods, even when exposed for some time to the same atmosphere, have different quantities of normal water ; and when from the same neighbourhood the normal water content is influenced by the sex of the animal. This view is also supported by the author in a series of experiments on the influence of low temperatures (—50° C.) on the tenacity of harness leathers, in which it is shown that no weakening of the fibres has resulted from a solidification of the contained water, and that the tenacity has been increased rather than diminished by the low temperature. This is taken to indicate that the normal water does not play a purely physical rôle in the leather. The bearing of the author's work on the theory of tanning is pointed out and it is suggested that one of the principal causes of the difference between raw material and finished leather is the decrease in the water content due to the astringent action of the tannin.—H. G. B.

Moisture ; Determination of —— in skins and leather.—P. Nicolardot. Bull. Soc. Chim., 1908, 3, 171—173.

The author proposes to estimate the moisture in leather by first extracting it with chloroform, removing in that way all the natural and added fat, and then drying at 100°—110° C. The results show that the chloroform is completely eliminated in the subsequent drying, that it is possible to obtain constancy in 3 or 4 hours and that no appreciable quantities of mineral matters are removed by the solvent. The chloroform is considered to assist the elimination of water not only by its removal of the fats, but also by its dehydrating and contracting influence on the colloid fibres. The amount of fat removed by the solvent is determined and correction made for the loss sustained thereby. The method is stated to give results which are accurate within 0·5 per cent., and which are approximately 2·0 per cent. higher than the method of 48 hours drying *in vacuo*.—H. G. B.

Gelatin ; Physical modifications of —— in presence of electrolytes and non-electrolytes. J. L. des Bancels. Compt. rend., 1908, **146**, 290—291.

Gelatin dissolves in water at the ordinary temperature in presence of various neutral salts which differ considerably in the extent of their influence. In equal concentration, salts of bivalent metals have more influence than those of univalent metals, whilst for the same metal, nitrates are more active than chlorides. In presence of electrolytes gelatin will dissolve in mixtures of non-electrolytes and water as for example alcohol or acetone. A certain small proportion of water is necessary for solution, this once attained, the gelatin dissolves the more rapidly the more non-electrolyte is present. Gelatin is easily recovered from such solutions if the salts present are eliminated either by dialysis or by precipitation.—E. F. A.

Patents.

Skins, textile fabrics, and the like ; Apparatus for treating ——. W. R. Smith, and Buffalo Leather Co., Buffalo, U.S.A. Eng. Pat. 18,769, Aug. 20, 1907.

See Fr. Pat. 381,084 of 1907 ; this J., 1908, 82.—T. F. B.

Tannic extracts ; Process of decolorising ——. L. Dufour, Genoa, Italy. U.S. Pat. 878,618, Feb. 11, 1908.

See Fr. Pat. 369,917 of 1906 ; this J., 1906, 1227.—T. F. B.

XV.—MANURES, &c.

Calcium cyanamide ; Action of —— on various soils. Th. Remy. Biedermann's Zentralbl., 1908, **37**, 91—93.

Only about 50—60 per cent. of the calcium cyanamide applied as manure actually becomes active. It works very slowly and may be compared in this respect with organic nitrogenous manures. Quantities containing 0·07 grm. of nitrogen per kilo. of earth are injurious to plant growth. The effects of calcium cyanamide are definitely related to the nature of the soil on which it is employed ; the best results are obtained on soils rich in clay, in which cases even when relatively large quantities are used, no deleterious effect is observed. On sandy soils it is much less active and has a harmful action on the vegetation ; this is particularly the case in pure quartz sand. In light soils calcium cyanamide has an adverse effect on those bacteria which grow on gelatin but not on those races which decompose peptones ; it also retards the growth of the azoter bacterium. On heavy soils no action on the bacteria was observed.
—E. F. A.

Patents.

Superphosphates and other fertilisers ; Process for the manufacture of ——. A. Dickson and J. G. Alder, Dublin. Eng. Pat. 2796, Feb. 4, 1907.

Calcium phosphate and the necessary quantity of sulphuric acid are put into a mixer, provided with an agitator, and the mixture is delivered on to a belt or conveyor, which travels continuously through a tunnel. The mixture then passes through a disintegrator, and finally through a slowly revolving cylinder having a fixed agitator, or through a fixed cylinder with a revolving agitator. Hot air may be drawn through the whole apparatus, to dry the product, and all deleterious fumes are removed by means of a fan or the like.—F. Sodn.

Fertiliser from natural or artificial materials ; Process for the manufacture of a ——. E. Pohl. Fr. Pat. 381,975, Sept. 18, 1907.

The patent relates to the manufacture of fertilisers from various raw materials containing clay, silica, or clay, silica, and potassium, such for example as various minerals, ash from lignite, waste refuse, etc. The dried and finely-divided raw materials are mixed with lime, treated with steam at ordinary or increased pressure, then dried and ground. Other substances such as potassium compounds, phosphates, ammonium compounds, etc., may be mixed with the lime or with the final product. In the case of waste refuse, this is first screened, and only the finer portion treated with lime, etc. Special claim is made for the application to the above process of the methods of slaking, mixing, etc., which are generally employed in the manufacture of artificial stone from lime and sand.
—A. S.

XVI.—SUGAR, STARCH, GUM, &c.

[Beetroot] Diffusion processes ; Hot and ordinary ——. J. Dostál. Z. Zuckerind. Böhm., 1908, 32, 280—290.

The author has made comparative experiments on the hot and ordinary diffusion processes with a view to determining their relative efficiencies. The hot diffusion battery consisted of 14 diffusers each of 60 hectolitres capacity. The fresh chips were mashed with juice at 90°—93° C. ; this juice was then pumped off, heated again, and filtered through the chips whilst the next diffuser was being discharged and charged. By this successive treatment with hot juice, the temperature of the fresh chips was raised to 84°—

85° C., and, in the course of the work, the temperatures of the next six or seven diffusers became automatically adjusted, decreasing from 77° to 72° C.; moreover, there was no need to heat the individual diffusers. The battery employed for the ordinary diffusion process consisted of 16 diffusers, each of 40 hectolitres capacity, and the process was worked in the ordinary way. The investigations showed that the hot diffusion gives better results than the cold diffusion, the advantages of the former being as follows:—The high temperature of the juice increases the diffusion of the sugar and causes coagulation of a certain amount of albuminous matter, with the result that the concentration and purity of the juice are increased. If the juice in the circulation heater can be heated with steam from the evaporating apparatus, an appreciable economy of high-pressure steam may be effected. By maintaining the temperature of the battery without the employment of an injector, a heating which is uniform and independent of the workman is obtained, and dilution of the juice with water condensed from the superheated steam, is avoided. The high temperature to which the fresh chips are subjected, prevents any possible decomposition of the sugar by bacterial action. —L. E.

Starch; Colloidal properties of ——, and the existence of a perfect solution of this substance. E. Fouard. Compt. rend., 1908, **146**, 285—287.

The colloidal solutions prepared from starch which has been de-mineralised and partially hydrated at 80° C., when filtered through a membrane of collodion yield a liquid of the mobility of pure water which constitutes a perfect solution of starch. A specimen prepared from a colloidal solution containing 5 per cent. of starch was found to contain 2·74 per cent. of starch. That it is not a colloidal solution is shown by the observation that a ray of light does not show any trace of polarisation when passed through it. The viscosity of the solution is of the same order as that of a 1 per cent. solution of sugar and nearly that of water. It differs entirely from that of the colloidal solution containing the same amount of starch. It gives a strong coloration with iodine appearing as an intensely blue solution rather than a blue precipitate. The perfect solution is unstable and when left to itself, becomes cloudy and forms a granular deposit. A colloidal starch solution is a heterogeneous system containing without doubt some dissolved molecules along with starch in all degrees of molecular condensation. The division produced by the collodion membrane destroys this equilibrium.—E. F. A.

Starch; Polarimetric determination of ——. E. Ewers. Z. öffentl. Chem., 1908, **14**, 8—19. Chem. Zentr., 1908, **1**, 556—557.

Contrary to Lintner (this J., 1907, 281), the author considers that the optical activity of other constituents in starch-yielding cereals, is not so small as to be negligible in the polarimetric determination of starch, but that a control experiment to determine the optical rotation of the soluble carbohydrates is always necessary. He has made some alterations in his previous process (this J., 1906, 139). For the control experiment, 5 grms. of substance and 70 c.c. of water (10 grms. and 100 c.c. in the case of potatoes) are digested for 1 hour at 50° C., then 25 c.c. of glacial acetic acid are added, and the digestion continued for half an hour. When the material under examination is not the flour or grains, but the separated starch, the time of digestion can be shortened and a lower temperature employed. In carrying out the actual test, the determination of the rotatory power of 5 grms. in 200 c.c. can be dispensed with, as the difference between the value thus obtained and that observed with 10 grms. in 200 c.c. is not greater than the error of experiment. The author further states that with different concentrations of the solution, the specific rotatory power remains practically constant, the values obtained being:—wheat starch, +183·62°; rice starch, +186·07; maize starch, +184·19; potato starch, +186·46.—A. S.

Starch in barley; Polarimetric determination of ——. O. Wenglein. Z. ges. Brauw., 1908, **31**, 53—56.

Lintner's process for the polarimetric determination of starch in barley (this J., 1907, 281), which has given excellent results in practice, presents a disadvantage owing to the injurious fumes from the strong hydrochloric acid employed. The author has now found that sulphuric acid of a certain concentration may be used as a substitute for the hydrochloric acid prescribed by Lintner. The procedure to be followed is thus described:—5 grms. of the barley meal, containing about 95 per cent. of fine flour, are triturated in a mortar with 20 c.c of water to a uniform paste; 40 c.c. of sulphuric acid of sp. gr. 1·70 are then added whilst stirring. The mixture liquefies rapidly and is transferred to a 200 c.c. measuring flask after standing for about 15 minutes. The mortar is washed out, with the help of a rubber spatula, with sulphuric acid of sp. gr. 1·30. After the addition of 10 c.c. of a 4 per cent. solution of phosphotungstic acid, the contents of the flask are diluted to the mark and filtered through a folded filter supported at the point by a small plain filter. The first 20—30 c.c. of the filtrate are generally not quite clear, but the later portions are suitable for polarising. The specific rotatory power of barley starch in sulphuric acid of this strength differs slightly from the value observed in hydrochloric acid, and the author gives for the purpose of the present method the value $[\alpha]_D = 191{\cdot}7^\circ$. The solutions of starch in sulphuric acid, if kept in closed flasks, preserve their rotatory powers unchanged for a period of 8 hours, whereas the hydrochloric acid solutions must be polarised within 2 hours. The author notes that the laboratory mill of Seck, in the process of grinding barley to fine meal, produces a distinct fractionation of the sample, so that the whole of the corns selected must be finely ground and the meal thoroughly re-mixed before proceeding to the analysis.—J. F. B.

Patents.

Sugar; Impts. in, and apparatus for manufacture of ——. E. T. Newton-Clarke, London. Eng. Pat. 26,871, Nov. 26, 1906.

The object of this invention is the conversion of clarified, defecated, and concentrated cane juice into "amorphous" sugar. The juice (previously heated by passage through a pipe coil situated in a heating chamber) is introduced into a chamber from which the air has been exhausted, and through which passes a rotating shaft fitted with a number of blades. The motion of these blades stirs the boiled mass and thrusts it forward to a discharge opening at the further end of the chamber, at which place it arrives in the state of a loose, dry powder. The powder may be discharged continuously or intermittingly, and, in either case, without breaking the vacuum. For continuous discharge, the chamber exit may be connected to a discharge pipe worked by a piston, entrance of air into the chamber on the return stroke of the piston being prevented by a counterbalanced valve at the end of the discharge pipe. For intermittent discharge, two hoppers with valved connection may be used. The sugar falls from the chamber into the top hopper. When the latter is full, the valve is opened and the sugar passes into the second hopper which has been previously exhausted to the same degree as the top hopper. The connecting valve is then shut and the sugar is discharged from the second hopper by opening a discharge valve.—L. E.

Maltose and glucose [dextrose]; Manufacture of ——. C. B. Duryea, Cardinal, Ontario. Eng. Pats. 11,799 and 11,800, May 21, 1907.

(1). Highly modified, thin boiling starch (see Eng. Pat. 11,801 of 1907; this J., 1908, 171) is diluted to a density of about 16° B., and, if necessary, neutralised with alkali. The liquor is then boiled, cooled to, say, 59° C., and saccharified at about 58° C. for about sixty minutes with malt or malt extract in the proportions of about 5 lb. of malt (dry basis) to 100 lb. of the highly modified starch. The product (maltose) is then boiled, filtered, and refined by the treatment described in Fr. Pat. 380,680 (see this J., 1908, 32).

(2). Highly modified, thin boiling starch, diluted to a density of about 16° B., is heated with about 0·05 per cent. of hydrochloric acid for thirty minutes under a steam pressure of 30 lb. The product (dextrose) is then neutralised, filtered, and refined by the treatment described in Fr. Pat. 380,680 (see this J., 1908, 32).—L. E.

Syrup ; Process of refining ——. C. B. Duryea, Cardinal, Canada. Eng. Pat. 11,802, May 21, 1907.

See Fr. Pat. 380,680 of 1907 ; this J., 1908, 32.—T. F. B.

Beets and sugar-cane ; Diffusion of —— *and the treatment of saccharine juices.* V. Martinand. Fr. Pat. 382,168, Dec. 1, 1906.

This patent aims at the destruction of the invertase contained in beets and sugar-cane, either before or after the enzyme is extracted by diffusion, rasping or pounding. The means adopted are : (1), the use of alkaline liquids for the diffusion or by rendering alkaline the rasped or pounded products ; (2), the use of a current at a voltage sufficiently high to decompose the saline matters and thus yield alkali ; (3), the oxygenation of the diffusion water ; (4), destruction of the enzyme by heating, or (5), removal of the enzyme by filtering the saccharine liquid through a fine filter. The outer parts of the beet and cane, which are rich in invertase, may also be separated mechanically by appropriate instruments.—T. H. P.

Diffusion and defecation ; Process and apparatus for the continuous —— *of the juice from the second and third mills in cane-sugar factories.* A. Moulé. Fr. Pat. 381,817, Aug. 1, 1907.

In this apparatus a screw raises the bagasse from one mill to the following one and is provided, at the edges of several of its turns, with a facing of rubber so as to form a tight joint with the cylinder containing it. Steam injected into the cylinder brings the temperature of the bagasse to about 100° C. and so hastens the diffusion. Defecation is effected by dissolving a small proportion of lime in the diffusion liquor.—T. H. P.

Diffusion battery ; Continuous ——. J. von Hyross and A. Rak. Fr. Pat. 382,319, Sept. 7, 1907.

This diffusion battery consists of a number of similar receivers furnished with screw conveyors and connected by means of chambers containing rotating vanes by which the beet slices are passed from one receiver to the next and so advance continuously. Each of the receivers is kept under pressure by the arrangement in each of the pressure screws, of a zone of obstruction, in which the slices are compressed under re-inforced pressure, so that the passage of the juice from one receiver to the next cannot take place along the path followed by the slices, and thus a partial extraction is effected in each unit of the battery. The walls of each of the diffusion and junction chambers are divided into two equal parts by a plane passing through the axis, so that the interior of the apparatus is readily accessible.—T. H. P.

Ammonia by fermentation, etc. Fr. Pat. 382,689. *See* XVII.

XVII.—BREWING, WINES, SPIRITS, &c.

Barley ; Bio-chemistry of ——. *I. Amylase of resting barley.* J. S. Ford and J. M. Guthrie. J. Inst. Brewing, 1908, **14**, 61—85.

It has been previously shown (this J., 1904, 875) that barley amylase conforms to Kjeldahl's "law of proportionality," the velocity curve of the action in presence of excess of starch being approximately linear until the reducing power of the mixed products is about $R=35$. The amylolytic activity of the aqueous extract of a barley is determined by extracting with constant agitation 20 grms. of the finely-ground barley with 500 c.c. of water at 18° C., filtering without delay and proceeding as already described (this J., 1905, 556) ; the result is expressed as grms. of maltose produced by the filtered extract of one grm. of the barley acting on excess of soluble starch for one hour at 40° C. When the barley is digested with water in the proportions above given and in presence of an antiseptic, at 30—35° C. for some hours, a considerable increase of amylolytic activity is observed in the filtered extract, the value thus obtained being termed the "autodigestion activity." In this autodigestion, 10 grms. of the finely-ground grain are digested with 250 c.c. of a saturated aqueous solution of chemically pure nitrobenzene at 30° C. for 20 hours, at the end of which period a condition of equilibrium is attained ; here too, the results are expressed as grms. of maltose produced per grm. of barley. Very considerable differences exist between the ordinary amylolytic activity and the autodigestion activity, the disparity being much greater with some barleys than with others. Further extracts, prepared in presence of extracts of germinated seeds or of one of the proteolytic enzymes, bromelin, animal trypsin and papain, exhibit greater diastatic activity than appears with autodigestion. The best results were obtained with papain and the preparations of this enzyme employed were found to be devoid of amylolytic power, either actual or potential. Boiled solutions of papain also give a marked increase of amylase, though never so great as that yielded by active papain. On dialysing boiled papain solutions, both dialysate and residue, when digested with barley, increase the amount of amylase in solution. Following on this, it was found that digestion of barley with sodium or potassium chloride, potassium sulphate, potassium dihydrogen phosphate, calcium sulphate, glycine, asparagine or α-alanine also results in an increased diastatic activity. The influence of small amounts of salts is very considerable and it is probable that, but for the presence of saline and other substances in the barley, the aqueous extract would exhibit little activity. When entire barley corns are steeped for about 48 hours, then ground and extracted as usual, a considerable diminution in activity is exhibited, owing, not to solution of the enzyme during steeping, but to the removal, by diffusion, of salts and other substances which help to dissolve and protect the amylase during the extraction of the ground grain. One of the functions of papain in increasing amylolytic activity consists in liberating latent amylase present in the barley in an occluded, insoluble form. Parallel determinations of amylolytic activity and nitrogen content of barley extracts prepared under various conditions show, however, that the above-mentioned function of the papain is not the main one to which the increase of amylolytic activity is due ; it is found, indeed, that a boiled solution of papain also produces an increase of activity without corresponding solution of nitrogen. The results are more in accord with the view that the amphoteric proteins in the papain prevent that destruction of amylase which occurs under other conditions of extraction. Even under the influence of active papain, barley yields only about one-half of its total nitrogen in the soluble form and it is a question whether the solution of the remaining nitrogen would be accompanied by the liberation of a further amount of diastase. The "aqueous extraction" and "autodigestion" values apparently represent the algebraic sum of solution and destruction of the enzyme under the conditions employed and are not so much a measure of the amylase, but of other substances in the barley.

The relation between the authors' numbers and values on the Lintner scale is shown by the fact that the aqueous extract of a malt having a diastatic power Lintner of 50, produces, under the conditions employed in the present work, 11·2 grms. of maltose per 1 grm. of malt. Various unsuccessful attempts to develop an increased activity in barley extracts have been made, but the results do not render it possible to deny the existence of a zymogenic or inactive soluble variety of translocation amylase. The so-called auto-excitation of malt and barley extracts is discussed in this connection. By far the greater part of the amylase obtained by treatment of barley with active papain is derived from the endosperm, the embryos containing an insignificant quantity. This is in conflict with the statement of Brown and Morris that there is a much larger proportion of enzyme in the proximal than in the distal portion of the endosperm. Further, whilst the enzyme apparently permeates the entire amyliferous tissue, its concentration is considerably greater in the peripheral zone and aleurone layer than in the other parts. Barley extracts must, before being added to the soluble starch solution, be subjected to filtration, an operation which is unnecessary in the case of malt extracts (compare Ford, this J., 1905, 556). The salt content of soluble starch has an influence on the action of solid barley flour on the starch, but the results obtained neither prove nor disprove the possibility of hydrolytic action being caused to some extent by the insoluble enzyme. The relative weights of soluble salts, estimated by measuring the electrical conductivity of their solutions, in equal weights of various parts of the barley corn, are: endosperm, including aleurone layer, 1; embryo, 4; and husks, 3; the concentration in the peripheral layers of the endosperm is about twice as great as that in the core. Further, in many barleys, the husks show a distinctly alkaline reaction towards rosolic acid, whilst the reactions of the embryos and endosperms tend towards faint acidity. Translocation diastase appears to be adsorbed, to some extent, when its solution remains in contact with solid starch. The amylolytic activity of barley does not appear to be associated with the hordeïn or edestin present. At all events no amylolytic activity is exhibited in the products obtained by the action of papaïn on these two proteïns.—T. H. P.

Diastatic power; Determination of —— by Lintner's method. G. C. Jones. J. Inst. Brewing, 1908, **14**, 13—32.

The author confirms the statement, made by Ford (this J., 1904, 417), that litmus, whether as paper or solution, is useless for testing the neutrality of soluble starch for use in determinations of the diastatic power. He makes use of alizarin and works as follows. One grm. of alizarin is suspended in 200 c.c. of water and two drops of the mixture added to 200 c.c. of starch solution in a porcelain dish. The titration must be conducted at boiling point, at which temperature one drop (0·05 c.c.) of $N/10$ alkali in excess of that required to effect neutralisation will change the clear yellow tint to an incipient purple. Experiments made with starches of different reactions show that diastatic action is stimulated by small quantities of acid but restricted by large amounts or by any trace of alkali. The optimum reaction is represented by 0·1 c.c. of $N/10$ acid per 200 c.c. of starch solution, that is by an acidity of $N/20,000$. Such acidity raises the diastatic power obtained from 30 to about 30·8, whilst if 0·5 c.c. of $N/10$ alkali or acid is required to neutralise 200 c.c. of the starch solution, the value is lowered to about 27 in the first case or 25·7 in the second.

As the cupric-reducing power of soluble starch depends to some extent on the temperature of the mixture of potato starch and hydrochloric acid during digestion, the author suggests that this digestion be carried out at 70° or as near 70° F. as can be arranged conveniently, and not at "room temperature" as recommended by the Malt Analysis Committee of the Institute of Brewing. Further, as the value obtained for the diastatic power depends on the amount of the malt extract employed in the starch conversion as carried out in the Committee's modification of Lintner's method, it is recommended that for brewing malts, the volume used be 3 c.c. in all cases. The removal of the hydrochloric acid from the soluble starch at the end of the digestion is effected by the author as follows. After the starch has been washed eight times with twice its weight of distilled water, a little of it is filtered off on a perforated porcelain plate, most of the adherent water being removed by means of a filter pump; 10 grms. of the moist starch are then dissolved in 200 c.c. of boiling neutral water contained in a porcelain dish and the solution titrated with $N/10$ sodium carbonate solution, alizarin being used as indicator. Sodium carbonate solution is then added to the bulk of the starch in an amount 25 per cent. in excess of that calculated on the initial quantity of potato starch taken. The whole is shaken, allowed to stand for a day, washed four times with distilled water, filtered and dried. The resulting starch will be found to be faintly acid, 200 c.c. of a 2 per cent. solution requiring 0·1 c.c. of $N/10$ alkali for neutralisation. The proportion between the amounts of malt and water employed in preparing the extract may exert a considerable influence on the resulting value for the diastatic power. The following values are given by the author:—

5 per cent. extract	30
10 ,, ,, ,, filtered and diluted to half strength ..	32
20 ,, ,, ,, ,, ,, ,, quarter ,, ..	34
40 ,, ,, ,, ,, ,, ,, eighth ,, ..	36

When the 10 and 20 per cent. extracts were diluted previous to filtration, the values obtained for the diastatic powers were 28 and 27 respectively. These variations are found to be connected with the brilliancy of the filtered extract, a brilliant extract yielding often, though not invariably, a high diastatic power. Slight modifications in the procedure of filtering the extracts may produce very considerable variations in the value of the diastatic power obtained, but the conditions determining the minimum numbers cannot be defined. Concordant numbers, closely approaching the maximum obtainable, may be obtained as follows:—25 grms. of malt are extracted with 500 c.c. of water in a beaker, and the well-stirred mixture transferred to a 24 cm. filter. After the filtration has proceeded sufficiently far to allow of the whole of the contents of the beaker being transferred to the funnel, the next 20 c.c. of filtrate is collected and employed to rinse out a 200 c.c. beaker in which the next 100 c.c. of the filtrate is collected for use in the test.—T. H. P.

Extracts [of malt]; Determination of —— during summer. G. C. Jones. J. Inst. Brewing, 1908, **14**, 9—12.

Malt delivered during the summer and early autumn is often returned as showing a falling-off in extract compared with earlier deliveries. This deficiency in extract is, to some extent, explained by the fact that the specific gravity of the laboratory wort is, in warm weather, determined at 65°/65° or 70°/70° instead of at 60°/60° F. The author finds that the results obtained at these different temperatures differ appreciably from one another, so that the temperature at which the specific gravity of the wort is determined must be taken into account in calculating the extract of a malt. From a number of experiments, it is found that the following corrections should be added to extracts in the neighbourhood of 94 lb. per quarter, when these are determined at temperatures other than 60°/60° F.:—

Temperature.	Correction.	Temperature.	Correction.
61° F.	0·0	70° or 71° F.	0·5 lb.
62° or 63° F.	0·1 lb.	72° F.	0·6 ,,
64° or 65° F.	0·2 ,,	73° or 74° F.	0·7 ,,
66° or 67° F.	0·3 ,,	75° F.	0·8 ,,
68° or 69° F.	0·4 ,,		

Further, the water-content of the specific gravity bottle should be determined daily, one and the same thermometer being used for all the weighings during the day.
—T. H. P.

Beer sarcinae. F. Schönfeld. Jahrb. Berl. Vers. u. Lehr. Brau., 1907, **10**, 546—559; Z. ges. Brauw., 1908, **31**, 67—68.

A large number of species of pediococci are capable of existing in beer, and their acclimatisation and development may be greatly assisted by passing a current of carbon dioxide through the beer. In many cases it is not possible to produce turbidities even with vigorous cultures of species which are most dangerous in this respect, but the carbon dioxide tends to convert the growths into the suspended form. Ropy pediococci produce in lager beer a thick, viscid slime, and the beer becomes cloudy with the suspended germs. Ropy pediococci transferred from wort to lager beer do not produce ropiness, but those transferred from "Weissbier" do. In this way diseases have been produced in lager beer by pediococci which have not hitherto been recognised as dangerous to such beers. This omission may be due to the general purity of lager beer yeast, the low temperatures of fermentation and cellarage and to the protective influence of the hops. In certain cases the appearance of a red colour in beer may be traced to the activity of sarcinæ. This is not a direct product of their growth but is probably caused by a transference of oxygen induced by enzymes secreted by them. The form of growth of sarcinæ is dependent on the composition of the medium; the addition of coloured malt extracts to beer causes them to grow in clumps, although in pure extracts of caramelised malt they tend to assume the form of a finely divided sediment of single individuals; they also assume the latter form in hopped worts. A special character of the sarcinæ is the inconstancy of their forms, which gradually change in various ways depending on the composition of the medium. The most dangerous beer-sarcinæ (group of *Ped. odoris melisimilis*) produce only moderate degrees of acidity, whilst the ropy sarcinæ and certain species which infest "Weissbier" are strongly acidifying, but these differences are liable to disappear in the case of media, such as lager beer, in which certain species cannot develop unrestrictedly. Of the methods available for isolating sarcinæ, Claussen's ammonium fluoride process is very good for separating small quantities of pediococci from "Weissbier" yeast. For detecting the ropy pediococci, ammoniacal yeast water yields the best results. The most suitable medium for all kinds of pediococci is an extract of dried yeast. After their isolation, most of the pediococci may be further cultivated on beer-gelatin. The chief nidus of the ropy pediococci is found in animal excrements; stable drainings are the most dangerous source of infection. The purely acid-forming pediococci, which may also become dangerous to beer, are to be traced chiefly to barley, wheat and malt. The same applies to the most dangerous group of *Ped. odoris melisimilis*. The author holds that all pediococci found in water and on grain must be regarded with suspicion.—J. F. B.

Fermentation; Studies in ——. Part II. Mechanism of alcoholic fermentation. A. Slator. Chem. Soc. Proc., 1908, **24**, 11.

The velocity of the conversion of dextrose, lævulose, galactose, and mannose into alcohol and carbon dioxide by the action of living yeast has been measured in the manner already described (this J., 1906, 227). The main results are as follows:—1. The rate of fermentation of dextrose, lævulose, galactose, and mannose is approximately independent of the concentration of the sugar between the concentrations 1 grm. to 10 grms. per 100 c.c. 2. The fermentation of dextrose and lævulose under all conditions proceeds with approximately equal velocities. 3. The temperature-coefficient is almost the same in the case of the fermentation of dextrose, lævulose, and mannose, but is somewhat less in the case of the fermentation of galactose. 4. Many yeasts (very probably all yeasts) are unable to ferment galactose unless the yeast has been grown in the presence of this sugar. 5. The ratio of the rate of fermentation of dextrose to mannose varies greatly, depending on the treatment the yeast has undergone. 6. When two sugars are fermented simultaneously in the same solution, interference takes place between the reactions. 7. The velocity of fermentation by living yeast can be easily lessened by the addition of certain inhibiting agents, but cannot be appreciably raised. 8. In all probability the fermentation of sugars by preparations from yeast proceeds on the same lines as that by living yeast, but the reaction is much complicated by secondary changes. The supposition that the reaction which has the main control of the velocity of fermentation is the decomposition of a stable compound between the enzyme and the sugar can be made to explain these results. Possibly three enzymes are present in yeast which will ferment the four sugars: glucozymase which ferments dextrose and lævulose, galactozymase which ferments galactose, and mannozymase which ferments mannose.

Starch in barley; Polarimetric determination of ——. O. Wenglein. *See* XVI.

Starch; Polarimetric determination of ——. E. Ewers. *See* XVI.

Peroxydase; The active —— in tyrosinase. Tyrosinase; Nature of action of ——. Peroxydase; Behaviour of —— towards light. Oxidation ferments; Nitrogen content of ——. A. Bach. *See* XXIV.

Tyrosinase and racemic tyrosine. G. Bertrand and M. Rosenblatt. *See* XXIV.

Salicylic acid intended for use in Komarowsky's reaction [for detection of fusel oil in spirit]; Examination of ——. H. Kreis. *See* XXIII.

Tartaric acid in wine lees, tartar, and other crude substances containing tartaric acid; Goldenberg's 1907 *method for the determination of ——.* *See* XX.

Patents.

Grains for malting; Preparation of ——. A. J. Boult, London. From H. Heuser and T. Brain, Chicago. Eng. Pat. 12,544, May 30, 1907.

See U.S. Pat. 856,637 of 1907; this J., 1907, 835.—T. F. B.

Brew-house equipment. M. Henius, Chicago. U.S. Pat. 878,136, Feb. 4, 1908.

This equipment comprises, in combination, a number of inter-communicating vessels, all on one floor of the building. The various steps involved in producing the wort, are performed in these vessels, which are equipped with the necessary temperature and liquid gauges visible from a common and convenient point on the said floor. Means are provided for controlling the operations in the said vessels, these means centring at the same point. —T. H. P.

Vinaceous beverages from pure hæmoglobin and fermentable sugar; Process of producing ——. F. G. Sauer, Assignor to P. Höpfner, Berlin. U.S. Pat. 878,900, Feb. 11, 1908.

See Fr. Pat. 373,403 of 1907; this J., 1907, 709.—T. F. B.

Brewers' pitch; Manufacture of ——. L. Schmied, Prague. Eng. Pat. 3421, Feb. 11, 1907.

See Fr. Pat. 374,611 of 1907; this J., 1907, 886.—T. F. B.

Brewers' pitch. C. N. Forrest, Brooklyn, New York. Assignor to The Barber Asphalt Paving Co., Philadelphia. U.S. Pat. 877,888, Jan. 28, 1908.

The pitch is composed of a hard bitumen free from mineral matter together with any of the following additional substances: (1), "wax tailings"; (2), "wax tailings" combined with a petroleum pitch; or either of the foregoing combined with (3), an antiseptic agent; or (4), a mixture of colophony and rosin oil.—O. R.

Wine vinegar; Manufacture of strong ——. H. Dechert. Fr. Pat. 382,030, July 10, 1907.

In this process, each of a number of fermenting vessels is connected with the next by means of an automatic siphon, the last being similarly connected with the sterilising apparatus. A distributing apparatus placed on the bottom of each fermenting vessel ensures uniform distribution of the liquid.—T. H. P.

Ammonia; Production of —— by the fermentation of organic nitrogenous substances [residues from sugar refineries and distilleries]. J. Effront. Fr. Pat. 382,689, Oct. 8, 1907.

The nitrogen present in the residues from sugar refineries and in the vinasse from distilleries (from molasses, beetroot, grain, potatoes, etc.) may be converted into ammonia by means of the butyric acid ferment, acting at a temperature of 38°—42° C. Butyric acid, to the extent of 15—20 litres per 100 kilos. of molasses, is also formed during the process, which, under favourable conditions, is completed in about 3 days; and during this time about 1·5 grms. of free alkali per litre are maintained, by the occasional addition of lime, for example. The ferment requires to become acclimatised to the amido compounds to be transformed into ammonia, and is preferably allowed to act, in the first instance, on such amides as glutamic acid or asparagine, or on the products of the autodigestion of yeast, in gradually increasing quantities.—F. Sodn.

XVIII.—FOODS ; SANITATION ; WATER PURIFICATION, & DISINFECTANTS.

(*A.*)—FOODS.

Flour ; Composition of —— and its relationship to bread-making value. F. T. Shutt. Canadian Dept. Agric., Bull., 1907, [57], 37—51.

Analyses were made of a number of flours in the hope that the data obtained would throw some further light on the relation of the composition of flour to its bread-making value. The flours examined comprised 12 samples milled during the winter of 1905-6 from 11 specimens of cross-bred spring wheat and 1 of winter wheat, and also 30 samples milled during December, 1906, from wheats, 25 of which were spring varieties, 3 winter, and 2 Durum. The results obtained show that whilst there is a distinct relation between the protein, gliadin, and wet and dry gluten, there is no evidence of a definite or absolute ratio. The gliadin value is not definitely related either to the nitrogenous compounds or to the "baking-strength." Although it may not be possible to prognosticate from the nitrogen determinations (protein, gliadin, and gluten) the particular order in which the members of any series of flours will fall when submitted to a baking-test, these determinations are of great importance in judging the values of a flour for bread-making purposes, especially when the physical character of the gluten is taken into account. The results from both series of flours indicate a distinct relationship between the above chemical data and the "baking-strength"—a figure made up chiefly of the values for volume, shape, and weight of the loaf. If the size of the loaf produced be controlled by the volume of gas evolved in the bread-making process, then this volume is dependent on the degree of the enzymic action (which may affect the proteids as well as the carbohydrates) rather than on the amount of sugar present in the flour. There is no apparent relation between the ratio of total ash to protein and "baking-strength," nor between the ratio of ash in gluten to protein and "baking-strength." (See also this J., 1907, 1290.)
—W. P. S.

Casein in cows' milk ; Variation in the amount of ——. E. B. Hart. J. Amer. Chem. Soc., 1908, **30**, 281—285.

From the results of analyses of the milk of cows of different breeds, the author draws the following conclusions : (1) the relation of casein to fat is a variable one ; (2) one of the principal factors controlling its relation is individuality ; (3) the relation of casein to fat varies among animals of different breeds and among animals of the same breed ; (4) direct determination of both fat and casein seems necessary in determining the value of the milk of any single cow for cheese production.
—F. Sodn.

Milk ; Rapid determination of potassium bichromate in——. Gouère. Compt. rend., 1908, **146**, 291—292.

It not infrequently happens that a chromated milk has to be compared with a natural milk, or two milks require comparison, to each of which a different portion of bichromate has been added. (The bichromate added, is used, it is stated, as a preserving agent.) The ashes of 10 c.c. of the milk are dissolved in a little water and about 3 c.c. of a 10 per cent. solution of potassium iodide and 4—5 c.c. of hydrochloric acid added. If potassium bichromate be present, the liquor immediately becomes brown due to the iodine liberated, which is titrated with sodium thiosulphate until the yellow colour is just discharged and the blue colour of the chromium salt becomes perceptible. The presence of the other salts in the ash of milk do not interfere with the reaction.
—E. F. A.

Seaweeds ; Economic —— of Hawaii and their food value. M. Reed. Hawaii Agr. Expt. Sta. Report, 1906, 61—88.

It is remarked that "if the seaweed industry of Japan is the source of an annual income of $2,000,000 it seems possible that the edible Hawaiian algæ might be similarly available. Large factories might thus be established for making gelatin, glue, farina, etc." Algæ, known in Hawaii as "limu," form an important article of diet among the natives. A list is presented of about 70 edible species, of which about 40 are in general use. Some of the seaweeds occur native in abundance along the coast and some are cultivated in a crude way. Methods of gathering, preparing, and serving limus, together with native methods of cultivating and preserving them are described at length, and analyses, by R. A. Duncan, of 3 species are reported as follows for the air-dry material.

Kind of algæ.	Water.	Protein.	Fat.	Carbohydrates.	Crude fibre.	Ash.
	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.
Limu akiaki (*Ahnfeldtia concinna*)	20·16	5·60	0·07	57·62	2·66	16·55
Limu pahapaha (*Weva fasciata and W. lactuca*).	18·68	14·87	0·04	50·84	0·19	15·57
Limu manauea (*Gracilaria coronopifolia*)	12·87	7·91	0·05	61·39	2·98	17·78

The limus are said to occupy much the same place in the diet as green vegetables. They are rich in phosphates, chlorides, bromides, iodides, etc., and the algæ gelatin is believed to be of importance in counteracting a tendency to constipation. They are used to a great extent as salads and relishes, although the author believes that they are more palatable when served in other ways, such as in soups and gravies or with meats or made into jellies. Experiments indicated that the limus could also be utilised as a source of commercial gelatin, glue, mucilage, and agar agar, and the author believes that their economic value for these purposes might be considerable if properly developed.

Coffee. I. K. Gorter. Annalen, 1908, **358**, 327—348.

A resume of the literature on the chemistry of the coffee bean is given by the author. Raw, powdered Liberia coffee was percolated with alcohol of sp. gr. 0·9. The first portion of the percolate was diluted with 96 per cent. alcohol causing the precipitation of slimy material. The clear liquid was mixed with the remainder of the percolate, the alcohol distilled off *in vacuo*, and the residue evaporated to a syrup on the water-bath. Crystals of potassium-caffeine chlorogenate $K_2(C_8H_{10}N_4O_2)_2C_{32}H_{36}O_{19}.2H_2O$, separated, and were recrystallised from 60 per cent. alcohol, forming groups of white prisms. The substance becomes brown at 225° C., without melting. It is present to the extent of 3·3 per cent. in Liberia coffee. The author finds that caffeine is not removed from this compound by chloroform unless it is previously moistened with water. To determine the amount of caffeine in raw coffee, the following method is therefore suggested. 11 grms. of the finely powdered coffee are moistened with 3 c.c. of water and extracted for 3 hours in a Soxhlet's apparatus with chloroform. The chloroform is distilled off, the residue taken up with hot water and filtered through a plug of cotton-wool to remove the fat. The filtrate and washings are made up to 55 c.c. 50 c.c. of this are shaken out 4 times with chloroform, which is distilled off in a tared flask, and the residue dried at 100° C. The caffeine-potassium chlorogenate was dissolved in water, and enough sulphuric acid added to convert the potassium into the sulphate. The liquid was shaken repeatedly with chloroform to remove the caffeine, and allowed to stand, when crystals of chlorogenic acid separated out. Chlorogenic acid, $C_{32}H_{38}O_{19}$, is a dibasic acid, stronger than acetic acid. It crystallises from water in groups of needles, melting at 206°—207° C. It is soluble to the extent of about 4 per cent. in water, easily soluble in ethyl and isobutyl alcohols and acetone, slightly soluble in ethyl acetate, insoluble in ether, chloroform, and carbon bisulphide. It has $[\alpha]_D = -33{\cdot}1°$. It gives a grass-green coloration with ferric chloride, and a yellowish-red coloration with potassium hydroxide, darkening on exposure. A number of metallic and alkaloidal salts were formed, some of which were crystalline.—F. Shdn.

Tamarind seeds; Uses and composition of ——. D. Hooper. Agric. Ledger, 1907, [2], 13—16.

The tamarind fruit (*Tamarindus indica*) contains 55 per cent. of pulp, 33·9 per cent. of seeds, and 11·1 per cent. of shell and fibre. 100 seeds weigh 75·88 grms. The seeds are used as a foodstuff in India in times of famine, and also occasionally at other times. They are also used for the preparation of size or glue, and are moreover regarded as having some medicinal value. Analyses of the whole seeds and of the white kernels gave the following results:—

	Seeds. Per cent.	Kernels. Per cent.
Water	10·50	9·35
Proteins	13·87	18·06
Fat	4·50	6·60
Carbohydrates	63·22	62·88
Fibre	5·36	0·66
Ash	2·55	2·45
Nitrogen	2·22	2·89
Phosphoric anhydride	0·40	0·55

The semi-drying oil obtained from the seeds by extraction with ether is thick, and of a light yellow colour. It solidifies at 15° C. and has the acid value, 0·84; saponification value, 183; iodine value, 87·1; fatty acids, 94·9 per cent.; and m. pt. of fatty acids, 46° C. The fatty acids after two crystallisations from alcohol yield an acid melting at 74·5° C., resembling arachidic acid.—A. S.

Cocoanut oil; Crude proteins in ——. J. Freundlich. *See* XII.

Vegetable fats and mixtures used as substitutes for cacao butter in the manufacture of chocolate. O. Sachs. *See* XII.

Patents.

Food materials. E. F. Harrison, London. Eng. Pat. 1667, Jan. 22, 1907.

Wheat, or another substance containing a high proportion of carbohydrates, is boiled with water and treated, after cooling, with a diastatic ferment such as barley malt, so as to produce dextrin and maltose. The strained liquid is evaporated *in vacuo* at a low temperature until it becomes syrupy, after which a solution of a glycerophosphate and a flavouring substance are added, and the whole thoroughly mixed.—O. R.

Nutritive elements of cereals, feculent vegetables and other seeds; Process for rendering the —— *as digestible as possible.* D. Finkler. Fr. Pat. 382,686, Oct. 8, 1907.

The nutritive elements are freed from the membranes enveloping them by a vigorous mechanical treatment under water in presence of a chemical agent facilitating the expulsion of the protein matters, or by pulverisation after subjection to a change of temperature such as freezing, or by grinding in the dry state with the help of hard substances favourable to pulverisation; these substances may be friable and provided with sharp angles and are preferably soluble, such as rock salt, or they may be agglutinants friable in the dry state, such as gluten, with which the material is mixed, dried and pounded. The chemical agent added to the water may be calcium sulphate or other calcium salt, common salt, or an acid or alkali.—T. H. P.

(*B.*)—SANITATION; WATER PURIFICATION.

Patents.

Filter beds [*for treatment of sewage*]. J. Howard, London. Eng. Pat. 11,282, May 14, 1907.

To improve the bacterial efficiency of newly constructed filter beds, the top layer of the bed is charged with a film of finely-divided mineral matter. This is best done by admitting water, preferably filtered, to the bed from below, until it is fully charged, and then shutting off the supply. Water mixed with suitable mineral matter is then directed on to the surface of the bed, and some of the water, with which it was previously charged, allowed to drain away from underneath. The desired filmy deposit is thus procured. Suitable mineral matters are aluminium sulphate, fuller's and infusorial earths, iron oxide, chalk, coal, etc. Where aluminium sulphate is used, the water in which it is dissolved must either contain sufficient calcium carbonate to separate all the alumina, or else lime must be added.—O. R.

Sewage; Tanks and filtering appliances for the treatment and purification of ——. G. H. Ellis, Newton Abbot. Eng. Pat. 14,704, June 26, 1907.

The apparatus consists of a central "solutionising" tank, preferably cylindrical, for the bacterial treatment of crude sewage. Surrounding the tank are grouped a series of suspended filtering floors or oxidising beds, one above the other. Ample spaces are left between the beds for air to have free access to the sewage that is being filtered as well as to the filtering media, both above and below.—O. R.

Purifying liquids [*water*]; *Process and apparatus for* ——. J. T. Harris, New York. Eng. Pat. 13,522, June 11, 1907.

See U.S. Pat. 857,277 of 1907; this J., 1907, 829.—T. F. B.

XIX.—PAPER, PASTEBOARD, &c.

Sulphite wood-pulp; Bleaching of ——. *The chlorine contents of bleached pulps.* G. Schwalbe. Z. angew. Chem., 1908, 21, 302—303.

The author refers to an investigation by Cross and Bevan (this J., 1890, 450) in which it was shown that during the bleaching of wood pulp and esparto, chlorine combines with the residual non-cellulose constituents of the pulp forming organic chlorinated compounds, some of which are volatile whilst others may remain fixed on the fibres after washing. The author has submitted a sample of sulphite wood-pulp to bleaching experiments under various conditions. He has used both calcium and sodium hypochlorites, both neutral and acid, in industrial proportions and in excess. After bleaching, the products were washed and dried. They were then heated in a Dennstedt's combustion apparatus in such a way that the organic chlorinated derivatives were determined as far as possible in a volatile form, whilst the chlorine remaining in the ash was determined separately. The results are shown in the following table:—

Bleaching liquor.	Ash, per cent.	Chlorine remaining in ash, per cent.	Organic chlorine, per cent.	Total chlorine, per cent.
Calcium hypochlorite	0·83	0·011	0·058	0·069
Do., double quantity	1·35	0·014	0·053	0·068
Sodium hypochlorite	0·47	0·012	0·071	0·083
Do., double quantity	0·80	0·055	0·059	0·114
Calcium hypochlorite, acid	0·36	0·014	0·052	0·066
Do., double quantity	0·48	0·008	0·067	0·075
Sodium hypochlorite, acid	0·37	0·002	0·049	0·051
Do., double quantity	0·68	0·006	0·047	0·053
Unbleached pulp	0·60	—	0·012	0·012
Commercial bleached sulphite pulp	0·99	0·011	0·042	0·053

In spite of the figures recorded for the organically combined chlorine, the author concludes that no appreciable chlorination of the pulp takes place and that the products of the bleaching are removed during the process of washing. He does not agree with Cross and Bevan in their view that the subsequent discoloration of bleached pulps is due to the presence of organic chlorinated derivatives, but attributes it to the presence of oxycellulose. —J. F. B.

Patents.

Paper machines; Utilisation of waste waters from ——. B. Schmidt, Dresden, Germany. Eng. Pat. 1903, Jan. 25, 1907.

The water which flows from the first part of the paper machine is collected in a separate pit from the water which flows from the suction boxes, couch-rolls and presses. The water first mentioned is pumped into a settling tank, where a portion of the clear water is eliminated, whilst the portion containing the useful ingredients is used again in the mixing chest for diluting the pulp. The waste water collected from the latter parts of the paper machine is pumped into a settling tank situated above the beating engines in which the solid ingredients are utilised.—J. F. B.

Paper-pulp from new fibres without the use of alkalis; Preparation of ——. C. Badoil. Fr. Pat. 382,439, Oct. 1, 1907.

Plants belonging to the families of *Urticaceæ* and *Liliaceæ*, including agaves, phormium and daffodils, are first subjected to a mechanical washing process to remove dirt; they are then boiled with water until soft, separated into filaments by a crushing process and returned to the boiler in the same water. Finally they are pressed and washed with cold water. Such treatment may suffice or may only be a preliminary to the usual alkaline treatments, but in the latter case smaller quantities of chemicals are required.—J. F. B.

Printing paper; Process for the preparation of white —— *from brown wood pulp.* E. Kolb. Ger. Pat. 189,882, Oct. 1, 1905.

Brown wood pulp from steamed wood is bleached electrolytically or with a bleach-liquor prepared electrolytically from common salt.—A. S.

Sulphite-cellulose; Process for the preparation of —— *from wood.* R. Eichmann. Ger. Pat. 184,991, May 31, 1906.

The wood is first subjected to the action of gaseous sulphur dioxide and is then boiled with sulphite liquor in the usual manner. The preliminary treatment may be performed with dried and cooled sulphur dioxide or with the vapours containing sulphur dioxide produced by heating the sulphite liquor in the digester before introducing the wood. It is claimed that by this process a larger yield of cellulose of better quality is obtained in a shorter time than by the usual method, and also that weaker sulphite liquors may be used.—A. S.

Celluloid and similar products; Manufacture of ——. C. Gillet aîné. Fr. Pat. 382,350, Dec. 5, 1906.

A portion of the camphor or similar substance ordinarily used in the manufacture of celluloid is replaced by a mixture of resin and castor oil. The proportions of oil and resin are variable according to the degree of pliability or rigidity desired; as an instance, the quantity of oil may range from 3 to 10 per cent. of the resin.—J. F. B.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

Strychnos aculeata; Active principles in the fruits of ——. (*Absence of strychnine.*) A. Hébert. J. Pharm. Chim., 1908, **27**, 151—155.

The fruits of *Strychnos aculeata*, used by the natives of the Ivory-Coast as a fish poison are found to contain no strychnine, and only a trace of brucine, not exceeding 0·05 per cent. in the kernels, which contain the most. A principle toxic to fish, probably a glucoside, is, however, present. The addition of 1 part of the fruit to 10,000 parts of water is sufficient to kill the fish contained therein. In small doses, this substance is without effect on batrachians and mammals.—J. O. B.

Atractylis gummifera; Toxic glucosidal compound in the root of ——. F. Angelico. Archiv. farmacol., 1907, [2]; Nouveaux Remèdes, 1908, **24**, 59.

The root of *Atractylis gummifera*, which has occasioned several cases of fatal poisoning, contains the potassium compound of a complex glucoside, to which the formula, $C_{30}H_{52}K_2S_2O_{18}$, is attributed. When this substance is treated with dilute hydrochloric or sulphuric acids, or with alkalis, it is hydrolysed; an oily product which solidifies on cooling, sulphuric and valeric acids, and a pentose sugar are formed. When warmed with strong sulphuric acid, it evolves a powerful odour of valeric acid; and the liquid, at first wine red, becomes brownish then gradually violet. After some hours, the liquid gradually becomes lighter in colour and deposits a violet, crystalline precipitate. This gives a colourless solution with alkalis, but becomes violet again on acidifying. The original potassium compound is shown, by physiological experiments, to be the toxic principle of the root.—J. O. B.

Micromeria Chamissonis (Yerba Buena); Chemical examination of ——. F. B. Power and A. H. Salway. J. Amer. Chem. Soc., 1908, **30**, 251—265.

The results of the authors' examination of *Micromeria Chamissonis* (Benth.) Greene (syn. *M. Douglassi*, Benth.) show that the plant contains some essential oil, resins, and other amorphous substances, and the following compounds: (1), *Xanthomicrol*, $C_{15}H_{10}O_4(OH)_2$, a phenolic substance crystallising in fine, lemon-yellow needles melting at 225° C., and yielding a *diacetyl derivative* melting at 116° C.; (2), an alcohol, *micromerol*, $C_{33}H_{51}O_3.OH,2H_2O$, crystallising in fine, colourless needles melting at 277° C., and with $[\alpha]_D = +57°$; the *acetyl derivative* forms colourless needles melting at 188° C., and with $[\alpha]_D = +47·1°$; the *methyl derivative*, $C_{33}H_{51}O_3.OCH_3,H_2O$, melts at 116° C., or at 167° C. when anhydrous; (3) a second alcohol, *micromeritol*, $C_{30}H_{44}O_2(OH)_2,2H_2O$, crystallising in fine, colourless needles, melting at 294°—296° C., and with $[\alpha]_D = +61·4°$; the *diacetyl* and *monoacetyl derivatives* melt at 204° and 255° C. respectively (all the above substances were present to the extent of less than 0·25 per cent.); (4), hentriacontane, $C_{31}H_{64}$, m.pt. 66°—67° C.; (5), a phytosterol, $C_{27}H_{46}O,H_2O$, m.pt. 135° C.; (6), the glycerides of palmitic, arachidic, and behenic acids; (7), formic, acetic, and butyric acids in the free state; (8), dextrose. The total amount of crude resin corresponded to 3·5 per cent. of the weight of the plant, and most of the above crystalline substances were isolated from it. The amount of essential oil obtained by direct distillation amounted to 0·16 per cent. of the weight of the plant. This oil had a pale yellowish-brown colour, an agreeable mint-like odour and had the sp. gr. 0·9244 at 20° C., and $[\alpha]_D = -22° 48'$ in a 100 mm. tube. The alcohols, micromerol and micromeritol, have the same general formula, $C_nH_{2n-14}O_4$ as lippianol (this J., 1907, 1159), and morindanol (Chem. Soc. Trans., 1907, **91**, 1918). Both appear to be cyclic compounds containing a benzene nucleus.—F. Shdn.

Marrubiïn. H. M. Gordin. J. Amer. Chem. Soc. 1908, **30**, 265—271.

The bitter principle of horehound (*Marrubium vulgare*, L.) is known as marrubiïn, $C_{21}H_{28}O_4$. The plant was extracted with cold acetone, the solvent distilled off, and the residue treated with light petroleum and warm water. The insoluble portion was taken up with hot alcohol, which on cooling deposited marrubiïn. After recrystallisation this melts at 154·5—155·5° C., and boils at 297—299° C. at 15 mm. About 0·25 per cent. of pure marrubiïn was obtained. It crystallises from alcohol in two forms, of which measurements are given. It has $[\alpha]_D = +45·68°$ at 24° C. in acetone, and is soluble

in 60 parts of alcohol at 20° C., and 20,835 parts of water at 21·5° C. It does not reduce Fehling's solution either before or after warming with dilute mineral acids; it contains no methoxyl groups, and does not decolorise bromine. It contains no hydroxyl or carboxyl groups, but behaves like a γ-lactone. Marrubic acid, $C_{20}H_{29}O_3.COOH$, was obtained by treating marrubiïn with alcoholic potassium hydroxide and acidifying. This substance melts at 173—174° C. It reduces Fehling's solution and has $[\alpha]_D = +7{\cdot}86°$ at 21·5° C. in acetone. When heated to 190°—200° C. at 15 mm., the acid loses a molecule of water and is converted back into marrubiïn. Boiling with acetic anhydride has the same effect. Ethyl marrubate crystallises from ether and light petroleum in large heavy crystals, consisting of layers of leaflets. Unlike marrubiïn and marrubic acid, this compound is tasteless. It melts at 87° C., and when heated to 100° C. at 28 mm. it loses a molecule of alcohol and passes into marrubiïn.
—F. Shdn.

Lavender oil; Notes on ——. P. Jeancard and C. Satie. Bull. Soc. Chim., 1908, **3**, 155—159.

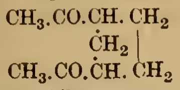
The authors give further tables showing the influence of altitude on the composition of lavender oil (see this J., 1900, 770). After examining oils from plants grown at various altitudes and in different years, they conclude that a true oil of lavender should have the following constants:—sp. gr. at 15° C., 0·880—0·8900; optical rotation, —6° to —10°; saponification value after acetylation, above 160. Adulteration with oil of aspic brings the optical rotation towards zero, and lowers the saponification value. The monoacetate of glycerol is used to adulterate oils. Such oils when treated with 4 or 5 vols. of benzene or light petroleum shew an oily layer, which, when warmed with potassium bisulphate, gives the acrolein reaction.—F. Shdn.

East Indian sandalwood oil; [U.S. P. and B.P.] requirements for ——. A. R. L. Dohme and H. Engelhardt. Amer. J. Pharm., 1908, **80**, 51—55.

The experiences recorded in England by Evans, Sons, Lescher and Webb, and by W. J. Bush and Co. (this J., 1907, 1027) are confirmed. The official requirements of the U.S. P. 1900, and of the B. P. 1898, are not met by a large percentage of normal genuine oil distilled in America, on the commercial scale, from East Indian sandalwood of good quality. If the official solubility test of 1 : 5 or 1 : 6 in 70 per cent. alcohol is to be retained, the temperature at which it is performed must be raised, and specified at 30° C. As this test now stands, many normal oils will not respond to it, not even one containing 97 per cent. of santalol. The limit of official figures for optical rotation "not less than —16° or more than —20° at 25° C.," is too narrow; the first figure should be lowered to —12°. Only 15 oils from 30 different samples of sandalwood distilled by the authors attained the lower limit, $\alpha_D = -16°$; and the main distillate of 5 special trials, fell far below this figure. The percentage of santalol should not fall below 90 per cent. This is the most crucial character of all, and renders rigid adherence to limits of specific gravity or optical rotation needless. If figures for sp. gr. be maintained, they should range from 0·965 to 0·980 at 25° C. To detect crude adulteration with acid resins a maximum acid value might be given.
—J. O. B.

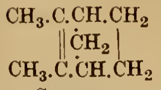
Essential oils; Constituents of ——. *Constitution of santene.* F. W. Semmler and K. Bartelt. Ber., 1908, **41**, 385—389.

When santene, C_9H_{14}, is oxidised by ozone or potassium permanganate, there is a quantitative yield of a diketone, $C_9H_{14}O_2$ (this J., 1907, 1292). This diketone when oxidised with excess of an alkaline solution of bromine, is now found to yield *trans*-cyclopentane-1.3-dicarboxylic acid, $C_7H_{10}O_4$, as the principal product. This acid melts at 86° C., and was found by its reactions to be identical with the *trans*-cyclopentane-1.3-dicarboxylic acid of Wislicenus and Pospischill (Ber., 1898, **31**, 1950). Hence the diketone, $C_9H_{14}O_3$, and santene must have the following formulæ respectively:—



$$\begin{array}{l} CH_3.CO.CH.\,CH_2 \\ \qquad\quad \dot{C}H_2 \; | \\ CH_3.CO.\dot{C}H.\,CH_2 \end{array}$$

Diketone.



$$\begin{array}{l} CH_3.C.CH.CH_2 \\ \qquad \| \dot{C}H_2 \; | \\ CH_3.C.\dot{C}H.CH_2 \end{array}$$

Santene.

These results do not affect the constitution of π-norborneol, previously given by the authors (this J., 1907, 1253).
—F. Shdn.

Tarragon [Artemisia dracunculus]; Constituents of essential oil of ——. M. Daufresne. Bull. Sci. pharmacol., 1908, 11. Apoth.-Zeit., 1908, **33**, 115.

Tarragon oil contains from 15 to 20 per cent. of terpenes, $C_{10}H_{16}$; one, an aliphatic hydrocarbon, contains three double linkages, analogous to myrcene and ocymene, and is probably identical with the latter; another, a hydrocyclic hydrocarbon, is strongly dextro-rotatory, and very like phellandrene. The oil also contains from 60 to 75 per cent. of methyl-chavicol (estragol), free from anethol, 0·5 to 0·6 per cent. of methoxycinnamic aldehyde, and 5 to 20 per cent. of higher boiling constituents, which, when heated, separate water, and form lævo-rotatory substances, probably aldols.—J. O. B.

Dithymol; Preparation of and action of bromine on ——. H. Cousin and H. Hérissey. Compt. rend., 1908, **146**, 292—294.

Dithymol is conveniently prepared by dissolving thymo in a large quantity of water and oxidising it with ferric chloride during several days at about 15° C. The precipitate formed is dissolved in dilute sodium carbonate solution and precipitated again by acetic acid and finally crystallised from alcohol. The pure product forms a hydrate, $C_{20}H_{26}O_2 + H_2O$, melting at 100—101° C. and when anhydrous melts at 164—165° C. It does not give a yellow coloration with alkalis. The dibromide produced by brominating in chloroform solution forms yellowish-white prismatic crystals melting at 156—157° C. and on further treatment with bromine gives rise to dibromodithymoquinone which separates from organic solvents in garnet-red needles decomposing at 134° C.
—E. F. A.

Tartaric acid in wine lees, tartar, and other crude substances containing tartaric acid; Goldenberg's 1907 *method for the determination of* ——. Chem. Fabr. vorm. Goldenberg, Geromont and Co. Z. anal. Chem., 1908, **47**, 57—59.

As a result of communications with a number of chemists interested, the following modification of Goldenberg's method is put forward. At the next Internat. Congress of Applied Chemistry to be held in London, in 1909, the question of the determination of tartaric acid is to be discussed, and it is hoped that the method or some modification of it may then be adopted as an international basis for the determination of all crude materials containing tartaric acid. Six grms. of substances with a content of more than 45 per cent. of tartaric acid, or 12 grms. in other cases, are digested for 10 minutes with 18 c.c. of hydrochloric acid of sp. gr. 1·10. The mixture is then rinsed into a 200 c.c. flask and made up to the mark. After well shaking, the liquid is filtered through a dry folded filter into a dry vessel. 100 c.c. of the filtrate are transferred to a beaker of 300 c.c. capacity containing 10 c.c. of a solution of potassium carbonate (66 grms. K_2CO_3 per 100 c.c.), the mixture is boiled for 20 minutes, the whole rinsed into a 200 c.c. flask, cooled, made up to the mark, well shaken, and filtered through a dry folded filter. 100 c.c. of the filtrate are concentrated to 15 c.c., then treated gradually, with continuous stirring, with 3·5 c.c. of glacial acetic acid, and the stirring continued for 5 minutes longer. After 10 minutes, 100 c.c. of 95 per cent. alcohol are added, the whole well stirred for 5 minutes, and after a further 10 minutes, filtered with the aid of the pump, and the filter washed with alcohol till the washings are no longer acid. The filter and precipitate are now rinsed into a porcelain dish with 200 c.c. of hot water, heated to boiling, and titrated with $N/5$ alkali (standardised against pure potassium hydrogen tartrate) with neutral litmus paper as indicator. In order to allow for the volume of the insoluble matter of the material, 0·80 per cent. must be deducted from the result in the case of substances containing less than 45 per cent. of tartaric acid, 0·30 per cent. for substances containing 45—60 per cent., and 0·20 per cent. for substances containing 60—70 per cent. of tartaric acid.—A. S.

Patents.

Lactic acid; Preparation of pure ——. H. and F. Noerdlinger, Flörsheim, Germany. Eng. Pat. 26,415, Nov. 29, 1907. Under Int. Conv., Dec. 1. 1906.

Pure lactic acid can be prepared from technical lactic acid by a process of distillation with the aid of a current of an inert gas. The water is first expelled and then pure lactic acid passes over.—F. Shdn.

Chloral and esters of methylpropanol dialkamino acids; Derivatives of ——. Soc. Anon. des Etab. Poulenc Frères and E. Fourneau. Fr. Pat., 382,787, Dec. 17, 1906.

This invention relates to the production of compounds of chloral and alkylpropanol dialkamino acid esters of the general formula,

$$NR_2.CH_2.C(CH_3)(COOC_nH_{2n+1}).O.CH(OH).CCl_3.$$

When chloral is allowed to stand in contact with 3-dimethylamino-2-methyl-propane-ol acid ethyl ester, condensation takes place and a substance of the above type of constitution is produced. This boils at 140—142° C. at 22 mm., and crystallises from light petroleum in large quadrangular prisms melting at 66°—67° C., soluble in organic solvents, but insoluble in water. The hydrochloride crystallises in fine needles melting at 181°—182° C.—F. Shdn.

Camphor from pinene hydrochloride [chiefly from turpentine]; Preparation of ——. O. L. A. Dubosc. Fr. Pat. 382,790, Dec. 17, 1906.

The acetate, stearate, or phenate of sodium, potassium, calcium, barium, magnesium, or zinc, with an excess of either acetic or stearic acid, or phenol, and a dehydrant are shaken with the solid pinene hydrochloride. The borneol ester thus formed is removed by distillation and hydrolysed and oxidised in the usual manner to obtain camphor.—F. Shdn.

Formic acid; Decomposition of formates for the production of concentrated ——. Usines des Moulins, Soc. Anon. Fr. Pat. 382,339, Sept. 19, 1907. Under Int. Conv., Sept. 10, 1907.

Sulphuric acid is previously diluted with some liquid containing water, such as commercial formic acid and cooled. The heat of hydration of the acid is thus allowed to escape. The diluted sulphuric acid is then added to the formate in sufficient amount for the sulphuric acid to be neutralised, and the pure formic acid separated by distillation.—F. Shdn.

Hydrazine; Process for producing ——. F. Raschig, Fr. Pat. 382,357, Sept. 25, 1907. Under Int. Conv., Nov. 22, 1906, and June 6, 1907.

See Eng. Pat. 22,957 of 1907; this J., 1908, 91.—T. F. B.

Tetraalkyldiaminodiphenylmethanemonosulphonic acids; Process for preparing ——. Act.-Ges. f. Anilinfabr. Ger. Pat. 183,793, Feb. 22, 1905.

Formaldehyde is allowed to react with a mixture of molecular proportions of dimethylaniline (or diethylaniline) and dimethylaniline-*m*-sulphonic acid.—T. F. B.

Aromatic fluorine compounds from diazo- and tetrazo-compounds; Process for preparing —— by decomposition with concentrated hydrofluoric acid. Valentiner und Schwarz. Ger. Pat. 186,005, Oct. 1, 1905.

About 40 per cent. of the theoretical yield of aromatic fluorine compound is obtained by treating the azo compound with concentrated hydrofluoric acid in presence of ferric chloride. Other processes give yields of 6 to 20 per cent.—T. F. B.

Phenylthioglycollic acid; Process for preparing ——. Kalle und Co. Ger. Pat. 181,658, Nov. 1, 1905.

o-Diazobenzoic acid is treated with alkali polysulphides, and the thio-derivative thus obtained is converted into phenylthioglycol-*o*-carboxylic acid by treatment with chloracetic acid.—T. F. B.

Thiosalicylic acid (SH : COOH = 1 : 2); Process for preparing ——. L. Cassella und Co. Ger. Pat. 189,200, June 29, 1906.

Thiosalicylic acid is obtained by heating *o*-halogen derivatives of benzoic acid with alkali sulphydrates to a high temperature, preferably in presence of copper or a copper salt.—T. F. B.

Vanillin from guaiacol; Process for preparing —— by the action of hydrocyanic acid. Roesler. Ger. Pat. 189,037, Oct. 24, 1906.

Increased yields of vanillin (70 per cent. of the weight of guaiacol used) may be obtained by treating guaiacol with hydrocyanic acid, hydrochloric acid, and zinc chloride in presence of infusorial earth.—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Gelatin; Physical modifications of —— in presence of electrolytes and non-electrolytes. J. L. des Bancels. *See* XIV.

Patents.

Photographic emulsions, printing paper, and the obtainment of permanent photographs. J. de Ruiter, Bandveng, Java. Eng. Pat. 13,736, June 13, 1907.

See Fr. Pat. 380,502 of 1907; this J., 1908, 140.—T. F. B.

Photographic pictures and printing plates; Preparation of —— from colloid films by means of bichromate. W. Triepel. Fr. Pat. 380,775, Aug. 12, 1907. Under Int. Conv., Sept. 11, 1906.

See Eng. Pat. 19,889 of 1907; this J., 1908, 140.—T. F. B.

Photographic developers. Chem. Fabr. auf. Aktien vorm. E. Schering. Fr. Pat. 382,367, Sept. 27, 1907.

The condensation products of *p*-aminophenol with aromatic aldehydes can be readily reduced, for instance, by zinc dust in alkaline solution, to arylalkyl-*p*-aminophenols, $HO.C_6H_4.NHCH_2R$, which are of value as photographic developers. Their salts are stable in air, and are soluble in water. The bases themselves are sparingly soluble in water, and soluble in alcohol, ether, and alkali hydroxide solutions. The preparation of benzyl-*p*-aminophenol and of anisyl-*p*-aminophenol is described in detail.—T. F. B.

XXII.—EXPLOSIVES, MATCHES, &c.

Nitrocelluloses; Decomposition curves of some ——. O. W. Willcox. J. Amer. Chem. Soc., 1908, **30**, 271—281.

The author used the Obermüller apparatus in studying the decomposition of nitrocellulose (see this J., 1905, 347). The samples examined were "decanitrocelluloses" of about 12·60 per cent. nitrogen content and 99 per cent. solubility in ether-alcohol. The nitrocellulose was heated to 140° C. *in vacuo* and the pressure read off every 15 minutes. During the first four periods the gases were allowed to accumulate and exert pressure; after the first hour the gases were continually withdrawn during the odd periods, and allowed to accumulate during the even periods. Curves showing the relation between time and pressure are then given. For a nitrocellulose of good quality, the author finds that the curve after the end of the first hour ("constant initial pressure") shows a step-like character, being made up of several approximately horizontal portions connected by inclined straight lines.—F. Shdn.

Smokeless powder; Residue from —— and its effect on the formation of rust in guns. G. van Pittius. Proc. VI. Intern. Congress Appl. Chem., Rome, 2, 553.

For these experiments two explosives were used, (1) Nobel powder: 40 per cent. of nitroglycerin, 60 per cent. of nitrocellulose, and (2) a nitrocellulose powder, both in the form of graphited flakes. The charge of the former was 2·05 grms., and of the latter 2·4 grms. These powders were used in a 6·5 mm. gun which was washed after each 5 shots, 60 shots for each powder, and the washings united and examined. The solution from the Nobel powder was feebly alkaline, contained 5 mgrms. of insoluble matter (graphite and oxides of iron and copper). The soluble residue weighed 230 mgrms., being about 0·2 per cent. of the powder used. Analysis showed this residue to consist of potassium carbonate, 57 per cent.; potassium chloride, 38 per cent.; potassium antimoniate, 11 per cent.; and traces of iron and sulphate. Nitrates, nitrites, chlorates, cyanides, ferrocyanides, sulphides, and ammonia were absent. The solution from the nitrocellulose powder was faintly alkaline, contained an insoluble residue of 15 mgrms. (graphite, oxides of copper and iron and traces of antimony trisulphide). The soluble residue weighed 150 mgrms., being about 0·1 per cent. of the powder used. Analysis of the residue gave the following results: potassium ferrocyanide, 17 per cent.; ammonium carbonate, 17 per cent.; ferric chloride, 13 per cent.; potassium carbonate, 31 per cent.; calcium chloride, 10 per cent.; copper sulphate, 7 per cent.; potassium antimoniate, 5 per cent.; absent were nitrates, nitrites, chlorates, cyanides, and sulphides. The results of both analyses show that: (1) the residues contain no oxidising materials which could attack and rust the gun; (2) the residue from the nitrocellulose powder, on the contrary, contains reducing substances; (3) both residues contain carbonates, and are alkaline, showing that the rusting is not produced by free acids; (4) the antimony, sulphates, chlorides and the potassium came from the primer, the iron from the gun, the copper from the copper-nickel jacket of the bullet and the calcium from the powder, which contained traces of calcium carbonate. Experiments were made with different salt solutions to determine which salts produce most rusting. Pieces of a gun were immersed separately in the following solutions: calcium chloride, potassium chloride, potassium sulphate, potassium ferrocyanide, potassium hydrogen carbonate, and a mixture of potassium carbonate and potassium hydroxide, and suspended in a room as free as possible from acid vapours. These solutions produced rust in the following order: calcium chloride most, then potassium chloride, sulphate and ferrocyanide; the potassium hydrogen carbonate and the mixture of potassium carbonate and potassium hydroxide produced only a trace of rust. The chlorides therefore produce most rust on account of their hygroscopicity. Accepting the general belief that not the oxygen of the air directly, but the oxygen in the water in presence of carbon dioxide is the cause of rusting, these researches show that none of the residues from the powders are in themselves rust producers but become so after a time because they are hygroscopic and in contact with the air. To most effectively prevent rusting in guns they should be washed out immediately after each shot, or the bore should be greased.

Patent.

Nitroglycerine explosives; Method of making plastic ——. Rheinische Dynamitfabrik, Cöln, Germany. Eng. Pat. 1784, Jan. 23, 1907. Under Int. Conv., Feb. 10, 1906.

The explosive is made by adding an "auxiliary gelatin" to nitroglycerin explosives, more especially to gelatin-dynamite, the object of this addition being to render the explosives less dangerous to handle and more proof against fire-damp. The "auxiliary gelatin" is made with water, ammonium nitrate, starch or other amylaceous material, and some "drying salt" such as ammonium chloride.—F. Shdn.

XXIII.—ANALYTICAL CHEMISTRY.

INORGANIC—QUALITATIVE.

Sodium sulphite in the presence of sodium sulphate and thiosulphate; Detection of ——. F. E. Weston and C. W. Jeffreys. *See* VII.

INORGANIC—QUANTITATIVE.

Permanganate; Titration with —— in presence of hydrochloric acid. T. W. Harrison and F. M. Perkin. Analyst, 1908, **33**, 43—47.

As the result of their experiments the authors conclude that permanganate cannot be employed for exact titrations of solutions of ferrous salts, if the latter contain hydrochloric acid. It is shown that dilution up to a volume of 500 c.c. does not affect the sensitiveness if the solution be acidified with sulphuric acid alone, but that if hydrochloric acid be present, the quantity of permanganate required for the titration is increased and dilution appears to be disadvantageous. The addition of certain salts, such as potassium sulphate, magnesium sulphate, borax, sodium acetate, mercuric sulphate, manganous sulphate, and phosphoric acid, in order to retard the action of hydrochloric acid on permanganate, was without the desired effect except in the case of manganous sulphate. The retarding action of this salt was distinct, but the end reaction of the titration was somewhat obscured.

In the discussion which followed the reading of the paper, O. Hehner said that hydrochloric acid solutions of ferrous salts could be titrated accurately with permanganate if Fresenius's directions were followed. Fresenius operated in very dilute solutions, and added, after the titration, to the same liquid a second measured volume of the ferrous solution, titrated again with permanganate, and repeated this twice more, always in the same solution, taking only the figures obtained in the third and fourth titrations, which are constant whilst those of the first and second titrations are too high. The chlorine which is liberated by the action of the hydrochloric acid on the permanganate, and which in the first and second titrations causes an excessive consumption of permanganate, reaches equilibrium, and then no longer interferes. (See Loewenthal and Lenssen, Z. anal. Chem., 1861, 1, 329, 361). —W. P. S.

Silver and copper; Electrolytic separation of ——. H. W. Gillett. J. of Physical Chem., 1908, **12**, 26—27.

On account of the difference of 0·65 to 0·85 volt in the decomposition voltages of silver and copper in ammoniacal tartrate solutions, this electrolyte can be successfully employed for the analytical separation of these metals. With rapid rotation of the anode a current density of 0·45 ampère per sq. dm. can be employed at 70° C., and good adherent deposits of silver are obtained showing close concordance with the theoretical values. The copper is best determined subsequently in an ordinary sulphuric and nitric acid solution.—R. S. H.

Copper; Electrolytic determination of minute quantities of ——. E. E. Free. J. of Physical Chem., 1908, **12**, 28—29.

Employing a small platinum wire spiral as cathode, the author has successfully determined quantities of copper as small as 0·05 mgrm. About 25 c.c. of electrolyte are employed containing 2 to 4 per cent. of nitric acid and a few drops of sulphuric acid. Uniformly good deposits are obtained from solutions containing nothing but copper salts and acids; if, however, carbon (organic matter) or platinum are present in the solution, the deposit is black and loosely adherent, and re-precipitation of the metal is necessary.—R. S. H.

Manganese ; Detection and determination of traces of ——. Duyk. Ann. Chim. anal. appl., 1907, **12**, 465—466.

When a moderately alkaline 10 per cent. solution of potassium hypochlorite is boiled with a trace of a manganese salt, and then a drop of a 10 per cent. solution of cupric sulphate is added, a precipitate of cupric oxide is at first formed. On continuing the heating, the manganese is entirely dissolved, with the production of a fine violet colour in the supernatant liquid, due to the formation of potassium permanganate. The reaction is very sensitive ; the presence of 0·00025 grm. of manganese may be thus detected. The reaction will also serve for the colorimetric determination of manganese. —J. O. B.

Titanium ; Volumetric determination ——. H. D. Newton. Amer. J. Science, 1908, **25**, 130—132.

Titanic acid is reduced by zinc in an atmosphere of hydrogen, an excess of ferric sulphate is added and the ferrous sulphate formed estimated by titration with potassium permanganate. The reaction between the salts of iron and titanium takes place according to the following equation : $Ti_2(SO_4)_3 + Fe_2(SO_4)_3 = 2Ti(SO_4)_2 + 2FeSO_4$. The solution containing titanic acid in the presence of sulphuric acid is introduced into a flask of about 100 c.c. capacity fitted with delivery tube and separating funnel. A definite amount of zinc containing a known amount of iron is added, and the flask gently heated, an atmosphere of hydrogen being kept above the liquid until all the zinc is dissolved and the solution cooled. An excess of ferric chloride is then added through the separating funnel and the flask filled to the neck with cold, freshly distilled water. The contents of the flask are then poured into a litre flask containing more cold distilled water, and the whole titrated with $N/10$ potassium permanganate solution. —O. F. H.

Tungstic acid ; Separation of —— *from phosphoric acid.* G. von Knorre. Z. anal. Chem., 1908, **47**, 37—57.

Attempts to utilise the quantitative precipitation of tungstic acid by benzidine hydrochloride (this J., 1905, 292) for the separation of this acid from phosphoric acid, were not wholly successful, the benzidine phosphate not being easily enough dissolved to allow of more than an approximate separation. Good results were obtained, however, with tolidine hydrochloride, and this reagent is also to be preferred, in many cases, to benzidine hydrochloride for the determination of tungstic acid, as the precipitate filters well even without the addition of sulphuric acid such as is required in precipitating with benzidine hydrochloride. For the separation of tungstic and phosphoric acids, 300—400 c.c. of a dilute solution of the substance containing the two acids is treated with about 3 c.c. of hydrochloric acid of sp. gr. 1·12, then heated to boiling, and the tungstic acid precipitated with excess of tolidine hydrochloride solution (20 grms. of *o*-tolidine and 28 c.c. of hydrochloric acid of sp. gr. 1·12 per litre). After thorough cooling, the precipitate is filtered off, washed with a dilute solution of tolidine hydrochloride, and incinerated in a platinum crucible. The residue is fused with sodium carbonate, the cooled product dissolved and the precipitation repeated. The final precipitate, after washing, is dried and incinerated, and the resulting tungsten trioxide weighed.—A. S.

Iron vanadate ; Technical analysis of ——. A. M. Wilson. *See* X.

Phosphorus in steel ; Determination of ——. F. W. Hinrichsen. *See* X.

Tungsten and chromium in steel ; Determination of ——. F. W. Hinrichsen. *See* X.

Arsenic in ores ; Rapid method for the determination of ——. H. E. Hooper. *See* X.

Tungstic acid in tungsten ores ; Determination of ——. J. B. Ekeley and G. D. Kendall, jun. *See* X.

ORGANIC—QUALITATIVE.

Cholesterol ; Colour reaction of —— *due to oxidation.* J. Lifschütz. Ber., 1908, **41**, 252—255.

The characteristic colour reactions and absorption spectra obtained by the addition of concentrated sulphuric acid to a solution in glacial acetic acid of the first oxidation products of cholesterol may be used for the identification of that substance. The peroxides of organic acid radicals are excellent oxidising agents for the purpose. Thus, if a few mgrms. of cholesterol be dissolved in 2 to 3 c.c. of glacial acetic acid, and the solution boiled with a few particles of benzoyl peroxide, and treated, when cold, with 4 drops of concentrated sulphuric acid, a blue-violet or blue-green coloration appears at the bottom of the tube. On shaking the contents of the tube, the colour becomes violet-red, changing to blue (violet by transmitted light) and finally, after long standing, to green ; or it becomes green immediately. This difference depends upon the proportion of benzoyl peroxide used, and the consequent formation of the first oxidation product of cholesterol, the so-called oxycholesterol ester, $(C_{26}H_{43}O)_2O$, or of the further oxidation product, oxycholesterol, $C_{26}H_{44}O_2$. The sensitiveness of the reaction in a layer of 12 to 15 mm. is 1 : 10,000, and the test is thus less sensitive than Liebermann's cholestol reaction, though it has the advantages that the absorption spectrum (bands between C and *d* in the red) are plainly perceptible even in the presence of impurities (resins and hydrocarbons), and that there is no risk of by-reactions being caused by a rise of temperature. The new reaction may be used for the identification of oxycholesterol in animal organs. Oxidation of cholesterol by means of benzoyl peroxide is a much better method of preparing oxycholesterol than the old method of oxidation with permanganate. The "combined cholestol reaction" may be employed for the detection of unaltered cholesterol in the product. Thus the addition of an equal volume of acetic anhydride to the acetic acid solution of the oxycholesterol after the treatment with sulphuric acid causes an acceleration of the appearance of the last (green) stage with its characteristic absorption bands in the spectrum ; but if traces of unaltered cholesterol were also present, the colour and absorption spectrum of the oxycholesterol solution disappear in a short time, giving place to the coloration and totally distinct absorption spectrum of Liebermann's cholestol reaction.—C. A. M.

Salicylic aldehyde intended for use in Komarowsky's reaction [for detection of fusel oil in spirit] ; Examination of ——. H. Kreis. Chem.-Zeit., 1908, **32**, 149.

The author has had his attention drawn to the fact that samples of so-called pure salicylic aldehyde are on the market which are not suitable for carrying out Komarowsky's reaction (see this J., 1903. 1017, 1259). He therefore gives the following simple methods of ascertaining the suitability of a particular specimen of the aldehyde for the purpose. If alcohol free from fusel oil is available, the best way is to perform a blank test with the salicylic aldehyde. In other cases, three drops of the salicylic aldehyde solution are mixed with ten drops of concentrated sulphuric acid. Pure salicylic aldehyde gives a light orange-red colour, whilst impure specimens give more or less dark brownish-red colours. On the further addition of 5 c.c. of 95 per cent. alcohol, the pure aldehyde yields a colourless liquid, whilst impure preparations give red solutions.—A. S.

Milk ; Rapid determination of potassium bichromate in ——. Gouère. *See* XVIII*A*.

ORGANIC—QUANTITATIVE.

Extracts [of malt] ; Determination of ——. G. C. Jones. *See* XVII.

Diastatic power ; Determination of —— *by Lintner's method.* G. C. Jones. *See* XVII.

Benzene in illuminating gas ; Determination of ——. L. M. Dennis and S. S. McCarthy. *See* II.

Tungstic acid in tungsten ores ; Determination of ——. J. B. Ekeley and G. D. Kendall, jun. *See* X.

Water ; Determination of —— *in skins and leather.* P. Nicolardot. *See* XIV.

Starch ; Polarimetric determination of ——. E. Ewers. *See* XVI.

Starch in barley ; Polarimetric determination of ——. O. Wenglein. *See* XVI.

Tartaric acid in wine lees, tartar, and other crude substances containing tartaric acid ; Goldenberg's 1907 *method for the determination of* ——. *See* XX.

XXIV.—SCIENTIFIC & TECHNICAL NOTES.

Pyridine bases as halogen carriers ; Use of ——. W. E. Cross and J. B. Cohen. Chem. Soc. Proc., 1908, **24**, 15.

The authors have shown that the process of halogen substitution in the case of aceto-*p*-toluidide and other amides is preceded by the formation of additive compounds (Chem. Soc. Proc., 1907, **23**, 326), but attempts to effect substitution in a similar manner by means of the additive compounds of the pyridine bases with bromine, failed.

The result, however, suggested the possibility of employing these bases as halogen carriers, an anticipation which has been confirmed by the following experiments :—*Chlorobenzene.*—Chlorine was passed into 50 grams of benzene containing a few drops of pyridine, and the mixture was warmed to 50°. The action proceeded rapidly with evolution of hydrogen chloride. The product was shaken with alkali, dehydrated, and distilled. Some unchanged benzene and a little dichlorobenzene were separated. The yield of pure chlorobenzene was 30 grams. *Chlorotoluenes.*—The chlorination proceeds at the ordinary temperature. From 43 grams of toluene, 25 grams of mixed chlorotoluenes were obtained, b.p. 150—165°, together with a few grams of higher boiling products. *Bromobenzene.*—A few drops of pyridine were added to a mixture of 50 grams of benzene and 120 grams of bromine, which were warmed to 25° in the water-bath. The action proceeds vigorously with the evolution of hydrogen bromide. The temperature was finally raised to 65—70°. The crude product, which boiled at 148—158°, amounted to 60 grams. The same result was produced with quinoline and *iso*-quinoline. *Dibromobenzene.*—The *p*-dibromo-compound was obtained in a similar manner. From 33 grams of bromobenzene, 20 grams of the para-compound, m. p. 87°, were obtained, the remainder being unchanged bromobenzene. No ortho-compound was detected. *Bromotoluene.*—Fifty grams of toluene yielded 87 grams of bromo-toluene, b. p. 178—182°. 4-*Chloro*-1-*bromotoluene.*—Fifty-five grams of *p*-chlorotoluene gave 56 grams of chlorobromotoluene, b. p. 220—235°, and a small quantity of lower and higher boiling products. *a-Bromonaphthalene.*—The *a*-compound was prepared by dissolving 25 grams of naphthalene in 100 c.c. of chloroform and adding 36 grams of bromine and a few drops of pyridine. The mixture was left in the cold for twenty-four hours. After purification, 35 grams of *a*-bromonaphthalene were obtained, b. p. 276—278°.

Sulphur on hydrocarbons ; Action of ——. G. Capelle. Bull. Soc. Chim., 1908, **3**, 150—154.

Acetylene, carefully purified and dried, was passed over the surface of melted sulphur in a retort. The retort was heated till there was a slight glow, when the heating was discontinued. The products of the reaction were collected in a flask containing carbon bisulphide. On fractionation, thiophthene, $C_6H_4S_2$, was obtained as an oil boiling at 225° C. This was confirmed by the formation of the picric acid compound, $C_6H_4S_2,C_6H_2(NO_2)_3OH$, melting at 134° C. The thiophthene remained liquid at —10° C., but it was solidified by using a mixture of solid carbon dioxide and ether, and formed small groups of radiating needles.—F. Shdn.

Complex chemical compounds ; Decomposition of —— *in a vibrating magnetic field.* J. Rosenthal. Sitzungsber. Kgl. Pr. Akad. Wiss. Berlin, 1908, 20—26.

If an electric current be passed through a solenoid, and an electrolytic interruptor interposed in the circuit, or if a solenoid be brought into the secondary circuit of a flame arc with an alterable self-inductance and a "capacity," then at a current strength of 5—10 ampères, vibrations are produced which exert a chemical action on complex substances brought within the solenoid. For each substance a definite frequency is required for chemical action to be induced ; in the case of starch the requisite frequency is 440—480 vibrations per second. Similar effects are obtained whether an interrupted direct current or an alternating current be employed. When subjected to this action starch paste is gradually liquefied, loses its power of giving a reaction with iodine, becomes capable of dissolving cupric hydroxide, and finally shows strong cupric-reducing power. The starch molecule thus undergoes a hydrolytic decomposition quite similar to that caused by diastatic ferments. In an analogous manner, proteins are split up into albumoses and peptones.—A. S.

Peroxydase ; The active —— *in tyrosinase.* A. Bach. Ber., 1908, **41**, 216—220. (Compare this J., 1906, 649.)

The colour of the black oxidation product formed by the action of vegetable tyrosinase on tyrosine can be discharged by dilute potassium permanganate in sulphuric acid solution. This affords a simple and accurate volumetric method of following the action of the ferment. In suitable dilution, hydrogen peroxide has no influence on freshly prepared normal tyrosinase. On older preparations, however, the addition of hydrogen peroxide has a markedly favourable influence, and this is greater the weaker the activity of the original ferment solution. This loss of activity is due to the partial destruction of the oxygenase which can be replaced by hydrogen peroxide. On shaking the fungus extract with magnesium carbonate, a partial separation of the peroxydase from its oxygenase is achieved, as the magnesium carbonate retains far more peroxydase than oxygenase. When extracted with water after drying, the precipitate gives an extract which on the addition of hydrogen peroxide is active towards tyrosine. Precipitation with methyl alcohol gives a similar partial separation. The peroxydase contained in tyrosinase remains almost unaltered on keeping, whereas the corresponding oxygenase vanishes. —E. F. A.

Tyrosinase ; Nature of action of ——. A. Bach. Ber., 1908, **41**, 221—225.

The action of tyrosinase (from *Russula delica*) on tyrosine was followed by titration with dilute potassium permanganate in presence of sulphuric acid (see foregoing abstract). The quantity of tyrosine changed increases with the amount of ferment but more slowly than this, whilst the reaction ceases sooner in more concentrated ferment solutions. For equal amounts of change the product of ferment concentration and time is a constant in accordance with mass action, provided the middle part of the change is studied. An increase of tyrosine proportionately increases the amount changed by a given quantity of ferment. This holds both for the initial and middle stages ; subsequently the ferment itself becomes affected and this takes place the more rapidly the greater the concentration of ferment substance acted upon.—E. F. A.

Peroxydase ; Behaviour of —— *towards light.* A. Bach. Ber., 1908, **41**, 225.

Under the combined influence of oxygen and light there is a gradual decrease in the activity of peroxydase which in general is to be regarded as one of the most stable enzymes.—E. F. A.

Oxidation ferments ; Nitrogen content of ——. A. Bach. Ber., 1908, **41**, 226—227.

A peroxydase preparation from horse-radish, purified by solution in water and precipitation with alcohol, yielded ammonia and pyrrole when heated with potassium.

To ensure the detection of nitrogen in oxidising ferments the test must be made with a fair quantity of metallic potassium, not sodium.—E. F. A.

Tyrosinase and racemic tyrosine. G. Bertrand and M. Rosenblatt. Compt. rend., 1908, **146**, 304—306.

Racemic tyrosine is completely converted into melanine by tyrosinase; throughout the change there is no preferential oxidation of *d*- or *l*-tyrosine. It is shown that ordinary tyrosinase is not a mixture in equal quantities of two enantiomorphous tyrosinases but a single enzyme which is capable of oxidising a number of substances containing a phenolic hydroxyl without the nature or even the absence of the lateral chain affecting its activity. —E. F. A.

The National Physical Laboratory.

The report of the committee appointed by the Treasury "to inquire generally into the work now performed at the National Physical Laboratory, together with a Treasury Minute, dated February 1, 1908, recording their lordships' approval of the recommendations contained in the report of the majority of the committee," has been issued as a Parliamentary paper [Cd. 3926].

The committee, after endorsing the opinion of the committee of 1898 as to the value to both science and industry of the testing and verification of instruments of precision carried on at Kew, state that the great bulk of the time of the staff at Bushy House Laboratory is occupied in research and the maintenance of standards, and in the installation of apparatus connected therewith; and they are of opinion that the work proper for a National Physical Laboratory to undertake was correctly laid down, so far as the main lines were concerned, by the committee of 1898, and that this work should include not only physical research directly or indirectly bearing on industrial problems, and the standardisation and verification of instruments, but also—under proper restrictions—the testing of materials.

A considerable amount of evidence was taken and a marked divergence of opinion was disclosed on two subsidiary points to which the committee's attention was specially directed by the Treasury Minute—namely, (1) the possibility that the mechanical, physical, and chemical tests actually undertaken by the laboratory may interfere unduly with private enterprise; and (2) the desirability of publishing the results of all such testing work. The evidence received by the committee showed that private testing establishments, and also professional analysts who are in the habit of adding engineering tests to chemical analyses, were beginning to look on the policy they attributed to the laboratory as a serious menace to their interests. The committee are disposed to regard these fears as exaggerated, but they cannot regard them, in view of the diverse interpretation placed upon the report of 1898, and of the important additions recently made to the equipment of the laboratory, as unreasonable or wholly without foundation. Before stating their conclusions on this point, the committee distinguish "commercial testing" into "contractual" and "investigatory" testing—"contractual" testing being the ordinary testing of materials to ascertain whether their quality and behaviour are in accordance with the requirements of contracts; "investigatory" testing the investigation for commercial purposes of various substances in which no question of contract arises. They are of opinion that to place restrictions upon "investigatory" testing would be to hinder the advance of knowledge, and they sum up their conclusions on this point thus:—

"We think that the laboratory should remain absolutely free with regard to 'investigatory testing,' but that no public harm would ensue, while the case of those representing private testing establishments would be substantially met, if as a general rule it were debarred from undertaking 'contractual testing' as above defined. We therefore recommend this restriction, subject, however, to the following exceptions:—There are some tests, chiefly electrical, thermal, optical, and other physical tests, which cannot be carried out adequately, if at all, in any existing private establishment. In such cases it would obviously be absurd to debar the laboratory from undertaking the work merely on the ground that the tests are intended to ascertain whether certain materials comply with the requirements of a contract. In the second place, no restriction should apply to 'reference' testing wherever, in cases of dispute, the parties concerned agree to refer their differences to the authoritative decision of the laboratory, or where the laboratory is called in by a Court of law or of arbitration. Lastly, in view of the character of the laboratory as a public institution. we think it ought to be free to accept any work which any Government Department may desire to commit to it. In this category we include the work until lately carried out at Cooper's Hill on behalf of the Indian Government. Reference testing, for the settlement of disputes, would not, in our opinion, involve any undue interference with the work of outside agencies; while as to Government work, it is improbable that much of this would in any circumstances find its way to private testing establishments. As an additional safeguard against injurious competition with private enterprise, we think, wherever the same tests of materials are carried out both by the laboratory and by outside agencies, care should be taken that the fees charged by the former should be at least as high as those normally current. In the case of reference testing we think they should be distinctly higher. . . ."

On the question of the publication of all testing work conducted at the laboratory the committee are of opinion that the executive committee of the laboratory should hold themselves somewhat freer than heretofore to exercise a discretion as to the withholding of results from publication, either wholly or in part, for a limited number of years, but they also think that in cases where publication is thus deferred a considerably higher fee should be charged to the persons for whose immediate benefit the investigation is to be carried out. The committee further recommend that the sub-committees of the laboratory should be kept up to date and in close touch with the executive committee, and conclude:—

"Subject to these observations, we do not consider that any alteration is required in the scope of the work of the National Physical Laboratory as defined by the committee of 1898."

The report is signed by all the members of the committee, but Sir Andrew Noble and Sir J. Wolfe Barry add the following note:—"We are of opinion that the restriction which we have recommended in respect of 'contractual testing' should come to an end after a definite time. A restrictive period of ten years would, we think, adequately meet the case presented to us on behalf of private testing establishments, and would safeguard the interests of the public, which will be best served by leaving the authorities entrusted with the administration of the National Physical Laboratory completely free (as is the case in the national laboratories of Germany) to exercise their discretion in accepting or refusing any description of testing work."

The Treasury Minute of February 1 records that "my lords approve of the recommendations contained in the report of the majority of the committee. They learn that the president and council of the Royal Society accept in principle the recommendations contained in the report of the committee, and that the executive committee of the National Physical Laboratory have expressed their readiness to use their best endeavours to carry the recommendations into effect."

Trade Report.

Straits Settlements; Export trade of ——. Board of Trade J., Feb. 20, 1908.

The Registrar of Imports and Exports at Singapore states that the exports from Singapore and Penang of

Straits produce to the United Kingdom, the Continent of Europe, and the United States of America during the years 1906 and 1907, were :—

	1906.	1907.
	1000's of pikuls.	1000's of pikuls.
Tin	961	883
Gambier*	560	488
Copra	679	955
Gutta percha*	45	51
Borneo rubber	35	26
Para rubber	5·6	12
Gum copal*	151	168
Hides, raw	59	55
Sugar†	103	185

NOTE.—Pikul = 133⅓ lb. * Exports from Singapore only. † Sugar is shipped entirely from Penang.

New Books.

THERMODYNAMICS OF TECHNICAL GAS-REACTIONS. SEVEN LECTURES BY DR. F. HABER, o. Professor at the Tech. Hochschule, Carlsruhe. Translated by ARTHUR B. LAMB, Ph.D. Longmans, Green, and Co., 39, Paternoster Row, London, New York, Bombay, and Calcutta. 1908. Price 10s. 6d.

8vo volume, containing 346 pages of subject matter, with 20 illustrations, and alphabetical indexes of subject matter and names of authors. The subjects of the seven lectures in question, are the following :—I. The latent heat of chemical reaction and its relation to reaction energy. II. Entropy and its significance in gas reactions. III. Another derivation of the formula previously obtained, and its bearing on reactions between solids. IV. Examples of reactions which proceed without a change in the number of molecules. V. Some examples of reactions involving a change in the number of molecules. VI. Determination of the specific heats of gases. VII. Determination of gaseous equilibria, with a theoretical and technical discussion of related questions.

THE CHEMISTRY OF THE DIAZO-COMPOUNDS. By JOHN CANNELL CAIN, D.Sc., Editor of the Publications of the Chemical Society. Edward Arnold, London. 1908. Price 10s. 6d.

THIS volume, of 8vo size, containing 168 pages of subject matter with indexes of subjects and names, is dedicated to the memory of Johann Peter Griess, in this, the 50th anniversary of the discovery of the diazo-compounds (1858—1908). The contents of the volume are classified as follows :—I. Preparation of the diazo-compounds. II. Mechanism of the diazotising process. III. Reactions of the diazo-compounds. IV. Action of various reagents on diazo-compounds. V. Formation of diphenyl derivatives in the diazo-reaction. VI. Interchange of groups in diazo-compounds. VII. Action of light on diazo-compounds. VIII. Diazoamino-compounds. IX. Azo-compounds. X. Metallic diazo-derivatives. Diazo-hydroxides. XI. Diazo-compounds of the aliphatic series. XII. Constitution of the diazo-compounds. XIII. Constitution of the diazo-salts after 1894. XIV. Other views of the constitution of diazo-compounds from 1895. XV. Review of the various theories of the diazo-compounds to 1907. XVI. New theory of the constitution of the diazo-compounds.

BENEDIKT-ULZER. ANALYSE DER FETTE UND WACHSARTEN. Fünfte, umgearbeitete Auflage, unter Mitwirkung von E. BADERLE, G. BUCHNER, H. BULL, J. GALATZER, K. GLAESSNER, J. KLAUDY, J. NEUDÖRFER, F. WALLENSTEIN, and M. WEGER, bearbeitet von FERD. ULZER, P. PASTROVICH, und A. EISENSTEIN. Julius Springer's Verlag., Moubijouplatz, 3, Berlin. N. 1908. Price M.26.

8vo volume, containing 1141 pages of subject matter, with 113 illustrations, and alphabetical indexes of subjects and names of authors. The subject matter is subdivided as follows :—I. General analysis of fats and waxes, and investigation of the technical products of the fat industry. II. Materials and products of the fat industry. III. Natural fats and waxes and their investigation. IV. Identification according to their chemical and physical properties. V. Distinguishing animal and vegetable oils. VI. Description and investigation of the natural fats and waxes. VII. Identification and quantitative determination of such foreign admixtures as may be present dissolved in the fat, or have been melted up with it. VIII. Vegetable fats and oils. (i.), Drying oils. (ii.), Semi-drying oils. (iii.), Non-drying oils. (iv.), Solid fats. IX. Animal fats and oils. (i.), True animal oils. (ii.), Fish oils. (iii.), Solid animal fats. X. Waxes. (i), Vegetable waxes. (ii.), Animal waxes. (i.), Liquid animal waxes. (ii.), Solid animal waxes.

THERMOCHEMISTRY. By JULIUS THOMSEN, Emeritus Professor of Chemistry, University of Copenhagen. Translated from the Danish by KATHERINE A. BURKE. Longmans, Green, and Co., 39, Paternoster Row, London, New York, Bombay, and Calcutta. 1908. Price 9s.

8vo volume, containing 474 pages of subject matter with 8 illustrations, and an alphabetical index. The treatment of the entire subject may be gathered from the following excerpt of contents :—I. OBJECT OF THERMOCHEMICAL RESEARCH. Experimental calorimetric methods. II. Formation and properties of aqueous solutions. Absorption of gases and solution of liquids and solids in water. Heats of solution of partially dehydrated salts, their heats of hydration, and constitution. III. Influence of the amount of water upon the heat of solution. Heat of dilution of aqueous solutions. IV. Neutralisation of acids. Neutralisation of bases, together with single and double decompositions. V. Partial decomposition. VI. Influence of temperature upon the magnitude of the thermal effect of chemical processes. VII. COMPOUNDS OF NON-METALS. Methods of investigation and theoretical results. Comparative tables of the numerical results. VIII. COMPOUNDS OF METALS WITH NON-METALS. Oxides, hydroxides, halides, salts, sulphides, etc. IX. Systematic review of the numerical researches on compounds of the metals. X. Nature of chemical reactions regarded from the dynamical standpoint. XI. ORGANIC SUBSTANCES. Heats of combustion of volatile organic substances. XII. Theoretical investigation of the thermal phenomena of volatile organic substances, and their dependence upon the molecular constitution. XIII. Formation and decomposition of organic compounds regarded from the dynamical standpoint.

NOTES ON THE PATENTS AND DESIGNS ACT, 1907. Lloyd Wise and Co., 46, Lincoln's Inn Fields, London, W.C. 1907. Price 1s.

THE provisions of the Patents and Designs Act, 1907, which came into operation on the 1st Jan., 1908, and involving certain important alterations in the English patent law, are here set forth.

STATISTICAL ABSTRACT FOR THE BRITISH EMPIRE IN EACH YEAR FROM 1892 TO 1906. FOURTH NUMBER [Cd. 3893]. Wyman and Sons, Fetter Lane, London, E.C. Price 1s. 1d.

THIS publication contains statistics of the trade of each portion of the Empire with foreign countries and with other portions of the Empire, figures as to the shipping of the Empire, and statements as to the production of coal, iron, diamonds, gold, silver, copper, tin, cereals and other food-stuffs, rubber, cotton, jute, wool, and live stock, and of the consumption of various staple articles. Particulars are also given of the area and population of the Empire and the British Protectorates. In the present number particulars as to imports and exports are given in greater detail.

BULLETIN OF THE IMPERIAL INSTITUTE. VOL. V., No. 4, 1907. Price 1s.

THIS issue of the Bulletin contains reports on recent investigations made in the Scientific and Technical Department of the Imperial Institute regarding tanning materials from India, the Colonies and other sources ;

cocoa from the Gold Coast: "Nsa-Sana" seeds from Southern Nigeria; Para rubber from Mergui, Burma; *Cryptostegia grandiflora* rubber from India; jute substitutes from the Nyasaland Protectorate; and materials for cement manufacture from Trinidad; as well as general notices respecting economic products and their development.

Patent List.

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

Applications.

3738. Von Michalkowski. *See under* II.

3786. Muller. Filtering vessel.* Feb. 19.

4053. Bock. Method of crystallisation. [Belg. Appl., Jan. 30, 1908.]* Feb. 22.

4123. Wilson. Firing rotary or like kilns or furnaces.* Feb. 24.

4142. Foniakoff. Agglomeration of finely-divided substances.* Feb. 24.

4491. McNeil and McNeil. Apparatus for drying or roasting pulverulent or granular material. Feb. 28.

4540. Hawes. Obtaining dry products from liquids and semi-liquids. Feb. 28.

Complete Specifications Accepted.

1473 (1907). Hodder. Apparatus for raising liquids. Feb. 26.

19,780 (1907). Artmann. Rectifying column. Feb. 26.

II.—FUEL, GAS, AND LIGHT.

Applications.

3738. Von Michalkowski. Drying peat and similar materials.* Feb. 19.

3785. Laigle. Filaments for incandescent mantles. [Fr. Appl., Oct. 11, 1907.]* Feb. 19.

4266. Parker. *See under* III.

4461. Michaud and Delasson. Manufacture of filaments for illuminating and heating. [Fr. Appl., June 10, 1907.]* Feb. 27.

4492. Blakeley. Producer gas plants. Feb. 28.

4529. Maly. Gas generators.* Feb. 28.

Complete Specifications Accepted.

4067 (1907). Parker. Retorts for distilling coal and other carbonaceous substances. Feb. 26.

5793 (1907). Farnham. Generator for suction gas plant for use with bituminous or other coal. Feb. 26.

6500 (1907). Ellis (Paterson). Production of gas from hydrocarbon oils. March 4.

8066 (1907). Keough. Retorts for making oil gas. Feb. 26.

8293 (1907). Tully. Apparatus for making gas. Feb. 26.

9136 (1907). Hassman and Puterbaugh. Artificial fuel. Feb. 26.

9859 (1907). Love. Gas retorts. March 4.

19,530 (1907). Assmann, and Stellin Gaswerke Ges. Air gas apparatus. March 4.

23,097 (1907). Oberbayerische Kokswerke und Fabr. Chem. Prod. Kiln for coking peat, lignite, and wood. March 4.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

Applications.

3720. Marriott. Treatment of natural pitch, asphalt, or bitumen. Feb. 19.

3901. Dyes (Hempel). Manufacture of ketones, especially acetone. Feb. 21.

4266. Parker. Apparatus for destructive distillation of coal and other carbonaceous substances. Feb. 25.

IV.—COLOURING MATTERS AND DYESTUFFS.

Applications.

3628. Wiegand and Rieder. *See under* XIV.

3655. Chem. Fabr. Griesheim-Elektron. Manufacture of aminonaphtholdisulphonic acid. [Ger. Appl., Feb. 18, 1907.]* Feb. 18.

3875. Bloxam (Act.-Ges. f. Anilinfabr.) Manufacture of *p*-phenylenediamine, its homologues and derivatives. Feb. 20.

3966. Bloxam (Act.-Ges. f. Anilinfabr.). Manufacture of aniline, its homologues and derivatives. Feb. 21.

4044. Bloxam (Act.-Ges. f. Anilinfabr.). Manufacture of *p*-aminophenol, its homologues and substitution products. Feb. 22.

4141. Johnson (Badische Anilin und Soda Fabrik). Manufacture of anthracene dyestuffs. [Addition to No. 16,775 of 1907.] Feb. 24.

4423. Newton (Bayer und Co.). Manufacture of indigo compounds and their leuco derivatives. Feb. 27.

4541. Imray (Meister, Lucius, und Brüning). Manufacture of dyestuffs containing sulphur. Feb. 28.

Complete Specifications Accepted.

3929 (1907). Lake (Curatorium der G. and F. Speyerschen Studienstiftung). Preparation of diazo and azo compounds of aromatic amides which contain the residue of arsenic acid. March 4.

8729 (1907). Bloxam (Act.-Ges. f. Anilinfabr.). Manufacture of red azo dyestuffs. Feb. 26.

13,428 (1907). Chem. Fabr. vorm. Weiler ter Meer. Manufacture of indophenol-like products. March 4.

15,607 (1907). Meister, Lucius, und Brüning. Manufacture of brown vat dyestuffs. March 4.

19,479 (1907). Johnson (Badische Anilin und Soda Fabrik). Manufacture of azo colouring matters. March 4.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

Applications.

3751. Johnson (Badische Anilin und Soda Fabrik). Producing reserve effects on fabrics in dyeing with sulphur colouring matters. Feb. 19.

4295. Shaw, and Whitefield Velvet and Cord Dyeing Co., Ltd. Dye jiggers or dyeing apparatus. Feb. 26.

4586. Brintons, Ltd., and Osborne. Apparatus for dyeing, washing, or bleaching yarns and slubbing. Feb. 29.

4624. Fowler. Dyeing and dyes for use therein. Feb. 29.

Complete Specifications Accepted.

3645 (1907). Schneider. Treatment of vegetable fibres or fabrics to produce varying effects in dyeing. Feb. 26.

4963 (1907). Hall and Brandt. Machines for scouring, bleaching or dyeing fibrous materials. March 4.

5016 (1907). Cross and Briggs. Textile products obtained with cotton or other celluloses. March 4.

5612 (1907). Kammerer. Treatment of wool, woollen goods, mixed goods, or union fabrics with oxidising agents. Feb. 26.

6152 (1907). Schneider. Dyeing wool and woollen fabrics. Feb. 26.

13,948 (1907). Imray (Soc. Chem. Ind. in Basle). Dyeing with sulphurised dyestuffs cotton mixed with wool or silk. March 4.

16,655 (1907). Albert. Dyeing or printing warps, yarns, or fabrics by means of a vacuum. Feb. 26.

18,312 (1907). Wallach. Concentrating dilute lyes in connection with mercerising processes. March 4.

24,978 (1907). Imray (Soc. Chem. Ind. in Basle). Printing sulphurised dyestuffs. March 4.

VII.—ACIDS, ALKALIS, AND SALTS.

Applications.

23,217A (1907). Johnson (Verein Chem. Fabr.). Manufacture of sodium carbonate and hydrogen sulphide from sodium sulphide.* Feb. 18.

23,217B (1907). Johnson (Verein Chem. Fabr.). Manufacture of anhydrous, pulverulent sodium hydrosulphide.* Feb. 18.

23,217C (1907). Johnson (Verein Chem. Fabr.). Manufacture of anhydrous, pulverulent thiosulphate.* Feb. 18.

3685. Place. Apparatus for liquefying air.* Feb. 18.

3740. Ward, and Barnstone Blue Lias Lime Co. Lime kilns. Feb. 19.

3902. Dyes (Hempel). Manufacture of calcium oxalate. Feb. 21.

3903. Dyes (Hempel). Manufacture of nitrites. Feb. 21.

3904. Dyes (Hempel). Manufacture of oxalic acid. Feb. 21.

4090. Dyes (Hempel). Manufacture of nitrates. Feb. 24.

4091. Dyes (Hempel). Manufacture of tungstic acid. Feb. 24.

4471. Haase. Obtaining alkali formates and hydrate of alumina. [Ger. Appl., March 15, 1907.]* Feb. 27.

Complete Specifications Accepted.

1625 (1907). Van Berckelaer. Separating cadmium from zinc sulphate in the manufacture of the same. March 4.

8643 (1907). Chem. Werke F. Friedlaender. Manufacture of insoluble organic aluminium salts. Feb. 26.

10,225 (1907). Hall, and Hull and Liverpool Red Oxide Co. Apparatus for treating waste zinc liquid with hydrogen sulphide. Feb. 26.

19,988 (1907). Grossmann. Treatment of ammonia liquors before and after distillation. Feb. 26.

VIII.—GLASS, POTTERY, AND ENAMELS.

Application.

3801. Tyrer. Manufacture of pottery, earthenware, fireclay ware, and metal enamelled ware. Feb. 20.

Complete Specification Accepted.

8687 (1907). Lovatt, Lovatt, and Lovatt. Decorating or finishing earthenware or pottery. Feb. 26.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Applications.

4117. Brase. Preservation of wood.* Feb. 24.

4579. Laverty. Continuous kilns for bricks, &c. Feb. 29.

Complete Specification Accepted.

4530 (1907). Cowper-Coles. Making cement from blast furnace slag. Feb. 26.

X.—METALS AND METALLURGY.

Applications.

7223A (1907). New Delaville Spelter Co., and Shortman. Extraction of zinc. Feb. 18.

3651 and 3652. Casterline. Hardening and tempering steel.* Feb. 18.

3680. Hiorth. Reducing ores, especially iron ores. [Appl. in Norway, Feb. 21, 1907.]* Feb. 18.

3982. Painter. Hardening steel.* Feb. 21.

4052. Herrenschmidt. *See under* XI.

4385. Bauer. Producing gilded and silvered surfaces. [Ger. Appl., March 7, 1907.]* Feb. 26.

4424. Harbord. Drying blast for metallurgical furnaces. Feb. 27.

4644. British Thomson-Houston Co. (General Electric Co.). Reduction of metallic compounds. Feb. 29.

4647. Goldschmidt and Goldschmidt. Manufacture of calcium-silicium. [Ger. Appl., May 18, 1907.]* Feb. 29.

4648. Defries. Purifying molten metals. Feb. 29.

Complete Specifications Accepted.

3981 (1907). Cowper-Coles. Zinc and aluminium alloys. Feb. 26.

4912 (1907). Mallmann. Crucible furnaces. Feb. 26.

5100 (1907). Côte and Pierron. *See under* XI.

8543 (1907). Galbraith. Producing metal for use in making malleable iron castings. March 4.

12,591 (1907). Imbert. Treatment of sulphurous ores by the precipitation process. March 4.

12,592 (1907). Imbert. Treatment of oxidised zinc ores by the precipitation process. March 4.

21,595 (1907). King's Norton Metal Co., Smith, and Brownsdon. Obtaining copper from copper ores and residues. March 4.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

Applications.

4052. Herrenschmidt. Processes of melting in electric furnaces and their application to the extraction of metals. [Fr. Appl., Feb. 23, 1907.]* Feb. 22.

4410. Gibbs. Production of metallic articles by electro-deposition. Feb. 27.

Complete Specifications Accepted.

28,638 (1906). Gin. Application of induction furnaces. Feb. 26.

5100 (1907). Côte and Pierron. Electric furnace for continuous extraction of zinc from ores. Feb. 26.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

Complete Specification Accepted.

25,276 (1907). Lindemann (Gebr. Körting). Manufacture of soap powder. March 4.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(*A.*)—Pigments, Paints.

Application.

3883. Hardingham (Pepin). Manufacture of artificial ultramarine. Feb. 20.

(*B.*)—Resins, Varnishes.

Application.

4546. Meyer. Preparation of substitutes for shellac.* Feb. 28.

(*C.*)—India-Rubber.

Applications.

3572. Wallace and Reynaud. Manufacture of india-rubber and products similar thereto. Feb. 17.

4147. Grognot. Manufacture of indiarubber substitutes. [Belg. Appl., April 16, 1907.]* Feb. 24.

4442. Watson. Manufacture of balata. Feb. 27.

4484. Gare. Manufacture of hard rubber or ebonite. Feb. 28.

Complete Specifications Accepted.

4268 (1907). West. Treatment of vulcanised india-rubber. March 4.

4510 (1907). Norzagaray. Apparatus for treating rubber. March 4.

XIV.—TANNING, LEATHER, GLUE, SIZE, &c.

Applications.

3628. Wiegand and Rieder. Drawing the extractive matter from tannic materials, dye-wood, beet, etc. [Ger. Appl., Feb. 23, 1907.]* Feb. 18.
3956. Schmiedel. Adhesive materials. [Ger. Appl., Feb. 26, 1907.]* Feb. 21.
4202. Nodon. Leather substitute. [Fr. Appl., May 13, 1907.]* Feb. 25.
4358. Redlich and Pollak. Manufacture of quebracho extract.* Feb. 26.
4536. Woosnam (Oesterr. Pluviusin A.-G.). Manufacture of artificial leather. Feb. 28.
4627. Fairweather (Hartmann). Production of imitation leather.* Feb. 29.

Complete Specifications Accepted.

6216 (1907). Guilleteau. Manufacture of artificial leather. March 4.
13,879 (1907). Aslanoglou. Preparation for use in tanning. Feb. 26.

XVI.—SUGAR, STARCH, GUM, &c.

Applications.

3628. Wiegand and Rieder. *See under* XIV.
4515. Rivière. Manufacture and use of molasses freed from potash. [Fr. Appl., Feb. 28, 1907.]* Feb. 28.

XVII.—BREWING, WINES, SPIRITS, &c.

Application.

4622. Kuhn. Manufacture of fermented beverages, Feb. 29.

Complete Specification Accepted.

16,995 (1907). Heymann. Preparation of malt. March 4.

XVIII.—FOODS; SANITATION, WATER PURIFICATION; AND DISINFECTANTS.

(*A.*)—Foods.

Applications.

4028. Westrup. Testing flour. Feb. 22.
4527. Borgström. Manufacture of butter.* Feb. 28.

Complete Specification Accepted.

4436 (1907). Schwickerath. Manufacture of a proteose preparation from fish. Feb. 26.

(*B.*)—Sanitation; Water Purification.

Applications.

3542. Beall. Treating, purifying, and distributing sewage.* Feb. 17.
3957. Van Gundy. Water purifying apparatus. [U.S. Appl., Feb. 26, 1907.]* Feb. 21.

(*C.*)—Disinfectants.

Applications.

3638. McMullen. Manufacture of disinfectants. Feb. 18.
4535. Howorth (Lutz et Cie.). Manufacture of microbicide agents.* Feb. 28.

XIX.—PAPER, PASTEBOARD, &c.

Application.

4390. Stevens. Manufacture of celluloid. Feb. 26.

Complete Specifications Accepted.

2026, 2026a, and 2026b (1907). Wetter (Knoll und Co.). Manufacture of cellulose esters from cellulose or from products of transformation resembling cellulose. March 4.
18,164 (1907). Crumière. Manufacture of a plastic, imputrescible material of considerable resistance from a solution of cellulose. March 4.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

Applications.

3750. Schmitz und Co. Manufacture of camphor. [Ger. Appl., March 12, 1907.]* Feb. 19.
3901. Dyes (Hempel). *See under* III.
4359. Lüdy und Co. Manufacture of the borneol and menthol esters of α-bromoisovalerianic acid. [Ger. Appl., March 9, 1907.]* Feb. 26.

Complete Specification Accepted.

3934 (1907). Lake (Curatorium der G. und F. Speyerschen Studienstiftung). Manufacture of acidyl derivatives of α-aminophenylarsenic acid. Feb. 26.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Complete Specifications Accepted.

4932 (1907). Brasseur. Production of photographs in natural colours. March 4.
5692 (1907). Woodiwiss. Colour photography. Feb. 26.
17,452 (1907). Macwalter. Iso- or orthochromatic photographic plates or films. Feb. 26.

XXII.—EXPLOSIVES, MATCHES, &c.

Application.

4046. Bawden. Explosives.* Feb. 22.

XXIII.—GENERAL ANALYTICAL CHEMISTRY.

Complete Specifications Accepted.

5244 (1907). Westover. Apparatus for analysis of gases. Feb. 26.
5927 (1907). Hodge. Testing of moisture in tobacco and the like. March 4.

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Official Notice.

ANNUAL GENERAL MEETING.

The Annual General Meeting will be held in Newcastle-on-Tyne on Wednesday, July 22nd. Full particulars will appear later.

Proceedings of the First General Meeting of the Society under the Charter.

ADOPTION OF BY-LAWS.

Held on Friday, 13th March, 1908, at the House of the Royal Society of Arts, London.

SIR BOVERTON REDWOOD, PRESIDENT, IN THE CHAIR.

The Secretary read the Notice convening the Meeting as follows:—“Take Notice that in pursuance of the provisions of Clause 37 of the Charter, a General Meeting of the Society will be held at the House of the Royal Society of Arts, John Street, Adelphi, London, on Friday the 13th day of March, 1908, at 3.30 o'clock in the afternoon, for the purpose of considering and adopting the Draft By-laws which, after due consideration of the observations received from Members in response to the invitation in that behalf, have been finally settled by the Council; and a print of such finally settled By-laws was sent to each Member of the Society in their January 31st number of the Journal. By order of the Council, Charles G. Cresswell, Secretary.”

The President.—Gentlemen, this is a Meeting arising out of the necessity imposed by Clause 37 of the Charter upon the Society of considering and adopting new By-laws. The clause in question directs that the Council shall, within six months from the date of the Charter, prepare draft By-laws, and shall send these to each Member of the Society, and invite them to offer observations thereon. The date of the Charter being the 17th June, the draft By-laws were sent out on 15th December, which was within the six months provided. In due course, the Council received and took into consideration a number of observations made by Members of the Society, and finally settled the draft By-laws; and, in accordance again with Clause 37, sent a copy of the finally settled draft By-laws to each Member of the Society. This is a Meeting called for the consideration and adoption of the By-laws so sent out—it being provided that this Meeting should be held on a day not less than one month nor more than three months after the expiration of six months from the date of the Charter, and not less than 14 days' notice to be given of the Meeting. Therefore, the latest date on which the Meeting could be held would be the 17th of this month. We are, therefore, in holding the Meeting to-day, within the period.

I have now formally to enquire whether there are any observations on the proposed By-laws which have been so circulated and which we have met here for the purpose of considering and adopting?

If there are no observations, I will proceed to move:—

“That the Society do make By-laws and that the By-laws contained in the print produced at this Meeting, and signed by the President for the purpose of identification, be adopted as the By-laws of the Society to come into operation and take effect so soon as they shall be allowed by the Members of His Majesty's Most Honourable Privy Council.”

Mr. A. Gordon Salamon.—I have much pleasure in seconding that Resolution. The care which has been given to the preparation of these By-laws will go far to make them successful in their working. They evidently are received with approval, not only by our Members in this country but across the sea, because they make for the consolidation of the Society and promote the harmonious working of the whole body.

The President.—I now put to you the Motion which has been duly moved by myself and seconded by Mr. Gordon Salamon. Those in favour of the Motion, please signify the same in the usual way.

On the contrary:—

I declare that it is duly carried unanimously.

That, Gentlemen, concludes the business of the Meeting; and I thank you for your attendance.

Mr. A. Gordon Salamon.—I venture to speak again, and to propose a vote of thanks to you, Sir, for presiding at this Meeting, and for the trouble you have taken in the work of drafting these By-laws and bringing them to their present state of perfection. Perhaps you will permit me to add my appreciation of the great services rendered in that connection by Mr. Markby, our Solicitor.

Mr. Thomas Tyrer.—As Treasurer of the Society, I indorse all that Mr. Salamon has said. In this connection, we also owe very considerable thanks to our Secretary for the care and caution he has exhibited in bringing this rather serious matter to a satisfactory conclusion.

The President.—I would ask Mr. Salamon to put this Motion, and to add to the names which have been already mentioned, the name of Mr. C. C. Hutchinson.

Mr. A. Gordon Salamon.—I will put the Motion; and I also add with great pleasure the names of Mr. Hutchinson and Mr. Cresswell.

The Resolution was carried unanimously.

The President returned thanks.

Birmingham Section.

Meeting held at Birmingham on January 23rd, 1908.

MR. HARRY SILVESTER IN THE CHAIR.

THE REDUCTION OF GOLD CHLORIDE BY CHARCOAL.

BY D. AVERY, M.SC.

Charcoal is used largely for the precipitation of gold from its solutions in the extraction of this metal from its ores by the “chlorine” or the “cyanide” process. In the former case, the solution of gold chloride is heated, and filtered through tubs filled with wood charcoal. The precipitation is rapid and complete. The charcoal with which the solution first comes into contact soon becomes covered with a beautiful tough yellow deposit of metallic gold; as the solution becomes more dilute no deposit is visible on the charcoal, but the ash left on incineration is coloured pink by the finely-divided metal. In the cyanide process, the filtration through charcoal takes place in the cold. The solutions are much more dilute with respect to their gold content, a longer column of charcoal is used, and no metallic deposit appears. After the charcoal has been in use for some time the precipitation of gold takes place less actively, but it can be renewed by heating the charcoal to redness in absence of air and replacing in the filters. It has also been noticed that if a current of electricity is passed for a short time through the filter, so arranged that the charcoal is the cathode, the gold is afterwards precipitated for some time by the charcoal so treated, even more readily than by freshly-burnt material. The reaction that takes place during this reduction does not appear to have been satisfactorily investigated, although it has been noticed and various suggestions made regarding it. The reducing action of lamp-black, animal charcoal, bone-black, and coke, on various metallic salts has been described by several investigators, who have attributed the action to impurities in the carbon, to occluded hydrogen, or to the mechanical attraction of carbon for the dissolved salts. In most cases no quantitative work has been attempted. Weppen (Annalen, **55**, 241) found that the greater part of the acid was present in the free state after the reduction of the salt, and that it was very difficult to recover the last portions of the acid. König (Chem. News, **45**, 215), working with purified charcoal, found that carbon dioxide was formed. He assumed the reaction to be in accordance with an equation which, expressed in modern form, would be: $4AuCl_3 + 6H_2O + 3C = 4Au + 12HCl + 3CO_2$; but in his experiment he found only 1/20th of this theoretical amount of carbon dioxide. He concluded that this fraction only of the reduction of gold chloride was due to the charcoal, the rest being due probably to physically absorbed gases.

Experimental.—Attempts were made to prepare charcoal free from all occluded reducing gases, so that the part played by the charcoal alone might be determined. Sugar was first heated to a high temperature in absence of oxygen, but it was found that the light porous mass so obtained was less suitable for manipulation than wood charcoal, and, moreover, that even after prolonged heating it still contained appreciable quantities of hydrocarbons. Ordinary wood charcoal was used, crushed to small size, treated with acids to dissolve out mineral matter, heated in chlorine to decompose hydrocarbons, and then in nitrogen to get rid of the chlorine. It was found that even after prolonged heating in nitrogen, traces of chlorine were still present. Finally a very pure form of charcoal was obtained from cocoanut shell. This was strongly heated in closed clay crucibles for some hours, then boiled with nitric acid for 5 or 6 hours, and washed thoroughly till the washings were nearly free from acid—the washing taking several days. It was then dried in the air, crushed and sieved, collecting the particles between 1 and 3 mm. diameter. These were dried first in a desiccator over strong sulphuric acid, then over phosphorus pentoxide, and finally heated to redness in a closed platinum crucible and cooled in a desiccator over phosphorus pentoxide. The crucible was heated in a muffle in an oxidising atmosphere to avoid the possibility of absorption of hydrogen or other reducing gases from the furnace. This charcoal was examined, first by heating it for one to two hours in a current of pure nitrogen and finding its loss of weight. It was then heated in a current of oxygen and the amount of water formed, determined. From this the amount of hydrogen still present in the charcoal was calculated. The weight lost when heated in nitrogen was found to be due to water and carbon dioxide. The gas current was carried through another combustion furnace containing copper oxide, but no hydrogen, hydrocarbons, or carbon monoxide were found present.

The results of the analysis of the charcoal were as follows:—

	Heated in nitrogen.	Combustion in oxygen.	
	Loss.	Water formed, calculated as hydrogen.	Ash.
	Per cent.	Per cent.	Per cent.
No. 1	[*]5·0	0·16	0·26
No. 2	0·1	0·25	0·23
No. 3	0·5	0·15	0·20

[*] No. 1 was dried over phosphoric anhydride but not ignited in platinum crucibles. Nos. 2 and 3 were dried, ignited and cooled over phosphoric anhydride before analysis.

These results show that the amount of absorbed gases in this charcoal is very small—the loss in nitrogen and amount of hydrogen found on combustion (0·25 per cent. at most), being due to a large extent probably, to moisture still present. In the subsequent work the charcoal is regarded as pure, the small amount of reducing agent other than carbon, possibly present, being ignored.

The gold chloride used, was prepared from pure cornet gold, by dissolving a carefully weighed quantity in *aqua regia* and evaporating three times nearly to dryness on the water bath, care being taken to avoid decomposition of the gold chloride. The remaining excess of acid was nearly neutralised by carefully adding sodium hydroxide, and the solution diluted up to decinormal strength. This value was checked by titration with potassium iodide and decinormal thiosulphate solution in the usual way. It was found that if the gold chloride was too concentrated, the aurous iodide formed by the potassium iodide, slowly decomposed, forming metallic gold and liberating iodine, so that the end-point could not be obtained sharply; but by largely diluting, a very satisfactory titration could be made, the further decomposition taking place only on long standing. The amount of free acid was also determined iodometrically. Ordinary indicators were found to be inadmissible owing to the oxidising action of the gold chloride. The amount of gold was first found by diluting, adding potassium iodide, and titrating, using starch indicator. Potassium iodate was then added, and the acid calculated from the liberated iodine. This was found to give consistent results. All solutions used were standardised against decinormal hydrochloric acid, which in turn was standardised with Iceland spar.

Estimation of hydrochloric acid formed.—It seemed certain that the chlorine present must on reduction form hydrochloric acid. Preliminary experiments showed that the amount of acid present in the reduced solution was less than the theoretical quantity, also that some of the acid formed was retained by the charcoal and could be slowly washed out by repeated treatment with distilled water. It was hoped that by adopting a uniform method of washing, the quantities of acid obtained, might be plotted in a curve, and by extrapolation, the total quantity estimated. It was found that the curve soon became asymptotic and comparison of curves showing the acid obtained from charcoal treated with gold chloride solution, and from charcoal soaked for the same time in free acid of the same equivalent strength, showed that the acid washed out much more rapidly in the latter case. Hence it was not possible to plot another curve showing absorption of acid from fresh lots of $N/10$ hydrochloric acid, and finding the mean of two asymptotic curves in the usual way.

Determination of hydrochloric acid by the Iceland spar method.—Instead of attempting to separate the acid from the charcoal and determine it in the solution, a weighed piece of pure Iceland spar was introduced into the flask with the gold chloride and charcoal. This was taken out at intervals, washed, dried, and weighed, and then returned to the flask again, the operation being repeated as long as any further loss of weight was found. At first this loss was rapid, but soon became slow, the last traces of acid remaining persistently in the charcoal, even after this was carefully ground and returned to the flask. About 2 grms. of charcoal were used and 150 c.c. of the gold solution (1 c.c. = 0·00686 grm. of gold). The original weight of the Iceland spar was 7·3720 grms.; after 50 days it was 6·6120 grms.; and after 59 days it was reduced to 6·6071 grms. The charcoal was then ground and returned to the flask, and after 60 days the weight was 6·5970 grms., and at the end of 65 days it was 6·5920 grms. Thus, the total loss of weight amounted to 0·78 grm. of calcite, which is equivalent to 0·5686 grm. of hydrochloric acid.

Now 150 c.c. of the solution used contained 0·0054 grm. of free hydrochloric acid, and should form on reduction, 0·5820 grm. (total, 0·5874 grm. of acid). Hence there is $0·5874 - 0·5686 = 0·0188$ grm. of hydrochloric acid not accounted for.

A fresh solution of gold chloride was prepared containing nearly the same amount of gold, but slightly more free acid.

50 c.c. of this solution contained 0·3440 grm. of gold (0·00688 grm. per c.c.) and 0·0097 grm. of free hydrochloric acid, and would form on reduction, 0·1905 grm. of acid. 50 c.c. therefore represented 0·2002 grm. of (total)

hydrochloric acid. 50 c.c. of this solution were added to the charcoal and calcite of the last experiment. In 12 days the weight was 6·3830 grms., and in 26 days, 6·3265 grms. The flask was corked and stood for about 15 months: the calcite then weighed 6·2863 grms. Thus, the total loss of weight from the beginning is 7·3720−6·2863=1·0857 grms. of calcite, equivalent to 0·7904 grm. of hydrochloric acid. Now the total hydrochloric acid value of all solutions used =0·5874+0·2002=0·7876 grm., or slightly less than that calculated from the loss of weight of the calcite.

It had meanwhile been found that the character of the reaction was not altered by heating the solution, but that the reduction was thereby hastened very greatly. Accordingly 50 c.c. of the same gold chloride solution, about the same amount of charcoal, and a piece of calcite, were heated to boiling, the calcite being weighed at intervals as before.

Original weight of calcite	6·2865 grms.
After boiling 4 hours with reflux condenser	6·0167 ,,
,, standing overnight, boiling 15 minutes	6·0134 ,,
,, ,, 3 days ,, ,, ,, ...	6·0116 ,,
,, ,, 3 weeks ,, ,, ,, ...	6·0114 ,,

The total loss of calcite was 0·2751 grm.=0·2005 grm. of hydrochloric acid, which is just over the calculated amount.

Estimation of carbon dioxide formed.—The equation that has been suggested for the reaction is:—

$$4AuCl_3+6H_2O+3C=4Au+12HCl+3CO_2.$$

Charcoal was heated in nitrogen to expel occluded gases, then transferred to a flask containing a measured quantity of the gold chloride solution. The flask was connected, through a reflux condenser, to drying tubes and weighed soda lime tubes, then (in case some of the carbon was oxidised only to the monoxide) to a tube containing heated copper oxide, and again to soda lime tubes. It was found that, on boiling the solution, carbon dioxide was given off, but in rapidly diminishing amounts, and that it was not possible to boil out the amount of gas that should be present according to the above equation—even though the apparatus was connected with a pump and boiled at greatly reduced pressure. No carbon monoxide was found, and in subsequent experiments this part of the apparatus was not included. 100 c.c. of gold chloride containing 0·00688 grm. of gold per c.c. was boiled for periods of usually half an hour; the soda lime tubes were then weighed with the following results:—

Interval.	Total weight of carbon dioxide obtained.	Increase for interval.
	grm.	grm.
½ hour..........	0·0475	0·0475
½ ,, ...	0·0530	0·0055
1 ,, ...	0·0705	0·0175
½ ,, ...	0·0749	0·0044
½ ,, ...	0·0781	0·0032
½ ,, ...	0·0803	0·0022
½ ,, ...	0·0813	0·0010

Theory requires 0·1150 grm., and although the end was not reached, there seemed to be little hope of obtaining this quantity. Finally the charcoal was treated in the same manner, but after the boiling had been continued from one to two hours, it was rapidly filtered into a short length of combustion tubing, plugged with a wad of asbestos. A current of purified hydrogen was passed through this tube, dried, and the carbon dioxide collected in soda-lime tubes as before. The tube containing the charcoal was slowly warmed to 100° C. and kept at this temperature till no moisture could be seen collecting on the cooled end of the tube. It was then gradually raised to about 300° C., being kept below the melting point of lead (326° C.) so as to avoid reduction by the carbon of any carbon dioxide present.

50 c.c. of gold chloride solution (1 c.c.=0·00688 grm. of gold) were introduced into the flask, and the tubes weighed at about half-hour intervals, the hydrogen being displaced by a current of pure air before weighing.

	Total weight of carbon dioxide	Increase.
	grm.	grm.
Boiling for 2 hours	0·0310	0·0310
Heating in hydrogen and weighing at ½-hour intervals...	0·0488	0·0178
	0·0548	0·0060
	0·0568	0·0020
	0·0578	0·0010

Theory requires 0·0575 grm. of carbon dioxide. The equation may therefore be taken to correctly represent the reaction that takes place when gold chloride is reduced by pure charcoal in presence of water.

Occluded gases.—It was found that carbon monoxide reduced gold chloride to metallic gold when simply bubbled through the solution. The monoxide was passed through potassium hydroxide to free it from any carbon dioxide, then through lime water, gold chloride, and finally through lime water again. After a few minutes the gold solution darkened, changing to brownish green, a film of metallic gold appeared on the surface of the solution, and at the same time the second calcium hydroxide solution became milky. On boiling, the gold collected into spongy masses, the solution becoming clear. Free hydrochloric acid was formed in the solution. The reaction is probably expressed by the equation: $3CO+3H_2O+2AuCl_3=3CO_2+6HCl+2Au$.

Hydrogen.—On passing hydrogen into the gold solution no reduction of gold was observed either cold or when heated, but a ring of metallic gold was slowly formed on the glass tube at the point of contact of the gas and liquid, the hydrogen bubbling slowly through meanwhile. This was repeated when a freshly-cleaned tube was used. The hydrogen was purified only by being passed through strong sulphuric acid. This reduction might be due to traces of impurities (unsaturated hydrocarbons) in the hydrogen, but seems more probably due to increased concentration of hydrogen owing to surface tension. It has been stated that hydrogen under pressure will reduce silver and platinum from their solutions—probably gold solutions would be reduced similarly.

It seemed probable that occluded hydrogen, at any rate, would cause reduction of gold from its solution. To test this, charcoal was heated and allowed to cool in hydrogen, then heated with gold chloride solution, the carbon dioxide being driven out by boiling and heating as before. The total carbon dioxide obtained, was 0·0555 grm. instead of the theoretical amount 0·0575 grm. The difference, 0·002 grm., is about that which would be caused by the hydrogen which the charcoal used (2 grms.) would absorb.

Reduction of other substances than gold by charcoal has been noticed. Weppen (Annalen, 59, 254), amongst others, has noted the reduction, partial or complete, of a number of metallic salts, such as those of copper, zinc, iron (ferric), chromium, nickel, cobalt, silver, and mercury. Some of these were repeated, the action being studied qualitatively only. Carbon dioxide and free acid were found to be formed, and it was assumed that the reaction was of the same character in these cases as with gold chloride.

Conclusion.—The reduction of metallic salts by charcoal in aqueous solution is due to the splitting of the water molecule with formation of the free acid of the salt and oxidation of the charcoal to carbon dioxide, the reaction being hastened by heating. The reaction is correctly expressed by the equation: $4AuCl_3+6H_2O+3C=4Au+12HCl+3CO_2$.

Occluded gases, such as hydrogen or carbon monoxide, will reduce gold chloride, and possibly also other metallic salts. A large proportion of the products of the reduction is persistently retained by the charcoal, and cannot be removed by simply boiling; but can be removed by the methods described.

Discussion.

Prof. T. Turner said he knew from experience that the passing of chlorine over charcoal, even at a full red heat, was a very slow process for completely removing the hydrocarbons. He did not know what other suggestion they could accept than that proposed by the author, provided always that the charcoal was pure.

Mr. F. H. Alcock said that the charcoal had been purified to such a high degree (there being only 0·25 per cent. of ash) that it would not materially reduce any of the gold.

Mr. H. L. Heathcote said the property of the oxidation of carbon in solution to carbon dioxide seemed at first sight almost incomprehensible, but when one added to the consideration the fact that in all probability all these processes were electrolytic in their origin, and that hydroxyl was deposited on the carbon by local electric currents, he thought the oxidation became a little more comprehensible.

Mr. Stacey Jones said that a firm he acted for, reduced about £40-worth of gold as chloride at once ; and the most advantageous process he knew of was to use zinc rods as reducers in dilute solution. He had tried to reduce by dropping the solution through charcoal, but it did not seem that he could remove it completely. Possibly, however, he might be mistaken.

London Section.

Meeting held at Burlington House on Monday, March 2nd, 1908.

DR. J. LEWKOWITSCH IN THE CHAIR.

The Hon. Secretary read an obituary notice of the late R. J. Friswell, Chairman of the Section.

THE PREPARATION OF *PARA*-TOLUIDINE FROM MIXED TOLUIDINES BY MEANS OF *PARA*-TOLUIDINE HYDRATE.

BY THE LATE R. J. FRISWELL. REVISED BY THE HON. SECRETARY.

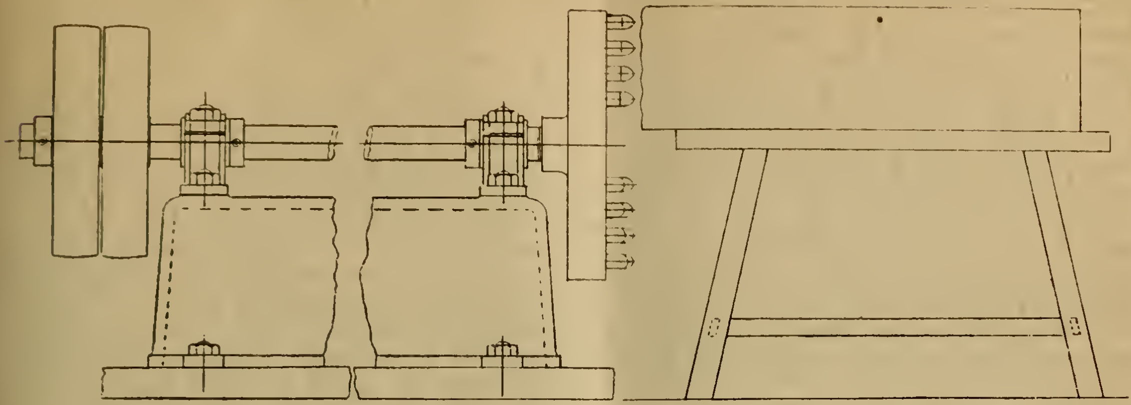
A paper has recently been published (Trans. Chem. Soc., 1907, **91**, 1797) by J. W. Walker and Miss Beveridge describing a hydrate of *p*-toluidine. The authors remark that no mention of such a substance is to be found in Beilstein, but that the existence of a hydrate had been indicated by Levy (Ber., 1886, **19**, 2728) who observed that crystals of *p*-toluidine from water effloresced in the air.

Since I discovered this hydrate independently, and made many tons of it in 1889 and the following years, I believe that a description of the process of making *p*-toluidine on a large scale through the medium of the hydrate may be of interest.

The manufacture of *p*-toluidine is one of the most difficult economical questions with which a chemical manufacturer has to deal, for it is surrounded by a series of intricate problems which ramify into all departments of an aniline works. It is of course well known that *p*-nitrotoluene can be separated from *o*-nitrotoluene by cooling to 0° C. or below, and this at first sight looks a very promising direction in which to work, but the difficulties are great, and I soon had to abandon the method. In the first place the separation is by no means complete, much *p*-compound remains in the fluid, and some *o*-derivative adheres to the solid. Next the reduction of the nearly pure *p*-nitrotoluene with swarf is difficult and there is the additional difficulty of keeping the condensers at about 70° C. and of handling the separated *p*-toluidine, a liquid near to its solidifying point and therefore most treacherous in passing through pipes, cocks, etc. When, owing to the discovery of primuline, it became necessary to prepare pure *p*-toluidine on a very large scale, these problems were presented to me with great force and demanded an immediate solution. It may be easily imagined that the separation of the nitro-compounds was abandoned, and here I may digress to say that concurrently with the work to be detailed below I set on foot a series of researches which were largely carried out by the late Dr. T. A. Lawson, then one of my assistants, to endeavour to increase the proportion of *p*-nitrotoluene to *o*-nitrotoluene obtained under ordinary conditions. As is well known, the nitration of toluene under ordinary conditions gives 60 to 65 per cent. of ortho with to 40—35 per cent. of *p*-nitro compounds, with a minute amount of the *meta*-isomeride, and it is remarkable that the sulphonation of toluene gives the same proportions of the corresponding sulphonic acids. To vary the yields, the nitric and sulphuric acids in the nitrating mixture were varied in proportion and in strength, 60 per cent. sulphuric anhydride was used to prepare strong sulphuric acid, also the temperatures were varied by nitrating at or below 0° up to the highest temperature compatible with safety. Nitrating with nitric acid alone was tried, and a long series of experiments were devised on the order and rate of mixing, culminating in a device I constructed where the acids and the toluene were allowed to fall drop by drop into a long inclined tube so that the reaction took place in a thin layer and not in a mass. The result of all this work was to convince us that the ratio of 60—65 per cent. to 40—35 per cent. was unchangeable, and to create a desire, impossible to satisfy in a chemical works, to devote time to an elaborate study of the mechanism of the reaction. The ground having thus been cleared, the only practical alternative consisted in separating the ordinary toluidine into its constituents. I was soon convinced that separating by freezing was the quickest and cheapest method, and began to devise a mode of carrying this out on the large scale, when I noticed great variations in the amount of product obtained at similar temperatures, and found that the presence of water hastened the separation. Carefully pressed specimens showed this to be due to the presence of a hydrate, and a small apparatus was installed in which the mixed toluidines were churned with water and cooled with excellent yields of crystals. Such results were still more easily obtained when a slight modification of the process was made at the suggestion of Lawson, and ice added instead of water.

I now designed and had made the apparatus shown. I had at first intended to have the spindle working inside another hollow spindle or sleeve each provided with mitre wheels gearing into the same driving wheel, so as to get a very thorough beating action as is done in various churns and similar apparatus, but I abandoned this in favour of a single acting beater and an apparatus for reducing the ice to very small fragments or brash. This was carried out as follows :—A heavy disc wheel, 3 ft. in diameter, was provided with four radial slots and mounted on the end of a spindle opposite a tube capable of taking a 2 cwt. prism of ice. Into the slot were fixed blocks of hard metal each having cast into it about twelve strong steel claws made like stout tenterhooks in plan. This disc was revolved at about 600 revolutions per minute, and the prisms of ice forced against its face. The steel hooks tore away the surface, and the ice was thus reduced to small brash or pebbles at the rate of one ton per hour. The beater consisted of strong +-sectioned breaking bars secured to rings surrounding the spindle and the wrought iron body. The arms were skewed, and the spindle stepped in a four-legged cast-iron support which straddled over the opening in the centre of the dished bottom. The top and bottom were of cast iron, the spindle passing through a gland. A manhole and a 4 in. by 6 in. charging hole with slotted cover and two strong hinged bolts served for introducing the crushed ice. The toluidine was forced up by air from an underground receiver into which it was weighed. Everything being prepared, the charge of toluidine was introduced and the agitator set going slowly. 600 lb. of crushed ice was then quickly put into the charging hole, the cover screwed up and the beaters started at about 150 revolutions per minute. The temperature now fell rapidly to about 5°, when the changing of the sound made by the beaters indicated the formation of the hydrate, the whole contents being of the consistency of thick porridge. The air was now

Ice-Breaking Machine.



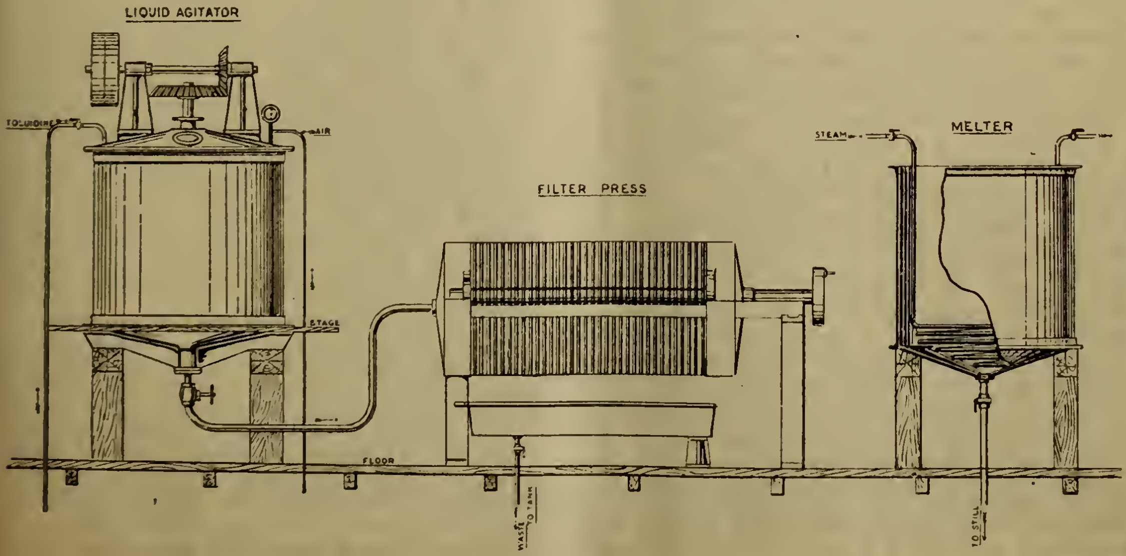
admitted up to a pressure of about 60 lb. per inch, when the full way cock was thrown open and the contents blown into the filter press. Water and fluid toluidine now streamed from this and presently air when the blow-off cock was opened and the agitators stopped. The press was opened, each ring removed, and the "cheese" of *p*-toluidine hydrate punched out into a steam melter kept at 50—60° C. Under these conditions the hydrate is decomposed into a mixture of *p*-toluidine hydrate and *p*-toluidine, the latter floating about as a mobile, almost colourless oil. The mixture was run off to tanks where it was cooled, when it gave magnificent crystals of the hydrate from which very pure *p*-toluidine could be prepared. The toluidine was run into a still where it was freed from water, and the dry *p*-toluidine distilled and collected in slightly conical enamelled pans. Here it solidified into hard blocks which were broken up and passed through a ½ in. sieve and put into tall conical drainers, the crystals resting on cast iron grids covered with coarse flannel. They here parted with some *o*-toluidine which flowed away containing about 70 per cent. *p*-toluidine. This fluid was known as No. 4, and a proportion of it was always included in each charge of the toluidine in the ice chamber.

The result achieved is shown by the following record of eleven charges each of 875 lb. of toluidine and 600 lb. of ice: a total of 9617 lb. of mixed toluidines and 3 tons of ice gave 3593 lb. of crude *para*-base which yielded on distillation 2238 lb. of pure *p*-toluidine, and, in the form of drainings, 862 lb. of No. 4 toluidine. The toluidines flowing from the press contained about 15 per cent. of *para*-base; this was subjected to steam distillation with weak sulphuric acid in a still with a copper body and head but an iron condensing coil, for, copper in the presence of air, acts as disastrously on *p*-toluidine or *o*-toluidine as it does on aniline. In this way it was resolved into pure *o*-toluidine and a toluidine containing 40—45 per cent. of *para*-base which went back to the ice churn and the drainings as before went through the process. The quantity of ice of course varied with the season of the year, and so did the draining from the once run *p*-toluidine, for another record states: 81,015 lb. of toluidine, 34 tons of ice and 20,605 lb. of *p*-toluidine. It will be noted that more ice was used and less *para*-base obtained; this was always the case in the warmer part of the year.

There were at the time no practical methods of separating the toluidines known except the tedious methods of distillation with dilute sulphuric acid followed by cooling, and the patented process of L. Levy, which depends on the addition of disodium phosphate when a comparatively insoluble *p*-toluidine phosphate is formed, which is allowed to crystallise out and then decomposed with caustic soda solution—a process not to be recommended for the manufacture of an article wanted by the ton.

Discussion.

The Chairman said there was a melancholy interest attaching to this paper, doubly melancholy, because had the late Chairman been still alive he would have been able to see the revival of the tar colour industry in this



country in consequence of the new Patent Law. Referring to the future development of the coal-tar colour industry in this country, he said that, according to the latest German statistics, the export of indigo and other tar colours, reached, in round figures, 9¼ millions sterling. This showed what amount of business might be recovered in this country. In the paper it was stated that there was no mention of this process made in Beilstein; but he might add that even in special works, such as Schultz's book, a description of this process could not be found.

Dr. J. C. Cain said he had seen the plant used by Mr. Friswell for this process. The stirrer consisted of a central axle fitted with wings which were rapidly revolved. From an engineering point of view he would suggest that the vessel be raised considerably higher, so that the pipes might lead directly into the filter press, which would tend to prevent the solid material settling in the bend. The modern process of separating *ortho*- and *para*-toluidine was already carried on at the nitrotoluene stage by fractional distillation under diminished pressure.

Dr. G. T. Morgan said the paper had an important bearing on the theory of ammonium bases, as it showed that at least one aromatic base, *p*-toluidine, had the property of combining with water to form a compound resembling the ammonium hydroxides. Possibly other benzenoid amines were capable of yielding hydrates which, however, were only stable at lower temperatures. In those works where arsenic acid was available this acid might be employed to separate *p*-toluidine from *o*-toluidine by taking advantage of the difference in solubility of their arsenates instead of using the phosphates as in Levy's process.

Dr. R. Lessing drew attention to the analogy of *p*-toluidine with phenol. In the manufacture of carbolic acid a certain percentage of water was desirable for obtaining crystallised phenol from the mixture of the tar acids. Here, as in the case of *p*-toluidine, a hydrate was formed which, by its crystallising properties, was distinguished from the liquid hydrates of the cresols.

THE CHLORAMINE REACTION OF THE PROTEINS, AND TECHNICAL APPLICATIONS.

BY C. F. CROSS, E. J. BEVAN, AND J. F. BRIGGS.

The interactions of the simpler amines and the halogens have been studied by numerous observers. One of these reactions of particular interest, for reasons which we hope to make evident by the present communication, is that which leads to the production of monochloramin, NH_2Cl. This compound is readily obtained in solution by the interaction of chlorine (water) and ammonia, but more conveniently by substituting a hypochlorite for the free halogen. In a brief account of this reaction by F. Raschig (Ber., 1907, **40**, 4586) it is shown that it takes place according to the equation: $NH_3 + M'OCl = NH_2Cl + M'OH$. The product reacts with iodides similarly to the hypochlorites, thus, $NH_2Cl + 2HI = NH_3 + HCl + I_2$; that is, using the terminology of "bleaching" chemistry, the "active chlorine" is double the actual combined chlorine. But the chloramin is in other respects markedly different in chemical activity from the hypochlorites, notably in the extreme feebleness of its bleaching actions. Although unstable and readily decomposing according to the equation, $3NH_2Cl = N_2 + NH_3 + 3HCl$, under certain conditions it undergoes the characteristic synthetic transformation to hydrazine — thus: $NH_2Cl + NH_3 = H_2N.NH_2,HCl$. The conditions specified by Raschig are, to heat together 200 c.c. aqueous ammonia (20 per cent. NH_3) with 100 c.c. of normal sodium hypochlorite in presence of a small quantity of gelatin (0·05 grm.) which he has found to favour the reaction by "raising the viscosity of the solution." The resulting hydrazine is obtained in the form of sulphate on adding sulphuric acid, or as the relatively insoluble double salt $CuSO_4.N_2H_5SO_4$ on adding a saturated solution of copper sulphate. The yield of hydrazine under the above conditions is 40—50 per cent. of the theoretical. (*See also* Chem. Zeit., 1907, **31**, 126.) The general import of these reactions is indicated in a paper by the same author (Zeits. angew. Chem., 1907, **20**, 2065), thus:—Phenylhydrazine has been obtained from aniline. As a means of introducing the amino group it is shown that phenol and the simple chloramine give *p*-aminophenol followed by interaction of two molecules with production of dihydroxydiphenylamine, which is directly oxidised to the indophenol. This explains the blue reaction of phenol solutions containing ammonia with hypochlorites.

The author also discusses the formation of dinitroazobenzene from *p*-nitraniline, and fully discusses the interaction of aniline and hypochlorites. These discussions are limited to bodies of the aromatic group.

We note in a paper by Knecht and Milnes (this J., 1892, **11**, 131) on "The action of chlorine on wool," that the chlorinated wool was observed to retain its activity towards potassium iodide after many hours. The authors suggest that the results may be due to free chlorine or chlorinated quinone-like bodies. Other authors have dealt with the interaction of chlorine and hypochlorites with ammonia. Noyes and Lyon (J. Amer. Chem. Soc., 1901, **23**, 400) have investigated the ultimate breakdown to nitrogen. J. Effront (Ber., 1904, **37**, 4290) has proposed to use the interaction of hypochlorites with ammonia and proteins in drinking waters that is, under conditions of extreme dilution. He refers incidentally to the formation of nitrogen chloride (Chlorstickstoff), but regards the reactions involved as those of destructive oxidations. We shall revert to his observations on the proteins in a later communication.

We are concerned at the moment with the widely diversified group of such derivatives, *viz.*, the nitrogenous colloids which we shall refer to under the group designation of proteins, used in the general sense, and without reference to the special classifications of the most recent literature of this vast field.[*]

These bodies react with chlorine and the hypochlorites to form chloramine derivatives. Our observation of these reactions and their products have satisfied us that they take place in constant and characteristic quantitative porportions, and that the derivatives are simply related to the original substance, that is, are formed without destructive actions. Hence, these reactions may be made the basis of a number of quantitative methods which prove useful in the province of technical investigations. But further, such reactions occur in a number of industrial operations the significance of which will be found to be further elucidated by reference to the fundamental facts established for the simplest chloramine derivatives.

It will perhaps facilitate the exposition of our theme, as a contribution to industrial chemistry, if we approach it through the subject of flax bleaching.

Chloramine reactions in flax bleaching processes.—Raw flax as is well known retains a proportion of the nitrogenous constituents of the plant, derived from the cortical parenchyma which surrounds the bast fibres. In the full "linen bleach," the product of which is the pure flax cellulose, these residues are progressively eliminated together with the residues of the lignocellulose or wood. In various grades of partial bleaching to which both flax cloths and yarns are subjected (creaming—half-bleach—three-quarter bleach) these residues survive in considerable proportion, being whitened or decolourised by the processes of alkaline hydrolysis and hypochlorite oxidation which, while of the same character as those employed in the "cellulose bleach" are limited in intensity to produce the maximum of decolorisation consistent with the minimum removal of the non-cellulose constituents of the fibre.

It is to the production of chloramine derivatives in the hypochlorite baths that we have to call attention. These bodies when formed on the fibre are remarkably stable, they resist protracted washing; they resist the acid treatments (souring), which usually follow, and they do not yield to the exhaustive washing which again supervenes. As follows inferentially from our account of the properties of the simplest chloramine, the chloramine group is characterised by "active chlorine," and its presence is brought to evidence by the ordinary reagent, potassium iodide. Also the iodine set free may be estimated by titration with an alkaline arsenite—translated in calculating into its equivalent of "active chlorine."

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[*] Kossel, *ibid*, 1901, 34, 3214. E. Fischer, *ibid*, 1904, 38, 530.

We may state here, that in standard trade samples of "creamed" linen yarns, we have found such "active chlorine" to amount to as much as 0·1 per cent. We shall revert to the consequences of this defective practice after a more definite proof of the fundamental relationships involved, *i.e.*, of the reaction of the flax proteids with hypochlorite chlorine. The maximum fixation of active chlorine, we may note, is determined by reaction with the pure halogen; further, this maximum is for particular cases invariable.

The following quantitative observations were made upon a series of specimens of a sample "green" yarn damask, *viz.*, (*a*) the original untreated cloth; (*b*) after lime boiling, sour and wash; (*c*) after a further lye boil (caustic soda) sour, and wash. The total nitrogen was estimated in these specimens and found to be:—(*a*) 0·5 per cent.; (*b*) 0·2 per cent.; (*c*) 0·05 per cent. Portions were then, after weighing, wetted out in boiling water, squeezed through rollers, and exposed in one case to 1 per cent. "bleach" solution, and in another to an atmosphere of chlorine gas, each series in one vessel. They were then well washed to remove any soluble inorganic chloroxygen compounds; then covered separately, with $N/10$ sodium arsenite solution, and titrated back with $N/10$ iodine. The percentages of active chlorine fixed were as follows:—

	(*a*)	(*b*)	(*c*)
	Per cent.	Per cent.	Per cent.
From 1 per cent. "bleach".	0·069	0·024	0·007
From chlorine gas	0·250	0·066	0·019

The relation between the two series of numbers is so far convincing.

We may mention incidentally that the chlorination of the lignone residues to lignone chlorides has been ascertained, by experiment with typical nitrogen-free lignocelluloses, not to contribute to the result. Nor does the flax cellulose treated under these conditions show any fixation of active chlorine (or oxygen).

We have now to mention an observation which has a particular technical interest, as well as furnishing another link in the chain of evidence connecting the fixation of "active chlorine" with the amine constituents of the flax. In the reactions of the ordinary "steeps" or bleaching baths, which are dilute solutions, generally slightly basic, of the hypo-chlorites, there is a partial breaking down of the chloramine compounds to soluble derivatives, which are by no means unstable; consequently they tend to accumulate in the standing liquors of the bleach works. This accumulation, however, is opposed by their tendency to "work out" of solution and fix themselves upon cellulose after the manner of colloidal mordanting oxides, or of dyestuffs. If a pure cotton cellulose be steeped in one of these "old" liquors for some hours, and thereafter exhaustively washed, it will be found to show the reactions of those chloramin derivatives. In order to establish again the relations of nitrogen to "active chlorine" in such a case we carried out quantitative observations as follows:—

Nitrogen in 500 c.c. of old filtered bleach liquors (by Kjeldahl and Nessler tests) $N=4{\cdot}2$ mgrms. 16 grms. of mercerised cotton steeped 24 hours in 500 c.c. of this liquor, washed, and corrected by blank steeped in fresh bleach liquor (Kjeldahl and Nessler tests), $N=4{\cdot}2-1{\cdot}6$ mgrms. $=2{\cdot}6$ mgrms. fixed. This cotton showed the characteristic active chlorine after exhaustive washing. We also fixed chloramines on pure cotton by steeping in bleach liquors after reaction with the proteins of wheat (flour) as of barley (wort), the liquors being filtered clear before use.

Having regard to these observations, it was of interest to devise a plan of analysis of "old" bleach liquors, to determine the presence of soluble chloramines. This plan follows from a characteristic differentiation of the chloramines from the hypochlorites, in their resistance to hydrogen peroxide. The latter is added in slight excess to destroy hypochlorites, the solution is then acidified, and the excess of peroxide destroyed by adding dilute permanganate till the solution is faintly pink. On then adding a soluble iodide, the chloramine is brought into reaction, and may be estimated by thiosulphate solution. We need not elaborate the details of this method, necessary to eliminate the errors due to the possible presence of other oxidising compounds. It will be modified by observers to meet the requirements of particular cases. We may observe that we have also found it of considerable use in studying chloramine reactions in solution with amino compounds of known constitution. We also think it would serve no useful purpose to multiply records of our observations. Those we have cited are typical; we have made many series of determinations for the purpose of convincing ourselves, but we may well leave it to those interested to make their own observations.

We may conclude this section of our subject by stating our own conclusions in general form:—

(1) No flax fabrics washed from hypochlorite treatment can be safely assumed to be free from "active chlorine," however thorough the washing.

(2) The fixation of chlorine as "active chlorine" is in general in direct proportion to the nitrogen contents of the fabric. It is probably actually proportionate to the amino-groups of the protein constituents. It therefore progressively diminishes as these are removed through the various stages of bleaching.

The reaction conversely is a test of the purity of a bleach, and will be found of use in comparing one bleach with another.

Low-bleached damasks when treated with chlorine gas will be found to have a marked chloramine reaction, and it is important to note that the nitrogenous bodies thus reacting are the most resistant of the non-cellulose impurities, and are the last to be eliminated in the cellulose bleach.

(3) A hypochlorite liquor which has been used upon flax goods may contain some form of dissolved chloramine chlorine, which is not only devoid of bleaching action, but may influence prejudicially the action of the bleaching bath.

These conclusions are of direct import to the flax bleacher, and follow immediately from our experimental results and actual observations of the industrial processes and their products. In so far as they have not entered into consideration in the conduct of flax bleaching, they afford a new basis of experimental observation and control of the processes. But by control we must understand as chemists the regulation of processes to bring about particular results. If, for instance, it is recognised that to the more obvious functions of the hypochlorite bleaching liquors, which are those of hydrolysis and oxidation, we must add that of chloramine production, it becomes necessary to re-investigate the processes in relation to this function. We make this suggestion to those interested directly or indirectly in the industry. But as the lines to be followed in such an investigation will be obvious to every chemist, it is unnecessary to develop the matter in detail.

Application to histological investigations.—We have to pass on to a further application of the reaction originating in the same field of investigation, but suggesting extensions in many other directions. It is a matter of interest to localise the fibre constituents giving this characteristic reaction. If the flax in any form is treated with mercerising soda (15 per cent. NaOH) the "pectic" constituents of the fibre are considerably attacked, and on washing are removed in solution. The fibre thus treated is chlorinated and washed, and then treated with iodide solution. The distribution of the reaction is seen to be local, and on subjecting the fibre to microscopic examination, it is easy to resolve the strongly reacting regions into a complex of non-reacting fibres (cellulose), and more or less intensely coloured cellular masses, either still adherent to the fibres, or detached as a result of the mercerising treatment. We shall pursue this investigation as a development of histological method, by observations upon growing flax of this season's crop.

It will be seen from the quantitative observations upon gelatin (*infra*) that the quantity of chlorine fixed under maximum conditions is very large, when calculated in terms of the protein under reaction, an important point in respect of microchemical reactions that is for visual demonstration. Further the presence of lignocellulose does not vitiate or obscure the observations. These latter constituents have specific relationship to chlorine in virtue of their quinonoid character, and as will be remembered, after chlorination the particular reaction is localised by a careful application of sulphite of soda. (Cellulose, Cross and Bevan, p. 134.). Thus it is easy to differentiate these reactions for the purpose of localising their source, and by examining sections of raw flax after chlorination, we have detected the layer of proteid bearing cells situated between the cuticular tissue and the bast fibres proper.

It is obvious that this reaction has a general value in histological research. It can be graduated to any required intensity by using more or less dilute solutions of hypochlorous acid, or where considerable intensity of reaction is required, the pure halogen. We need not go into details of manipulation of histological objects, whether in their original form or in the form of sections.

Reverting in conclusion, to the question of flax, the distribution of these nitrogenous bodies may be altered by the processes of alkaline preparation. Generally, these bodies are extremely resistant, and they are only gradually broken down by the successive alkaline boils. As the result of progressive hydrolysis we have to reckon with the absorption of the dissolved products at all events in traces, by the cellulose of the fabric, as shown above in the case of pure cotton, and the problem of obtaining absolute purity of the flax cellulose is thereby complicated. Further, on placing pure cotton cellulose (bleached) in contact with flax goods, (*a*) in the lime boil, and (*b*) in the lye boil (caustic soda) which follows, it is found that the cotton cellulose is permanently stained by taking up the products of the action of the alkali upon the flax constituents. These resist washing and then on exposing to chlorine or acid hypochlorite and exhaustive washing, the characteristic fixation of the chloramine chlorine is noted by the relative intensity of the potassium iodide and starch reaction, the colour developed in (*a*) being stronger than that developed in (*b*). This, of course, is a point of some practical importance, and affords a basis of critical study of the processes which are a necessary preparation for the ordinary bleaching operations.

We have observed that the "active chlorine" of chloramines is possessed of an inferior oxidising power as compared with the active chlorine of hypochlorites, and that it has no direct bleaching actions upon colouring matters and dyestuffs. This is an important consideration when it is remembered that "creamed" flax yarns containing "active chlorine" are "blued" by the addition of sensitive dyestuffs such as Methyl Violet. Whether the blue resists the chloramine during a period of storage is not so certain, but the possible discharge of the dyestuff should not be overlooked. We have made experiments with reduced leuco-derivatives of triphenylmethane dyestuffs which show that the oxidising power of the chloramine existing on creamed flax yarns is sufficiently pronounced to restore the colour and dye the yarn. In reply to the question whether the active chlorine of the chloramine is sufficiently powerful to transform the cellulose into oxycellulose, the evidence is not conclusive. But we must lay stress on one danger of the presence of chloramine in these yarns, that is, the generally simultaneous presence of free acid. The decomposition of the chloramine which takes place gradually in the course of time, is accompanied by the formation of hydrochloric acid. If, as is often the case, the bleach works possess a supply of very soft water, the basic matters absorbed by the finished yarns are not sufficient to neutralise this acid, with the result that nearly all the yarns which show the presence of active chlorine, also show the presence of free acid when tested with methyl orange. In their destructive action on cellulose, acids are catalytic in their functions, their action is progressive and cumulative, and therein lies the danger of flax chloramine.

About a year ago we recorded (Zeits. angew. Chem., 1907, **20**, 570) the presence of active oxygen and acidity in a sample of bleached cotton cloth which had been thoroughly washed. On the evidence available we attributed the phenomenon to the formation of a cellulose "peroxide," but we were unable to reproduce the conditions on any pure cotton fabrics by the use of hypochlorites in the laboratory. We are now able to give an explanation of those reactions which brought about this exceptional condition of the cotton, which will at once be understood when we state that the cloth in question had been bleached in a hypochlorite liquor which had previously been employed on flax goods. The cotton had absorbed from the bleach liquors the protein chloramines which had diffused from the flax. It is to be noted that the results as regards peroxidation of cellulose are confirmed by Ditz (Chem. Zeit., 1907, No. 68), who obtained such products by the action of persulphates on pure cellulose. The products which we examined were characterised by a permanent acidity not removable by washing with distilled water, and it still remains therefore an open question whether the cellulose had merely combined with the chloramine, or as a result of the combination had itself undergone peroxidation on long standing at the expense of the chloramine.

Quantitative observations on protein-chloramin reactions—Gelatin.—It is of course a matter of importance to determine the relationship of the fixation of chlorine to the nitrogen groups of particular proteins. At present we have to be satisfied with the general proportion of chlorine to total nitrogen, though we have little doubt that this reaction may be extended to throw a light on the actual proximate constitution of the proteins. Before we consider these reactions we may mention two facts of importance. First, that the gelatin chloramine formed by interaction of chlorine gas and the hydrated substance is extremely stable. A preparation which we made in December last, which was washed, dehydrated with alcohol and dried and found to contain 6·6 per cent. of active chlorine was examined on the 24th February and found to contain 6·2 per cent. Secondly, the chloramine is sensitive to the reagents known as antichlors, and a gelatin chloramine treated with sulphurous acid reverts to the original condition, which is shown by a full reaction with chlorine. These, of course, are constitutional facts which will have their application in research.

We now have to deal with the technical application of the reaction.

Chlorine and gelatin.—The interaction of these bodies may be made to give results which are sufficiently constant to afford a quantitative method of determination of the protein. In order to secure these results we have first to reckon with the fact that a mass of gelatin is only attacked superficially. If a sheet of dry gelatin of convenient thickness be immersed in a solution of hypochlorite for some hours, the gelatin will be found to have swollen almost normally, but the surface will have a hard feel which suggests its insolubility. After exhaustive washing of the swollen sheet, sections of same when placed in potassium iodide solution, are found to show the chloramine reaction in superficial layers of varying thickness. If the section be boiled with water the interior portion is found to be perfectly soluble, but the two surfaces remain in the liquid as insoluble films. Thus we may say that hypochlorites have a "tanning" action on gelatin in converting it into its chloramine, and that the product constitutes a semi-permeable membrane, which permits the passage of water, but prevents the diffusion of the hypochlorite. To secure a general attack we have found it necessary to use chlorine gas, and to diffuse the gelatin through a mass of inert material presenting an indefinitely large surface, for which purposes cotton yarn is very convenient. Cotton yarn was impregnated with known quantities of gelatin solution containing aluminium sulphate, and then dried. Weighed quantities of this yarn containing a known weight of gelatin were steeped in cold water to hydrate the gelatin, they were then squeezed out and exposed to an atmosphere of chlorine for one hour. Exhaustive washing of the chlorinated product gave variable final results, because soluble products presumably formed by hydrolysis of the chloramin appeared to diffuse indefinitely and the results in terms of chlorine decreased as the time of washing was prolonged. We were able to arrive at a fixed point by suspending the yarn without washing in a current of air from a small fan, until perfectly dry. The yarn was then placed in an excess of $N/10$ sodium arsenite solution (diluted) about one hour being allowed for complete penetration, and the excess of arsenite was titrated back with $N/10$ iodine. It might be presumed that the proportion of active chlorine fixed would be a measure of the quality of the gelatin, but we find that such is not the case, and that three samples of skin gelatin of very different qualities gave approximately identical results. As the mean of a large number of determinations we have fixed the proportion of active chlorine taken up by gelatin under these conditions at 15·4 per cent. of its air dry weight. This number is not appreciably changed if the gelatin be previously combined with formaldehyde. Further if the chloramine be immediately destroyed by sulphurous acid and washed, the gelatin will again take up the same amount of active chlorine on a second treatment with the gas.

From this work we have evolved a method for the detection and estimation of gelatin in tub-sized papers. The qualitative test possesses the advantage that any number of samples may be tested simultaneously, and that a very small fragment of each sample is sufficient. We have to bear in mind that iron compounds which are present in traces in the majority of papers would interfere with the test. In order to eliminate this error, and to arrive at a rapid result, we place the moist fragments after chlorination in a bath of 2 per cent. solution of sodium phosphate, previously heated to 45° C. and leave them for exactly five minutes. This reduces the otherwise inconvenient delicacy of the reaction, and ensures that only papers containing proteid matter will show a positive result. The fragments are removed from the bath and tested with potassium iodide and starch. Papers containing only 0·5 per cent. of gelatin still show a strong coloration. It should be noted that the presence of large quantities of mechanical wood pulp in a paper will produce a faint chloramine reaction owing to traces of proteid matter contained in raw wood. For the quantitative determination we suspend the sheets of paper after chlorination in front of the fan and expose to a full blast of air for at least 1½ hour. We find that exposure for only ¾ hour gives too high results owing to the greater density of paper as compared with cotton yarn, whilst exposure for 2½ hours gives the same result as for 1½ hour. The paper is then torn up, placed in $N/100$ arsenite for a considerable time (at least 1 hour), and the excess titrated with iodine. If these conditions be followed the divisor 15·4 noted above gives the quantity of gelatin in the paper as shewn by the following examples :—

Paper.	Percentage of gelatin by Kjeldahl (air dry weight) N% × 6·53.	Percentage of gelatin by chlorine (air dry weight).
Ordinary note paper (air dried vellum)........	7·1	7·1 7·25 7·4 7·3
Typewriting paper (cheap quality)	2·62	2·8 3·0
Hand-made ledger paper (Royal)............	*8·15	7·7 7·7

* This number has been corrected for ammonia alum, which was used in the size in the proportion of 15 per cent. on the gelatin.

Silk and chlorine.—We have selected silk as a convenient type of protein for the quantitative investigation of the relations between the active chlorine of the chloramine and the total chlorine fixed by this and other groups of the molecule (*e.g.*, unsaturated and quinonic groups). We have not succeeded in obtaining constant results, possibly because the reagents do not penetrate the substance of the fibre, but the relative results possess a certain interest. In determining these relations, exhaustive washing, which is very difficult to attain, is necessary; the total chlorine is then determined by heating with nitric acid and silver nitrate. In the first place, silk, like the flax and gelatin, shows much lower results for active chlorine when treated with hypochlorite solutions than when exposed to chlorine gas, and in the latter case the result appears to increase with the time of exposure; this may be a question of penetration or of proteolytic hydrolysis The following results may be recorded :—

Boiled-out silk. (Air-dried weights.)

Conditions.	Active chlorine.	Total chlorine.
	Per cent.	Per cent.
Silk and 0·5 per cent. neutral hypochlorite (washed)	1·2	—
Silk and chlorine gas ½ hour (washed)	3·01—3·04	6·01
,, ,, 1 hour ,,	5·46	7·24
,, ,, (blown off) ...	6·40	—
,, ,, (sulphurous acid and washed	nil	3·38

(Acidity produced during chlorination, 11 per cent. of hydrochloric acid.)

Titration of nitrogenous substances in solution.—We are not prepared to propose a finished method for the rapid titration of nitrogenous bodies in solution, however desirable such a method would be for many technical purposes, but we believe that the chloramine reaction will ultimately lead to such a process. In this case it will be necessary to ascertain whether the chloramine reaction is a measure of the total amino-groups present, or only of amino-groups in a certain state of freedom. (Compare the nitrous acid process of H. T. Brown for determination of the amino-acid index.)

We have made a few preliminary experiments on gelatin solutions using the hydrogen peroxide and potassium permanganate method noted above. We found that it was necessary to employ slightly alkaline solutions of the hypochlorite, because in presence of acid other groups of the proteid are chlorinated and precipitates are formed. The difficulty of these titrations lay in the tendency to spontaneous decomposition of the chloramine, but by limiting the time of action of the hypochlorite to about 1 hour the results were fairly constant. Ten c.c. of a 1 per cent. gelatin solution were placed in a flask with 50 c.c. of water, and 5 c.c. of normal caustic soda solution. An excess of hypochlorite was then added and allowed to act for one hour, a slight excess of hydrogen peroxide solution was then added, the solution acidified, and titrated back with permanganate. The chloramine was titrated by $N/10$ thiosulphate after addition of potassium iodide. For periods ranging from ½ to 1½ hour, the results were sufficiently constant, and showed 12·0 to 12·4 per cent. of active chlorine on the air dry gelatin. No difference could be detected between a very good sample of gelatin and a very poor sample. We hope that this titration may be considerably simplified, and perhaps standardised by taking advantage of the fact that hypochlorite chlorine will bleach a solution of indigo-carmine, whilst chloramine chlorine has no action on the dyestuff; we put forward this suggestion for the benefit of those who are interested.

In conclusion we observe that in this communication we limit ourselves intentionally to the positive experimental results of our investigations. We would only mention one matter of rather theoretical or speculative interest, that is the application of this reaction to the investigation of the colloidal state. There can be no doubt that the reaction with the nitrogenous colloids is well defined, and is available for solving constitutional problems as regards the constituent groups actually reacting. But the colloid is the proximate complex, and the chloramine reaction taking place in such large quantitative ratio, without, so far as we can see, breaking down the complex, *i.e.*, the colloid itself, as measured by its characteristic physical properties, it becomes an important pioneer reaction, comparable with the quinone-chloride reaction of the lignocelluloses, which has proved of great utility in the investigation of the fibre colloids.

Discussion.

The Chairman said the experiments which had been shown were of extreme importance, as they furnished a new key for unlocking the chemistry of the proteins and the organic colloids in general. They were also of great practical value in helping to solve the difficulties which beset the path of the bleacher. For it would seem that boys need now only go about the works and test whether each " boil " had been accomplished successfully, in that it destroyed all those proteins which in the " bleaching " process formed the chloramines.

The Chairman then referred at length to the views of Raschig on catalysis (this J., 1907, 1108), and which found a corollary in the papers by Pope and Barlow—which had led him to add glue to the solution of hypochlorite and ammonia in order so to influence the chemical change that the yield of hydrazine, which was at first only a few per cent., was brought up to a percentage of 40 or 60. Indeed, Raschig gave a very practical proof of what could thereby be achieved in that he now manufactured hydrazine at a very low price. Raschig's hypothesis that the shape of the molecules was altered by making the solution more viscous through the addition of glue (gelatin), caseïn and proteins in general, would seem to become untenable in the light of the facts brought forward by the authors of this paper. For they proved that the formation of chloramines from proteins and chlorine took place in stoichiometrical proportions. This opened up a new vista of investigation which would require an army of chemists to work out thoroughly. The authors had now put the action of chlorine of proteïns on a line with ordinary chemical reactions, amenable to the laws of the atomic theory. Reverting to Raschig's views he (the Chairman) pointed out that Raschig had also obtained favourable results by introducing glycerin, sugar, and starch into the solution of hypochlorite and ammonia. As these substances were characterised by hydroxyl groups he would like to ask the authors whether, in their opinion, the hydroxyl groups were perhaps attacked in a similar manner as were the amino groups of the proteins by chlorine.

Dr. S. Rideal referred to some previous work by himself and Mr. Bevan on the action of electrolytic chlorine in bleaching. They found that the Hermite process gave quantities of available chlorine in excess of the theory, and after much discussion the explanation was not quite cleared up. It would seem that this combination with nitrogenous substances present might offer some further solution to the peculiar behaviour of electrolytic chlorine both in bleaching and in sewage treatment. He (Dr. Rideal) recently had had a good deal to do with the sterilisation of sewage effluents by electrolytic chlorine, and found that ammonia and amino-compounds influenced the germicidal action. These unstable amino-chlorides explained this phenomenon. The authors had overlooked a paper by himself and Mr. Stewart, in the Analyst, 1897, p. 228, in which they had described a method for the determination of proteins by chlorine in which they showed that gelatin and allied proteins gave an insoluble chlorine compound which could be dried and weighed, or the nitrogen estimated by Kjeldahl's process. Bromine behaved similarly, and Allen and Searle (Analyst, 1897, p. 258) later worked out an analytical process using the latter reagent. In the course of that work he found that Mulder (Berzelius, Jahresb., **19**, 734) and others as far back as 1840 had prepared several of these bodies, " protein chlorous acid " and chlorite of albumin being the names ascribed to those from gelatin and albumin.

Mr. J. L. Baker, in reference to the statement that proteins formed substituted chloramines, asked if that would also apply to proteolytic degradation products. Would peptones form such compounds ? It would be of interest particularly in showing the differential distribution of proteins in seeds, etc. How would the authors proceed to examine a barleycorn for the distribution of proteins ? Was it necessary to remove the starch ?

Mr. Clayton Beadle said this paper was very interesting in connection with the paper trade, as it offered a simple method of ascertaining the amount of gelatin or casein in paper. It also appeared to throw a considerable light on problems in connection with the bleaching of celluloses. It was possible to bleach raw cottons containing 2½ to 5 per cent. of protein by means of certain accelerators very rapidly, but it required the use of about 10 per cent. of active chlorine; whereas the same cotton after treatment by boiling, which removed the bulk of this protein, would bleach with only about 1 per cent. of chlorine. This difference might be accounted for by the formation of the substituted chloramine. In connection with the bleaching of wood pulp also, the amount of chlorine consumed varied enormously with different pulps, and appeared to have no relationship with the amount of actual cellulose contained in them. Some doubt had been raised with regard to the actual chlorine consumption in the Hermite process, but, as a matter of fact, the chlorine consumption per unit of bleaching effect was estimated by three independent chemists, and he did not think there was the least difference. Three pounds of chlorine in the case of the Hermite liquor was equal in bleaching effect to five of chlorine in the case of only bleaching powder solution. The ratio of efficiency was therefore 3 : 5.

Mr. W. P. Dreaper drew attention to the extreme difficulty in many cases of deciding the cause of changes taking place when fabrics " tender " or develop stains on keeping. The authors had certainly thrown light on the alterations which might take place in the case of flax. In the case of wool and silk, the indications were that the matter was even more complicated. The figures given in the paper showing the different ways in which chlorine might be adsorbed, or held, by silk was interesting from hheory of dyeing side of the question.

Dr. G. T. Morgan said he had had an opportunity of repeating Raschig's original experiments, and it certainly afforded a simple means of obtaining hydrazine. It was a very significant fact that the catalysts, gelatin, casein, or ordinary joiner's glue, which induced the formation of hydrazine from the hypochlorite and ammonia, were found by the authors to be capable themselves of forming complex chloramines. It seemed as if the presence of a substance capable of yielding complex chloramines favoured the formation of chloramine itself, and it was therefore unlikely that non-nitrogenous compounds such as glycerin would not be so efficacious. It had been known for a long time that the treatment of wool by small quantities of hypochlorite considerably modified the action of this fibre towards colouring matters, and it would be interesting to know whether the authors considered this change in the properties of wool to be due to the production of chloramines.

Mr. W. C. Hancock said some years ago he was engaged with Messrs. Cross and Bevan in experiments to try to obtain ammonium hypochlorite, but they failed to get a definite compound or anything which showed any characteristic reaction. It appeared on the face of it, from the reactions described to-night, that the actual ammonium hypochlorite, if formed at all, would be immediately split up into this chloramine compound and water.

Mr. Cross, in reply, said the Chairman had raised the point of catalysis in reference to the hydrazine reactions (Raschig), and Dr. Morgan had anticipated the answer that should be given. There was a catalytic action here, the gelatin holding the chloramine group more firmly than the simple amine, enabled the synthesis to take place, otherwise the conditions of reaction were almost explosive. He should not think that compounds such as the carbohydrates would act in that way. He did not think it was a question of viscosity, as suggested by Raschig, who had overlooked the chloramine reaction of the proteids, though suggesting catalysis of a certain order. Dr. Rideal had reminded them of a long stretch of ancient history, which was extremely interesting. Though the hypochlorites and proteins had been brought together *ad infinitum*, the specific chloramine reaction had been entirely overlooked as such. It was the work of Raschig's which furnished the clue to the situation, and would, as now developed, clear up many matters of history. He agreed with Dr. Rideal that many must have observed the formation of these compounds, and it was remarkable that it required so long a time to get a clear explanation of the causes at work. He regretted that they had overlooked Dr. Rideal's communication to the Society of Public Analysts, which had an obvious and direct bearing on this particular matter. As far as he knew, it was a point of general knowledge that chlorine reacted with these proteins, and they had referred to wool and silk in this communication. The new point was the fixation of the "active" chloramine chlorine. When they came to look into Dr. Rideal's experiments no doubt they would find they had been very carefully done, and in combination with the present contribution would still further develop the examination of protein mixtures, by more exact methods of analysis. With regard to Mr. Baker's question as to the reaction becoming an index of proteolytic resolution, they had referred to the paper of Effront in the Berichte of 1904, who proposed to use the hypochlorite reaction for the estimation of the ammonia and proteins in drinking water. Starting with ammonia he showed that it would break up into nitrogen and hydrochloric acid; the proteins and peptones also entered into reaction with hypochlorites in constant proportions. He overlooked what was actually taking place, but his experiments bore directly on the point raised by Mr. Baker. That the series of peptones would react was undoubted, and probably in proportion to the free amino-groups. It would also be possible to correlate the chloramine reaction with Dr. Horace Brown's index, and throw a new light on the hydrolytic resolutions of the proteins. Mr. Baker also asked as to the localising of proteins in histological reactions: they would exhibit a section of potato which was a typical case. It was an extremely delicate reaction, and required graduating: the experiment with barley-corn sections could be easily carried out so that the starch did not interfere.

Dr. Rideal and Mr. Beadle particularly raised the question of electrolytic oxidation under conditions which they examined many years ago. They did certainly admit that probably chlorine might have got locked up in this particular way, especially as in certain of the bleaches investigated nitrogenous compounds were involved, and chloramines would undoubtedly be formed. Of course, in dealing with sewage and disinfectant reactions they had a whole line of new investigations opened out.[*] He had no doubt they must assume that the bacteria themselves would be chloraminated by this process, but how they would behave under those modified conditions remained to be shown. Mr. Dreaper had mentioned the application of this reaction in connection with the theory of dyeing. He was welcome to look at the numbers they had obtained for silk. No doubt the application of this reaction would enable them to investigate a number of problems which previously were not open because they had no means of quantitatively modifying the proteins, as, for instance, they could do with cellulose to form cellulose esters and other derivatives; in the case of nitrogenous colloids they had to make their observations on the substances which nature presented to them. Now they had the means of definitely modifying them. He had already made use of Dr. Morgan's suggestion in accounting for what he suggested was catalysis in regard to Raschig's use of a protein in promoting the hydrazine reaction. He might say that in this paper they had carefully limited themselves to what they had actually done. It was not fair in a matter of this wide application that they should attempt to anticipate a great deal of work which each specialist was entitled to bring forward himself. They had not thrown out a number of speculations as to the extensions which might be made, but he would recommend all those who had not come across Raschig's papers to take them into consideration, for it was quite clear that a large extension of investigation would result.

New York Section

Meeting held at Chemists' Club on Friday, Jan. 24, 1908.

MR. GEO. C. STONE IN THE CHAIR.

PRESENTATION OF THE PERKIN MEDAL TO MR. J. B. FRANCIS HERRESHOFF.

(Abstract of Proceedings.)

After a few introductory remarks by the chairman, in which he emphasized the importance of stimulating research by proper recognition, and drew attention to the work of Perkin, who not only discovered a new product, and developed the method of using it, but sold it, the Secretary, Dr. Hugo Schweitzer, read the report of the Medal Committee, and gave a history of Perkin's life work, quoting thus Adolf von Bayer: "The key to the knowledge of the nature of aniline colours lies in the basic properties of the carbon atom. The aniline colours which delight the eyes have thus attained more importance to science. Their rays are the torch which enlightens the path of the explorer in the dark regions of the interior of the molecule, and the man who has lit the torch is William Henry Perkin." Dr. Schweitzer observed that the discovery of mauve by the youthful Perkin led to the development of one of the most wonderful and scientific of human achievements, the coal tar industry. It exercised a predominant influence on all branches of chemical technology and had given employment, comfort, and health to millions. Dyestuffs innumerable have been and are still being evolved from coal tar giving a "rainbow" range of colours complying with every demand of taste and fashion, equalling in beauty, brilliance, stability and fastness to time, light and chemicals those supplied by Nature from plants and animals.

A host of therapeutic agents for the treatment of most diverse maladies has been and still is produced from coal tar. Anæsthetics and the active principles of animal glands and even a remedy for the African "sleeping sickness" are synthetically produced from this source.

Artificial "sweeteners," 550 times sweeter than sugar; artificial oils of almond and musk; odours of wintergreen, violets, roses, jasmin, and heliotrope are produced. Photographic developers and colour photography; "safety" explosives, smokeless powders; preservatives, alike against the destroyers of the forest and the bacteria in foods are all derived from the same source. Yet what do all these signify compared with von Bayer's encomium on Perkin's work: "It lit the torch enlightening the path of the explorer into the dark regions of the molecule."

Dr. Schweitzer recalled the celebrations of the 50th anniversary of the foundation of the coal tar industry—in London on July 26th; in America in October, 1906,[*] in honour of Sir William H. Perkin. On these occasions the chief scientific and technical societies of the civilised world and many universities congratulated him and accentuated his marvellous work and personal worth. The American celebration was in hands of a Committee.[†] This Committee collected funds for a chemical library—to be placed in the Chemists' Club and to be called the "Perkin Library." On the happy suggestion of Mr. H. A. Metz, a sum was set aside to provide for the award of a gold medal—to be called the "Perkin Medal"—to that chemist residing in the United States who had accomplished the most valuable work in applied chemistry during his career, whether this had proved successful at the time of execution or publication, or had subsequently become valuable in the development of industry. The first impression in gold of the medal designed by the artists of Tiffany under the direction of Dr. Kunz, was presented to Sir William Perkin on the occasion of his visit to America in 1906, at a banquet at Delmonico's.

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[*] Dr. Raschig, in a private communication (March 5) suggests that the particular and persistent odour, raised in the human skin in contact with hypochlorite solution may be due to chloramine reactions. We have made observations which confirm this suggestion (March 9).

[*] This J., Vol. XXV., 1906, pp. 783-6 and 1207-8.

[†] The Committee was constituted as follows:—G. C. Stone, H. Schweitzer, C. F. Chandler, W. H. Nichols, T. J. Parker, Clifford Richardson, V. Coblentz, R. W. Moore, Maximilian Toch, and F. C. R. Hemingway (representing the New York Section of the Society of Chemical Industry); W. McMurtrie, S. P. Sadtler, W. H. Walker, C. B. Dudley, H. C. Sherman, F. J. Pond and C. M. Joyce (representing the American Chemical Society); E. F. Roeber, S. A. Tucker, C. O. Mailloux, and A. von Isakovics (representing the American Electro-Chemical Society).

The Committee formulated rules, and in December, 1907, Mr. J. B. Francis Herreshoff was selected from among the names submitted by the various chemical societies as the American chemist to receive the first Perkin Medal. Dr. Schweitzer concluded thus:—"Alas, we who but a short time ago had the supreme pleasure of listening to Sir William's words and of rejoicing at his apparently perfect physical condition, which seemed to promise many years of active service in the cause we all love, are left to mourn his loss on this occasion of the first award of the medal which bears his name."

Prof. M. T. Bogert, President of the American Chemical Society, said life would indeed be gloomy and cheerless were there no recognition of good work. The form of recognition varied with the people and the age. The splendour and magnificence of the recognitions of victorious Roman generals, when the spoils of the conquerors were paraded before the eyes of the nation, were characteristic of the age. In ours, degrees, titles, medals and the like indicate the accomplishments of the individual, and to-night we gather to award one of these tokens of pre-eminence.

The victories of the chemist are those of peace, but they are not always peaceful victories. Many are won by desperate struggles and in face of great danger. The experimentor with explosives is in perils scarcely less than those of the soldier himsef. Bunsen in his memorable researches upon deadly cacodyl compounds — notably cacodyl cyanide—was a victim not only to an explosion which destroyed the sight of one eye, but to its terribly poisonous effects. Success crowned his efforts, nevertheless. Professor Campbell, of Michigan, lost both eyes through a chemical experiment, but he bravely works on, still directing the work of the analytical laboratories. No investigator will gainsay that the discovery of truth is itself a reward for the inevitable toil and tribulation endured. The thrill of delight in solving a problem that has for years baffled the most skilful investigator is a sensation of which no man can rob one and which brings not only deep and abiding satisfaction, but new inspiration and enthusiasm. Recognition of good work is none the less fitting or desirable in this account, since it furnishes to the individual direct evidence as to the regard in which his work is held by his fellows, and occasions like this are sources of mutual stimulation. Professor Bogert cited the influence of Sir Humphrey Davy's lectures at the Royal Institution on Faraday, while a bookbinder's apprentice. He congratulated American chemists upon the existence of two medals for annual award—the Nichols Medal of the American Chemical Society and the Perkin Medal of the Society of Chemical Industry. The recipient of the medal presented would not only regard it as a souvenir to be handed as a heirloom, but as an outward and visible token—a fusion, as it were, in artistic mould, of the golden opinions won by splendid work in his chosen field. It was his good fortune to be present at a banquet to Professor Michelson of the University of Chicago on his return with the highest honours of the Old World—the Nobel prize and the Copley medal, and it was, therefore, a very great pleasure in uniting in honouring America's most distinguished chemical engineer, Mr. Herreshoff.

Mr. H. A. **Metz** dilated upon "The services rendered by the Chemist in the Development of the Coal Tar Industry."

THE SERVICES RENDERED BY THE CHEMIST IN THE DEVELOPMENT OF THE COAL TAR INDUSTRY.

BY H. A. METZ.

In taking a broad view of this subject we may say that in giving an account of the services of the chemist in the industry, or better, industries originating in the utilization of the various products contained in the substance known as coal tar, it is necessary to give a complete history of these industries. It is impossible to separate in any way the scientific and the commercial development, as they are so closely interwoven in the advance made in the manufacture of the various products, whether colouring matters, medicines, technical products, or raw materials. The whole displays a system of evolution which we can appreciate more thoroughly than those in some other branches of science, as we have before us the visible results of each step forward in working out the possibilities of the application of trained scientific knowledge to the problem of these industries.

Although in the first half of the nineteenth century several investigators in the examination of certain substances obtained in various ways, discovered aniline and nitrobenzene, and the fact that these substances yielded coloured bodies under suitable conditions, was known, it was not until 1856 that the first of what are now commonly known as "aniline dyes" was discovered and manufactured commercially. This discovery was due to William Henry Perkin. Two years after the appearance of Perkin's mauve on the market, Hofmann discovered Magenta or Fuchsine, and the next year Verguin manufactured it commercially. Medlock and Nicholson introduced the arsenious acid process for its manufacture in 1860. In the same year Girard and de Laire discovered that by phenylating Rosaniline or Magenta, a blue colouring matter was obtained, known as Spirit Blue, being only soluble in alcohol, and in 1862 Nicholson discovered that this Spirit Blue by the action of sulphuric acid could be sulphonated and made soluble in water. This introduced a new series of colours, known as Soluble Blues, Water Blues, and Alkali Blues.

These dyestuffs all belong to the triphenylmethane group of colours. In 1858, P. Griess discovered what is known as the diazo reaction which opened the way to what now is the largest and most useful group of colours in practical use known as "azo colours." The first of these was introduced by Simpson, Maule and Nicholson in 1863, and called "Aniline Yellow." This was amino-azo-benzene, and the same firm introduced in the same year the methylated and ethylated Rosanilines discovered by Hofmann the year before.

In 1863 Lightfoot, in England, discovered the method of forming on the vegetable fibres, what is known as "Aniline Black." This, although one of the most widely known colouring matters, has defied analysis until last year, when R. Willstaetter and C. Moore claimed to have discovered the constitution of this elusive body.

The dyestuff industry at this time was located principally in England, as the names of the new colours which appeared from time to time show, but owing to the advances of technical education in France and later in Germany, it soon passed to these countries.

In 1868 Graebe and Liebermann announced the synthesis of alizarin from the anthracene in coal tar. The original source of this was madder-root, the product of almost all warm climates, and up to that time the most important of the natural red dyestuffs; the synthetic production of the pure colouring matter practically extinguished this trade and limited the profitable production to two to three countries, so that "madder-root" became largely a matter of name.

The synthesis of alizarin from anthracene led not only to immediate results in regard to the red dyestuff, but started researches for other possibilities in the production of dyestuffs from anthracene.

The effect of these efforts has been most marked. After the reds appeared orange, blue, brown, directly derived from anthracene and alizarine. Then somewhat later R. E. Schmidt brought out the higher oxyanthraquinone products which had marked advantages over the older dyestuffs. Next appeared the dyestuffs found by the condensation of various amino bodies with anthraquinone and its derivatives, and the latest, within two or three years, vat dyeing anthracene dyestuffs. All of these are the result of patient, untiring work on the part of chemists in the employ of the several large German manufacturing establishments.

The first of the aniline colours was found to require in dyeing cotton a mordant of some kind; either the fibre had to be treated with tannin or alum, or another metallic salt had to be used in the dyebath. This condition continued until 1884, when Boettiger patented Congo Red, which dyed unmordanted cotton in a bath containing merely common salt. This was followed by others in rapid succession, and to-day, these dyestuffs often called the "tetrazo dyestuffs" are one of the largest groups of colouring matters known. To this class belong the colours which are developed on the fibre, the first being the Primuline Yellow introduced in 1887. This is the prototype of all the dyestuffs which are dyed and afterwards developed on the fibre, a class in general use on account of the fastness of the resulting shades.

In 1873, Croissant and Bretonnier introduced a dyestuff which they obtained by heating organic substances, such as bran, sawdust, etc., with sodium sulphide, known commercially as "Cachou de Laval." This was used in dyeing on a limited scale, but the method of making attracted little attention until 1890, when Turners in England, and 1893, when Raymond Vidal in France, brought out the first, of what are known as Sulphide or Sulphur Blacks. This opened up a new field, which was immediately entered by numerous investigators, and the results are shown in the sample cards of the various manufacturers.

The greatest recent development as a result of chemical research is the manufacture and sale of synthetic indigo. The original processes for the synthesis of indigotin from toluene were discovered by Dr. A. Baeyer, in 1880, but were not commercially profitable. The Farbwerke Hoechst and the Badische Anilin und Soda Fabrik had an agreement to work out the Baeyer processes, and took up the investigation of a new process invented by Carl Heumann in 1890, using benzene and naphthalene as starting points.

Before the technical development of Heumann's method had been brought to a successful result, the Farbwerke Hoechst succeeded in perfecting a method for the commercial application of Baeyer's orthonitrobenzaldehyde process, and commenced the commercial manufacture of synthetic indigo by this process in 1896, and shortly afterwards, the Badische Anilin und Soda Fabrik, the manufacture of indigo by Heumann's process. The "Societe Chimique des Usines du Rhone," in Lyons, France, having at the same time succeeded in producing orthonitro-benzaldehyde cheaply, began also to produce indigo on a commercial scale.

While the commercial manufacture of indigo was now fully established, the most promising method, that of its production from benzene as indicated by Heumann, was still impracticable, on account of the unsatisfactory yields. A German chemist, J. Pfluger, discovered that the addition of sodium amide increased the yield sufficiently to make Heumann's process the most satisfactory and successful method for the synthetic production of indigo, and it is this process that is now generally used.

The cost of production of indigotin, or indigo, as it is commonly known, has decreased so rapidly that the natural indigo trade has suffered a severe decline, and the Government of India has called into service a number of expert scientists for the purpose of investigating the present state of the industry and the possibility of improving the conditions caused by the competition of the synthetic product with the natural.

The synthetic product is now almost exclusively used by the large manufacturing countries of the world. The total consumption in the United States for the year is equivalent to 1,500,000 pounds of 100 per cent. indigotin.

While the manufacturers were developing the coaltar dyestuff in the way shown, they were not idle in other lines, as the list of medicinal chemicals derived from coaltar shows. Some of the older ones, as antipyrin, acetanilide, phenacetin, have become so popular as to claim even the attention of the United States Government, but these are only a few of the total number.

All this is undoubtedly due to the effect of the services rendered by the chemist, as the number of products and their improvement so constantly and consistently shown in their manufacture indicate a corresponding increase in the scientific and practical knowledge of the subject. That this is recognised by the manufacturers is shown by the number of chemists employed; some of the larger works in Germany each having 200 and more on their staff.

The manufacturing establishments in the United States have begun to employ chemists more and more in their works, and we are here to-night, to present this medal which is given as a reward of their labours in this field. If this spirit is encouraged and the use of scientific knowledge increased, the manufacturing interests of the United States will at last take their proper position among the other nations of the world.

Mr. Samuel A. Tucker contributed an essay on "Electrochemistry as applied to Industrial Chemistry."

ELECTROCHEMISTRY AS APPLIED TO INDUSTRIAL CHEMISTRY.

BY SAMUEL A. TUCKER.

The application of electricity to industrial chemistry may be divided into two classes.

First, the application of electric energy to motive power and illumination, and secondly its utilisation to bring about chemical changes in order to form new and useful materials. The first is a matter with which the electrical engineer has to deal, nevertheless, the more extensive use of electricity for power purposes in chemical engineering make it necessary for the chemist to keep abreast of the times, and be familiar with the advance of electric power as appplied to his own industry. With the second application, however, industrial chemistry is very deeply concerned, and, although we may strive to divide the subject into electrochemistry, electrometallurgy, etc., they are all very closely associated with industrial chemistry, and the industrial chemist or engineer requires at the present time a very broad training in order to fit himself for the many diverse lines with which he may be connected.

We all know that electricity may be used in two ways to bring about chemical change. The more purely electrochemical is shown by the passage of a current through a solution of some chemical compound, the result being the formation of a new compound, or the deposition or separation of an element of which the compound is composed.

The other is the application of electricity to effect chemical or physical change by the generation of heat alone. In general it may be said that with the first class it has the advantage of usually producing a purer product than the strictly chemical process was able to accomplish, and also the production of compounds that without electrochemical means are impossible of production. The advantage of making a substance practically chemically pure in one operation is very apparent, and immediately puts a premium on the electrolytic article; such chemicals as caustic soda and cyanide, and electrolytic copper might be taken as examples of this. Metals such as aluminium and calcium and compounds like the persalts can only be produced by electrolytic means.

For purely thermal reactions the use of electricity is particularly advantageous, for it is possible by means of the electric furnace to reach temperatures higher than by other means, and also to bring this heat to bear within the material itself to be treated, and at the same time in a confined space, the result being a more efficient use of the heat energy and the production of a peculiar product which is alone attainable by such means.

I think it is very striking to note the rapid introduction into everyday life of material that was quite unknown or regarded as a chemical curiosity, and carefully preserved in museums. Carborundum, artificial graphite, silicon, aluminium, and acetyline have become such everyday matters that they no longer occasion any remark, but we can all remember when we had none of them. High temperatures open up many lines of investigation, and one particularly of which very little is known. I refer to the change of state or allotropic modifications that are possible by change of temperature. A piece of lime placed in the electric furnace and raised to a temperature of approximately 2200° C., is melted and then consists of crystals of definite form. But the crystalline lime bears little or no resemblance to the ordinary variety except in chemical composition. It no longer slakes in water even after standing for several days, and can be boiled with hydrochloric acid without chemical action setting in. There are other instances of this phenomenon, but the reason for such a change is not known. We speak of crystalline form, but of the real nature of crystals we probably know as little as of the real nature of electricity.

It would seem as if the development of applied electrochemistry had been very slow since the discoveries of Sir Humphrey Davy and Faraday, but we must remember that electricity had to be studied first, and while Faraday was announcing the laws of electrochemistry he was also giving us the fundamental principles of electrical engineering. It is therefore not surprising that the development of electricity should have been along the lines of light and power, and not until this advancement took place was such attention paid to what electricity could do in chemistry. One of the first uses of the dynamo was in electroplating, and although this industry is probably the oldest in electrochemistry, it stands in the peculiar position of having had but little advance since the days when it was established. This is largely due to the rule of thumb methods employed by most electroplaters, who are still content to employ what might be termed the "Wizard of the plating of the vat" and we have only to look over the so-called textbooks of electroplating to see how far science has penetrated. Electroplating forms, however, but a small part of applied electrochemistry, and it is significant to note that when the Census of 1890 was taken, no mention is made of chemical substances produced by electricity. In the next ten years the industry had grown to such magnitude as to make serious inroads on the older processes. According to the Census of 1900 there were fourteen establishments in this country for the manufacture of chemical substances by electric means, in which $9,173,000 capital and 739 wage earners were employed, and this did not include aluminium and copper. In the last seven years' expansion has taken place and many new lines have been developed. It might be well to look for a moment in what direction this development has taken and is likely to take.

Perhaps the most important advances have been made in the metallurgy of iron and steel, and the fixation of atmospheric nitrogen, because they are subjects of the first importance. With regard to the electrochemical processes for iron and steel, there is no question that they have come and come to stay. The investigation of the Canadian Commission did much to give a clearer understanding of the subject, at least in this country, and to show that there were established processes of great value to iron metallurgy. The developments of these processes in Europe was largely due to a peculiar condition—from the fact that the over-production of calcium carbide caused the furnaces to be put to other uses. The production of ferro-alloys in these same furnaces probably marked the beginning of the industry. Then came the Kjellin and Héroult processes to supersede the crucible process for high-grade steel. The product from either gives us steel of the highest quality with great economy, and their more extended use is likely to make a great advance in metallurgical progress. Furnaces of considerable size are now being operated in Europe from which much may be expected. The recent experiments in Canada with the Héroult reduction process have clearly demonstrated that it is entirely possible from a commercial standpoint. The peculiar conditions of fuel and refractory quality of the ore to be treated are the reasons for this. Indeed, the quality of the Canadian ores are such as to make them impossible of treatment in the ordinary blast furnace, and as a result of these experiments a commercial plant using the Héroult process is now under construction.

The importance of nitrogen fixation can hardly be overestimated, and it is not surprising that the inventors have turned their attention to this subject with good advantage. Much work has been done with the mechanical alteration in the high tension arc with some success, but the general belief that the combination of nitrogen and oxygen is alone dependent upon thermic considerations appears to be losing ground, and we will have to look for the cause of this combination from other standpoints.

Cyanamide furnishes a new use for carbide, as well as a means of fixing nitrogen, and it may be said that the electrochemist has been as clever in finding uses for his discoveries as in the discovery itself. For instance, Castner made so much sodium that it required all his power to find a market for it, but he succeeded, and the same may be said of the overstocked market for chlorine and bleach. Occasionally a substance is produced electrochemically that seems to come before it is wanted, and this is true of metallic calcium. Some day we will probably find uses for the abundance of calcium which is available.

The electrochemist is quick to make the first use of electrochemical products that have been made by some process not necessarily his own, and this is shown by Castner in the use of graphitized anodes for his caustic soda process. Other uses of graphite were not long in coming, and indeed that material has so many valuable properties that it would take too long to enumerate them. A word must be said, however, about the most recent of Acheson's triumphs, for deflocculated graphite bids fair to revolutionise the subject of lubrication, and the systematic and clever way in which it was developed only adds to our admiration of its able inventor.

Really, this ability to invent uses for an invention seems to be peculiar in the electrochemist. The new compound "Monox" seems to place Potter on an equal plane with some others in this respect, for the surprising things that are attributed to that interesting compound remind one of the probable patent claim that the alchemists would have included if Patent Offices had been in operation in those days.

We must remember, however, that the electrochemical side of chemical industry is peculiarly dependent upon cheap power, and that is a problem of the first importance for the scientific world to solve. Advantageous as it may seem to obtain power from Niagara, the price is too high for the successful operation of many processes of an electrochemical nature, and this is due largely to the heavy outlay necessary for the engineering work, which makes the interest charges so great that the price for power must be high. Apparently in this country we have few localities to compare in natural advantages for water power that are to be found in Europe, and we have the additional disadvantage of high labour cost for the engineering work, so that water power for chemical industries forms in this country a less attractive proposition than at first seemed the case. The location of the available water power also has a great influence on its usefulness in connection with transportation facilities, and the proximity of raw material. High tension power transmission is a help in this connection, but this also adds to the cost of power which is too high already at the place where it is generated.

The use of gas power is extending and will certainly have something to do with the advance in electric iron and steel production, but for the greater extension of electrochemical industries cheaper sources will have to come. The small return in power from coal even in the best engines of any description makes it seem almost vital to get at a more advantageous way of using fuel, but so far nothing promising has come in spite of electrochemical ideas in this connection. As the demand becomes greater we will probably have the problem solved on lines that we do not dream of at present.

Inventions come so fast that we are apt to think some problems impossible if they are not solved at once, but when the time is ripe we usually get what we want. It is therefore best for the present to content ourselves with such splendid advance as this last branch of chemical industry has had—an advance largely due to men of the stamp of the one we are honouring to-night.

PRESENTATON OF THE PERKIN MEDAL.

BY PROF. C. F. CHANDLER.

The improvements and inventions of Mr. Herreshoff began in 1875 and have continued down to the present time. From 1875-1890 he was associated with the firm of G. H. Nichols & Company; from 1890-1900 with the Nichols Chemical Company, and from 1900 to the present time with the Nichols Copper Company and the General Chemical Co. During these thirty years of active industrial development, Mr. Herreshoff has applied his mind to a great variety of chemical and metallurgical industries, and has perfected many radical improvements that have assisted greatly in reducing the cost of production and improving the quality of the products manufactured by these companies. He has substituted scientific management for the old fashioned rule of thumb in the conduct of all the operations which have come under his direction, and has thus developed the highest standard of factory control.

At an early date Mr. Herreshoff devoted his attention to copper smelting and invented the well-known smelting furnace for this metal which has long borne his name and was patented in 1883. Prior to this date brick furnaces had been almost exclusively used and the separation of the matte gave very crude and unsatisfactory results. His furnace is steel enclosed and water jacketed, with a movable fore-hearth or well, placed on wheels, so designed that the slag or the matte running out of the breast of the smelter must pass directly into the hole in the side of the well placed 8 in. or 10 in. below the molten mass that overflows from the opposite side of the well. In this manner the air blast is suitably trapped and coke is prevented from running into the well. The matte after accumulating in the well is tapped out from time to time. The success of this furnace became generally known and the steel water-jacketed furnace with a movable well is now almost universally employed, except where reverberatory furnaces for special reasons offer economical inducements. A number of these furnaces have been used in Canada in the Sudbury district for smelting nickel and copper ores. They are also used in the Ducktown district in Tenessee, in Mexico, and have been used for a long time at Laurel Hill.

The chamber process for sulphuric acid.—Later Herreshoff directed his attention to the improvement of the chamber process for manufacturing sulphuric acid and succeeded in developing the most advanced process—at least up to a short time since. In accomplishing this result his ingenuity was taxed in innumerable ways to provide the necessary apparatus with which to put his advanced ideas into practice. The atomizers devised by him for the injection of weak sulphuric acid into the chambers were a great improvement, and at once reduced the steam consumption by one-third. He succeeded in reducing the consumption of nitre to 1 per cent. on the sulphur burned. He then devised the Herreshoff tower, which is a modification of the Glover tower, and is designed for denitration and for concentration. In place of the brick of self-sustaining walls of the Glover tower, finely crushed material (preferably quartz) is used and the lateral pressure due to the interior filling or filter bed of the tower is resisted by suitable iron plates outside of the lead sides of the tower. This lining of fine material is thus held suitably in place and is prevented from passing or washing into the filter portion of the tower by an intermediate layer of quartz crushed to sizes from $\frac{1}{4}$ to $\frac{1}{2}''$. The filter bed is sustained by cross bearers of quartz. The bottom is so construeted that it completely resists the action of very hot acid of very high strength.

The great advantage of this tower is that its life is very long, being nearly indestructible. In operation the heat of the burner gas is retained by having a non-conductor over the arch and this high temperature assists greatly in giving perfect denitration although the acid is concentrated up to 63° or 64° B. The acid coming from this tower is so free from iron and alumina that it is run directly into a platinum still or pan and concentration is completed in another pan constructed of iron, the hot gases from the furnace passing directly under steam boilers. This invention effected a very great saving and has been in use from 1885 to the present time in the earlier works of the Nicholas Company and in all those of the General Chemical Company.

Herreshoff then developed an extremely ingenious apparatus for concentrating the sulphuric acid delivered from the Herreshoff tower. The hot acid from the improved tower is first concentrated to 65° Bé. in platinum. It is then run into an iron pan for concentration to over 66° Bé. From this pan it runs into a large cast-iron pan and while passing through it most of it is distilled off and condensed in a platinum Liebig's condenser to 66° Bé. This acid is free from arsenic and very pure. The acid which passes through the stills without distillation represents a small proportion of the total and has a strength of 98 per cent. The amount of fuel used in the distillation is very small on account of the small latent heat of sulphuric acid of this strength. This improvement in the distilling apparatus came as the result of the increasing demand for a purer sulphuric acid than could be obtained by the ordinary methods of concentration. Dr. Lunge, in his treatise on this subject states that the claims Mr. Herreshoff made for his still were impossible. Nevertheless, at one single establishment 100 tons of distilled sulphuric acid were produced daily from pyrites, that compared favourably with the concentrated acid made from brimstone, satisfying the demands at the time for purity, at a price at which brimstone could not profitably compete.

His almost indestructible Glover tower made it possible to concentrate the acid to a much higher strength than had previously been attained, and this in conjunction with the aforesaid stills produced practical results that in the stage of development then existing were almost revolutionary.

Herreshoff's improvements in the Gay-Lussac towers were also very marked, enabling him to use enormous quantities of sulphuric acid in absorbing, while at the same time the elevation to which the acid had to be pumped was greatly reduced.

Roasting furnace for pyrites fines.—His next invention was patented in 1896 and consists in an improvement on the original idea of the Gilchrist & Johnson type of roasting furnace, that is, a roasting furnace intended for roasting fine iron pyrites ores. Heretofore a great many roasters had been devised but none of them were satisfactory. Even the Gilchrist & Johnson furnace was a failure on account of inability to make repairs without completely shutting down the furnace, the arms being bolted solidly to the central vertical shaft. This bad feature was overcome by an improvement that made it possible to take out an arm whose teeth were no longer serviceable and replace it by a new one in one minute.

A marked improvement in this furnace was made and patented by him in 1899. When this improved furnace was put on the market there were immense quantities of fines ore in various parts of the country that could not be sold on account of the inability to roast it, especially for sulphuric acid making, without great cost and trouble. This ore was used up very rapidly thereafter, rendering available say 3,600 tons a day of fines pyrites which hitherto had been a kind of drug in the market. When one estimates that this means the production of more than 1,500 tons of sulphuric acid a day, one can see the importance of this furnace to that industry. There must be over a million tons of fines ore roasted in these furnaces annually, or enough to make approximately two million tons of vitriol per annum. The enormous accumulation of fines ores thus became almost as valuable as lump ore. These furnaces have not only been adopted in a large way by chemical works and fertilizer factories, but also for desulphurising ores in connection with copper refining. Up to this time there have been sold 478 furnaces in the United States and 644 in Europe, making a total of 1122 furnaces. Most of these are used for roasting pyrites fines ore in manufacturing sulphuric acid. They have a capacity for burning 3000 lb. of sulphur in 24 hours, and assuming that they were all used in the manufacture of sulphuric acid, the amount of acid produced as O.V. would be about 2,500,000 tons per year. They are still being sold quite extensively in Europe as well as in this country. They have been a great boon to the fertilizer industry of the United States, especially in the South, where most of the pyrites ore is in quite a fine condition when mined. They have also made possible the use of pyrites for the production of paper pulp in place of brimstone because by their use a sufficiently rich gas can be produced.

The electrolytic refining of copper.—The next great work which Herreshoff undertook was the development of the electrolytic refining of copper which was at that time practised in a very small way in two different works in the United States. His plan for electrolytic refining of copper was not at that time well understood. Even the analytical work necessary was quite inaccurate. The improvements and development which resulted from Herreshoff's study of the problem were only made possible by the highest scientific attainments and the aid of a corps of men thoroughly trained by him for the work. As a result he has created in the past ten years the largest copper refinery in the world, which in itself is a clear indication of the fact that his processes have been eminently successful in the perfection of their results as well as in their pecuniary economies. The output of this refinery at the present time is about 1,000,000 lb. of copper per day, or about one-fourth of the world's entire output. In connection with this work, Herreshoff invented an apparatus for casting metal, used especially for the casting of the thin anodes employed in the series system for making electrolytic copper, which has brought about a large saving, and which is very extensively used.

The contact process for the manufacture of sulphuric acid.—Mr. Herreshoff's crowning achievement has been his work in developing the contact process for the manufacture of sulphuric acid. Taking the magnificent work of Dr. Knietsch as a foundation, and the splendid engineering work of the Badische Company in Germany, Herreshoff, as the result of more than one thousand investigations, in which he was ably assisted by others, whom he directed, made that process not only adapted to American conditions, but has also economised very much the whole cost of the operation, so that now the contact system is an established process in this country. It has made possible the production of sulphuric acid at a lower cost than the old chamber system with the necessary concentrating plants in connection therewith, and now an acid virtually chemically pure can be supplied to the largest manufacturing industries in unlimited quantities at a lower price than previously known.

In addition to the great achievements which I have already mentioned, there are many others. Herreshoff has produced almost a revolution in every chemical manufacture which he has undertaken, increasing the yields, decreasing the cost, and improving the qualities of the products. One of the great secrets of Herreshoff's success is his ability to concentrate himself upon any given subject which he has in hand.

It is impossible to make a catalogue of the achievements of a great man. Mr. Herreshoff is an engineer by birth and a chemist by education. He is a typical chemical engineer, unsurpassed in this calling. It is eminently proper that he should be selected by the representatives of the great chemical societies of this country to receive the Perkin Medal.

It gives me great pleasure as the representative of the Society of Chemical Industry and the affiliated chemical and electrochemical societies to place in your hands, Mr. Herreshoff, this beautiful token of the appreciation and affection of your fellow-chemists.

In reply Mr. J. B. FRANCIS HERRESHOFF said: It is with difficulty that I find words to fully express my high appreciation and thanks for the great honour that is conferred upon me by the Society of Chemical Industry, the American Chemical Society, the Electro-Chemical Society and the Committee who had the final awarding of the Perkin Medal.

The knowledge that through my efforts chemical industry and the world have been benefited, gives me intense satisfaction. The greatest pleasures I have experienced during my life have been derived from successful results attained after long periods of experimenting and developing. I did not realise that there would ever be so grand a consummation to that work as the award of the first Perkin Medal.

From an early age problems in chemistry and its application were so interesting to me that my love for the work appeared to supersede that of everything else. This reminds me of a remark made by Prof. Peckham of Brown University, while addressing a class of students in chemistry, of which I was a member. He said that in order to succeed in chemistry you must love it better than your own soul. I have often thought of this and felt that these words were especially applicable to those who give up their lives to chemical pursuits.

There are few who realise how much inventors have done to bring the world up to its present remarkable condition. It is fair to assume that since the creation of man some progress in improvement was made, this continuing very slowly, the crude methods being handed down from father to son, from generation to generation, until after a great many thousand years sufficient facts were collected to formulate laws.

Then there commenced the building up of what has since become the glory of the world, its scientific studies in engineering, electricity and chemistry. Inventors laid the foundation for these sciences and in turn the sciences have immensely assisted the inventors as shown by the remarkable advancement that has been made in the last hundred years. Edison has stated that invention is in its infancy, and judging from this there seems a great future for the chemists of this country. Inventions may be classed under two heads: First, inventions that require very little experiment and development. Sometimes a mere thought may result in one of the most important inventions the world has known. Second, inventions that require an immense amount of work in the way of experiment and development, and of this class we have a great many examples of long chemical processes, for instance, the sulphuric acid chamber process, the soda ash Le Blanc process, the soda ash Solvay process, and innumerable processes in the aniline industry and in metallurgy, and, quite recently, the manufacture of sulphuric acid by the contact system.

In the fall of 1900 I was entrusted with the problem of working out the contact process. The principle of the contact process depends upon the fact that when sulphurous acid gas is mixed with the proper amount of air and heated to a temperature of 700° or 800° F., and passed through platinised asbestos, reaction takes place between the oxygen of the air and sulphur dioxide, resulting in the formation of sulphuric anhydride. In large systems, using 16,000 lb. of sulphur per 24 hours, about 2,000 cubic feet of air per minute is required. The hot gases from the kilns are made to pass through a long series of apparatus, each piece having a different function, until at the end a stream of 98 per cent. sulphuric acid of high quality runs at the rate of about a ton an hour.

The process is divided into the following stages:—

1st. The cooling of the gases.

2nd. The purification of the gases.

3rd. Drying of the gases.

4th. Propelling or drawing and forcing by means of a blower.

5th. The contact ovens for conversion to sulphuric anhydride.

6th. The absorption of the anhydride by sulphuric acid.

7th. The cooling of the delivered sulphuric acid.

In order to properly design a system of this character, the elements that go to make up the first cost must be carefully considered. They are fuel cost, labour cost, repair cost, plant cost, and consideration of the efficiency. It seemed impossible to work out this problem to a successful result without proving every step of the work by careful investigations carried out by apparatus designed especially for this purpose. Over a thousand of these investigations were made in the first three years of the development of this process, some of them having a direct bearing upon the question of the fuel cost through every step of the process. The result has been that in operating on a large scale during the last few years, the fuel cost has been unusually low. Investigations were made having a bearing upon the labour cost, and a great many to ensure as far as possible freedom from repairs. Investigations were also made to determine best material to use for the contact mass, and the manner in which it should be used, all of this having a bearing upon the efficiency, as well as the power, required. Careful study of the question of plant was made and many investigations to prove the correctness of our ideas were carefully conducted. Without these investigations it would have been practically impossible to achieve the success that these plants are now giving.

In carrying on these investigations I wish to express my thanks for the very able assistance rendered me by Mr. W. C. Ferguson, Mr. Henry Wigglesworth, Mr. A. W. Elkins, Mr. T. L. Briggs and others, and also for the assistance of a large Research Laboratory, such as is only found in large corporations or companies. The popular idea is that these large corporations are a menace to the welfare of the public. This is a grave error. Aside from the security that a large aggregation of business talent affords, it is possible in these corporations to have complete physical, mechanical and research laboratories, with an able *corps* of men to work out improvements in the present well known manufacturing methods, and create new products that add to the comfort and happiness of the whole world. In Germany we notice a very great development in the chemical industry, due chiefly to the fact of large corporations employing skilled research chemists.

I feel that there is indeed a great future for you in the opportunity afforded by the improvements that are possible in the development of the great natural resources of this country, and in all the higher manufacturing products. Your efforts in this direction will be greatly stimulated by the Perkin Medals that are to be given each year, and you will join me in thanking the Committee and others who, through their wisdom and generosity, have made it possible for the chemists to look forward to these great prizes, as well as to the honour that they carry.

Dr. William H. Nichols, Past President of the Society of Chemical Industry, in making some closing remarks, said: A little over a year ago when we had the honour and inspiration of a visit from Sir William Perkin, on the occasion of the celebration of the fiftieth anniversary of his great discovery, it was my privilege to present to him on behalf of his American friends the first Perkin Medal which was then established, to be the reward in subsequent years of those who had succeeded in the greatest measure in following in his footsteps. It did not occur to me at that time that the first of the medals to be awarded would be to my old friend and associate, Mr. Herreshoff. Had I the gift of prophecy, that knowledge would have added even greater happiness to what was an extremely happy occasion. Sir William has passed away, but the influence of his work remains and will always remain. His wife, true to his memory and always interested in what interested him, cabled me to-day as follows: "Lady Perkin and family cordially congratulate Mr. Herreshoff on the award."

As might have been said by Dr. Chandler in his remarks preceding the presentation of the medal this evening, Mr. Herreshoff evinced great ability in chemistry almost at the beginning of his college career. As a Sophomore in Brown University, he was appointed to teach chemistry to the Senior class. This alone would account for the fact that he did not graduate from Brown. That great institution of learning, however, honoured itself and him by subsequently granting him one of its honorary degrees in recognition of his subsequent work.

My acquaintance with him has been close and intimate for a third of a century. When I was struggling alone in the endeavour to fill all of the various posts of a young chemical enterprise, my business partner having been lost at sea, Mr. Herreshoff applied for the position of manager of the works. We were both young and inexperienced, but I thought I saw about him the making of a great man; and so the arrangement was made, and I became relieved thereby of the works management and was permitted to attend more to the business part of our affairs. You have heard from Dr. Chandler of some of the things which Mr. Herreshoff has done to benefit the world in the years that have elapsed since that time.

I cannot forget the advice then given to me by an old friend and competitor in the chemical business to the effect that I had made a most serious blunder in employing a man without experience at the head of our little works He pointed to his own success which he ascribed very largely to his superintendent who had come up from below without previous education, and had obtained his knowledge by hard knocks and experience. He said he would be glad to compare results with me at the end of ten years and see how little educated theory could do as against intelligent practice. Long before the ten years had elapsed my friend's works had been pulled down, the land sold, and to-day I would not be able to identify the exact spot where they were constructed, although it is somewhere in plain sight of my office-window, if some distance from it. This little story indicates as well as anything I can think of the importance of what Sir William Perkin himself demonstrated, namely: the employment in chemical works or in charge of chemical processes, of those who had been thoroughly prepared in the theory of the subject.

Fortunately Mr. Herreshoff, an educated chemist, was a born engineer. His possession of these two great powers accounts for much of his success. In addition to these, however, he possessed three gifts, which in my opinion are absolutely essential to great success along the lines which will lead to the acquisition of this medal. First: His modesty. Anyone who has ever had the pleasure of meeting Mr. Herreshoff in private, even when the most important matters were being discussed, could not fail to recognise his possession of this virtue in a high degree. Second: His simplicity. I use this word in contrast with the other word "duplicity," as I thereby make my meaning plainer. I do not believe that a man who follows the line of duplicity will ever succeed in obtaining anything really worth having. Third: His freedom from all thought of self. In all of these years, I have never known him to be governed for one moment by any motive other than the pursuit of the question in hand, no matter what effect it might have upon himself personally. He has been a scientist in the highest sense of that term. He neither played to the galleries, nor for his own advancement, but always for the discovery of the truth and its application afterwards.

In congratulating him upon this well-earned token of the appreciation of his fellow chemists, I desire particularly to call these three traits of his character to mind as an encouragement and inspiration to those who, emulating them, shall be at work in our chosen field of science for the benefit of the race.

Scottish Section.

Meeting held at Edinburgh on Tuesday, February 18th, 1908.

MR. JOHN S. MACARTHUR IN THE CHAIR.

NOTE ON CHLOROFORM AND ACETONE.

BY D. B. DOTT, F.I.C.

(*Abstract.*)

The author points out that three different equations are given in books to indicate the formation of chloroform from alcohol. According to (1), four molecules of ethyl alcohol yield two of chloroform; (2) three molecules of alcohol yield two of chloroform; (3) two molecules of alcohol yield two of chloroform. According to some authorities, a large amount of formate is produced in the reaction. This is probably purely theoretical, as at the close of the reaction no appreciable amount of formate is found. The equation which best agrees with experimental results is: $3C_2H_6O + 8Ca(OCl)_2 = 2CHCl_3 + 3CaCO_3 + CO_2 + 8H_2O + 5CaCl_2$. The equation generally given for the formation of chloroform from acetone agrees very well with observed facts:

$$2CO(CH_3)_2 + 3CaOCl_2 = 2CHCl_3 + Ca(CH_3COO)_2 + 2Ca(OH)_2.$$

There is abundance of acetate in the liquor after distilling off the chloroform, and the yield practically agrees with the relative molecular weights.

The author confirms the observation of Finnemore and Wade (J. Chem. Soc., 85, 938) that a small proportion of ethyl chloride is formed in preparing chloroform from ethyl alcohol. Unlike most impurities, it is not removed by washing with water, treatment with sulphuric acid, or with soda solution. It comes over with the first distillate on rectifying. When present in small proportion in the finished product, it is not an objectionable impurity, having anæsthetic properties analogous to those of chloroform. Attention was called to the importance of the impurities that may be present in commercial acetone. Samples which indicated 99 per cent. by the iodoform and other methods gave about 7 per cent. distilling above 58°. This was at first thought to be due to the presence of higher ketones or other bodies yielding iodoform, and Prof. J. Gibson suggested that it might possibly be caused by the presence of even 1 per cent. of a mixture of the condensation products of acetone (*e.g.*, mesityl oxide, phorone, and mesitylene), which have all relatively high boiling points. It was found that on mixing pure acetone with 1 per cent. of the mixed condensation products, it behaved on distillation and in its iodoform yield, and otherwise, like the samples referred to. When purifying acetone, the manufacturers should avoid treatment with mineral acids, or other method which is likely to cause formation of the condensation compounds.

So far as the author is aware, there is no published reference to the fact that when acetone and chloroform are mixed, there is a notable rise in temperature. When mixed in proportion of two molecules of chloroform to one of acetone, a rise of 11·7° C. was noted. In equimolecular proportions the rise was slightly less. The mixture distils for the most part above the boiling point of either constituent, indicating probably that combination has taken place.

In answer to a question as to why carbonyl chloride is sometimes found in chloroform, the author suggested that this took place very probably according to the equation: $CHCl_3 + H_2O_2 = COCl_2 + HCl + H_2O$. The conditions which favour the formation of hydrogen peroxide—a degree of moisture and direct sunlight—are also those which favour the decomposition of chloroform.

Journal and Patent Literature.

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I.—PLANT, APPARATUS, AND MACHINERY.

Patents.

Vacuum jacketed vessels for maintaining substances at a constant temperature. A. Stock, Berlin. Eng. Pat. 26,984, Dec. 6, 1907. Under Int. Conv., Dec. 8, 1906.

The space between the double walls of the insulating vessel is filled with sulphur dioxide, or some other easily condensable gas. When liquid air, or other very low-boiling fluid is placed in the inner vessel, the gas in the jacketing space is condensed to a liquid and a heat-insulating vacuum is formed.—W. H. C.

Roasting-kiln. J. Zellweger, St. Louis, Mo. U.S. Pat. 878,704, Feb. 11, 1908.

The heating flue which passes beneath the hearth of the kiln has air flues on both sides and beneath. Air is passed through these flues and becomes heated by the radiation from the bottom and sides of the heating flue. —W. H. C.

Distillation; Method of ——. T. A. Dungan, Chicago, Ill. U.S. Pat. 878,785, Feb. 11, 1908.

The heating of the still is effected by circulating a medium through coils within the still body and a coil placed in an external heater. The temperature of the heater is maintained at such a point that sufficient heat is imparted to the medium to effect the distillation of the desired fraction.—W. H. C.

Distilling apparatus. W. H. Bartholomew, East Orange, N.J., Assignor to C. B. Hill, Montgomery, N.Y. U.S. Pat. 879,236, Feb. 18, 1908.

The apparatus consists of a steam-boiler with a feed vessel arranged to keep a constant level within the boiler, an evaporator also provided with a constant-level feed vessel and heated by a coil through which steam from the boiler passes, and a jacketed condenser. The boiler is fed with warm water from the jacket of the condenser and the evaporator is fed with the condensed water from its steam coil, which is provided with a steam trap so that only the condensed water can escape.—W. H. C.

Separating the moisture from the constituent solids of liquids; Process for ——. L. C. and I. S. Merrell and W. B. Gere, Assignors to Merrell-Soule Co., Syracuse, N.Y. U.S. Pat. 878,977, Feb. 11, 1908.

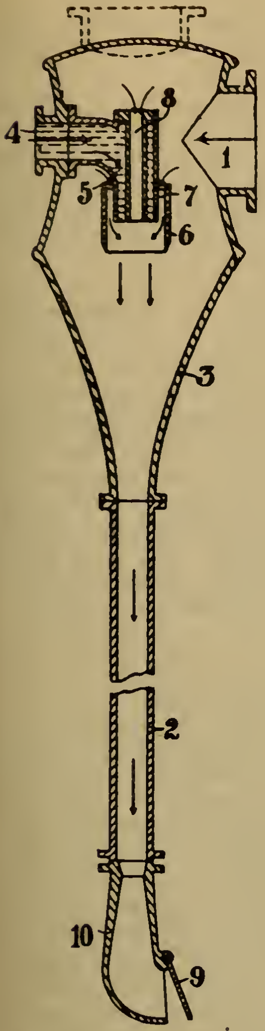
The liquid is rendered viscous by the addition of some "compatible" substance and is then sprayed into a chamber into which a current of heated air, or gas, is delivered. The liquid is converted into vapour and the dry solid is collected as a powder. The vapour-laden air is discharged at a separate opening from that by which the powder is taken out.—W. H. C.

Desiccating apparatus. S. P. Rasmussen, Hanwell. U.S. Pat. 879,490, Feb. 18, 1908.

See Eng. Pat. 25,750 of 1906; this J., 1907, 1106.—T. F. B.

Concentrating liquors. J. H. Campbell, Assignor to C. H. Campbell and to E. and C. H. Campbell, New York. U.S. Pat. 879,515, Feb. 18, 1908.

The apparatus consists of a jacketed tank in which a coil is placed. The coil is formed of several superposed horizontal sections which can be turned into a vertical position for cleaning purposes. Air is introduced into the liquid through a removable perforated pipe which is placed along the bottom of the tank.—W. H. C.



Jet condenser for producing a vacuum. J. Tinsley. Fr. Pat. 382,874, Oct. 14, 1907. Under Int. Conv., Oct. 15, 1906.

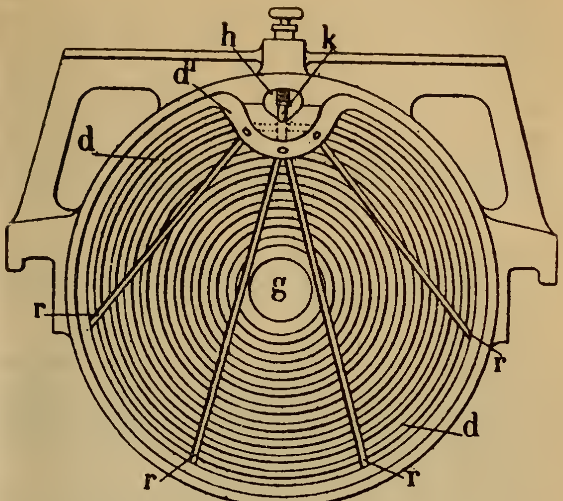
The vapour enters the condenser by the pipe, 1, and is drawn into the annular space between the concentric tubes, 6, 7, and into the central space, 8, as shown by the arrows, by the fall of an annular jet of water which enters at 4, and is delivered as a liquid annulus from the tube, 5. The water along with the condensed steam or vapour flows down the long vertical tube, 3, 2, 10, and escapes from the bottom through the flap-valve, 9, which allows liquid to flow out into the tank placed below, but prevents air from entering the tube.—W. H. C.

Evaporation, concentration and desiccation of liquids containing solid bodies in solution or in suspension ; Process for the rapid ——. C. Gosset and L. Calmels. Fr. Pat. 383,295, Jan. 4, 1907.

The liquid is sprayed into a closed vessel heated by a jacket and connected to a surface condenser and a dry vacuum pump.—W. H. C.

Filter-press. J. M. A. Faure. Fr. Pat. 382,959, Dec. 21, 1906.

The plates of the press have the form shown in the figure. The liquid to be filtered enters through the central opening, *g*, into the space between the cloths with which the plates are covered. The clear liquid passes through the cloth and passes by the circular channels, *d*, and the cross channels, *r*, to the collecting chamber, d^1. From d^1, the filtrate passes by the channels indicated by the dotted lines to the opening, *h*, which forms with the corresponding openings in the other plates a closed channel, extending the full length of the press, through which the filtrate escapes. Filtration can thus be carried on in a closed system and any of the plates can be shut off and isolated by the screw-valve, *k*, which when screwed down closes the connection between the opening, *h*, and the channels indicated by the dotted lines.—W. H. C.



Filtering apparatus ; Rapid ——. T. Frick. Fr. Pat. 382,835, Oct. 10, 1907.

The filter-elements are formed of a disc of coarse metallic gauze between two discs of finer gauze and enclosed between two discs of filter-cloth. The discs are bound together by a U-shaped metal ring which is connected to a collecting box at each side. Several of these elements are placed one above the other with a space between, and the collecting boxes fit into one another so as to form vertical effluent pipes. The pile of elements is placed in a tank provided with a removable cover and supported by trunnions, so that it can be tilted at any angle, on a portable stand provided with wheels. The collecting boxes of the uppermost element are closed above, and those of the lowest element are open below and connected to two delivery pipes which pass vertically through the bottom of the tank. The liquid to be filtered is introduced under pressure by two horizontal pipes which enter at opposite sides of the tank at about the level of the trunnions, and have their interior orifices protected by baffle-plates to cause the liquid to enter quietly. The solids are deposited on the exterior surfaces of the elements and the clear liquid passes through the filter-cloth into the interior, and thence to the U-shaped rims, the collecting boxes and the delivery pipes.—W. H. C.

Compressing air and other gases ; Processes for ——, with arrangements for purifying, drying and cooling. W. O. Felt. Fr. Pat. 382,761, Oct. 11, 1907.

Glycerin is drawn into the cylinder along with the air during the compression, and absorbs the heat produced as well as the aqueous vapour and the impurities of the air. The mixture of glycerin and compressed air is delivered from the pump into a separator provided with shelves or trays where the glycerin is separated. The purified compressed air either passes from the separator into the cylinder of an engine where it expands and does work, or it may be used directly. The glycerin is withdrawn from the separator and after being passed through a cooler, is used over again until is is saturated with moisture. It is then withdrawn and the absorbed water is driven off by heat.—W. H. C.

II.—FUEL, GAS, AND LIGHT.

Patents.

Fuel ; Preparation of a ——. T. Parker. Fr. Pat. 383,144, Dec. 27, 1906.

See U.S. Pat. 865,724 of 1907 ; this J., 1907, 1078.—T. F. B.

Combustible or other agglomerates; Process of manufacturing ——. H. Poulet. Fr. Pat. 383,298, Jan. 4, 1907.

To 1000 parts of the powder to be agglomerated are added from 10 to 12 parts of previously dried and ground skin parings (the waste from curriers' or glovers' factories), and from 4 to 6 parts of rice starch. After being thoroughly mixed in an apparatus provided with jets of steam, the mass is briquetted.—W. H. C.

Briquettes; Process for the manufacture of coal or coke —— in the cold, using water and sodium or potassium silicate. J. F. Blaveau. Fr. Pat. 383,357, Oct. 28, 1907.

The powdered coal or coke is mixed with a suitable proportion of water, varying according to the amount of moisture contained in the material. From six to ten per cent. of sodium or potassium silicate is previously added to the water, and the mass after being well mixed, is pressed into moulds.—W. H. C.

Coke ovens. G. Wilton, London. Eng. Pat. 3098, Feb. 7, 1907.

The oven comprises two rows of coking chambers placed back to back, and a charging and discharging apparatus travelling between them. Each chamber is large enough to hold several tons of coal; the floor is inclined upwards from front to back at about the angle of repose of the fuel, the roof is parallel to the floor, and the front is closed by a vertically sliding door covering its whole area. The charging and discharging apparatus comprises a hopper for feeding coal through openings near the top of the rear walls of opposite chambers, and two comparatively small rams working along the inclined floors of opposite chambers for discharging the coke when the doors at the lower end are removed.—A. T. L.

Waste coal and coke; Utilising ——. C. Wahlen, Köln, and N. Caro, Berlin, Germany. Eng. Pat. 13,668, June 13, 1907.

The material forming the "wash, or dirt heaps" of collieries, mixed with waste coke from coking ovens, is heated in a shaft furnace, heated externally, through which steam is passed. Combustible gases and porous coke are obtained, and the nitrogen in the waste material is converted into ammonia, which may be recovered from the gas. The waste coke used with the coal, etc., prevents the material from caking in the furnace.—A. T. L.

Waste coal; Utilising —— [for the production of ammonia]. N. Caro, Berlin. Eng. Pat. 13,669, June 13, 1907.

The invention consists in treating the material of colliery "wash heaps" (which may contain twice as much nitrogen as corresponds to their content of pure coal) in a gas producer by the Mond process, in order to obtain the nitrogen of the coal and of the non-combustible nitrogenous waste in the form of ammonia.—A. T. L.

Water gas; Apparatus for the manufacture of ——. Felten und Guilleaume-Lahmeyerwerke Akt.-Ges., Frankfort-on-the-Maine. Eng. Pat. 2,676, Feb. 2, 1907. Under Int. Conv., Feb. 3, 1906.

To avoid the heating up of a water-gas producer by blowing and make the process continuous, the use of an electric furnace has been proposed. This invention relates to a modified form of a known electric resistance furnace built as a water-gas producer, the heat generated by the electric current being utilised to keep the fuel at the required temperature. A shaft is filled with coke through a hopper; the coke constitutes a resistance mass between poles of carbon or cooled metal embedded in the walls of the shaft. Steam or water is introduced through a pipe at the bottom of the producer and the gas is taken off at the top.—R. L.

Gas; Apparatus for the production of ——. C. B. Tully, London. Eng. Pat. 3689, Feb. 14, 1907.

The invention relates to apparatus in which heavy hydrocarbons or tar are sprayed into a producer chamber containing a bed of incandescent fuel. The hydrocarbon is sprayed through the vertical walls of the producer at a number of points into spaces kept free of fuel, each nozzle being shielded by an arch which forms the top of a frame built into the refractory lining, the arch extending a suitable distance into the producer chamber. The frame is provided with an inspection door below the nozzle, so that obstructions due to decomposition of the hydrocarbon can be localised and removed by poking.—A. T. L.

Producer gas or suction gas for gas engines and other purposes; Manufacture of ——. G. Wilton, London. Eng. Pat. 3911, Feb. 16, 1907.

The invention consists in washing the gas with water containing iron oxide and a salt of iron, such as the sulphate, in order to remove sulphur and ammonia from the gas and to avoid the production of an objectionable effluent such as is obtained when the gas is washed with water alone. The scrubber may be of the kind described in Eng Pat. 13,787 of 1906 (this J., 1907, 191). The liquor is cooled and used repeatedly in the scrubber until it is sufficiently concentrated to be treated for the recovery of by-products if desired. The liquor leaving the scrubber may be brought into contact with the air to convert the sulphides into sulphur and iron oxide.
—A. T. L.

Gas-producers. T. V. Hughes, Birmingham. Eng. Pat. 7454, March 28, 1907.

The invention relates to a portable inclined hollow grate for generating steam for gas-producers and to devices for automatically controlling the supply of water to the grate. The portable grate consists of two hollow triangular end standards with hollow transverse bars at the upper and lower ends forming a frame for alternate hollow and solid fire-bars, the solid bars being loose in the frame. The two standards are connected at the lower part by transverse pipes. Water is supplied to one of the standards through an inverted siphon pipe, and the steam is led to the producer from the upper ends of the fire-bars. For controlling the water supply, part of the producer gas is led to a water-jacketed diffusion apparatus provided with a mercury manometer, so that an excess of hydrogen in the gas, causing increased pressure in the apparatus, raises a float in the open limb of the manometer and closes the water-supply cock. In a modification, the water supply is controlled by an electric pyrometer in accordance with the temperature obtained by the combustion of the gases.—A. T. L.

Coal; Apparatus for distilling ——. J. W. Aylsworth, East Orange, and F. L. Dyer, Montclair, N.J. U.S. Pat. 878,490, Feb. 11, 1908.

A long vertical retort is surrounded by a furnace chamber which maintains a distilling zone in the middle portion of the retort. There is a continuous closed circulation of gases through a heating coil in the furnace and through the distilling zone in the retort. Inclined wings extend through the walls of the retort into the surrounding flue, and means are provided for feeding coal at the top and withdrawing coke from the bottom of the retort.
—A. T. L.

Fuel gas; Process of and apparatus for manufacturing ——. C. H. Rider, St. Louis. U.S. Pats. 879,320 and 879,321, Feb. 18, 1908.

See Eng. Pat. 21,078 of 1907; this J., 1908, 67.—T. F. B.

Gas-producer. R. B. Cissel. Elizabeth, N.J., Assignor to Backus Water Motor Co., Newark, N.J. U.S. Pat. 879,441, Feb. 18, 1908.

WATER vapour is supplied to a producer through a ring-shaped pipe which is placed beneath the grate. The pipe has symmetrically spaced apertures for the passage of the vapour, which open downwards and are protected from the falling ashes by hoods.—W. H. C.

Producer gas ; Generator for ——. A. Deneuville. Fr. Pat. 381,683, Nov. 16, 1906.

THE generator consists of a body without refractory lining. The hopper through which the fuel is charged is surrounded by an annular chamber in which the gas accumulates previous to being aspirated by the engine. The body of the generator is provided with a water jacket ; steam is raised in this jacket and passed through an outlet pipe at the top into the base and under the grate of the generator. A constant level is maintained in the water jacket by an overflow which is controlled by a float. The feed of the water, and the supply of steam and of fuel are automatically regulated.—R. L.

Retorts for the distillation of coal or other fuel. A. and S. Seigle. Fr. Pat. 382,055, Nov. 28, 1906.

IN the manufacture of combustible gases, retorts preferably of the ⌓-shaped type are provided with a lining of chromium to avoid the contact of the fireclay or other refractory material with the fuel to be gasified. This lining consists of a sheet of chromium, cast or forged, or may be made by electrolytically depositing chromium or an alloy sufficiently rich in chromium on sheet iron. The lining need not be complete, but may only cover the bottom and sides of the retort.—R. L.

Gas and coke ; Retort furnace for the production of ——. H. Koppers. Fr. Pat. 382,066, Sept. 2, 1907. Under Int. Conv., Sept. 13, 1906, and Jan. 26, 1907.

THIS invention relates to a retort furnace for the production of gas and coke in which the heating ducts, with their respective regenerators, are arranged symmetrically with regard to the gas inlets through which the gas flows constantly from the gas generators of the same set. The employment of U-shaped heating ducts and the admission of the gas at the apex of the U, permits the reversal of the direction of flow of the combustible gases by altering the position of the dampers for the escaping gases of combustion and for the air entering the regenerators. —R. L.

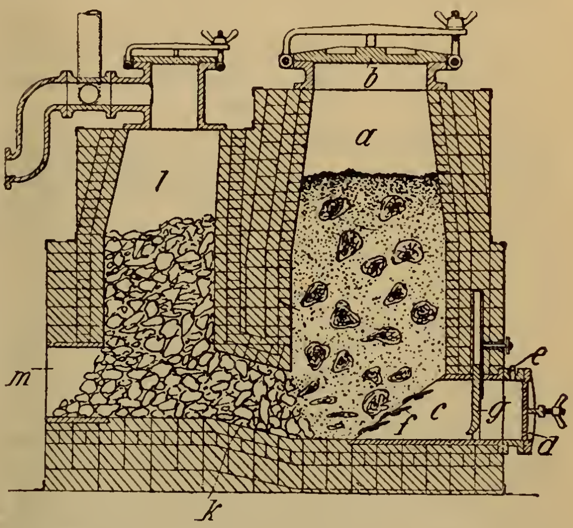
Gas ; Mixture for increasing the combustible matter and calorific value of ——. G. de Velna. First Addition, dated Sept. 20, 1907, to Fr. Pat. 376,622, April 12, 1907.

THE mixture of pitch, tar or other hydrocarbons with a saturated solution of caustic soda as described in the principal patent is now utilised for quenching coke. By this means a substitute for gas coal is obtained. The same coke may be treated in this way several times. —R. L.

Gas ; New method of production of industrial lighting and heating ——. L. Vignon. First Addition, dated Oct. 15, 1907, to Fr. Pat. 371,337, Nov. 12, 1906 (this J., 1907, 310).

IN order to oxidise the carbon monoxide as completely as possible, it is necessary to carry out the operation described in the principal patent at definite temperatures. This may be accomplished in two ways, the first being intermittent and the second continuous. According to the first method water-gas is passed over ferric oxide at about 400° C. when the ferric oxide is reduced to the metallic state and carbon dioxide and hydrogen are obtained. The temperature is then raised to between 800 and 1000° C. and steam is passed over the reduced iron ; ferric oxide is regenerated and hydrogen is set free. According to the second method a mixture of water-gas and steam is passed continuously over metallic iron or ferric oxide and a mixture of carbon dioxide and hydrogen is obtained.—W. H. C.

Gas-producer for utilising all kinds of combustible materials (anthracite, lean coal, wood and other industrial waste, etc.). V. Carette and L. Hairaye. Fr. Pat. 383,345, Oct. 26, 1907.



THE generator consists of a chamber, *a*, provided with a charging opening above, closed by the cover, *b*, and connected by the passage, *k*, to a second chamber, *l*, filled with refractory material. Air is blown through the pipe, *e*, into the air chamber, *c*, provided with a door, *d*, and an adjustable damper, *g*, and enters the lower part of the generator between the adjustable rocking bars, *f*, of the grate. The gas generated passes through the passage, *k*, into the chamber, *l*, where the dust and tarry matters are retained by the packing. The purified gas leaves this chamber by a pipe near the top and may, if desired, be further purified and reheated before being used. The dust which collects in *l*, is removed from time to time by connecting an aspirator to the channel, *m*, just before stopping the producer.—W. H. C.

Gas purification and apparatus therefor. D. Vass, Airdrie. Eng. Pat. 26,032, Nov. 25, 1907.

To allow for lateral expansion of purifying material such as hydrated oxide of iron mixed with sawdust, which swells during use, furrows are formed in the layers of oxide in the purifier. The grids are made solid, or closed by baffle-boards, beneath the furrows, where the depth of oxide is reduced. Wet steam or water spray may be injected to keep the oxide moist, and a steam coil is placed in the lower part of the purifier. —A. T. L.

Gases ; Purifier for ——. W. Towns, Liverpool. U.S. Pat. 879,219, Feb. 18, 1908.

SEE Eng. Pat. 10,993 of 1905 ; this J., 1905. 1164.—T. F. B.

Coal, lignite and peat ; Process and apparatus for the extraction of by-products from the distillation gases of ——. J. Plzák. Fr. Pat. 381,600, Aug. 24, 1907. Under Int. Conv., Sept. 4, 1906.

THIS is a process for the recovery of by-products from the gases obtained in the dry distillation of coal, lignite or peat in such a manner that the tar, ammonia and the sensible heat of the gas coming from the retorts are simultaneously taken up by the washing liquor circulating between the first washer and the scrubber. The tar separates from the aqueous solution and is run into a well. The hot ammoniacal liquor is cooled by a current of air which becomes saturated with ammonia and steam and is subsequently passed through sulphuric acid for the manufacture of ammonium sulphate. The cooled liquor is returned to the washer and may be from time to time distilled with lime for the recovery of fixed ammonia.—R. L.

Electric lamps; Manufacture of incandescing bodies for ——. The British Thomson-Houston Co., Ltd., London. From Allgem. Elektricitäts-Ges., Berlin. Eng. Pat. 24,232, Oct. 30, 1906.

Filaments for incandescence lamps may consist of tungstous oxide. These bodies for incandescent lamps are prepared by heating metallic tungsten filaments at about 500° C. in an atmosphere of oxygen, whereby the oxygen is absorbed. The heating may be effected *in vacuo* or in the lamp itself. The initial pressure should be 0·07 mm. Only a limited amount of oxygen is admitted.—R. L.

Electric lamps having incandescing bodies of refractory metal. The British Thomson-Houston Co., Ltd., London. From Allgem. Elektricitäts-Ges., Berlin. Eng. Pat. 24,233, Oct. 30, 1906.

Metal filaments in incandescence lamps have to be supported on account of their length and brittleness, by holders which in the case of osmium lamps, for instance, are made by pressing into rods a mixture of thorium oxide with 10 per cent. of magnesium oxide and igniting the rods. These holders are not durable at the temperature required for the incandescence of tungsten. To raise the fusing point of the holders, they are now made of pure thorium oxide or magnesium oxide, containing not more than 2 per cent. of impurities, by forming a paste with a suitable binding material and moulding this into the required shape. The thin glaze which is formed on the surface by ignition to 2000° C. is removed by dipping into a hydrofluoric-sulphuric acid mixture, whereby the impurities are dissolved off and a highly refractory surface remains.—R. L.

Electric lamps; Incandescing bodies for ——. The British Thomson-Houston Co. Ltd., London. From the General Electric Co., Schenectady, U.S.A. Eng. Pat. 4364, Feb. 21, 1907.

Carbon filaments of the type now commonly used for the manufacture of incandescence lamps are packed in pulverised quartz and heated in a vacuum. The quartz should be free from microscopic inclusions of water, salts or volatile impurities. To this end it is heated in a vacuum furnace of the type described in Eng. Pat. 20,809 of 1904 (this J., 1905, 446, 976). The filaments are packed in bundles of several hundreds in graphite crucibles and heated in a similar furnace for one hour at 1500 to 1600° C. By this treatment the quartz is not fused, but its vapour tension is sufficiently increased to allow the silica vapour to permeate the carbon filaments, thereby changing their colour and decreasing their length. The filaments are finished by a further heating at 2000° C. in the absence of quartz.—R. L.

Incandescence filaments for electric incandescence lamps; Manufacture of ——, and apparatus therefor. Siemens und Halske Akt.-Ges., Berlin. Eng. Pat. 22,746, Oct. 15, 1907. Under Int. Conv., Oct. 16, 1906.

See Fr. Pat. 382,898 of 1907; following.—T. F. B.

Filaments; Process for the manufacture of —— for electric incandescence lamps. Siemens und Halske Akt.-Ges. Fr. Pat. 382,898, Oct. 15, 1907. Under Int. Conv., Oct. 16, 1906.

This invention purposes to combine in filament making the advantages of ductile metals with the characteristics of the more infusible metals. It consists in coating a thread or wire of tantalum with one or more layers of tungsten. The tantalum wire is passed through a colloidal mass of a tungsten compound. The plastic mass described in Fr. Pat. 379,069 of 1907 (this J., 1907, 1192) is suitable. The thread coated with the colloidal tungsten compound is passed vertically through a dryer, and the tungsten is then reduced to the metallic state by heating it in a hydrogen atmosphere. Heating by the passage of an electric current through the filament is not suitable. After reduction the operations may be repeated until a coating of the desired thickness is obtained.—R. L.

Filaments fusible with difficulty; Process for the manufacture of metal —— for electric lamps. Siemens und Halske Akt.-Ges. Fr. Pat. 382,899, Oct. 15, 1907. Under Int. Conv., Oct. 26, 1906.

A metal of high fusing point is enveloped by particles of a more fusible metal, for instance by introducing it in the form of a finely divided powder into the molten mass of the more fusible metal. The metallic mixture obtained is ductile enough to be formed into filaments. By passing a suitable current, the metal of lower fusing point may be volatilised. If thorium be employed as enveloping medium, this may remain in the filament.
—R. L.

Filaments; Process for the manufacture of —— for electric lamps by heating to incandescence with an electric current. Glühlampenwerk Anker, G.m.b.H. Fr. Pat. 382,922, Oct. 15, 1907. Under Int. Conv., May 2, 1907.

In heating moulded metallic filaments by an electric current, deformation and distortion takes place through the influence of the magnetic field established. To prevent these distortions which are produced both by continuous or alternating current, the inventors propose to heat the filament by a continuous current in an atmosphere of inert gases, at the same time inserting a commutator between the filament and the source of electricity. From time to time the direction of the current is reversed and by this means the distortions are produced in opposite directions and thus counteract one another.—R. L.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

Dimethylanthracene by the action of ethylene chloride, chloroform, or acetylene tetrabromide on toluene in the presence of aluminium chloride; Simultaneous production of 1.6-, and 2.7- ——. J. Lavaux. Compt. rend., 1908, **146**, 345—348.

When ethylene chloride acts upon toluene in the presence of aluminium chloride, a mixture of 1.6- and 2.7-dimethylanthracene is produced. The same result is obtained when chloroform or acetylene tetrabromide is used in place of the ethylene chloride.—F. Shdn.

Asphaltic substances; Determination of ——, in mineral oils. E. Lecocq. Bull. Soc. Chim. Belg., 1908, **22**, 81—87.

Holde's method—treatment of 1—2 c.c. of the oil in a stoppered flask with 20—40 c.c. of a mixture of 4 volumes of alcohol and 3 volumes of ether, filtration after two days, thorough washing with the alcohol-ether mixture, treatment of the residue with benzene, evaporation of the benzene solution in a tared capsule, drying at 100° C., and weighing—has given the author good results save where the oil contained solid paraffin, as do many cylinder oils. In such cases he distils the mixture in superheated steam, which carries with it both the solid and liquid hydrocarbons. After distillation has practically ceased, the residual substance is treated by Holde's method.

The author suggests the following specifications for cylinder oils, for temperatures corresponding to (*a*) 1, (*b*) 4, (*c*) 5—7, (*d*) 9—12 atmospheres, (*e*) higher pressures, and for superheated steam :—

	a.	*b.*	*c.*	*d.*	*e.*
Specific viscosity at 50° C.	8—10	15	20	25	30—50
Steam-distillation ; 75 per cent. should pass between	150°—180°	150°—200°	160°—220°	170°—230°	240°—260°
Maximum solid paraffin	3·5%	3·5%	3·5%	1% locomotives 3·5% others	4%
Maximum asphaltum	none	none	2·0%	3·0%	3—4%

An ideal oil would be free from asphaltic substances, but it is impossible to produce the more viscous oils by steam-distillation at reasonable prices, and a certain amount of non-distilled residue (containing asphaltum) must always be contained in them.—J. T. D.

Paraffin ; Determination of the solidification point of commercial ——. R. Kissling. Chem. Rev. Fett- u. Harz-Ind., 1908, **15**, 46—49.

Shukoff's method of determining the melting point of paraffin (this J., 1899, 403) is here shown to give results varying considerably with such factors as the method and duration of the shaking of the tube. Thus after a certain limit, *e.g.*, 7 minutes, the temperature becomes constant as soon as the shaking ceases, whilst the readings taken after, *e.g.*, 8 and 15 minutes' shaking respectively may vary by nearly 0·5° C. Similar variations may be observed when the readings are taken as soon as the paraffin begins to froth after short alternate periods of shaking and rest. To obtain more uniform results the author suggests the following modification of the method. The Dewar's vacuum tube containing the melted paraffin is immersed to within about 10 mm. of its upper edge in water at a temperature about 5° C. above the solidification point of the paraffin. As soon as the temperatures are the same, the tube is shaken until the paraffin froths perceptibly, after which it is allowed to stand, and the temperature taken from minute to minute until 3 or more readings are identical, this being taken as the solidification point. The fact that considerable variations appear in the temperature curves thus obtained with different sorts of paraffin having nearly identical mean solidification points must be attributed to the influence of the varying proportions of the constituent hydrocarbons.—C. A. M.

Patents.

Acetone ; Industrial manufacture of ——. Pagès Camus et Cie. Third Addition, dated Oct. 10, 1907, to Fr. Pat. 361,379, April 14, 1905 (this J., 1906, 634, 687). Under Int. Conv., May 8, 1907.

The acetic acid, preheated by being passed through a serpentine tube heated in a furnace, is passed through a second serpentine tube or decomposer also heated in a furnace, and which has its interior surface coated with a thin layer of the reacting material, calcium acetate. In order to increase the capacity of the apparatus and to obtain a higher yield of acetone, the gases from the decomposer are washed and condensed under increased pressure. If it is desired to work the decomposer under reduced pressure, a pump is placed between the decomposer and the condensers and washers. The suction of this pump reduces the pressure in the decomposer and increases it in the condensers.—W. H. C.

Bitumen ; Substitute for ——. T. Marriott, Kingston, Surrey. Eng. Pat. 3063, Feb. 7, 1907.

The distillation of crude coal-tar is stopped at such a point above 280° C. as will leave 55—65 per cent. of volatile matter in the pitch, about 10—15 per cent. of this consisting of heavy green oils, which are usually distilled off. The pitch is mixed with 3—8 per cent. of kaolin free from mica, and preferably dried before powdering.—A. G. L.

Petroleum ; Process for the distillation of illuminating ——, *and apparatus therefor.* U. Ganz, Adliswil, and C. J. Faller, Zurich, Switzerland. Eng. Pat. 6878, March 22, 1907.

See Fr. Pat. 375,889 of 1907 ; this J., 1907, 959.—T. F. B.

Paraffin wax ; Apparatus for treating ——. N. M. Henderson, Broxburn, N.B. Eng. Pat. 25,152, Nov. 13, 1907.

The invention relates to the process described in Eng. Pat. 7630 of 1905 (this J., 1906, 12). In order to hasten the cooling and render the process advantageous in tropical climates, the cells are arranged in a metal chamber to which cooling water can be supplied. The chamber may contain, for example, 72 cells arranged in six rows, three rows on each side of a central charging platform. A water-supply pipe and a drain pipe are provided near the bottom of the chamber, and the overflow pipe is about six inches lower than the top of the cells. Pipes are also connected to the bottom of each cell, through which either water or steam can be admitted. The bottom of each cell is covered with water before the molten wax is run in. After solidification, the water is drawn off from the cells and from the chamber, and the latter is heated by a range of steam pipes beneath the cells. At the commencement of the sweating process, steam is admitted to the lower part of each cell.—A. T. L.

Mineral oils ; Process for solidifying ——. E. Raynaud, Brussels. U.S. Pat. 879,193, Feb. 18, 1908.

See Eng. Pat. 7860 of 1903 ; this J., 1904, 483.—T. F. B.

IV.—COLOURING MATTERS AND DYESTUFFS.

Picric acid ; Determination of ——. M. Busch and G. Blume. *See* XXIII.

Patents.

Dyestuffs for dyeing direct upon cotton and other materials. Read Holliday and Sons, Ltd., J. Turner and H. Dean, Huddersfield. Eng. Pat. 3167, Feb. 8, 1907.

Sulphonated mono-, di-, or tri-β-naphthylated rosanilines are mixed with an organic acid (*e.g.*, oxalic or tartaric acid), or an inorganic acid salt, such as sodium hydrogen sulphate, or a salt which dissociates in a hot dye-bath, *e.g.*, ammonium acetate. Such mixtures give brilliant shades on cotton. (Compare Fr. Pat. 375,476 of 1907 ; this J., 1907, 961.)—T. F. B.

Aromatic glycin derivatives ; Process for producing ——. G. Imbert, Nuremberg, Bavaria. Eng. Pat. 13,176, June 6, 1907.

See Fr. Pat. 379,830 of 1907 ; this J., 1907, 1274.—T. F. B.

Dyestuffs of the safranine series; Manufacture of ——. A. G. Bloxam, London. From Act.-Ges. f. Anilinfabr., Berlin. Eng. Pat. 13,406, June 10, 1907.

See U.S. Pat. 872,815 of 1907; this J., 1908, 17.—T. F. B.

Azo dyestuffs containing radicals of higher fatty acids; Process of making ——. N. Sulzberger, Berlin. U.S. Pat. 879,424, Feb. 18, 1908.

See Ger. Pat. 188,909; this J., 1908, 220.—T. F. B.

Azo dyestuffs; Brown —— *and process of making same.* G. Kalischer, Frankfort, Germany, Assignor to Cassella Color Co., New York. U.S. Pat. 879,552, Feb. 18, 1908.

See Eng. Pat. 22,021 of 1906; this J., 1907, 1003.—T. F. B.

Azo dyestuffs; Production of new ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 383,000, Oct. 17, 1907. Under Int. Conv., Feb. 22, March 9, and June 7, 1907.

See U.S. Pats. 874,967 and 874,968 of 1907; this J., 1908, 116 and 117. Claim is also made for the dyestuffs obtained by combining 1-amino-7-naphthol with the diazo derivatives of the sulphonic acids of paraphenylenediamine or its homologues or substitution derivatives. —A. S.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

Cellulose; Colloidal phenomena of ——. *Colloidal copper in hydrated cellulose.* C. G. Schwalbe. Z. Chem. Ind. der Kolloide, 1908, 2, 229.

The author records a case in which cotton cloth was beaten in a paper-maker's beater for several hours until it was converted into a gelatinous cellulose hydrate. When this was dyed with Benzopurpurin 10B it was coloured a bluish-black instead of the normal red colour of the dyestuff. Congo Red and Benzopurpurin 4B, on the other hand, did not show the blackening. The abnormal reaction was finally traced to the presence of colloidal copper in the pulp, derived from the bronze knives of the beater. Benzopurpurin 10B is sensitive to copper and forms a blue copper compound.—J. F. B.

Patents.

Artificial silk threads; Manufacture of ——. H. W. Lake, London. From Soc. Générale de la Soie Artificelle Linkmeyer, Buysinghen, Belgium. Eng. Pat. 14,655, June 25, 1907.

Cellulose solutions are discharged under pressure through numerous orifices into a closed cylinder, in which a continuous circulation of the precipitating liquid is established in the direction of the discharge of the jets of solution. These jets are met by a funnel placed concentrically in the cylinder, with its mouth in close proximity to the discharge orifice of the jets; this funnel continues in a long tube which is bent twice at right angles and finally opens into a tank containing the precipitating liquid. The liquid is conducted by siphon action into the cylinder; it rises in the annular space between the cylinder and funnel so as to enter the latter and carry along with it into the tank the threads of cellulose, which have been discharged from the orifices. The liquid from the tank is returned by means of a pump into a vessel from which the siphon is fed. A claim is also made for a reel which directs the threads on their discharge from the precipitating liquid. This reel has an undulating surface and rotates in contact with another reel, which is covered with india-rubber and serves to dry the first reel besides preventing the fibres from adhering to or winding round it. —S. H. H.

Cellulose; Process of preparing —— *for artificial silk.* G. L. Shaefer, New York, and A. Shaefer, Basel, Switzerland. U.S. Pat. 879,416, Feb. 18, 1908.

The cellulose is boiled under pressure, and at a correspondingly high temperature, in a weak solution of sodium carbonate, a caustic alkali, and "tar benzin." It is then washed, treated with dilute sulphuric acid, the excess of water is removed, and it is finally bleached with hydrogen peroxide.—B. N.

Textile fibres or materials; Treating —— *by electrolysis in cleansing, extracting, carbonising, stripping and disinfecting same.* F. Spivey, Heckmondwike. Eng. Pat. 3184, Feb. 8, 1907.

A vat, cistern or trough as usually employed for scouring is provided on the bottom with a non-perforated, insulated electrode, while above this and below the surface of the liquor is a perforated electrode attached to a framework. The lower electrode is made the anode and the upper one the cathode. The machine receives the fibres from the scouring machine and after treating them delivers them to the drying machine. In this manner the processes of washing, disinfecting and drying of the fibres are continuous, and it is claimed that the quantity of material treated in a given time is thus considerably increased. —S. H. H.

Mercerising and bleaching cotton yarns or fabrics. A. Silverwood and J. Taylor, Bradford. Eng. Pat. 4251, Feb. 20, 1907.

The goods are first kier boiled or otherwise cleaned, then passed through the mercerising solution and afterwards washed in hot water. They are next passed through bleaching liquor, preferably a solution of calcium hypochlorite, then directly soured and washed. If desired, the goods may be washed between the bleaching and souring. The whole series of processes can be worked continuously.—P. F. C.

Mercerising vegetable fibres or textile materials; Process for ——. J. E. Bousfield, London. From Heberlein und Co., St. Gall, Switzerland. Eng. Pat. 4528, Feb. 23, 1907.

See Fr. Pat. 375,068 of 1907; this J., 1907, 869.—T. F. B.

Mordanting wool; Process of ——. S. Kapff, Aix-la-Chapelle, Assignor to Nitritfabrik A.-G., Cöpenick, Germany. U.S. Pat. 879,553, Feb. 18, 1908.

See Eng. Pat. 14,480 of 1905; this J., 1906, 425.—T. F. B.

Dye vats; Method and apparatus for charging ——. C. Corron, St. Chamond, France. Eng. Pat. 3114, Feb. 7, 1907.

The necessary solutions are successively introduced from appropriate reservoirs into vats containing the goods to be treated; but instead of effecting this transference by gravity, suction, or pumping, the solutions are transferred to the vats by means of compressed air introduced into the reservoirs (which are below the dye-vats), and thus the liquid is forced into the vats, return of the solutions, after use, into the reservoirs being effected by gravity.—P. F. C.

Dyeing hanks; Machinery for ——. J. H. Ashwell, and H. Ashwell and Co., Ltd., New Basford. Eng. Pat. 7224, March 26, 1907.

See Fr. Pat. 382,770 of 1907; this J., 1908, 222.—T. F. B.

Fibrous materials, skins, or the like; Method of and means for treating ——. W. R. B. Lockie, Bootle. Eng. Pat. 28,817, June 17, 1907.

A claim is made for the aspiration of gases denser than air through the liquor during the bleaching, dyeing, scouring, etc., of fibrous materials. These gases may serve to effectually agitate the liquor and in some cases they are requisite for the chemical treatment of the fibres. The active liquids may be circulated through the material under treatment by means of a circulating pump, injector or like means; but a claim is particularly made for the making and breaking of several consecutive vacua, these pulsations tending to disseminate the active liquids and gases and thus to give better saturation.
—S. H. H.

[Sulphide] Dyestuff solutions; Preparation of —— *in paste form for printing and dyeing.* E. F. Kur, Prestwich. Eng. Pat. 18,816, Aug. 21, 1907.

Sulphide dyestuffs are easily dissolved by the xanthogenic esters of starch. These solutions can be applied either cold or hot for printing and dyeing textile fibres; if the thickened dyestuff solution be applied in the usual printing or sizing process, the solvent can be afterwards removed by washing, leaving the dye fixed on the vegetable fibre. For example, 5 litres of the xanthogenic ester of starch are heated in a water-bath to 40° C. with 150 grms. of Immedial Green G.G. extra and the solution obtained is placed in one of the boxes of a warp-sizing machine. The warp passes through the solution, is squeezed, dried on the cylinders and led on to the beam ready for weaving. In printing, the paste is prepared in the same way. A claim is, however, made for the addition of hydrogen peroxide during the printing operation in order to prevent the action of the sulphide dyestuffs on the copper of the printing rollers.—S. H. H.

Textile fibres of all kinds; Application of an artificial dressing to ——. *Process of weighting silk, cotton, wool, and other textiles.* J. Boyeux. Fr. Pats. 383,075 and 383,219, Dec. 26 and 29, 1906.

See Eng. Pat. 233 of 1907; this J., 1908, 158.—T. F. B.

Silk-like effects on paper and textile fabrics; Production of ——. L. Lilienfeld, Vienna. Eng. Pat. 2998, Feb. 6, 1907.

A compound of viscose with one of the metals of the magnesium group is employed in place of the viscose described in Eng. Pat. 14,483 of 1903 (this J., 1903, 1345). The viscose-zinc salt gives the best results and this compound is prepared by precipitating a neutral or slightly acid viscose with a zinc salt dissolved in dilute alkalis, ammonia, solutions of alkaline salts, etc.—P. F. C.

Drying yarns, fabrics, and other materials; Apparatus for ——. P. Turlur, Wattrelos, France. Eng. Pat. 20,392, Sept. 12, 1907.

See Fr. Pat. 378,247 of 1907: this J., 1907, 1136.—T. F. B.

VI.—COLOURING WOOD, PAPER, LEATHER, &c.

Patent.

Dyeing leather; Composition for ——, *and process for the manufacture of the same.* C. Reinhold and C. Palm, Hanover, Germany. Eng. Pat. 12,256, May 27, 1907.

See Fr. Pat. 378,876 of 1907; this J., 1907, 1197.—T. F. B.

VII.—ACIDS, ALKALIS, SALTS, AND NON-METALLIC ELEMENTS.

Silver chloride and iodide; Separation of ——. H. Baubigny. Compt. rend., 1908, **146**, 335—336.

Hager in 1871 proposed a method of separating the three silver halides based on the solubility of silver chloride in a boiling 10 per cent. solution of ammonium sesquicarbonate in which the iodide is insoluble, whilst only traces of the bromide dissolve. The author now finds that even in the cold (25° C.) 10 per cent. ammonium sesquicarbonate dissolves 0·018 grm. of silver bromide per litre and the normal ammonium carbonate a still larger proportion. A mixture of silver chloride and iodide, however, can be very accurately separated by heating at 70—80° C. with a solution of 100 grms. of commercial ammonium carbonate and 20 c.c. of 20 per cent. ammonia per litre.—E. F. A.

Mercury oxychlorides; Formation of ——. M. Dukelski. J. Russ. Phys.-Chem. Ges., 1908, **39**, 988—989. Chem. Zentr., 1908, **1**, 798.

By the action of aqueous solutions of borax on mercuric chloride, different oxychlorides of mercury are formed. The compound, $4HgO,HgCl_2$, was obtained in two modifications, *viz.*, as dark brown needles and as golden-yellow scales.—A. S.

Iridium oxides; Dissociation of ——. L. Wöhler and W. Witzmann. Z. Elektrochem., 1908, **14**, 97—107.

The dissociation pressure of iridium dioxide has been investigated by the authors, and they show, by means of pressure curves, that, at the temperatures employed (800°—1100° C.), and at the dissociation pressure of the dioxide, the sesquioxide and monoxide are incapable of existence. These latter then do not result as decomposition products, but the dioxide dissociates directly into the metal and oxygen. From the data obtained, the heat of the reaction, $Ir + O_2 = IrO_2$, for constant pressure, has been calculated thermodynamically to be about 50 Cals. It is noticed that, after pumping out oxygen from the quartz tube used, the original equilibrium pressures are not regained. This is explained by assuming that solid solutions of iridium in the dioxide, and of this oxide in the metal, are formed, each of which has a definite dissociation pressure of its own. These solid solutions sometimes exhibit phenomena of supersaturation. It is practically impossible to completely oxidise iridium, even in a state of fine division, but in oxygen at 1070° C. conversion to the dioxide takes place more rapidly than at other temperatures. Iridium is volatile only in the presence of oxygen, and this volatility is responsible for a loss of 0·055 mgrm. on 1 grm. of metal in 10 mins. at 775° C. and of 0·082 mgrm. at 1010° C. Since the known oxides of iridium are unstable at these temperatures, the volatility must be due to the formation of another oxide, probably an endothermic one.—F. Sodn.

Common phosphorus in oil of turpentine; Chemical causes of the allotropic transformation of ——. A. Colson. Compt. rend., 1908, **146**, 401—403.

When a solution of common phosphorus in oil of turpentine is heated to 250° to 300° C., red phosphorus is deposited. This transformation is not reversible. At 250° C. no red phosphorus appears till the end of 50 hours; at 280° C. precipitation does not begin till after five hours. This change is accelerated by the presence of phosphine and, in a less degree, by hydrogen. The reaction is hindered by solvents containing oxygen. Common phosphorus dissolved in ethyl benzoate was heated to 305°—310° C. for 25 hours and no red phosphorus made its appearance. The author considers that chemical

"friction" plays no part in these phenomena, but that there is a closed cycle of changes wherein the influence of the solvent is greater than that of the temperature.
—F. Shdn.

Phosphorus and sulphur ; Compounds of ——. II. Phosphorus pentasulphide. A. Stock and W. Scharfenberg. Ber., 1908, **41**, 558—564.

Stock and Thiel (this J., 1905, 1108) by distilling phosphorus pentasulphide *in vacuo* and rapidly cooling the vapour, obtained a product melting at 255°—275° C., which they considered to be a new modification of phosphorus pentasulphide (m.pt. 276° C.). Further experiments with an improved apparatus of larger capacity have now shown that by distilling at a lower temperature than that at which Stock and Thiel worked, only a small quantity of the low-melting product is obtained. The low-melting product obtained by those authors was thus evidently due to decomposition caused by overheating. The vapour density of pure phosphorus pentasulphide was found to be 233 at 630° C., 198 at 670° C., and 174 at 750° C. The authors are unable at present to state the exact nature of the low-melting product, but point out that a substance of similar properties and composition can be prepared by melting together 90 parts of phosphorus pentasulphide and 10 parts of the sulphide, P_4S_7. For the preparation of pure phosphorus pentasulphide, Kékulé's method of 1854, as modified, is the best ; it consists in heating together a mixture of red phosphorus and sulphur, the latter being used in excess (10 per cent. more than the theoretical amount). A small portion of the mixture is heated in a wide test-tube in a slow current of carbon dioxide, until reaction sets in. The source of heat is then removed, and the remainder of the mixture added in small portions. The heat of the reaction is sufficient to keep the mass melted. After cooling, the mass is extracted with boiling carbon bisulphide, from which the phosphorus pentasulphide separates in crystals. Commercial phosphorus pentasulphide is not a homogeneous product.—A. S.

Hydrochloric acid ; Electrolysis of solutions of pure ——. E. Doumer. *See* XIA.

Sicilian sulphur industry. Eng. and Min. J., Feb. 29, 1908. [T.R.]

The exports of sulphur from Sicily for four years past are reported by Messrs. Emil Fog & Sons, of Messina, as follows, in the tons of 1030 kilos. used in the trade :—

Destination.	1904.	1905.	1906.	1907.
United States	100,680	70,332	41,283	9,476
France.............	103,042	96,170	67,536	59,725
Italy	79,619	99,633	79,519	58,926
United Kingdom ...	18 108	18 847	20 883	16 561
Russia	15,141	16,673	16,181	15,210
Spain and Portugal	12,436	15,674	15,422	12,778
Germany...........	31,613	28,319	34,967	37,100
Austria	23,374	25,111	22,756	24,597
Greece and Turkey .	25,376	25,069	26,560	27,608
Belgium	13,627	14,442	13,940	8,853
Scandinavia	20,120	18,288	21,608	25,155
Holland............	8,122	4,425	5,539	11,379
Other Countries	24,487	23,277	21,238	26,646
Total	475,745	456,260	387,432	334,014

During the last six years the production in Sicily has considerably exceeded the consumption, as is shown by the statement of stocks on hand at the close of each year. The unsold stocks on Dec. 31 are reported as follows, in metric tons : 1903, 361,220 ; 1904, 396,541 ; 1905, 462,437 ; 1906, 525,115 ; 1907, 576,377. The exports, added to the increase in stocks, give a production of 385,276 tons for 1907, so that the stocks at the close of the year were equal to about 1½ years' production.

Patents.

Absorbing gases and vapours, especially sulphuric anhydride vapour ; Apparatus for ——. G. Eschelmann, A. Harmuth, and Ges. der Tentelew'schen Chem. Fabr., St. Petersburg. Eng. Pat. 22,095, Oct. 7, 1907.

See Fr. Pat. 382,081 of 1907 ; this J., 1908, 225.—T. F. B

Sulphuric acid chambers ; Circular ——. O. Niedenführ née Chotko. Fr. Pat. 382,990, Oct. 17, 1907. Under Int. Conv., Jan. 9, 1907.

Circular sulphuric acid chambers are provided with interior vertical partitions in the form of spirals, so that the gases have to traverse the chambers in spiral fashion. The partitions, which may be perforated, are made of the usual materials, *e.g.*, porcelain, etc.—A. G. L.

Slaking lime ; Process for —— by means of cooled steam. R. Heydemann. Ger. Pat. 185,684, April 6, 1906.

In the slaking of lime by means of steam, the heat evolved is sufficient to superheat the steam, which is then incapable of combining with calcium oxide and also has an injurious action on the slaked lime. In order to overcome this difficulty, cooling chambers for the steam are interposed between the slaking chambers.—A. S.

Rock salt ; Purification of ——. New Salt Syndicate, Ltd., and H. Tee, Liverpool. Eng. Pat. 25,442, Nov. 12, 1906.

The salt is fused, and whilst in this state, is agitated by mechanical beaters, preferably moving at the rate of several hundred revolutions per minute, for 3—10 minutes. The impurities are then allowed to subside.—A. G. L.

Salt ; Mining of ——. H. Frasch, Cleveland, Ohio. U.S. Pat. 874,906, Dec. 24, 1907.

The invention consists essentially in introducing into the salt deposit, unsaturated brine heated to a temperature as high above that of the atmosphere as is economically possible, pumping out the brine when saturated, recovering a portion of the dissolved salt from it by partial evaporation and cooling, heating and diluting the residual brine, and then introducing it again into the salt deposit. The partial evaporation of the charged brine is effected at the expense of its own heat, whereby it is also cooled, and preferably the aqueous vapours given off during the evaporation are removed by exhaustion. The residual brine, before being again introduced into the deposit, is heated to the desired temperature, at least partially, by condensing steam in it, thus diluting it at the same time. The heating may be effected either at atmospheric or at increased pressure. It is recommended to work with exhaust steam at atmospheric pressure. If the deposit contain gypsum, the temperature of the unsaturated brine introduced into the deposit should be well above 32°—41° C., the temperature of maximum solubility of calcium sulphate, say 100°—104° C., and the charged brine should be cooled during the partial evaporation to a temperature near 32°—41° C., say 27° C. In this way the separation of calcium sulphate during evaporation is almost entirely prevented. The invention, which can be applied to other similar processes besides the recovery of salt, is claimed to possess the following advantages : (1). No heat-conducting walls (steam pipes, etc.) are used for the transmission of heat in the evaporation of the charged brine, and thus objectionable incrustations are avoided. (2). The column of unsaturated brine entering the deposit more nearly balances the ascending column of charged brine, than would a column of water, and thus entails less strain on the pumping machinery. (3). More salt is recovered than by the usual process for a given consumption of fuel and water.—A. S.

Salt; Mining of ——. H. Frasch, Cleveland, Ohio. U.S. Pat. 874,907, Dec. 24, 1907.

In the process described in the preceding abstract, the separation of salt from the saturated brine, without the application of external heat, is small, and the underground deposit is subjected, therefore, to the solvent action of nearly saturated brine, which is so slow that, if the deposit is newly opened or the cavity small, the usefulness of the process is impaired. It is proposed to supplement it as follows:—The temperature of a stream of brine, circulating above-ground only, is raised at one point by the surface condensation of steam in chambers jacketed or bathed by the brine. This promotes evaporation of the brine and gives a supply of hot condensation water, which is introduced into the deposit below-ground, while the cavity is small, instead of the unsaturated brine previously recommended, which latter may however be employed with success as the size of the cavity increases. Evaporation of the hot brine from the deposit is brought about partly by utilising its own heat, as by forcing it through sprinklers in a well-ventilated chamber, and partly by heat from steam or from the previously heated residual brine. Any calcium sulphate deposited on the heat-conducting walls is removed by occasionally reversing the relative positions of the steam and brine with respect to them.—F. Sodn.

Alumino-silicates or artificial zeolites. R. Gans, Pankow, Germany. Eng. Pat. 3494, Feb. 12, 1907. Under Int. Conv., Feb. 23, 1906.

See Fr. Pat. 374,525 of 1907; this J., 1907, 872.—T. F. B.

Calcium carbide; Manufacture of ——. H. L. Hartenstein, Duluth, St. Louis, U.S.A. Eng. Pat. 20,652, Sept. 17, 1907.

In order to produce ingots of calcium carbide which are uniform in gas-producing properties, the various "taps" are mixed together, preferably by being received in a common mould, the temperature of which may be maintained above the melting point of the carbide. The mass thus becomes homogeneous and the conversion of unconverted material leaving the furnace is promoted. —F. Sodn.

Calcium carbide; Apparatus and method for the manufacture of ——. H. L. Hartenstein. Fr. Pats. 383,053 and 383,054, Sept. 17, 1907.

(1). Calcium carbonate is first converted into lime by passing through an inclined rotatory calcination cylinder, from the lower end of which the lime is discharged, at the point of maximum temperature, and passes to the weighing machine. The cylinder also communicates, at its lower end, with a fixed horizontal combustion chamber, in which a mixture of air and gas, such as carbon monoxide from the electric furnaces, is burnt, in order to heat the cylinder. A regenerator, through which the waste gases pass, serves to heat the air necessary for combustion and also the carbonaceous matter used in making the carbide. The highly heated lime and carbon are thoroughly mixed in the proper proportions and then rapidly transferred to the electric furnace. (2). The carbonaceous matter used for the preparation of carbide consists of an intimate mixture of finely powdered anthracite (80—90 per cent.) and coke or wood charcoal (10—20 per cent.), with the addition of bituminous coal (3—20 per cent.), the tarry matter from which acts as an agglomerant. These additions also improve the electrical conductivity of the mass.—F. Sodn.

Calcium carbide; Manufacture of ——. H. L. Hartenstein. Fr. Pats. 383,057 and 383,056, Sept. 17, 1907.

See Eng. Pats. 20,654 and 20,652 of 1907; this J., 1908, 160, and preceding.—T. F. B.

Graphitic minerals; Process for the industrial utilisation of —— for the manufacture of calcium carbide and of ferrosilicon. A. F. Hiorth. Fr. Pat. 382,867, Oct. 14, 1907. Under Int. Conv., Oct. 20, 1906.

Minerals containing graphite and silica, but too poor in graphite to render its recovery economical, are mixed with chalk and iron (or a material containing iron) and heated in an electric furnace, when calcium carbide and ferro-silicon are produced.—A. G. L.

Nitrogenous compounds; Manufacture of —— by means of carbides. Cyanid-Ges. m. b. H. (1.) First Addition, dated Oct. 11, 1907; (2.) Second Addition, dated Oct. 12, 1907, to Fr. Pat. 382,743, of Oct. 10, 1907 (this J., 1908, 225).

(1.) The nitrogen to be absorbed by the carbide, as claimed in the principal patent, is made to pass over the mass in a direction opposite to that in which the reaction is being propagated. This prevents hindrance of the reaction by local fusion. Aggregation of the particles is further avoided by the admixture of indifferent substances, such as carbon, crude calcium cyanamide, wood, etc. (2.) For the purpose of starting the reaction by means of electrical heating, vertical cavities are constructed in the mass, the walls of which cavities consist of some conducting material, which is destroyed as the temperature rises and the cohesion of the mass increases. The electric heaters are thus introduced without coming into actual contact with the material. The carbide is surrounded by a layer of some porous substance, not affected by nitrogen, sand for instance, which protects the walls of the containing vessel and ensures a more uniform distribution of the gas.—F. Sodn.

Nitrogen oxides; Production of —— by aid of the electric arc. F. Spitzer. Fr. Pat. 383,078, Oct. 5, 1907. Under Int. Conv., Oct. 12, 1906.

See Eng. Pat. 22,201 of 1907; this J., 1908, 27.—T. F. B.

Peroxides; Process of making molten ——. H. Foersterling, Perth Amboy, N.J. and H. R. Carveth, Niagara Falls, N.Y., Assignors to the Roessler and Hasslacher Chemical Co., New York. U.S. Pat. 879,452, Feb. 18, 1908.

Alkali oxides, or peroxides, such as sodium peroxide, are obtained by oxidising the metal with an oxidising agent, (air), at such a temperature, that the resulting oxide, or peroxide, is instantly melted by the heat generated in the reaction.—B. N.

Calcium sulphate; Method of preparing ——. M. Wallerstein, New York. U.S. Pat. 879,603, Feb. 18, 1908.

Calcium sulphate is prepared in plate-like crystals by acting upon a calcium salt in solution with a soluble sulphate in the presence of a colloidal "retarding" agent, such as gelatin.—B. N.

Hydrofluosilicic acid and fluosilicates; Manufacture of —— principally by utilisation of residues from superphosphate factories. L. Rivière. First Addition, of Dec. 11, 1906, to Fr. Pat. 375,989, May 28, 1906 (this J., 1907, 936).

The present improvement is applied when alkali fluosilicates (especially potassium fluosilicate) are to be obtained, and consists in leading the gases, containing silicon fluoride, given off from the mixers, directly into wooden vats containing the waste alkali liquors, *e.g.*, molasses, or residues from distilleries. Absorption towers are thus rendered needless.—A. G. L.

Sodium sulphate ; Preparation of solid anhydrous reduction products of ——. [*Sodium sulphide, carbonate, hydrogen sulphide, and thiosulphate*]. Verein Chem. Fabrik., Mannheim. Fr. Pat. 383,136, Oct. 19, 1907. Under Int. Conv., Feb. 21, 1907.

A mixture of sodium sulphide and carbon, as a powder infusible even at 1000° C., is prepared by heating a mixture of finely-divided sodium sulphate and carbon at 700°—800° C., the proportion of the latter being double that indicated by the equation: $Na_2SO_4 + 4C = Na_2S + 4CO$. Sodium carbonate and sulphuretted hydrogen are obtained by heating the above product with a slight excess of sodium bicarbonate in a current of steam. Sodium hydrogen sulphide, in a state of anhydrous powder, is prepared by passing sulphuretted hydrogen, free from oxygen, over sodium sulphide, or the mixture of this with carbon, at about 300° C. If the sulphuretted hydrogen contain carbon dioxide, lime, sufficient to absorb the latter, must be added to the sodium sulphide. Sodium thiosulphate, as an anhydrous powder, is produced when air is passed over the sodium hydrogen sulphide at 100°—150° C., nitrogen, free from oxygen, resulting as a by-product.—F. Sodn.

Binding agents [*alkali silicates*] ; *Manufacture of* ——. F. J. Seyfried. Fr. Pat. 383,177, Oct. 22, 1907.

Solutions of the alkali silicates (soluble glass) become too rapidly thick and viscous on exposure to the air. This may be avoided by the addition of an alkali sulphate. For example, to a solution of potassium silicate, of sp. gr. 1·26—1·29, is added an equal weight of a 10 per cent. solution of potassium sulphate.—F. Sodn.

Inorganic chemical compounds which crystallise with difficulty ; Process for obtaining crystals of ——. W. E. Guertler. Ger. Pat. 182,200, June 5, 1904.

The compounds or the components from which the compounds are formed, are dissolved in a molten alkali metaborate, *e.g.*, $NaBO_2$, and recovered from the solution in a crystalline form by volatilising the borate. The alkali metaborates are stated to be good solvents of oxides, silicates, carbides, borides, silicides, phosphides, nitrides, fluorides, etc.—A. S.

Aluminium-sodium chloride and ferric chloride ; Process for the preparation of —— *together with a phosphate fertiliser soluble in citric acid.* H. Schroeder. Ger. Pat. 192,591, Nov. 17, 1906.

Phosphates of aluminium and iron are mixed with the chlorides of calcium and magnesium, either as such, or in the form of their double compounds with alkali chlorides (artificial or natural carnallite) or of the by-products of salt manufacture, and the mixture is heated strongly. The aluminium chloride vapours evolved at first are led into sodium chloride solution, whilst the vapours of ferric chloride which come over subsequently are collected separately. The residue is worked up into a phosphate manure.—A. S.

Barium chloride ; Process for the preparation of —— *from barium sulphide.* R. Heinz, Techn. Bureau f. d. chem. Ind., G.m.b.H. Ger. Pat. 186,738, Jan. 3, 1907.

Crude barium sulphide is heated with magnesium chloride (waste liquors of the potash industry) in aqueous solution under pressure in an autoclave. It is stated that under these conditions the barium sulphide is converted quantitatively into chloride, and that the magnesia produced at the same time is obtained in the form of a voluminous white powder.—A. S.

Sulphur ; Recovery of —— *from sulphur-bearing gases.* P. S. Smith, Assignor to The E. I. du Pont de Nemours Powder Co., Wilmington, Del. U.S. Pat. 878,569, Feb. 11, 1908.

Producer gas and water-gas are successively formed, and the water-gas is mixed with sulphur dioxide separated from the sulphur-bearing gases. The mixture of gases is then highly heated by means of the producer gas, and the sulphur vapour set free by the reaction between the sulphur dioxide and the water-gas, is condensed and collected.—E. S.

Boron ; Manufacture of ——. Cie. Franç. pour l'Exploitation des Proc. Thomson-Houston. Addition, dated Oct. 15, 1907, to Fr. Pat. 377,683, May 8, 1907.

See Eng. Pat. 25,978 of 1906 ; this J., 1907, 1015.—T. F. B.

Boron carbide or carbon boride in lumps ; Process for obtaining ——. S. A. Tucker. Fr. Pat. 383,182, Oct. 22, 1907.

See U.S. Pat. 869,114 of 1907 ; this J., 1908, 80.—T. F. B.

VIII.—GLASS, POTTERY, AND ENAMELS.

Patents.

Glass furnaces. C. J. Koenig, Alton, Ill., U.S.A. Eng. Pat. 8268, April 9, 1907.

The furnace consists of a central stationary melting chamber, provided with heating arrangements, and surrounded by an exterior wall which forms an annular space around the melting chamber. An annular trough is arranged to move round in this space, and means are provided for admitting molten glass from the melting chamber to the trough. Openings, or pockets, are arranged at points in the exterior wall to allow of the removal of glass from the trough, and means for heating the glass in the trough are provided at points situated between the solid parts of the exterior wall and the wall of the melting chamber.—W. C. H.

Glass ; Apparatus for drawing ——. O. Imray, London. From Window Glass Machine Co., Pittsburg, Pa. Eng. Pat. 24,979, Nov. 11, 1907.

In this apparatus the device by which the glass is drawn, is raised by the winding of a rope or cable on a drum, the winding surface of which has a definitely increasing radius, the change in which is proportional to the change in temperature of the glass being drawn. During the drawing of the neck of the glass cylinder, the rope is wound on a portion of the drum the radius of which is relatively small ; during the drawing of the cap, the rope is wound on a portion of the drum, the radius of which increases rapidly, whilst the main winding portion of the drum has a gradually increasing radius. This main winding portion is of curved conical form. After the cylinder is drawn, the clutch on the shaft that drives the drum is released, and the cylinder is lowered by its own weight. To prevent the cylinder descending too rapidly, a friction brake is provided for the gearing, and the gearing is connected with a governor which controls the friction brake. By these arrangements, the various parts of the process can be carried out at the proper speeds without altering the rate at which the motor works.
—W. C. H.

Sheet-glass ; Method of and apparatus for drawing ——. I. W. Colburn. Fr. Pat. 382,805, Sept. 10, 1907.

The molten glass is drawn vertically upwards by means of a bait in the drawing chamber ; it then passes over a bending roller, which changes its direction to a horizontal one, and which passes it on to a drawing table and other rollers, whilst keeping its width unchanged. The mechanism which moves the drawing table is reversible, so as to permit of the ready introduction of the bait into the drawing chamber. Means are also provided to prevent the scum floating on the glass from being drawn up by the bait.—A. G. L.

Mirrors on transparent objects ; Process for producing ——, and amalgams in a very fine state of division for use in the process. Chem. Fabr. von Heyden A.-G. Ger. Pats. 186,061, July 26, 1905, and 186,830 and 186,831, July 3, 1906. Additions to Ger. Pat. 178,520, July 26, 1905.

(1). For producing mirrors on glass, etc., a paste is used prepared by the alkaline reduction of mercury salts in presence of protein substances or similar colloids. (2). The articles are coated with pastes composed of amalgams in an extremely fine state of division. (3). The amalgams are prepared by mixing finely-divided mercury, prepared by reduction by a wet process, with suitable metals, alloys or amalgams. The amalgamation may be effected simultaneously with the reduction of the mercury or of the other metal. Example : 200 parts of a paste obtained by reduction of a solution of a mercury salt are mixed with 75—100 parts of tin. After some hours the amalgam is pressed through silk gauze in order to remove undissolved tin.—A. S.

Marl ; Method of melting ——. S. d'Après. Fr. Pat. 382,588, Oct. 5, 1907.

The marl is powdered and placed in a double-walled hopper, in which it is dried by circulating hot furnace-gases between the double walls. An endless conveyor then transports it to a number of crucibles, arranged within a furnace, which is heated to a very high temperature. The material is delivered in very small quantities at a time to these crucibles, in which it is reduced to the condition of a soft paste, which is tapped, by mechanism controlled from outside the furnace, on to the hearth of the furnace itself. The final product is a kind of " volcanic or obsidian glass."—A. G. L.

Earthenware ; Process for limiting or destroying the absorptive action of ——. W. Rettig. Ger. Pat. 191,004, Sept. 27, 1906.

The earthenware articles are dipped in a mixture of approximately equal parts of slaked lime and cement with water, and then allowed to stand for 14 days.—A. S.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Chrome iron ore as a refractory material. M. Simonis. Stahl u. Eisen, 1908, **28**, 334—335.

The melting points of mixtures of chromite (Cr_2O_3 52·9, FeO 22·6, Al_2O_3 4·8, MgO 10·1, SiO_2 9·6) and Zettlitz kaolin were determined. As the percentage of chromite increased from 0 to 30, the melting-point fell rapidly from Seger cone 35 to 17, then less rapidly to cone 15 at 65 per cent. (the eutectic-point). It now rose rapidly, reaching cone 35 again at 80 per cent., cone 41 at 90 per cent, and higher undetermined temperatures with higher percentages of chromite. Chromite can therefore be mixed with as much as 10—15 per cent. of kaolin for plasticity, and still yield a highly refractory mass.—J. T. D.

Cement manufacture ; Materials for —— from Trinidad. Bull. Imp. Inst., 1907, 5, 378—382.

In view of the increasing demand for Portland cement in Trinidad, which demand is at present met entirely by imported cement, samples of limestone and marl from extensive deposits on the island, were examined. The following analytical results were obtained :—(1) Limestone : lime, 56·05 ; magnesia, trace ; silica, 0·79 ; water and carbon dioxide, 43·63 per cent. Marl : lime, 23·03 ; ferric oxide, 3·32 ; alumina, 13·61 ; silica, 32·46 ; water and carbon dioxide, 28·28 per cent. Experimental tests showed that the ground materials, when mixed in the proportion of 5 parts of limestone to 4 parts of marl, and then burnt, would yield a cement of good quality. —A. S.

Patents.

Stone-like substance ; Artificial —— and process for producing same. W. Schleuning, Luneburg, Germany. Eng. Pat. 10,243, May 2, 1907.

Calcareous slag from blast-furnaces is allowed to disintegrate by exposure to air. It is then sifted and mixed with 1—1·5 parts of water-glass, to which a colouring matter may be added. The mass sets in 24—48 hours. To delay the setting, chalk, sand, etc., may be added, whilst the addition of Portland cement hastens the setting. —A. G. L.

[Artificial stone] Slate waste ; Process for utilising —— and material obtained from same. Soc. des Ardoisières de Pouance. Fr. Pat. 382,523, Oct. 4, 1907.

Slate waste is finely ground, mixed with casein or a solution of casein, and placed in moulds, with or without pressure and heat. The casein may be rendered insoluble by means of formaldehyde, and chalk, barium sulphate, sodium carbonate, resins, acids, colouring matters, etc., may be added to the mixture.—A. G. L.

Concrete ; Manufacture of ——. The Associated Portland Cement Manufacturers (1900) Ltd., and G. W. Butchard, London. Eng. Pat. 13,811, June 14, 1907.

Concrete is made from a mixture of cement or lime and burnt gault clay.—W. C. H.

Grindstones and polishing powders ; Industrial product for the manufacture of artificial ——, and process of making same. J. Rivas. Fr. Pat. 382,385, Dec. 6, 1906.

Garnet, especially almandine, is powdered, washed first with water, then with acid to remove soluble constituents, and heated at 500°—1300° C., but not beyond its melting point. The product is then again powdered and graded as usual. Its hardness is claimed to be comparable with that of corundum.—A. G. L.

Cement-burning apparatus. B. E. Eldred, Bronxville, N.Y. U.S. Pat. 879,448, Feb. 18, 1908.

A rotary inclined cement kiln is provided with coal-firing apparatus, adapted to produce relatively low calcining temperatures in the kiln, and the " calcines " are delivered into a rotary inclined regenerative clinkering kiln, through a sealing wall which closes the upper end of the latter.

Means are provided at the clinker discharge end for withdrawing the clinker, for gas firing, and for withdrawing the products of combustion.—B. N.

Cement kilns; Method and apparatus for burning in rotatory ——. T. M. Morgan. First Addition, dated Sept. 16, 1907, to Fr. Pat. 365,523, April 24, 1906 (this J., 1906, 987, 848).

The rotatory cement kiln is closed as completely as possible at its discharge end, and preferably also at its charging end, by a suspended wall adjusting itself to the expansion and contraction of the kiln (see Eng. Pat. 29,408 of 1906; this J., 1907, 691). Excentrically placed in the wall at the discharge end is a channel through which the fuel is delivered; through a second opening at the bottom of the wall, the burnt cement drops through a hopper into a receptacle. By means of an injector in a pipe leading from this receptacle, air is sucked into the latter; this air, in cooling the burnt cement, becomes heated and is then passed through the pipe mentioned above into the kiln at its lower end, where it meets the stream of fuel.—A. G. L.

Mortars or masses containing calcium silicate for the preparation of lime-sandstone; Process for the manufacture of ——. E. Stöffler. Ger. Pat. 184,555, May 17, 1905.

Artificial or natural sandy mixtures of quartz with relatively small proportions of calcium carbonate are burnt and the product slaked.—A. S.

Slabs composed of cement and similar binding agents and fibrous materials, for covering roofs and walls; Process af hardening —— *by means of hydrofluosilicic acid.* C. Thümmel. Ger. Pat. 181,504, Sept. 28, 1905.

The thin band of material composed of cement and fibrous material prepared in the usual manner, is sprayed with hydrofluosilicic acid while being rolled on a cylinder, whereby the calcium silicofluoride formed acts as a cementing and hardening agent for the individual layers of the material.—A. S.

Plaster of Paris; Process for increasing the adhesiveness of —— *to cement, concrete, etc.* B. Nöldner and M. Lau. Ger. Pat. 184,952, June 19, 1906.

The plaster is mixed with a solution containing not more than about 100 grms. of sugar per litre.—A. S.

X.—METALS AND METALLURGY.

Swedish iron industry; Development of the ——. O. Vogel. Stahl u. Eisen, 1908, **28**, 310—314.

The average yearly production of iron ore in Sweden from 1861 to 1906 is shown in the following table :—

Years.	Number of mines.	Yearly production in tons.	Percentage decrease or increase.
1861—1865....	500	453,486	—
1866—1870....	422	542,323	+ 19·6
1871—1875....	576	784,707	+ 44·7
1876—1880....	382	721,232	— 8·1
1881—1885....	496	874,423	+ 21·2
1886—1890....	530	930,037	+ 6·4
1891—1895....	339	1,517,434	+ 63·2
1896—1900....	339	2,293,858	+ 51·2
1901—1905....	332	3,563,214	+ 55·3
1901..........	346	2,793,566	—
1902..........	332	2,896,208	+ 3·7
1903..........	322	3,677,520	+ 21·2
1904..........	336	4,083,945	+ 11·1
1905..........	326	4,364,833	+ 6·9
1906..........	308	4,501,656	+ 3·1

The exports of iron ore have increased from 19,288 tons in 1886, to 1,150,695 tons in 1898, and about 3½ million tons at the present time, of which the greater part goes to Germany.

The development of the production of pig-iron and mild steel is shown in the following table :—

Year.	Pig-iron.		Mild steel.	
	Production in tons.	Number of blast-furnaces.	Bessemer.	Martin.
1833.......	98,964	227	—	—
1840.......	124,796	230	—	—
1860.......	185,894	229	—	—
1880.......	405,713	193	30,017	7,719
1890.......	456,103	154	—	—
1895.......	462,930	146	97,320	99,259
1901.......	528,375	—	77,231	190,877
1902.......	538,113	136	84,014	201,311
1903.......	506,825	136	84,229	232,878
1904.......	528,525	—	78,577	252,832
1905.......	539,437	—	78,204	288,675
1906.......	604,789	128	84,633	311,435

The production of steel in the electrical furnace has also made good progress in Sweden.—A. S.

Carbon in pig-iron, etc.; Determination of ——. L. L. de Koninck and E. von Winiwarter. Bull. Soc. Chim. Belg., 1908, **22**, 104—105.

The method consists in heating the metal with lead borate in a stream of oxygen, and determining the carbon dioxide produced. The iron and manganese are oxidised and the oxides dissolved by the borate, so that fresh surfaces are continually exposed until the whole is dissolved. The reduced lead is continuously reoxidised by the oxygen. Details will be given in a further paper.—J. T. D.

Manganese in pig-iron and steel; Determination of ——. E. Raymond. Bull. Soc. Chim. Belg., 1908, **22**, 75—80.

Steel and white pig-iron.— 3 grms. are weighed into a conical flask, and 60 c.c. of nitric acid of sp. gr. 1·20 are gradually added. After reaction the liquid is boiled to oxidise carbonaceous matter, removed from the flame, 8—10 grms. of potassium chlorate and 20 c.c. of nitric acid of sp. gr. 1·40 are added, the whole is carefully heated again till the manganese is completely precipitated, and then boiled down to about half its original bulk so as to expel oxides of chlorine. The liquid is now diluted with cold water and filtered, and the flask and precipitate well washed with cold water. The filter and precipitate are placed in a beaker, then 25 c c. of an acidified ferrous solution (40 grms. of ammonio-ferrous sulphate and 30 c.c. of concentrated sulphuric acid per litre) are run into the empty flask, and after dissolving any adhering precipitate, are washed into the beaker. The excess of ferrous salt is then titrated with permanganate. Of spiegel or manganese steel, 1 grm.; of ferromanganese 0·2 grm. is taken, and 50 or 75 c.c. of the ferrous solution may be needed.

Gray pig-iron: 2 grms. are treated in a porcelain vessel with 40 c.c. of nitric acid (sp. gr. 1·20), the solution heated after reaction, a few drops of hydrofluoric acid added and the liquid boiled for a while, then diluted with a little water, filtered (to separate graphite) into a conical flask, and further treated like a steel. This method of attack is effective also with ferrosilicon, provided a larger quantity of hydrofluoric acid be used. The method is rapid and accurate.—J. T. D.

Nickel in nickel-steel; Determination of ——. O. Brunck. Stahl u. Eisen, 1908, **28**, 331—333.

The nickel in nickel- and nickel-chrome-steels can be accurately determined by precipitation with dimethylglyoxime (this J., 1907, 643 and 1217). A number of analyses, both of mixtures of iron, nickel and chromium salts, and of nickel- and nickel-chrome-steels are given to shew the accuracy of the method. As the nickel commonly used in making such steels contains about 1 per cent. of cobalt, the author increases the result obtained by 1 per cent. of itself to give the amount of "commercial nickel" in the steel. The high price of the reagent will doubtless be reduced as the demand for it becomes greater; but so little is used in an assay, and the saving of time by the method is so great, that the process is not really an expensive one.—J. T. D.

"*Explosive*" *metals of the platinum group; Physico-chemical investigations on* ——. E. Cohen and Th. Strengers. Z. physik. Chem., 1908, **61**, 698—752.

THE residues left, after treatment with hydrochloric acid, of alloys of zinc with rhodium, iridium, and ruthenium, respectively, possess to a high degree explosive properties. The explosive property of platinum prepared in this manner is found to depend largely upon the conditions of carrying out the experiment, whilst from palladium and osmium no such explosive residues are obtainable. The "explosive rhodium," which the authors chose for carrying out their investigations on account of its properties being specially highly developed in this direction, was prepared by slightly varying Bunsen's original method (Annalen, **146**, 275). Small pieces of pure zinc, over which a weighed quantity of rhodium powder has been sprinkled, followed by a little ammonium chloride, are heated in a porcelain crucible, small quantities of ammonium chloride being added from time to time. The molten mass is finally well stirred with a glass rod. The contents of the crucible are either poured into cold water and the flocculent zinc oxychloride washed from the granular mass, or, preferably, they are allowed to cool until the regulus has hardened sufficiently to allow of its being separated from the still fluid oxychloride. The zinc-rhodium alloy is treated with hydrochloric acid, and after the violent evolution of hydrogen gas has ended, the residue is washed by decantation and collected on a hardened filter-paper in a Buchner funnel. Care is taken while washing to keep the powder covered by the liquid, as it is found that in presence of air and dilute acid, the rhodium is appreciably soluble. The rhodium is thus obtained as a shiny grey powder, which on heating in a test-tube explodes with a flash. It loses its explosive properties when heated gently for a length of time. Rhodium was alloyed with other metals and treated in the same way with hydrochloric acid; an explosive residue however was only obtained in the case of a cadmium-rhodium alloy. The zinc still retained by the "explosive rhodium" cannot be dissolved out with hydrochloric acid, suggesting therefore a case of solid solution. Heat generated by the explosion is equivalent to the calculated amount that would be liberated by the combination of the oxygen and hydrogen, found occluded in the "explosive rhodium." If this rhodium (also iridium) be completely shut off from contact with the air, during its preparation, a non-explosive residue results, while in the case of ruthenium an explosive product is obtained in either case. The residue of a rhodium-lead alloy, extracted with nitric acid, contains nitrogen oxides and remains explosive even when prepared out of contact with the air. When the explosive or exploded rhodium is placed in hydrochloric acid, to which is then added nitric acid, both go into solution. By using the acids in the inverted order, the two substances remain insoluble. In both cases the substances go into solution after becoming cathodically active in a citric acid solution. The results of these investigations go to show that the explosibility of these bodies depends upon their power of occluding an explosive mixture of hydrogen and oxygen. In the case of "explosive ruthenium," the possibility remains that an unstable allotropic modification of the metal may be produced.—W. S.

Coppers; Oxygen content, eutectics, density, capacity for gas absorption, etc., of various ——, *in the latter stage of the refining operation.* W. Stahl. Metallurgie, 1907, **4**, 761—71.

A SERIES of experiments undertaken to estimate the oxygen content of the various coppers, as determined by their fracture, during the poling operation. From the experiments, details of which are given, it is concluded that the coarse-rayed copper consists of a eutectic of 96·6 per cent. of copper and 3·4 to 3·5 per cent. of cuprous oxide, the average sp. gr. being 8·7312. The specific gravity of the copper increases to the end of the first period of poling; during the "tough" poling the specific gravity again decreases. The capacity for absorbing gases by molten copper increases with a decrease of temperature; sulphur dioxide, carbon monoxide and hydrogen, but not carbon dioxide, are absorbed by molten copper. For copper to be used only for casting purposes, this gas absorption is not harmful.

Affinity of sulphur for a series of metals. E. Schutz. Metallurgie, 1907, **4**, 659.

THE series of Fournet is here confirmed. The mixtures examined were charged into crucibles of graphite, for low temperatures heated in a gas furnace, for high temperatures, in a Kryptol furnace, the temperature being indicated by Wanner and Le Chatelier pyrometers. Theoretical proportions were used. *Series* $Mn + FeS$:—Action began at 1495°C. 99·08 per cent. of the sulphur charged, remained combined with the iron. *Series* $MnS + Fe$:—Action began at 1355° C. Metal obtained, contained:—Iron, 84·47; manganese, 9·69 per cent.; sulphur, trace. Matte obtained, contained:—Iron, 3·48; manganese, 60·07, and sulphur, 34·34 per cent. *Series* $Cu_2S + Fe$:—Metal obtained by reaction at 1205°, contained:—Copper, 50·46; iron, 42·33; sulphur, 2·93 per cent. Matte obtained, contained:—Copper, 57·15; iron, 18·56; sulphur, 23·31 per cent. 93·6 per cent. of the iron in the charge remained with the copper, the matte formed, containing a little more copper than would correspond to Cu_2S,FeS. *Series* $2Cu + FeS$:—At 1195° C., the metal contained copper: 62·77; iron, 30·13; sulphur, 5·28 per cent. The matte, copper, 55·9; iron, 21·11, sulphur, 21·74 per cent. Of the sulphur, 85·06 per cent. of the sulphur in the ferrous sulphide, united with the copper. *Series* $Sn + FeS$:—At a temperature of 1120° C., the metal obtained, contained:—Tin, 92·04; iron, 5·16; sulphur, 2·52 per cent. The matte contained:—24·14 per cent. of tin; 47·91 of iron, and 27·65 of sulphur. *Series* $SnS + Fe$:—At 1130° C., metal and matte were obtained, containing the same as the preceding. *Series* $2Ni + FeS$:—At 1085° C., 54·48 per cent. of the sulphur in the charge combined with the nickel, and the rest with the iron. *Series* $Ni_2S + Fe$:—At 1110° C., 56·06 per cent. of the sulphur in the charge combined with the nickel. *Series* $2Ni + ZnS$:—At 1370° C., 97·62 per cent. of the sulphur combined as zinc sulphide originally, went over to the nickel. *Series* $Ni_2S + Zn$:—Yielded at 1355° C. a reaction leaving 93·3 per cent. of the sulphur in the charge, combined with the nickel. *Series* $Zn + PbS$:—At 1140° C., after the reaction, 79·24 per cent. of sulphur in the charge was found combined with the zinc. *Series* $ZnS + Pb$:—At 1200° C., 81·11 per cent. of sulphur in the charge was combined with the zinc. Trouble was experienced in the case of zinc, owing to its vaporisation during reaction. Each metal was next mixed with lead sulphide, and the relative amounts of lead reduced were compared. The results were confirmed also by the reducibility with hydrogen under equal conditions for copper, nickel, and iron, and thus the following series was derived:—Mn-Cu-Ni-Fe-Sn-Zn-Pb. The addition of calcium sulphide caused a considerable decrease in the amount of lead reduced by iron from lead sulphide; barium sulphide did not show as much effect.

Iridium oxides; Dissociation of ——. L. Wöhler and W. Witzmann. *See* VII.

Mineral production of the United Kingdom in 1907. Board of Trade J., March 5, 1907. [T.R.]

THE following tables, showing the output of coal and other minerals in the United Kingdom at mines worked under the Coal and Metalliferous Mines Regulation Acts during the year 1907, with comparative figures for the preceding year, are extracted from an advance proof of the Mines and Quarries General Report and Statistics for 1907 :—

I.—Output of Minerals under the Coal Mines Regulation Acts.

——	1906.	1907.
	Tons.	Tons.
Barytes	7,199	10,297
Coal	251,050,809	267,828,276
Clay and shale other than fire-clay and oil shale	252,275	320,889
Fire-clay	2,971,173	2,890,197
Igneous rock	424	146
Iron pyrites	7,342	7,394
Ironstone	8,209,880	8,236,118
Limestone	32,816	22,366
Oil shale	2,546,113	2,675 779
Sandstone (including "ganister")	126,675*	128,103*
Petroleum	10	—
Total	265,204,716	282,119,565

* The quantity of ganister obtained was 119,803 tons in 1906, and 120,193 tons in 1907.

Wolframite discovery in India. Times Eng. Suppl., March 11, 1908. [T.R.]

WHILE digging in a band of mica schist rock, at Agargaon, 25 miles south-east of Nagpur, wolframite was discovered in some quartz stringers, of which the rock contains a considerable number. The wolframite differs in appearance and constitution from the best known specimens ; on analysis it yields 64·5 per cent. of tungstic acid, which is equal to that obtained from the best ores of Colorado, In Agargaon its existence has been proved in numerous stringers at intervals extending over a length of 1490 ft., and it has been found at opposite ends of the mica schist rock ten miles apart from each other.

Tin exports from the Federated Malay States. Board of Trade J., March 5, 1908. [T.R.]

THE following statement, showing the weight of tin and tin ore (tin exported in the form of ore having been taken at 70 per cent. of the gross weight of the ore) exported from the Federated Malay States during the years 1906 and 1907, is taken from the "Selangor Government Gazette" :—

State.	1906.			1907.		
	Tin.	Tin exported in the form of ore.	Total.	Tin.	Tin exported in the form of ore.	Total.
	Pikuls.	Pikuls.	Pikuls.	Pikuls.	Pikuls.	Pikuls.
Perak	132,870	303,039	435,909	99,245	332,141	431,386
Selangor	116,968	151,655	268,623	82,093	191,807	273,900
Negri Sembilan	47,490	30,276	77,766	40,199	34,956	75,155
Pahang	9,420	25,068	34,488	12,620	20,575	33,195
Total	306,748	510,038	816,786	234,157	579,479	813,636

NOTE.—1 Pikul=133⅓ lb.

II.—Output of Minerals under the Metalliferous Mines Regulation Acts.

——	1906.	1907.
	Tons.	Tons.
Barytes	27,827	30,343
Clay and shale	118,521	114,525
Gold ore	17,384	12,978
Gypsum	196,143	195,266
Igneous rock	72,722	69,871
Iron ore	1,824,415	1,803,063
Lead ore	30,226	31,215
Limestone	765,718	470,263†
Rock salt	230,558	243,345
Sandstone	168,077*	156,324*
Slate	126,699	116,570
Zinc ore	22,824	19,945
Other minerals	111,292	117,783
Total	3,712,436	3,381,491‡

* Including 3040 tons of ganister in 1906 and 11,864 tons in 1907.

† Including 8363 tons of calcspar.

‡ In addition, 80 tons of mixed ores (containing arsenic, copper, tin and tungsten) were obtained.

In addition to the above, large quantities of several important minerals, such as iron ore, limestone, sandstone, slate, clay, &c., are obtained from quarries under the Quarries Act and from other open workings, the returns from which are not yet available. The totals for coal, and the ores of copper, lead and zinc are substantially complete.

PATENTS.

Iron ; Process for purifying ——. E. von Maltitz, Chicago, Ill. U.S. Pat. 879,480, Feb. 18, 1908.

MOLTEN iron covered with basic slag is placed in a practically closed receptacle, which is then rotated, so as to continuously expose a fresh surface of the molten iron to the action of an oxidising blast injected into the receptacle, but without at any time breaking up the mass. When the slag has taken up a substantial quantity of iron oxide, the blast is cut off, and the rotation continued, so as to deoxidise the molten iron and remove iron oxide from the slag. Throughout, no external source of heat is used.—A. G. L.

Steel ; Process of, and composition of matter employed for, hardening and tempering ——. B. J. Casterline, Assignor to Casterline Cutlery Co., Portland, Oreg. U.S. Pats. 879,517 and 879,518, Feb. 18, 1908.

THE steel is heated to "cherry-redness," then submerged and cooled in a mixture of : salt, 2 lb. ; saltpetre, ¼ lb. : carbonate of iron, ¼ lb. ; borax, ½ lb. ; wood alcohol, 15 pints ; glycerin, 5 quarts ; and "oil," 5 gallons. After removal from this bath, the steel is coated with tallow, and held over a "slow" fire.—A. S.

Steel rails ; Method of improving ——. R. A. Hadfield, Sheffield. U.S. Pat. 879,634, Feb. 18, 1908.

STEEL rails containing more than 0·1 per cent. of phosphorus, are rendered harder and more resistant to shock by heating them to a temperature of at least 850° C., cooling quickly to a temperature between 500° and 700° C., and afterwards cooling slowly from this lower temperature. —A. S.

Cast-iron ; Autogenous soldering of ——. Soc. L'Acétylène dissous du Sud-Est. Fr. Pat. 382,463, Dec. 8, 1906.

A small quantity of carborundum, which may be mixed with borax or other flux, is first dissolved in the molten metal at the point at which the soldering is to be effected. The small piece of cast-iron generally used to make the joint may also be replaced by iron or steel, the operation being finished as usual.—A. G. L.

Briquettes of iron or other ore, blast-furnace slag, etc. ; Method of making ——. F. W. Dünkelberg. Fr. Pat. 383,157, Oct. 21, 1907.

See Eng. Pat. 14,538 of 1907 ; this J., 1908, 128.—T. F. B.

Gold, silver and like dust ; Method of and apparatus for recovering —— from jewellers' and others' washings or slop liquids. A. Aston, Birmingham. Eng. Pat. 3557, Feb. 13, 1907.

The liquid containing the valuable dust is passed by gravity through successive filters formed of coke-breeze, sawdust, etc., resting on false bottoms. In some of these filters the flow of the liquid is upwards. The liquid is evenly distributed over the filters by means of perforated plates, which may be faced with felt or baize.—A. G. L.

[Zinc] sulphide ores ; Method of treating poor ——. A. Holdsworth, London. Eng. Pat. 25,574, Nov. 13, 1906.

Poor sulphide ores are powdered and mixed with a quantity of sulphuric acid equivalent to the sulphur they contain so as to give a stiff dry mixture. For this purpose the acid may be added at once as acid of 60° B., or it may be diluted with water, or else the addition may take place in stages, and the ore may be dried after each addition. The mixture is then heated to a red heat, and afterwards extracted with water or dilute sulphuric acid.—A. G. L.

Drying air blast for metallurgical purposes. F. W. Harbord, Englefield Green, Surrey. Eng. Pat. 10,525, May 6, 1907.

The air-blast is dried by leading it through a chamber containing bricks of dried peat, or, less conveniently, trays of dried clay or other earthy material. The arrangement of the chambers is similar to that claimed in Eng. Pat. 25,112 of 1906 (this J., 1907, 1282).—A. G. L.

[Chromium oxide] ; Metallurgical process [for reducing ——]. F. von Kügelgen and G. O. Seward, Holcombs Rock, Va., Assignors to Electro Metallurgical Co., W. Va. U.S. Pat. 878,966, Feb. 11, 1908.

The metallic ore or compound (chromium oxide) is mixed with the phosphide of a metal, "which in its phosphide is chemically inert." The mixture is then heated until the metallic ore or compound is reduced, the metal of the phosphide combining with the reduced metal (chromium).—A. G. L.

Copper ore ; Process for the reduction of ——. L. Durand, Dumont, N.J., Assignor to R. O. Currie, New York. U.S. Pat. 879,530, Feb. 18, 1908.

The copper in the ore is first converted into a spongy state by the action of reducing gases. The spongy copper, mixed with a flux, is then smelted in a separate chamber placed at the bottom of the reducing chamber, by means of reducing gases at a high temperature. The molten copper and slag are drawn off separately, and the reducing gases, which are now at a lower temperature, are utilised to convert a fresh charge of ore to the spongy condition.—A. G. L.

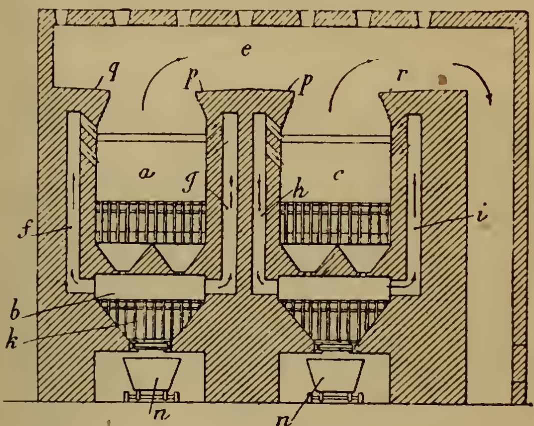
Copper and other ores ; Smelting-furnace for ——. H. H. Freeman, Wilkinsburg, Pa. U.S. Pat. 879,623, Feb. 18, 1908.

The apparatus comprises a smelting furnace and a water-jacketed gas-producer. The gas from the producer passes to tuyères at the hearth of the smelting furnace. Steam is generated in the water-jacket and operates an injector, at the upper part of the smelting-furnace, thereby producing suction in the smelting chamber.—A. S.

Tin-scrap ; Reclaiming ——. E. A. Sperry, Brooklyn, N.Y. U.S. Pat. 879,596, Feb. 18, 1908.

The tin is concentrated by electrolysis in alkaline solution. The "black scrap" is removed, and the impure tin treated with chlorine in the presence of anhydrous stannic chloride. The excess of chlorine is then removed, and the stannic chloride distilled from the residue.—A. G. L.

Antimony ores ; Process and apparatus for treating ——. E. Chatillon. Fr. Pat. 382,504, Oct. 3, 1907.



The furnace is said to render it possible to treat finely-divided antimony ores, and to obtain directly metallic antimony, antimony oxides, sulphides, etc. It consists essentially of two cupola furnaces, *a* and *c*, placed side by side, and having a common crown, *e*. Below each chamber is placed a smaller chamber, *k*, into which cinders and gangue from the main chambers are allowed to drop from time to time. The air necessary for combustion passes through these lower chambers, entering the main chambers through the flues, *f*, *g*, *h*, *i*, whilst the cooled cinders fall from time to time into trucks, *n*, *n*, placed below the furnace. Alternate layers of fuel and ore are charged on to the grills placed in the main chambers ; very finely divided ores are charged on to the projections, *p*, *q*, *r*, at the top of the furnace, which serve as auxiliary hearths. The products of combustion, carrying antimonial vapours, leave the furnace as shown by the arrows, and are conducted through a number of hearth furnaces containing antimony sulphide, with which they react to give the desired compound; or they may be used to heat crucibles containing antimony ores, etc. The gases are then cooled by passing through a chamber containing vessels of running water. Finally the gases pass through other chambers containing bags filled with cotton, etc., in which they deposit antimony fumes.—A. G. L.

Graphitic minerals; Utilisation of ——, etc. Fr. Pat. 382,867. *See* VII.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

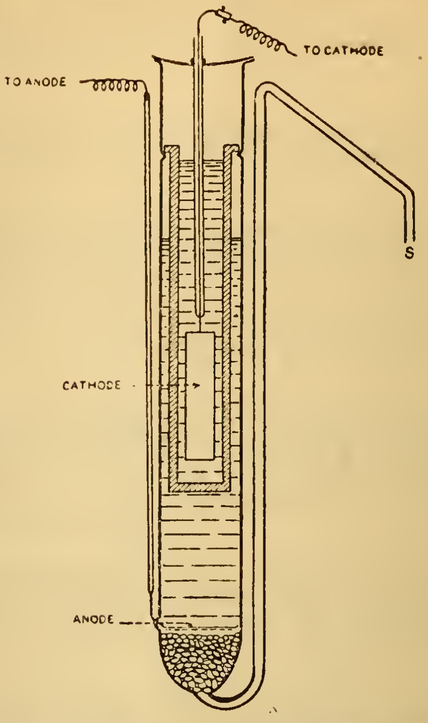
(*A.*)—ELECTRO-CHEMISTRY.

Hydrochloric acid; Electrolysis of solutions of pure ——. E. Doumer. Compt. rend., 1908, **146**, 329—331.

When a solution of hydrogen chloride is electrolysed, the theoretical weight of hydrogen is evolved at the negative electrode and a mixture of chlorine and oxygen at the positive electrode. The proportion of oxygen increases in weaker solutions of acid, reaching as much as one-quarter of the whole. This liberation of oxygen cannot be attributed to the secondary action of the chlorine formed on the solvent water; on the contrary the chlorine combines with a certain amount of the oxygen forming oxides. When silver or mercury anodes are employed, which fix the chlorine, a larger volume of oxygen is obtained than with platinum anodes. Not only the hydrochloric acid but also the water is decomposed electrolytically. The ratio $\frac{2v}{V}$ where v is the volume of oxygen and V that of hydrogen enables the ionisation factor—that is the ratio of the ions derived by electrolysis of the water to the total number of ions—to be calculated. This approximates in dilute solutions of acid to nearly one-half.—E. F. A.

Chloroplatinic acid; Preparation of —— by electrolysis, from platinum black. H. C. P. Weber. Bull. Bureau of Standards, U.S.A., 1908, **4**, 365—367.

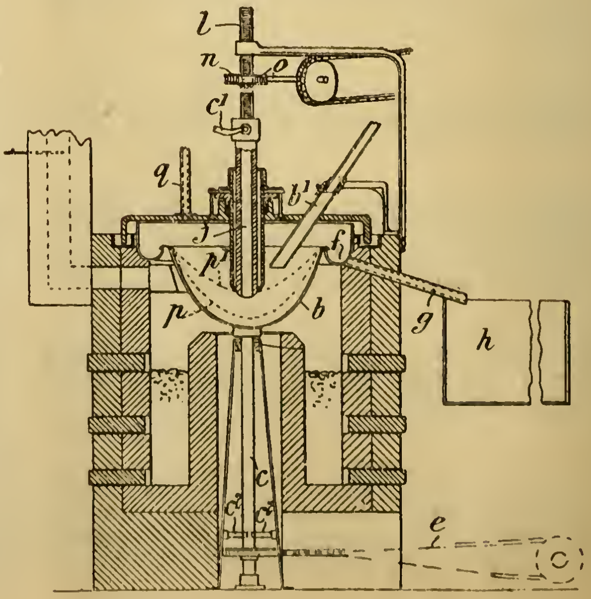
The platinum is prepared for electrolysis by dissolving platinum scraps or platinum sponge in *aqua regia*. The excess of acid is removed by evaporation or neutralisation, and the platinum solution reduced by zinc or an alkali formate, preferably the latter. The precipitated platinum is then treated with a little dilute hydrochloric acid to remove iron. The washing of the platinum precipitate is continued in the electrolytic apparatus, which consist of a cylindrical tube, 4 cm. in diameter and 35 cm. long, the bottom of the tube ending in a narrow siphon tube of 4 mm. bore. The anode consists of a thin platinum disc perforated by fine pin holes and resting on a bedding of glass beads at the point where the tube begins to narrow. A piece of platinum wire is welded to the disc and sealed through the walls of the tube, to the end of a glass tube which is carried to the top of the apparatus and filled with mercury to insure contact for the current. The cathode chamber consists of a porous porcelain filter, 18 cm. long and 25 mm. diameter, suspended by its rim to three notches pressed into the glass 5 cm. from the top of the tube. A sheet of platinum, 4 to 5 cm. long and 2 to 3 cm. wide, suspended by a platinum wire which passes through a glass tube, serves as the cathode. The mouth of the tube is covered by a watch glass in which is sealed the glass tube carrying the cathode. The whole apparatus is suspended in a long cylinder and can be cooled by running water when currents such as 8 to 10 amperes are used. The current may be taken from a 120-volt direct-current lighting circuit with a number of incandescent lamps in parallel with each other and in series with the cell. The platinum is placed on the anode plate and covered with concentrated hydrochloric acid to the level, S. The porous cylinder is filled to the top with hydrochloric acid. In an experiment extending over 4½ hours at 8 ampères, 64 grms. of platinum were dissolved. When the height of the hydrochloric acid column is properly adjusted in the anode cell, the heavy chloroplatinic acid solution is delivered at the tip of the siphon, S, drop by drop. In concentrating the solution of chloroplatinic acid, chlorine is passed through it for some time to insure freedom from platinous compounds.—W. S.



Nickel and zinc; Electrolytic separation of ——. F. Foerster and W. Treadwell, jun. *See* XXIII.

Patents.

Vessels for containing fused salts during electrolysis. S. O. Cowper-Coles, London. Eng. Pat. 3982, Feb. 18, 1907.



The vessel consists of an outer iron shell, *b*, which is mounted on a shaft, *c*, rotated by the gearing, *e*, and an inner lining of liquid metal, such as mercury, lead, or a suitable low-melting alloy. Under the action of centrifugal force, the metal applies itself to the inside of the outer shell, as shown by the dotted line, *p*. The liquid metal is supplied continuously through a hollow screw, *l*, attached to the hollow carbon electrode, *j*, the gearing, *o*, and nut, *n*, being designed to lower the electrode slowly into the fused salt, p^1, such as sodium chloride, which is supplied through the tube, b^1. Chlorine escapes through the pipe, *q*, and the alloy of liquid metal and sodium passes away into the annular trough, *f*, and through the pipe, *g*, into the vessel, *h*, in which the sodium is extracted in the form of caustic soda by the action of water. The current is supplied through the wire, c^1, and conveyed away through the brushes, c^2.—B. N.

Batteries; Storage ——. H. E. R. Little, New York, U.S.A. Eng. Pat. 13,983, June 17, 1907.

A solution of a halogen salt, such as zinc bromide, is employed as the electrolyte, and a liquid solvent, such as carbon tetrachloride, chloroform, etc., heavier than and not mixing with the electrolyte, is used for dissolving the electro-negative radical. Carbon electrodes, separated by perforated rubber plates and a layer of asbestos, are employed, and, during the charging of the cell, zinc is deposited on the upper electrode, while the bromine is removed from the electrolyte by the liquid solvent, the zinc and bromine again combining together during the discharge.—B. N.

Battery; Alkaline storage ——. T. A. Edison, Llewellyn Park, Orange, N.J., Assignor to Edison Storage Battery Co., West Orange, N.J. U.S. Pat. 879,612, Feb. 18, 1908.

The alkaline electrolyte is obtained free from albuminous or gelatinous matter, and thus rendered non-foaming, by filtering the solution through a medium of very fine porosity, such as bone-black, the latter being first subjected to the purifying effect of a hot caustic solution, followed by washing with water.—B. N.

Electrolytic apparatus. A. J. Boult, London. From Elektrizitäts A.-G. vorm. Schuckert und Co. Eng. Pats. 3000 and 3000A, Feb. 6, 1907.

See Ger. Pat. 181,656 of 1904; this J., 1907, 1016.—A. S.

Textile fibres or materials; Treating ——, *&c.* Eng. Pat. 3184, Feb. 8, 1907. *See* V.

Electric lamps; Incandescing bodies for ——. Eng. Pats. 4364 and 24,232. *See* II.

Electric lamps having incandescing bodies of refractory metal. Eng. Pat. 24,233. *See* II.

Filaments for electric lamps, etc. Fr. Pats. 382,898, 382,899 and 382,922. *See* II.

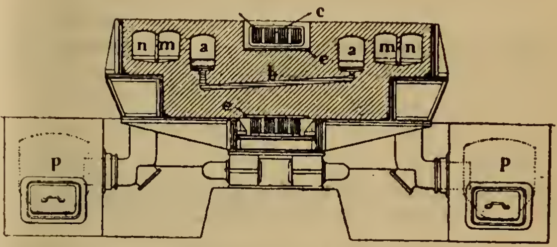
(*B.*)—ELECTRO-METALLURGY.

Patents.

Furnaces; Electric ——. A. Reynolds, London. Eng. Pat. 3914, Feb. 16, 1907.

For the generation of heat in metallurgical furnaces, one or more electric heating elements are embedded in the charge or in the walls or floor of the furnace. The heating element consists of a pot or tube of carbonaceous material, such as plumbago, in the upper part of which is a sleeve of refractory insulating material. A carbon rod is mounted in this sleeve so that it can be moved up and down inside the plumbago tube, and this rod forms one electrode. The other electrode is formed by the bottom of the plumbago tube or by a short carbon rod fixed thereto. The heat is generated by an arc struck between the electrodes, or by separating the latter by means of a resistance material. The cross-section of the resistance material may be reduced by partially filling the space between the electrodes with a refractory insulating substance, such as carborundum or siloxicon. In the case of a plumbago tube, embedded in the furnace wall, the end of the tube is closed by a carbon plug, which acts as one of the electrodes.—B. N.

Zinc-furnace; [Electric ——]. G. H. Gin. Fr. Pat. 382,872, Oct. 14, 1907.



The furnace is an electrical induction furnace, the primary circuit consisting of windings of copper wire, *c*, and the secondary circuit of a bath of molten iron contained in the two distillation chambers, *a*, which communicate by the channel, *b*, also filled with molten iron. The insulated copper wire is protected from radiated heat by water-cooled plates, *e*, between which and the windings are channels through which cold air is passed. The mixture of zinc ore and carbon is charged mechanically into the distillation chambers, *a*. Molten zinc condenses in the first condensation chambers, *m*, which are at a temperature of 500—700° C. Further condensation is effected in the second condensation chambers, *n*, and the vapours then deposit zinc-dust in further chambers, *p*, before they pass into the chimney (not shown). At the end of the distillation, the zinc is run out of the condensation chambers by tilting the furnace, and the residues in the distillation chambers are rabbled off, without interrupting the heating. The lining of the furnace consists of bricks of dolomite and magnesia.
—A. G. L.

Electroplating. S. O. Cowper-Coles, London. Eng. Pat 17,717, Aug. 2, 1907

The articles to be plated are clamped in a frame, which is provided at its ends with trunnions, the latter being supported in bearings fixed to the sides of the bath. The frame may be clamped in any desired position, in order to vary the inclination of the articles in the bath. The level of the electrolyte is varied, by allowing the liquid to flow continuously in and out of the bath, so that certain parts of the articles are covered for a greater length of time, and therefore receive a thicker coating, without showing any line of demarcation in the deposit.
—B. N.

Metallic [copper-nickel] ores or mattes; Process of treating ——. E. Günther and R. Franke, Eisleben, Germany. U.S. Pat. 879,633, Feb. 18, 1908.

Copper-nickel matte is used as anode in an electrolyte containing copper chloride, an alkali chloride, and free hydrochloric acid, whereby copper is deposited at the cathode. Copper chloride is added to the electrolyte during the electrolysis. When the electrolyte is sufficiently enriched in nickel, it is separated from the solid residue of the anode, and subjected to electrolysis, with insoluble anodes, for the purpose of separating the main quantity of the copper. The remainder of the copper is chemically precipitated from the solution, and then the latter is electrolysed with insoluble anodes to obtain pure metallic nickel. The chlorine produced at the anode is utilised for producing copper chloride from suitable copper ores for use in the first stage of the process.—A. S.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

Fatty acids; Esterification constants of the normal ——. J. J. Sudborough and J. M. Gittins. *See* XXIV.

Oxidising and fat-hydrolysing bacteria. E. de Kruyff. *See* XXIV.

Patents.

Fats, oils, and other fatty substances; Extraction of ——. E. Berliner. Fr. Pat. 383,231, Oct. 23, 1907.

See Eng. Pat. 23,146 of 1907; this J., 1908, 168.—T. F. B.

Soaps and mixtures containing soap; Preparation of ——. The Karsam Soap Co., Ltd. Fr. Pat. 383,250, Oct. 24, 1907. Under Int. Conv., Nov. 5, 1906.

See Eng. Pat. 24,822 of 1906; this J., 1907, 1244.—T. F. B.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(*A.*)—PIGMENTS, PAINTS.

Patent.

Zinc compounds suitable for paints; Process for the manufacture of ——. J. C. A. Meyer. First Addition, dated Dec. 28, 1906, to Fr. Pat. 373,027, March 6, 1906 (this J., 1907, 701).

The use of sulphuric acid, alone or mixed with acetic acid, in place of the acetic acid used in the main patent, is claimed.—A. S.

(*B.*)—RESINS, VARNISHES.

Patents.

Turpentine from gum and rosin; Still for extracting ——. G. F. Williamson, Savannah, Ga. U.S. Pat. 878,701, Feb. 11, 1908.

A regulated stream of water is conveyed by a pipe controlled by a valve, from the worm-tub to the head of the "kettle," or still.—W. H. C.

Lac; Process for the preparation of an artificial ——. H. Engelhardt and H. Beyersmann. Fr. Pat. 383,181, Oct. 22, 1907. Under Int. Conv., Feb. 25, 1907.

The process consists in heating resins at ordinary or increased pressure with small quantities of aldehydes, simple or polymerised. For example, 6 kilos. of colophony, 3 kilos. of gum sandarac, and 1 kilo. of gum elemi are melted, and 50 grms of paraformaldehyde are added. The mass is heated until it becomes clear. The product is soluble in all the usual solvents.—A. S.

(*C.*)—INDIA-RUBBER, &c.

Cryptostegia grandiflora rubber from India. Bull. Imp. Inst., 1907, **5**, 371—374.

The three samples of rubber examined gave the following results:—

Source.	Moisture.	Caoutchouc.	Resin.	Insoluble impurity.
	Per cent.	Per cent.	Per cent.	Per cent.
Madras	24·7	67·4	5·9	2·0
Jalaun	5·5	79 9	8·5	6·1
Bombay	3·6	64·3	10·1	14·1

The samples from Madras and Jalaun were valued at 2s. 4d. and 1s. 6d. per lb. respectively in London (August, 1903). The sample from Bombay contained 7·9 per cent. of proteins and yielded 8·22 per cent. of ash. In May, 1906, it was valued at 3s. 6d. per lb. as against 5s. 4d. per lb. for fine hard Para rubber.—A. S.

Ceara rubber in Portuguese East Africa. Report by W. H. Johnson. Bull. Imp. Inst., 1907, **5**, 401—422.

An account is given of experiments made with a view of ascertaining whether sufficient rubber could be extracted from Ceara (*Manihot Glaziovii*) trees to allow of their being profitably cultivated in Portuguese East Africa, and also to determine the method of tapping which would furnish the maximum yield of rubber with the minimum amount of damage to the trees. The detailed results are set out in tables, but it is not considered possible yet to state definitely which method of tapping will yield the best results. At present the total average yield of dry rubber per tree is 112·5 grms. composed of almost equal proportions of "biscuit" and "scrap." There are 175 trees per acre, so that the total yield of dry rubber per acre is about 19·69 kilos., of a probable value of £10 2s. 7d. As the trees were grown under unfavourable conditions, and as they may be tapped at least twice and possibly three times a year, the prospects of profitably cultivating the Ceara rubber tree in Portuguese East Africa are held to be distinctly favourable.—A. S.

XIV.—TANNING, LEATHER, GLUE, SIZE.

Patents.

Tanning; Preparation for use in ——. P. L. Aslanoglou, Smyrna. Eng. Pat. 13,879, June 15, 1907.

A semi-liquid or dry extract of valonia is obtained by placing valonia in a digester containing water at 100° C., and allowing the temperature to fall to 75°—85° C., at which it is maintained for at least 1 hour. The liquid extract is then partially decolorised, if necessary, by treatment with sulphur dioxide, filtered, and evaporated to the consistency of thick treacle. If a dry extract be required, the semi-liquid preparation is evaporated to dryness in a vacuum pan.—A. S.

Skins ; Process for the preparation of —— for the manufacture of leather. E. Leconte père. Fr. Pat. 383,273, Oct. 24, 1907.

The skins are treated in a weak bath of sulphurous acid before tanning.—A. S.

Leather ; Manufacture of ——. S. H. Knight and C. D. Lightband. Fr. Pat. 383,361, Oct. 28, 1907.

Leather for decorative purposes is prepared from the membrane of the stomachs of animals, which membrane has, in its natural condition, a wrinkled surface. The membrane is tanned in the usual manner, washed, dyed, and dried.—A. S.

Tanning, tawing, or preparing leather and skins. W. P. Thompson. Fr. Pat. 383,363, Oct. 28, 1907. Under Int. Conv., Oct. 30, 1906.

See Eng. Pat. 24,189 of 1906 ; this J., 1907, 627.—T. F. B.

XV.—MANURES, &c.

Soil carbonates ; Action of water and aqueous solutions upon ——. F. K. Cameron and J. M. Bell. Bureau of Soils, U.S. Dept. Agr., Bull. No. 49, 1907.

The solubility of calcium sulphate and phosphates has been recorded previously (this J., 1907, 1207), and the authors now give the results of their investigation on the solubility of the alkaline-earth carbonates found in soils. Of the two commonly occurring forms of calcium carbonate, calcite is the stable form at ordinary temperatures, whilst in concentrated salt solutions or at the higher temperatures, aragonite is probably the stable phase. An increase in the solubility of calcium carbonate in water takes place constantly if increasing quantities of sodium sulphate be added. The solubility of the carbonate, at 25° C., is about six times as great in saturated sodium sulphate solution as in saturated sodium chloride solution. A new solid phase, $2CaSO_4,3Na_2SO_4$, appears when solutions containing sodium sulphate and chloride are saturated with carbon dioxide in the presence of calcium carbonate. The presence of ammonium salts in solution increases the solubility of the carbonate, upon which other calcium and magnesium salts have also a solvent action. Magnesia dissolves in water at a temperature of 20° C. to the extent of about 10 mgrms. per litre, and the solubility is augmented by the presence of various salts, including magnesium salts. In solutions containing sodium sulphate, the solubility of magnesium carbonate increases as the concentration of the sodium salt is increased.—W. P. S.

Patent.

Hydrofluosilicic acid and fluosilicates, etc. Addition to Fr. Pat. 375,989. *See* VII.

XVI.—SUGAR, STARCH, GUM, &c.

Sucrose ; Theory of inversion of ——. J. Meyer. Z. physik. Chem., 1908, **62**, 59—88.

Hitherto, the hydrolysis of sucrose has been regarded as an instance of a simple monomolecular reaction, but the author points out that such cannot be the case, since the reaction-products, dextrose and lævulose, are mutarotatory ; he has deduced equations whereby the rotation of the solution and the concentration of each component, at any instant, may be calculated from the reaction-constants and the specific rotations of the components. Employing α-and β-glucose, the author has determined the conversion constants of the reversible reaction,

$$\alpha\text{-glucose} \underset{k_2}{\overset{k_1}{\rightleftarrows}} \beta\text{-glucose},$$

at 18° and 25° C., in neutral and in 0·02 N hydrochloric acid solutions. The results showed that the constants, k_1 and k_2, are proportionally increased to about the same extent by rise of temperature or addition of acid ; hence, the equilibrium point is practically independent of temperature or presence of acid. The constants obtained by working with α-and β-glucose respectively, agreed very closely, thus indicating, that in a glucose solution of constant rotation, there is not a third glucose modification but only the equilibrium mixture $(\alpha+\beta)$-glucose. At present, only one modification of fructose —α-fructose—is known ; hence, it is only possible to observe the approach to the equilibrium-state from one side. The author has done this, under the same conditions as for glucose, and has obtained the sum of the conversion constants (k_1+k_2). Investigation of the hydrolysis of sucrose (at 18° and 25° C., in 0·02 N hydrochloric acid solution) showed that, at first, the hydrolysis does not conform to the equation of a simple monomolecular reaction, but that after about 4—5 per cent. of the total change of rotation has occurred, the hydrolysis approximates very closely to this. The true inversion constant for an 8 per cent. sucrose solution in 0·02 N hydrochloric acid was found to be 0·000050 at 18°, and 0·000150 at 25° C.—L. E.

Starch ; Properties of pure ——. L. Maquenne. Compt. rend., 1908, **146**, 317—318.

The perfect solution of soluble starch recorded by Fouard (this J., 1908, 238) which lacks all colloidal properties and deposits a clotted substance on standing has been already described by Maquenne and Roux as amylose (this J., 1905, 630 ; 1906, 192). Pure amylose prepared perfectly free from mineral impurities gives absolutely limpid aqueous solutions, not coagulated by electrolysis, which pass through the usual filtering membranes, including the Chamberland filter, in the same manner as a salt solution. The clouding of the solution and precipitation of "artificial starch," observed by Fouard, have already been described by the author under the term "reversion" and attributed to polymerisation. The change is truly reversible, as the precipitate dissolves in water under pressure.—E. F. A.

Patents.

Sugar ; Apparatus for the treatment of —— in the centrifugal drying machine. J. W. Macfarlane, Cathcart, N.B. Eng. Pat. 10,196, May 2, 1907.

High-pressure steam is led into one or more chambers of the usual type of superheater, and passes through a restricted opening, regulated by a stop valve or adjustable plug, into a vertical helical pipe coil arranged within the chamber. From the top of this coil the steam passes through a stop-valve into a pipe from which it is discharged through a nozzle into the basket of the centrifugal apparatus through a hole in the cover of the basket. This nozzle does not project through the cover which, being divided into approximately semicircular halves, is thereby enabled to slide clear in guides inclined at an angle to each other. When the apparatus is not in use, any condensed water in the coil will drop out through the restricted opening, whence it may be drained off by a steam-trap. By these means minimum waste in cleansing the sugar results, and loss and cooling of superheated steam is prevented.—J. W. G.

Laevulose, glucose, etc.; Process of making ——. F. L. Stewart, Murrysville, Assignor to S. E. Gill, Pittsburg, Pa. U.S. Pat. 879,422, Feb. 18, 1908.

Jerusalem artichokes are reduced to pulp, which is heated with water and oxalic acid, an alkaline salt being then added to the mass to neutralise it. The saccharine solution is separated from the pulp and insoluble precipitate, acidified with tannic acid, clarified by means of a soluble silicate, neutralised with an alkaline salt, heated, filtered through bone-black and finally concentrated.—T. H. P.

Mother-syrups and massecuites of sugar houses and refineries; Process and apparatus for the filtration of ——. J. Dolignon. Fr. Pat. 382,377, Sept. 28, 1907.

The object of this invention is to recover the fine crystals which pass through the sieves of the centrifugal machine. The mother-syrup or malaxed low product massecuite after being heated to render it more fluid, flows to a vessel provided with a number of filtering compartments where it is filtered through cloth filters. When the apparatus is filled with crystals, juice from the second carbonation, heated to about 100° C., is passed through it, in order to dissolve the sugar.—L. E.

XVII.—BREWING, WINES, SPIRITS, &c.

Pure yeasts and some associated fungi [in cider musts]; Fermenting power of ——. W. B. Alwood. U.S. Dept. Agric., Bull No. 111, 8—28.

The fermentative powers of various selected wine and cider yeasts were determined by sowing standard quantities of active pure cultures in sterilised apple must in flasks fitted with a special trap. The losses in weight were recorded daily, together with analyses of the must before and after fermentation. In the first 24 hours the losses in weight were almost *nil*, because the carbon dioxide was absorbed by the liquid. The relative strength of the various races of yeast having thus been ascertained, experiments were made with a view to secure dominant fermentations by selected yeasts in unsterilised musts. These experiments showed that dominant fermentation with selected yeast did not destroy the objectionable organisms present, but it brought the fermentation under control for a certain period, provided the liquor was racked and handled at the proper temperature. By attention to details and temperature, it is possible to suppress the activity of the acetic and other ferments almost completely. The only correct way of introducing pure yeast into fruit juices on the large scale is by means of active cultures prepared in sterilised must. The quantity of "starter" required to control the fermentation depends on the adverse conditions to be overcome; 0·25 per cent. of an active culture is generally sufficient, but when the conditions are not good, 1 per cent. may be used for safety. The fermentation starts earlier the larger the quantity of pure yeast sown. *S. apiculatus* always shows an early start but the final result as regards production of alcohol is very poor. A mixture of pure yeasts has not so high a fermentative power as several of the same yeasts when sown separately. Owing to its precocity of development, *S. apiculatus*, when present together with a pure culture yeast, may dominate the fermentation and seriously affect the final result. Mould fungi, associated with the yeasts, may consume considerable quantities of sugar whilst producing only small quantities of alcohol. "Torulæ show decided strength as alcoholic ferments." They are the more objectionable on this account because their development in the musts may give rise to secretions likely to injure the bouquet of the product. Mycodermæ vary in their fermenting power, but some species are capable of producing as much as 4 per cent. of alcohol and thus, in competition with the yeasts, they are open to the same objection as torulæ, particularly in slow fermentations. —J. F. B.

Fungi; Influence of constitution of nutrient on the fermentative and reproductive capacities of various ——. *II.* H. Pringsheim. Biochem. Zeits., 1908, **8**, 119; Woch. für Brau., 1908, **25**, 131.

In the first communication (this J., 1907, 28) it was shown that yeast was capable of exerting its fermentative function only when a nitrogenous nutrient substance containing the group NH.CH.CO was available. The author has now made experiments in order to ascertain whether this rule is applicable generally to all classes of fungi. Five typical species were grown in media containing the following bodies, each of which contains the group in question: glycocoll, alanine, phenylalanine phenylglycocoll, aspartic acid, asparagine, tyrosine and uric acid, whilst nitrogenous bodies of other types were represented by metanilic acid, naphthionic acid, methylaniline, dimethylaniline, acetamide and pyridine hydrochloride. The results showed that *Mucor racemosus*, *Rhizopus tonkinensis* and *Torula* I followed the same law as yeast and only showed signs of fermentation in presence of nitrogenous bodies of the first class. But *Allescheria Gayonii* and *Torula* V behaved differently and were found to possess fermentative properties in all the media tested. Simultaneously with the fermentative experiments, determinations were made of the yield of fungus substance developed by reproduction in the various media. Here it was found that the amino-acid group, represented by the nitrogenous substances of the first class, was the most favourable to the growth of fungi, as had already been shown by Czapek for *Aspergillus niger*. But again *Allescheria* was an exception, and grew just as well on the nutrients of the second class as on those of the first. Torula V, however, like *Mucor* and *Rhizopus*, gave higher yields of fungus substance when grown in presence of the nutrients of the first class. The fungus substance of *Allescheria* contained from 1·7 to 3·1 per cent. of nitrogen, but the influence of the nutrients on this constituent could not be traced.—J. F. B.

Brewery worts; Use of the immersion refractometer for the analysis of ——. O. Mohr. Woch. für Brau., 1908, **25**, 129—130.

Two years ago (this J., 1906, 395) the author proposed the use of the immersion refractometer for the determination of solids in worts, and in the Woch. für Brau., 1906, No. 45, he gave a table of equivalent values for comparing the results obtained by the optical method with those found with the pyknometer. The author has always considered the possibility of worts prepared by different processes of mashing containing solids having different refractive values in solution. The table worked out by the author on worts prepared in the Berlin Experimental Brewery has now been checked in the laboratory of a large brewery on industrial worts and the validity of the table has been fully confirmed, at all events in the case of worts from pale malts.—J. F. B.

Vinegar; Preparation and sale of —— *in relation to the Food and Drugs Act.* J. M. Hamill. Local Govt. Board Reports of Inspector of Foods, No. 5, 1908, 1—28.

The total production of brewed vinegars in England and Wales is estimated at 10—20 million gallons per annum. Vinegars may be considered under two heads; fermentation vinegars and artificial vinegars. Of the former the only kinds produced in large quantities in this country are the "brewed" vinegars, from malt, converted grains and commercial sugars. In many cases brewing is conducted only in the winter months, and the fermented "wash" is stored in closed vessels until required for

acetification. In this way matters are deposited which otherwise would tend to clog the acetifiers. The temperature at which acetification is conducted is generally above 100° F., and in some cases is as high as 120° F. The yield of acetic acid is generally 15—20 per cent. below the theoretical quantity; but the losses may amount to as much as 50 per cent., although by careful manipulation of the air supply they may be reduced to as little as 10 per cent. A consumption of the acetic acid by the acetifying organisms themselves may occur if the acetifiers are packed so that the wash accumulates in pools instead of flowing straight through. A small amount of alcohol is left in the vinegar and becomes converted into esters during storage. Various means for clarifying are adopted, the most general being a filter-bed of beech-wood chips. To many brewers whose plant is unequal to the demand upon it, a more rapid process of clarification is a consideration, and the use of finings is resorted to before filtration. Potassium ferrocyanide is used as a fining agent for precipitating albuminous matters, but it is open to the objection that it might produce hydrocyanic acid by decomposition. The flavour of vinegar depends very much on changes which take place during storage, the vinegar losing its harshness and becoming more mellow. The great majority of vinegars, even those brewed wholly from malt, are coloured artificially by the addition of caramel. A good vinegar should require no preservative but in the case of weak vinegars, calcium bisulphite is the usual preservative, although salicylic acid is sometimes employed. Small quantities of sulphuric acid improve the keeping qualities of the vinegar. When a malt vinegar is diluted with water and its acid-strength is restored by the addition of commercial acetic acid, it is said to be "fortified." Such vinegars possess superior keeping qualities, owing to the dilution of the extractive matters. Vinegar brewers can readily detect fortification by the flavour when the commercial acetic acid exceeds 20 per cent. of the original acetic acid of the vinegar. The weakest vinegar sold is called "diamond" and contains only 3·2—3·5 per cent. of acetic acid. Distilled vinegar, wine vinegar and spirit vinegar are made in this country only in very small quantities. "Artificial" vinegar is made by diluting 80 per cent. acetic acid, imported from Germany or Holland, to a strength of 3·5—4·5 per cent., generally with the addition of a little malt vinegar and caramel. The industry is almost entirely confined to small local manufacturers. The cost of manufacture of a 5 per cent. vinegar is about 5d. per gallon for brewed and 3d. per gallon for "artificial" vinegar. At present no official standards exist for defining the description of the various vinegars, and considerable difficulty would be experienced in framing and enforcing such standards. There is no minimum standard of strength, but the author suggests that public analysts should adopt a minimum of 4 per cent. of acetic acid, since a weaker vinegar does not fulfil the purposes of a pickling agent. Under the Food and Drugs Act, the analyst should ascertain the absence of metals, such as copper and tin, derived from the pipes and pumps, of arsenic from the malt and sugars and of hydrocyanic acid. Sulphuric acid is to be regarded as an adulteration. The quantity and composition of the solid matters afford a ready differentiation between pure brewed vinegars and artificial vinegars, and the latter should not be sold as "vinegar" or "malt vinegar," but should bear some indication of their origin.
—J. F. B.

Patents.

Beer, ale, and other fermentable liquids; Process for fermenting ——. H. H. Freund, New York. U.S. Pat. 878,790, Feb. 11, 1908.

A closed vessel is partially filled with the prepared wort and the latter is then aërated strongly with sterilised air for about 20 hours, or until a white foam appears on its surface. An opening is provided at the top of the vessel for the escape of the air. The wort is next subjected to fine aëration with sterilised air for about 8 hours, and is then allowed to ferment for a considerable time. Arrangements are provided for cooling the wort during the period of fermentation and the carbon dioxide formed is replaced by sterilised air. The liquid is finally racked.
—W. P. S.

Clarification [of wort]. N. Minuth. First Addition, dated Oct. 7, 1907, to Fr. Pat. 375,963, March 21, 1907 (this J., 1907, 984).

The addition relates to the form of curve given to the real bottom of the mash-tun, the convexity being rapidly increased towards the centre. The object is to obtain a more even flow of the liquid.—W. H. C.

Tartaric acid from crude tartar, &c. Fr. Pat. 382,824. *See* XX.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

(*A.*)—FOODS.

Lecithin-phosphoric acid in pastry; Decomposition of ——, *when the pastry is kept.* H. Matthes and O. Hübner. Chem.-Zeit., 1908, 32, 186.

The authors have made determinations of the lecithin-phosphoric acid, total phosphoric acid, and ether-extract, in samples of pastry made with eggs, the analyses being made first on the fresh pastry and afterwards when the latter had been kept for periods varying from 16 to 30 months. The results show that the amount of lecithin-phosphoric acid decreases considerably as the pastry ages, particularly if the sample be kept in a ground condition. For instance, 3 samples containing originally 0·0380, 0·0454, and 0·0353 per cent. of lecithin-phosphoric acid, at the end of 2 years contained 0·0299, 0·0258, and 0·0267 per cent. respectively; in a fourth sample the amount decreased from 0·0484 to 0·0359 per cent. in 16 months, and in a fifth sample from 0·1903 to 0·1250 per cent. in 30 months. In the latter case the pastry was kept in a whole condition whilst the first four were finely ground before being stored. Even where the original quantity of lecithin-phosphoric acid was small, the decrease was considerable. The amount of total phosphoric acid remained unaltered. As the cause of the decrease in the quantity of lecithin-phosphoric acid is at present unknown, the authors consider that caution should be exercised in using this determination for detecting the presence or absence of eggs in pastry.
—W. P. S.

Vinegars; Preparation and sale of —— *in relation to the Food and Drugs Act.* J. M. Hamill. *See* XVII.

(*B.*)—SANITATION; WATER PURIFICATION.

Patents.

Water; Purification of ——. J. Wilson, London. Eng. Pat. 6220, Mar. 14, 1907.

The water to be treated is delivered to a distributing tank, the floor of which is divided by low partitions; each compartment thus formed is provided at the bottom with two (or more) orifices, the relative sizes of which can be adjusted. The larger orifice conducts the greater part of the water delivered into the compartment to a mixing tank, whilst the smaller hole allows a definite quantity of the water to pass to a lime-tower. The latter discharges an equivalent quantity of lime-charged water into the mixing tank. The orifices from the distributing tank discharge into intermediate channels whence the water is conducted to the lime and mixing tanks respectively. By providing a third orifice in each compartment, a portion of the water may be passed through a tank containing a second reagent and then introduced into the mixing tank. The water overflows from the mixing tank into a settling tank and is led from the top of this to the bottom of a filter through which it flows upwards. In case the filter becomes clogged, the water rises in the settling tank and then flows down a pipe, situated just above that leading to the bottom of the filter, to a vessel pivoted to a valve at the bottom of the filter. The weight of the water in the vessel causes the valve to open and the filter is flushed out, a valve at the top of the pipe leading to the bottom of the filter being at the same time closed. When the filter has been cleaned in this manner, the water is discharged by a siphon arrangement from the pivoted vessel, which then rises, the valves are operated in the inverse direction, and the water again flows upwards through the filter. —W. P. S.

Filtering apparatus [*for water, or sewage*]. F. Candy, London. Eng. Pat. 14,981, June 29, 1907.

The claim relates to a method of arranging the overflow and supply pipes of a series of filter-beds separated by channels which serve to conduct the effluent from the top of one bed to the space below the next. The pipes and valves are so arranged that any one or more of the filter-beds can be cut out of action and the effluent conveyed by a pipe past the inlet channel or channels of the bed, or beds to be cut out, to the next bed which it is desired to work.—W. H. C.

(*C.*)—DISINFECTANTS.

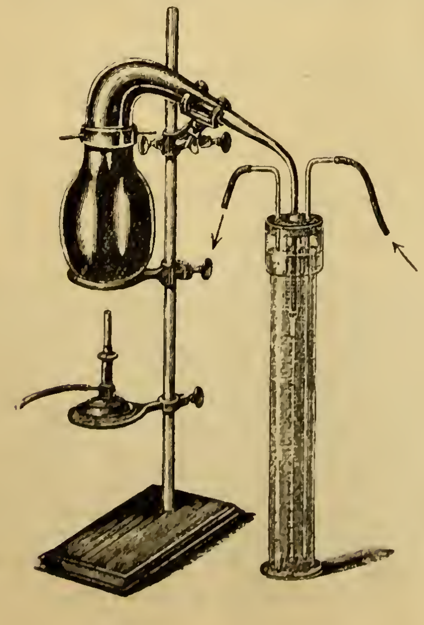
Patent.

Disinfection; Apparatus and process for ——. P. Gasparini, Turin, Italy. Eng. Pat. 10,128, May 1, 1907.

The apparatus consists of a portable insulated boiler within which is a steam generator. The supply of steam to the boiler is divided within the boiler by means of pipes. The articles to be disinfected are packed in a wire cage, movable on wheels running on rails carried by a frame, which can be fitted steam-tight into the boiler or drawn clear of it at pleasure. Disinfection is carried out at a temperature of 120° C. by steam mixed with the gaseous combustion products of a mixture, in any desired proportion, of sulphur and some nitrate such as potassium, sodium, or lead nitrate, burnt in suitable receptacles within the boiler.—J. W. G.

XIX.—PAPER, PASTEBOARD, &c.

Water contained in cellulose; Determination of the ——. C. G. Schwalbe. Z. angew. Chem., 1908, 21, 401—402.



Into a copper retort which is tinned inside, 50 to 100 grms. of the material, torn into pieces, are placed and covered by 1·5 to 2 litres of petroleum. The retort is joined to a tube, the narrow part of which is graduated and cooled by a stream of cold water as shown in the figure. The retort is heated for 10 to 15 minutes and the apparatus then allowed to cool during 3 or 4 hours; when the liquid in the graduated tube becomes clear, the volume of water distilled is read off. A correction for the water dissolved in the petroleum can be applied. The results obtained by this method agreed very well with those obtained by drying cellulose in a toluol drying stove. A mixture of benzene and toluene of boiling point 105° C. cannot be used in place of the petroleum.—S. H. H.

Cellulose; Colloidal phenomena of ——. *Colloidal copper in hydrated cellulose.* C. G. Schwalbe. *See* V.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

Quinine sulphate; Causes of error in the Kerner-Weller method for the detection of allied alkaloids in ——. P. Biginelli. Monit. Scient., 1908, 22, 175—185.

Although the method of Kerner for the detection of other cinchona bases in commercial quinine sulphate appears simple, in practice it is an extremely delicate process, and unless minute care be given to details, fails to give correct, or even concordant results. For example, the quinine sulphate weighed out, must be thoroughly effloresced, to avoid errors from the varying quantities of water of crystallisation contained in the salt; and also the slight influence of this water on the results. To achieve this, it is not always necessary to heat the crystals to 40—50° C. for two hours; they may be heated to a higher temperature for a shorter time, provided they are then kept for 12 to 24 hours at the ordinary temperature. The mixture of the ammonia reagent with the saturated quinine solution should be performed slowly, to avoid the formation of quinine hydrate with 8 mols. of water, which is less soluble. Kerner's reaction is, at the best, an imperfect test, even for detecting the presence of other cinchona alkaloids in quinine sulphate. It should be supplemented by the ash determination, and the solubility test, especially that in a mixture of alcohol and chloroform.

In order to ensure uniformity, it would be better, in all official tests (not only that of Kerner) to employ a definite weight of the effloresced salt. Instead of the temperature 50—60° C. generally prescribed for obtaining the saturated aqueous solution in Kerner's test, that of 70—80° C. is preferable, for some double salts are not completely dissociated at 50—60° C. In performing the test, more satisfactory results are obtained when operating with 3 or 4 grms. of quinine sulphate and 30 or 40 c.c. of water than with smaller quantities. Since a quinine sulphate may be pronounced impure if it contains free quinine or other free alkaloids, in the case where the result of Kerner's test is negative, it may be necessary to extract a definite weight of the salt with light petroleum spirit, and to test qualitatively the distillation residue, repeating Kerner's test, if necessary, with the salt left after this extraction. In all cases the limit of ash for quinine sulphate should not exceed 0·10 per cent. —J. O. B.

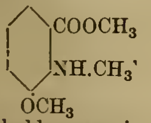
Quinine bisulphate; Direct application of the Kerner and Liebig-Hesse tests to ——. P. Biginelli. Monit. Scient., 1908, 22, 185—187.

Quinine bisulphate is converted into neutral sulphate by treatment with pure lead carbonate, which combines with 1 mol. of sulphuric acid, forming lead sulphate. In applying Kerner's test, 2·162 grms. of anhydrous quinine bisulphate (or its exact equivalent of hydrated salt, or of a mixture) are intimately mixed in a mortar with 1·5 grms. of pure, dry lead carbonate, and then rubbed down with a little water; the mixture is transferred to a flask, and made up to exactly 20 c.c. with more water. The mixture is then subjected to Kerner's test.

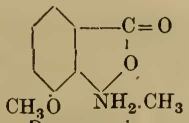
Liebig-Hesse's test is applied to a solution of quinine neutral sulphate prepared in a similar manner; but in the case of bisulphate, only half the above quantities of that salt and of lead carbonate are taken, with the same volume of water.—J. O. B.

Alkaloids of the species of Nigella. O. Keller. Arch. Pharm., 1908, **246**, 1—50.

The author has made an examination of several species of *Nigella* for alkaloids. The identity of the several species was confirmed by a botanical examination of seeds from plants specially grown, and figures of these seeds are given. The seeds of *Nigella damascena* contained no other alkaloid besides damascenine. The seeds of *N. sativa* contained no appreciable amount of alkaloid, but a substance, $C_{20}H_{34}O_7$, of the nature of a glucoside, and having some relation to melanthin was isolated. Of the following species, *N. arvensis*, *N. hispanica*, *N. orientalis*, *N. Garidella*, *N. integrifolia*, *N. diversifolia*, *N. damascena*, and *N. aristata*, the last two alone were found to contain noteworthy amounts of alkaloid. A quantity of the seeds of *N. aristata* was extracted with dilute hydrochloric acid, the acid nearly neutralised, and the liquid shaken out with light petroleum and ether-chloroform. The extracts were then shaken out with 5 per cent. hydrochloric acid, and the acid evaporated. A yield of 3·5 grms. of the hydrochlorides of two bases was obtained from 3 kilos. of the seeds. The salts were separated by recrystallisation. The less soluble was the hydrochloride of methyldamascenine, $C_{10}H_{13}O_3N$, which crystallises in clear, colourless, short, hard prisms, melting at 120°—122° C. The mother liquors yielded the hydrochloride of damascenine, crystallising in white needles and melting at 197°—200° C. The free base is a yellow oil, setting to a hard crystalline mass when placed on ice. Methyldamascenine is a secondary base. The methiodide of methyldamascenine, B,CH_3I, crystallises from water in short, transparent needles and tablets, easily soluble in water and melting at 140° C. The nitroso compound, $C_{10}H_{12}(NO)O_3N$, softens at 60° C. and finally melts at 72° C. No other alkaloid was found in the seeds of *N. aristata*. The constitution of these alkaloids is regarded as represented by the formulæ:—



Methyldamascenine.



Damascenine.

—F. Shdn.

Grindelia; Chemical examination of ——. *Part II*, F. B. Power and F. Tutin. Amer. Pharm. Assoc., Sept., 1907. Reports from Wellcome Chemical Research Laboratories, No. 75.

The portion of the resin of *Grindelia* which is soluble in light petroleum consists of a complex mixture of acids. These are, for the most part, optically active, unsaturated cyclic compounds. A very small amount of cerotic acid was found, also a trace of palmitic acid. In addition to hentriacontane, $C_{31}H_{64}$, and a phytosterol, which, were noted in a previous communication (this J., 1905, 1124), the authors have found a small amount of another hydrocarbon. The non-acidic portion of the petroleum extract consists of a mixture of esters, probably glycerides. The corresponding acids appear to be the same as those occurring in the free state. Cerotic, palmitic, and stearic acids were obtained from these esters in small amount. The ether extract of the resins yielded a colourless crystalline alcohol, $C_{17}H_{28}O_3$ or $C_{23}H_{38}O_4$, forming plates melting at 256°—257° C., and yielding an acetyl derivative, m. pt. 161° C. Associated with it, there was found a yellow phenol, $C_{14}H_{12}O_5$, crystallising in prisms melting at 227°—228° C, and yielding an acetyl derivative melting at 154° C. —F. Shdn.

Allyl mustard oil; Volumetric determination of ——. M. Kuntze. Arch; Pharm., 1908, **246**, 58—69.

The author recommends the following method for testing mustard oil for pharmaceutical purposes. 5 c.c. of mustard spirit are placed in a 100 c.c. measuring flask with 10 c.c. of ammonia and 50 c.c. of a *N*/10 solution of silver nitrate. The flask is closed by a cork bearing a tube 1 metre long, and heated on the water-bath for an hour. The liquid is cooled to 15° C., made up to the mark, and 50 c.c. of the clear filtrate made faintly acid with nitric acid, and 1 c.c. of ferric ammonium sulphate solution added. 16·6 c.c. to 17·2 c.c. of a *N*/10 solution of ammonium thiocyanate should be required to produce a red coloration. This method is suggested in place of the one described in the 4th edition of the German Pharmacopœa.—F. Shdn.

Umbellulone; Constitution of ——. *Part III.* F. Tutin. Chem. Soc. Trans., 1908, **93**, 252—260.

A criticism of recent work by Semmler (this J., 1908, 89). It is pointed out that the "umbellulone" obtained by the fractional distillation of the essential oil of Californian laurel is a mixture of substances, $C_{10}H_{14}O$ and $C_{10}H_{16}O$, which on reduction, gives about 70 per cent. of its weight of an unsaturated mixture of alcohols, $C_{10}H_{16}O$ and $C_{10}H_{18}O$. On oxidation of this mixture of alcohols, the former, $C_{10}H_{16}O$ (umbellulol), is readily broken down, whilst the latter gives a yield of less than 50 per cent. of a ketonic product, $C_{10}H_{16}O$ ("β-dihydroumbellulone"). It would appear, therefore, that "β-dihydroumbellulone" is not a derivative of the ketone from which it is named. Moreover it is not a definite compound but a mixture of at least two ketones, one of which is saturated and one unsaturated. As it was from this mixture that Semmler prepared the homotanacetonedicarboxylic acid on which he based his conclusions respecting the constitution of umbellulone, these conclusions must be looked upon as devoid of value. Further arguments are brought forward in support of the formula previously given by the author (this J., 1906, 776; 1907, 432).—A. S.

Sulphosalicylic acid; Action of —— *upon borax.* L. Barthe. Compt. rend., 1908, **146**, 408—411.

One molecule of borax is dissolved in boiling water, and a solution of 4 molecules of sulphosalicylic acid is added. On evaporating in a vacuum, large, brilliant, white crystals of sodium oxydiborodisulphosalicylate are obtained. This substance is slightly soluble in cold water, completely precipitates albumin on warming, gives a violet coloration with ferric chloride, and is not decomposed by cold mineral acids. If alkali is added till the solution of the substance is neutral to phenolphthalein, the liquid becomes acid on the addition of glycerol, and a further addition of the same quantity of alkali is required to produce neutrality. When treated in alcoholic solution with hydrochloric acid gas, it is decomposed into sodium chloride, and boric and sulphosalicylic acids. The constitution is represented by the formula,

$$(COONa)(SO_3H)C_6H_3O.B(OH).O.(HO)B.OC_6H_3(SO_3H)(COONa).$$

The sodio-potassium salt is produced when a hot aqueous solution of the above compound is neutralised with potassium hydroxide in the presence of phenolphthalein, and forms brilliant tablets.—F. Shdn.

Iron salts; Some organic ——. L. Rosenthaler and A. Siebeck. Arch. Pharm., 1908, **246**, 51—57.

Basic ferric tartrate, $2Fe_2(C_4H_4O_6)_3,3Fe(OH)_3,3H_2O$, was prepared by adding slowly an excess of a 5 per cent. solution of ferric nitrate to a boiling solution of 20 grms. of normal potassium tartrate in 180 grms. of water. The precipitate was collected on a porous cell and dried *in vacuo*. When moist the substance has the colour of yellow ochre, when dry it is a brownish-yellow, amorphous hygroscopic powder, slowly decomposed by light, and unstable at 100° C. It is soluble in water with difficulty (1 : 1640), soluble in a solution of an alkali tartrate, and insoluble in alcohol. Basic ferric citrate, $6FeC_6H_5O_7,7Fe(OH)_3,9H_2O$, is precipitated when a boiling solution of 78 grms. of ferric nitrate in 700 grms. of water is added to 550 grms. of a boiling 10 per cent. solution of sodium citrate. The liquid must be filtered hot, for the precipitate is soluble in the cold mother liquor. It is a bright yellow powder, stable towards light and when warmed to 100° C. It is less soluble in water than the tartrate, but dissolves in a solution of an alkali citrate. Basic ferric oxalate, $Fe_2 (COO)_6,7Fe_2O_3,9H_2O$, was prepared by adding 5 per cent. ferric nitrate solution to a boiling 1 per cent. solution of normal potassium oxalate. It is a yellowish-red amorphous powder, stable at 100° C., and slightly affected by light. It is insoluble in aqueous solutions of alkali oxalates. Basic ferric malate, $Fe_2(C_4H_4O_5)_3,2Fe (OH)_3,H_2O$, was prepared by treating a boiling 10 per cent. solution of normal sodium malate with a 5 per cent. solution of ferric nitrate. The precipitate must be filtered off and washed whilst hot. It is a yellow amorphous powder, stable at 100° C., and soluble in 975 parts of water. It is insoluble in alcohol, but soluble in a solution of an alkali malate. An attempt was made to produce ferrous malate by the action of malic acid solution upon metallic iron, but the product was not pure. A similar unsuccessful result was obtained in the attempt to form normal ferric malate by the action of malic acid on moist ferric hydroxide.—F. Shdn.

Phosphorus oxybromide. E. Berger. Compt. rend., 1908, **146**, 400—401.

Phosphorus oxybromide, $POBr_3$, can be made by heating a mixture of phosphorus pentabromide and phosphorus pentoxide, allowing to stand for several hours and then distilling. After washing with ether free from alcohol and draining, the crystals of phosphorus oxybromide are colourless, melt at 55°—56° C., and boil at 189° C. at 774 mm.—F. Shdn.

Picric acid; Determination of ——. M. Busch and G. Blume. *See* XXIII.

Chloroplatinic acid; Preparation of —— by electrolysis, from platinum black. H. C. P. Weber. *See* XIA.

Patents.

Reduction of organic substances. F. Bedford and C. E. Williams, Sleaford. Eng. Pat. 2520, Jan. 31, 1907.

In reducing organic compounds by hydrogen, in presence of nickel or other catalytic agent, it is proposed to bring the compound to be reduced, either in a liquid state or in solution, in the form of a spray or film, or in fine drops, into contact with the catalytic agent, a current of hydrogen being introduced either in the same or in the opposite direction to the spray: the result of this is that there is always an excess of catalytic substance and hydrogen, so that heating to high temperatures is not necessary, and the process can be carried on continuously. The process is applicable to the conversion of unsaturated fatty compounds into saturated compounds, to the reduction of nitro-compounds, ketones, etc. The nickel may be deposited on pumice-stone, etc., by reduction of its nitrate, and the material may be placed on grids or plates so that it offers a large surface and retards the passage of the substance to be reduced sufficiently long to enable reduction to be complete.—T. F. B.

Acetylene tetrachloride; Manufacture of ——. G. W. Johnson, London. From Chem. Fabr. Griesheim-Elektron, Frankfort on Maine, Germany. Eng. Pat. 13,411, June 10, 1907.

See Fr. Pat. 378,713 of 1907; this J., 1907, 1215.—T. F. B.

Isobornyl esters; Manufacture of ——. Chem. Fabr. von Heyden, Akt.-Ges., Radebeul, Saxony. Eng. Pat. 22,129, Oct. 7, 1907. Under Int. Conv., Oct. 26, 1906.

Isobornyl esters can be prepared by heating pinene hydrohalogenides with fatty acids and a halogen compound of zinc in the presence of cobaltous chloride or other suitable inorganic salt.—F. Shdn.

Formic esters of borneol and isoborneol, and subsequently borneol and camphor, by means of pinene hydrochloride, formates, and formic acid; Preparation of ——. O. L. A. Dubosc. First Addition, dated Dec. 17, 1906, to Fr. Pat. 370,293, Oct. 6, 1906 (this J., 1907, 278).

The formates of sodium, potassium, calcium, barium, magnesium, and aluminium can be used in the presence of a dehydrating agent, and an excess of formic acid for the preparation of the formic acid esters of borneol from pinene hydrochloride.—F. Shdn.

Dioxynaphthylmethane preparation soluble in water; Production of a ——. P. Bachmann, Cöln, Germany. Eng. Pat. 25,817, Nov. 21, 1907.

A preparation of dioxynaphthylmethane soluble in water is made by heating a solution of β-naphthol in a solution of formaldehyde with a liquid potassium soap. This liquid soap is made by the addition of methyl alcohol to soft soap.—F. Shdn.

Ethanolamines; Manufacture of aromatic ——. Farbwerke vorm. Meister, Lucius und Brüning, Hoechst a/Main, Germany. Eng. Pat. 27,117, Dec. 7, 1907. Under Int. Conv., Dec. 7, 1906.

The reduction of cyanhydrins of aromatic aldehydes to the corresponding ethanolamines can be accomplished if heat and the presence of excess of free acid or alkali be avoided. Thus, a solution of 10 parts of mandelic acid nitrile in 150 parts of "dilute" alcohol is slowly added to 400 parts of 4 per cent. sodium amalgam, the mixture being kept approximately neutral by simultaneous addition of acetic acid: when reduction is complete, the alcohol is distilled off, and the base is precipitated by addition of alkali and removed by extraction with ether. The products are identical with those obtained by reducing aminoacetyl derivatives of phenols (see this J., 1907, 1028).—T. F. B.

Dialkylbarbituric acids; Process of manufacturing ——. K. Stephan and P. Hunsalz, Assignors to Chem. Fabr. auf Actien, vorm. E. Schering, Berlin. U.S. Pat. 879,499, Feb. 18, 1908.

See Fr. Pat. 345,496 of 1904; this J., 1904, 1237.—T. F. B.

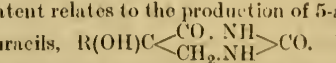
Dialkylbarbituric acid; Process of making ——. M. Engelmann, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pats. 879,156 and 879,835, Feb. 18, 1907.

See Fr. Pat. 367,872 of 1906; this J., 1906, 1232.—T. F. B.

Tartaric acid and its derivatives from cream of tartar, crude tartars, wine lees, etc.; Preparation of ——. J. M. Perigny and L. Mazet. Fr. Pat. 382,824, Dec. 18, 1906.

Tartaric acid can be prepared by the electrolysis of a solution of potassium bitartrate, or other materials containing tartar, in a vessel separated by a porous partition into two compartments. If a suitable metal is used for the anode, metallic tartrates can be produced instead of tartaric acid. The yield of acid can be increased by the addition of reducing substances, such as calcium sulphite, to the anode liquid.—F. Shdn.

Alkylhydroxyhydrouracils; Process for obtaining ——. Les Etabl. Poulenc Frères and E. Fourneau. Fr. Pat. 383,033, Dec. 24, 1906.

The patent relates to the production of 5-alkyl-5-hydroxyhydrouracils,  $R(OH)C{<}\genfrac{}{}{0pt}{}{CO\,.\,NH}{CH_2.NH}{>}CO$. For the preparation of the 5-methyl-compound, a solution of 810 grms. of potassium isocyanate in 1 litre of water is added, in small portions, with cooling, to a solution of 1835 grms. of the hydrochloride of the ethyl ester of 3-amino-2-methylpropane-2-ol acid (aminoacetonic acid). The mixture is allowed to stand for one day, and a large quantity of alcohol is then added. The precipitated potassium chloride is filtered off, the solution evaporated, and the residue boiled for two hours with 6—10 litres of 10—20 per cent. hydrochloric acid. On cooling, the larger portion of the methylhydroxyhydrouracil separates, and the remainder is obtained by concentrating the mother liquor. The crude product is recrystallised from boiling water. It forms small quadrangular tablets, slightly soluble in water and alcohol, but insoluble in most organic solvents. It is soluble in dilute alkalis and in hot strong ammonia, but is reprecipitated from these solutions by acids.—A. S.

XXI.—PHOTOGRAPHIC MATERIALS AND ESSENTIAL OILS, AND EXTRACTS.

Patent.

Photographic printing-out papers. W. F. Cooper, Watford. Eng. Pat. 2155, Jan. 28, 1907.

Ordinary low-grade papers, sized or unsized, are coated with a 1 or 2 per cent. solution of agar-agar, which may contain "baryta" or other pigment, and to which borax or alcohol, or both may be added. The paper is dried, calendered, and coated with the necessary emulsion. —T. F. B.

XXII.—EXPLOSIVES, MATCHES, &c.

Picric acid; Determination of ——. M. Busch and G. Blume. *See* XXIII.

Patents.

Explosives; Manufacture of ——. M. A. G. Himalaya, Washington, U.S.A. Eng. Pat. 4439, Feb. 22, 1907. Under Int. Conv., Feb. 24, 1906.

See Fr. Pat. 374,932 of 1907; this J., 1907, 840.—T. F. B.

Explosive; Safety ——. N. Ceipek, Vienna. Eng. Pat. 7837, April 3, 1907.

A safety explosive of enhanced disruptive effect is claimed consisting of a mixture of 90—94 parts by weight of an explosive composed of 85—88 per cent. of ammonium nitrate and 15—12 per cent. of aniline nitrate with 10·6 parts by weight of trinitrotoluene.—J. W. G.

Nitro-cellulose explosives; Treatment of gelatinized ——. G. H. Wadsworth, Lyndhurst, Hants. Eng. Pat. 16,492, July 18, 1907.

Nitrocellulose, gelatinised by means of a suitable solvent in which it is wholly or partly dissolved, is mixed with finely-ground barium nitrate in the proportion of not more than 1 to 2½. The mixture is dried, granulated, and the barium nitrate extracted with water. An explosive having a porous structure is thus obtained.—J. W. G.

Explosives; Manufacture of ——. M. A. G. Himalaya, Worcester Park, Surrey. Eng. Pat. 20,931, Sept 20, 1907.

The explosive consists of potassium chlorate, 70—78 parts; starch, 16 parts; and heavy mineral oil, 6—9 parts. Binoxide of manganese—4—10 parts—may also be added, in which case the amount of potassium chlorate is reduced to 68—74 parts. Protoxide of copper, or anhydrous chromium oxide may be used instead of manganese dioxide. The starch may be in the ordinary state or treated in accordance with Eng. Pat. 3179 of 1907 (See U.S. Pat. 853,085 of 1907; this J., 1907, 717). Hot or cold water may be added if necessary.—J. W. G.

Explosives; Manufacture of ——. P. Winand, Cologne, Germany. Eng. Pat. 26,261, Nov. 27, 1907. Under Int. Conv., Dec. 6, 1906.

An explosive of the "Sprengel" type is obtained by mixing, as a liquid oxygen vehicle, tetranitromethane with a combustible constituent.—J. W. G.

Powder; Smokeless ——. F. A. Halsey, Swanton, Vt. U.S. Pat. 878,726, Feb. 11, 1908.

A granular powder of the following approximate composition: Ammonium picrate, 43 per cent.; barium nitrate, 34; potassium picrate, 10; potassium ferrocyanide, 1; potassium permanganate, 4; and finely pulverised wood, 8.—J. W. G.

Chlorate explosives; Process for the preparation of granulated ——. F. H. von Schleinitz. Ger. Pat. 188,829, Aug. 14, 1902.

Granulated chlorate explosives resistant to moisture and shock are prepared by triturating an impalpable mixture of a chlorate and a nitro-compound (*o*-nitrophthalic acid, etc.) with an organic solvent which will not dissolve the oxygen-carrier, the quantity of the solvent being such that not the whole of the nitro-compound is dissolved, and the mixture does not become pasty.—A. S.

XXIII.—ANALYTICAL CHEMISTRY.

APPARATUS.

Patents.

Colorimeters. J. Szczepanik, Dresden, Germany. Eng. Pat. 22,995, Oct. 18, 1907.

The apparatus consists of four circular vessels fitting concentrically within one another and leaving a considerable space between their walls. Each vessel has a transparent bottom and screws into the cover of the next lower or larger one; the screw movement is measured by scales and verniers. The three lower vessels are partially filled with coloured solutions prepared by dissolving equal quantities of three substances each possessing a primary colour. The intensity of the coloration of the individual solutions is chosen so that on looking through them all three appear black. On screwing the vessels into each other, the depths of the solutions are diminished and any coloration may be obtained and can be expressed numerically by reading the scales provided. An optically coloured solution may thus be matched, or it may be observed through the apparatus and the depths of the solutions adjusted until a grey coloration is obtained. In this instance, the combination of the three solutions forms the complementary colour, the value of which is read on the scales. The readings obtained are subtracted from 1000 (the unit value taken) in each case, and on setting the vessels to the values thus obtained, the coloration of the solution under examination is ascertained.—W. P. S.

Colorimeter. J. Szczepanik. Fr. Pat. 383,141, Oct. 19, 1907.

See Eng. Pat. 22,995 of 1907; preceding.—T. F. B.

INORGANIC—QUALITATIVE.

Copper; Precipitation of —— *as metal by titanium sesquisulphate.* E. Knecht. *See* XXIV.

INORGANIC—QUANTITATIVE.

Carbon in pig-iron, etc.; Determination of ——. L. L. de Koninck and E. von Winiwarter. *See* X.

Manganese in pig-iron and steel; Determination of ——. E. Raymond. *See* X.

Nickel in nickel-steel; Determination of ——. O. Brunck. *See* X.

Silver chloride and iodide; Separation of ——. H. Baubigny. *See* VII.

Nickel and zinc ; Electrolytic separation of ——. F. Foerster and W. Treadwell, jun. Z. Elektrochem., 1908, **14**, 89.

The authors confirm a statement of Thiel and Windelschmidt (Z. angew. Chem., 13, 563), that nickel, deposited from solutions containing sulphites, always contains sulphur. While, therefore, the method of Hollard and Bertiaux, or the simplification of it described by Foerster and Blakenberg (this J., 1907, 1014), permits of an exact separation of nickel from zinc, it does not allow of the accurate determination of the nickel, which is always 1½ to 2½ per cent. too high. An allowance can be made for this, based on previous determinations under similar experimental conditions ; but for accurate work it is preferable to re-dissolve the deposit, and separate the nickel afresh from a solution containing no sulphite.
—J. T. D.

ORGANIC—QUALITATIVE.

Quinine sulphate ; Causes of error in the Kerner-Weller method for the detection of allied alkaloids in ——. P. Biginelli. *See* XX.

Quinine bisulphate ; Direct application of the Kerner and Liebig-Hesse tests to ——. P. Biginelli. *See* XX.

ORGANIC—QUANTITATIVE.

Vegetable substances ; Scheme for complete analysis of ——. J. M. Albahary. Compt. rend., 1908, **146**, 336—338.

The author sketches a complete scheme of progress for the successive examination of all the constituents of a vegetable substance. He first determines moisture (by drying at 110° C.), total ash, matter insoluble in alcohol and goes on to examine the alcoholic extract in which volatile acids and total soluble matter are estimated. Fats and colouring matter are estimated together by extraction with petroleum ether in a Soxhlet apparatus and after saponification, the colouring matters are extracted with chloroform. By continuing the extraction with ethyl ether, the free organic acids, cholesterol and lecithin are separated together. This ethereal extract is washed with water to remove the acids and after evaporation to dryness is hydrolysed with alcoholic potash to destroy the lecithins, and the soap extracted with chloroform to isolate the cholesterol. The amount of lecithin is calculated from the determination of phosphorus. Continuing, that portion insoluble in neutral alcohol is macerated for two days with 95 per cent. alcohol containing a little hydrochloric acid, the solution separated from the residue, which is washed with alcohol till free from acid, and evaporated to dryness. The residue is first extracted with ether to remove organic acids, then dissolved in water and made up to 1 litre, after the washings of the above residue insoluble in alcohol have been added. The following are determined in aliquot portions of this solution : (1), reducing sugars ; (2), mineral acids ; (3), total nitrogen ; (4), asparagine ; (5), total sulphur ; (6), soluble ash. In the residue insoluble in acid alcohol the total proteins and the albuminoids and nuclein nitrogen may be determined and lastly starch, inulin, glucosides and cellulose.—E. F. A.

Sulphur ; New method of determination of —— in organic substances. I. Bay. Compt. rend., 1908, **146**, 333—334.

The organic matter is burnt in a bayonet tube filled with a mixture of anhydrous sodium carbonate and calcined magnesium oxide in a stream of oxygen, whereby the sulphur is converted into soluble sulphates. A safety Liebig tube containing sodium bromate is attached to the end of the combustion tube to catch any sulphur products which may escape. At the end of the combustion the contents of the tube and of the Liebig tube are emptied into a beaker, dissolved in dilute hydrochloric acid, the bromine expelled by boiling and, after filtering, the sulphuric acid is precipitated and weighed as barium sulphate. The bayonet tube is filled as follows : first 3 c.c. of asbestos, then about 10 c.c. of a mixture of equal parts of sodium carbonate and magnesium oxide, then about 10 c.c. of the mixture of the substance to be analysed, if a solid, and the sodium carbonate-magnesia mixture, followed by a further 20 c.c. of the mixture of carbonate and magnesia and a final 20 c.c. of magnesium oxide and an asbestos plug. If a liquid, the substance is contained in a small glass bulb in the manner followed in elementary analysis.—E. F. A.

Picric acid ; Determination of ——. M. Busch and G. Blume. Z. angew. Chem., 1908, **21**, 354—355.

The method depends on the precipitation of the picric acid as nitron picrate (see this J., 1905, 291), which is practically insoluble in water. About 150 c.c. of a solution of the substance, containing not more than 1 grm. of picric acid per litre, are acidulated with 1—2 c.c. of dilute sulphuric acid, heated to incipient boiling, and treated with 10 c.c. of a 10 per cent. solution of nitron in 5 per cent. acetic acid, the precipitant being added slowly. After cooling to the ordinary temperature, the nitron picrate (lemon-yellow needles) is collected in a Neubauer crucible, washed with 50—100 c.c. of cold water and dried for 1 hour at 110° C. The weight multiplied by $\frac{229}{541}$ gives the quantity of picric acid present in the original substance. When necessary, the substance under examination can be dissolved in alcohol. Results are given showing the accuracy of the method, which, however, is not applicable in presence of hydrobromic, hydriodic, chloric, perchloric, nitrous, nitric, and chromic acids.—A. S.

Asphaltic substances ; Determination of —— in mineral oils. E. Lecocq. *See* III.

Brewery worts ; Use of the immersion refractometer for the analysis of ——. O. Mohr. *See* XVII.

Water contained in cellulose ; Determination of the ——. C. G. Schwalbe. *See* XIX.

Allyl mustard oil ; Volumetric determination of ——. M. Kuntze. *See* XX.

XXIV.—SCIENTIFIC & TECHNICAL NOTES.

(1). *Autoxidation ; A visible ——.* (2). *Copper ; Precipitation of —— as metal by titanium sesquisulphate.* E. Knecht. Ber., 1908, **41**, 498—499.

(1). A solution of permanganate acidified with sulphuric acid is divided into two portions, of which one is used for the purpose of comparison. To the other portion is added in small quantities, with shaking, a solution of titanium sesquisulphate. The colour of the permanganate changes gradually from bluish-red to scarlet, and then to the pure orange-yellow colour of titanium peroxide. Finally, with an excess of titanium sesquisulphate the solution is decolorised. Titanic sulphate gives no reaction with permanganate.

(2). About 1 c.c. of a 10 per cent. solution of copper sulphate is added to from 1 to 2 litres of distilled water, and then about 5 c.c. of a commercial titanium sesquisulphate solution are introduced, and the whole well stirred. After a few minutes, separation of metallic copper is observed. By reflected light the precipitate exhibits the characteristic colour of pure copper, but by transmitted light it appears blue. It is in such a fine state of division that only a small portion is retained by filter-paper. The reaction is capable of detecting 1 part of copper in 1,000,000 parts of solution.—A. S.

Fatty acids ; Esterification constants of the normal ——. J. J. Sudborough and J. M. Gittins. Chem. Soc. Trans., 1908, **93**, 210—217.

The authors determined the velocity of esterification of a number of normal fatty acids by methyl alcohol. The results show that the introduction of small radicals such as methyl and ethyl into the formic acid molecule has a considerable retarding effect on the rate of esterification. Butyric acid and the higher acids of the series up to stearic acid show practically the same rate of esterification. A saturated solution of stearic acid in methyl alcohol at 15° C. has the concentration 0·0111 N. In the titration of a mixture of methyl formate and formic acid by barium hydroxide solution in presence of phenolphthalein, the pink coloration persists only for a minute or two owing to the ready hydrolysis of the ester.—A. S.

Fruits of Cocos nucifera ; Investigation on the composition of the milk and on the diastases of the ——. E. de Kruyff. Bull. Départ. l'Agric. aux Indes néerland., 4: Chem. Zentr., 1908, 1. 746.

In the "milk" of cocoanuts the author found sucrose and also dissolved gases consisting of 98 per cent. of carbon dioxide, 0·2 per cent. of oxygen, and 0·3 per cent. of nitrogen. Evidence was obtained of the presence in the "milk" of ripe nuts, of a sucrase secreted by the albumin cells, an oxydase, and a catalase. In the "milk" of very young fruits, only the two latter are present. In the cells of the haustorium, there are present lipase, a proteolytic diastase, amylase, catalase, and peroxydase.—A. S.

Oxidising and fat-hydrolysing bacteria. E. de Kruyff. Bull. Départ. l'Agric. aux Indes néerland., 9. Chem. Zentr., 1908, 1, 752.

The author proposes the name "lipobacter" for the group of oxidising and fat-hydrolysing bacteria. The fat-hydrolysing action is best observed with a nutrient gelatin containing butyrin or triolein and 0·1 per cent. of nitrate ; it is indicated by a "zone of liquefaction." Some members of the "lipobacter" group are capable of reducing nitrates to nitrites. The fat-hydrolysing action is due to the presence of a lipase, the activity of which is governed by the presence of readily assimilable carbonaceous substances. Dextrose or glycerol, for example, diminish the secretion of the diastase, whilst peptone appears to have a favourable effect. The activity of the lipase is also diminished by the fatty acids produced by hydrolysis. Some lipobacteria oxidise fatty acids to carbon dioxide and water. *Bac. fluorescens liquefaciens* belongs to the "lipobacter" group.—A. S.

Trade Report.

Japanese import duties. Board of Trade J., March 12, 1908:—

The import duties on the following articles are to be increased as indicated, from Sept. 1st, 1908:—

Article.	Rate of Duty.			
	Present.		From 1st Sept., 1908.	
	Yen.		Yen.	
Grape sugar, malt sugar and the like	100 kins.	7·25	100 kins.	9·25
Saké	Litre	0·15	Liter	0·17
Chinese liquors, fermented	,,	0·15	,,	0·17
Beer, ale, porter and stout	,,	0·10	,,	0·12
All other alcoholic liquors (except wines)—				
In bottles	,,	0·90	,,	1·10
In other receptacles .	,,	0·50	,,	0·60
Alcohol	,,	0·65	,,	0·73
Alcohol, denatured	,,	0·65	,,	0·73
Alcoholic medicinal preparations (excluding tincture of opium)	,,	0·65	,,	0·73

[Note.—1 yen per 100 kin = 1s. 8d. per cwt.]

Patent List.

Where a complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

Applications.

4834. Wood. Drawing liquids through other liquids of varied densities. March 3.

4849. Imray (Meister, Lucius, und Brüning). Mixing machines. March 3.

4861. Bousfield. Pyknometer. March 3.

5011. Hodgkinson. Apparatus for evaporating liquid from brine or other solutions. March 5.

5069. McNeil and McNeil. Evaporating or concentrating apparatus. March 6.

5120. Dupré. Apparatus for stirring liquids. March 6.

5187. Schmatolla. Gas-fired kilns. March 7.

5224. Wärd and Wärd. Separating solid particles. March 7.

5334. Ogden. Apparatus for producing a vacuum. March 9.

5412. Edwards (Arbuckle and Osborn). Continuous filter presses. March 10.

5461. Danneberg. Drying apparatus.* March 11.

5774. Webb. Filters. March 14.

Complete Specifications Accepted.

5783 (1907). Wallis. *See under* VII.

12,087 (1907). Black and Lennox. Machines for drying coal, coke, slag, &c. March 18.

13,501 (1907). Coward. Concentrating or sorting apparatus. March 11.

13,804 (1907). Siemens. Regenerative gas furnaces. March 11.

16,150 (1907). Heim. Rendering barrels and like wooden receptacles impermeable. March 11.

22,732 (1907). Lamort. Recovery filters. March 11.

II.—FUEL, GAS, AND LIGHT.

Applications.

5040. Planchon. Metallic filaments for electric incandescent lamps. [Fr. Appl., Nov. 9, 1907.]* March 5.

5067. Fallot. Apparatus for generating and using acetylene and oxygen. [Fr. Appl., April 23, 1907.]* March 6.

5181. Bruce. Air-gas plants. [Addition to No. 3243 of 1907.] March 7.

5188. Schmatolla. Gas producers. March 7.

5307. Gargana. Manufacture of briquettes of carbon. March 9.

5405. Crombie. Producer gas apparatus. March 10.

5415. British Thomson-Houston Co. (General Electric Co.). Incandescing or heating bodies containing zirconium. March 10.

5416. British Thomson-Houston Co. (General Electric Co.). Filaments for incandescent electric lamps. March 10.

Complete Specifications Accepted.

6491 (1907). Lymn and Weil. Operating gas producers and producers therefor. March 11.

12,087 (1907). Black and Lennox. *See under* I.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

Application.

5437. Robertson and Graham. Motor spirit. March 11.

Complete Specifications Accepted.

7550 (1907). Lake (Friedlaender). Rendering hydroxyl derivatives of aromatic hydrocarbons soluble in water. March 11.

19,565 (1907). Schultz. Production of aromatic nitro-compounds from solvent naphtha. March 18.

IV.—COLOURING MATTERS AND DYESTUFFS.

Applications.

4848. Bloxam (Chem. Fabr. Griesheim-Elektron). Manufacture of brown sulphurised dyestuffs. March 3.

5299. Imray (Meister, Lucius, und Brüning) Manufacture of bromo substitution products of β-naphthyl-indigo. March 9.

5484. Newton (Bayer und Co.). Manufacture of trisazo dyestuffs. [Addition to No. 14,248 of 1907.] March 11.

5485. Newton (Bayer und Co.). Manufacture of sulphur dyestuffs. March 11.

5581. Newton (Bayer und Co.). Manufacture of acidylised *p*-diamines of the benzene and naphthalene series. March 12.

5582. Newton (Bayer und Co.). Manufacture of indigo compounds and leuco derivatives. [Addition to No. 4423 of 1908.] March 12.

5589. Meister, Lucius, und Brüning. Manufacture of red vat dyestuffs. [Ger. Appl., April 25, 1907.]* March 12.

Complete Specifications Accepted.

2769 (1907). Imray (Meister, Lucius, und Brüning). Manufacture of vat dyestuffs. March 11.

7148 (1907). Bloxam (Act.-Ges. f. Anilinfabr.). Sulphurised dyestuffs. March 11.

15,138 (1907). Durand, Huguenin et Cie. Manufacture of condensation products of gallocyanines with amines. March 11.

344 (1908). Basler Chem. Fabrik. Manufacture of a red vat dyestuff. March 18.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

Applications.

4687. Jennings. Recovery of liquids from yarns, cloths, or other fabrics. March 2.

4719. Day (Erste Triester Reisschäl-Fäbr.). Manufacture of a finish for cloth, &c.* March 2.

5278. Boult (Jaloux). Bleaching by oxygen.* March 9.

5595. Courtauld and Co., Ltd., and Wilson. Manufacture of threads, filaments, strips, or threads of cellulose [Addition to No. 21,405 of 1907.] March 12.

Complete Specifications Accepted.

4910 (1907). Dassonville. Electrolytic apparatus for bleaching and scouring fibres and fabrics. March 11.

9241 (1907). Denison and Preussner. Imparting a permanent finish to cloths. March 11

12,831 (1907). Ransford (Cassella und Co.). Method of dyeing wool. March 18.

17,870 (1907). Lorimer. Drying machines for textile material. March 18.

18,156 (1907). Schirp. Carbonising textiles. March 11.

VII.—ACIDS, ALKALIS, AND SALTS.

Applications.

4750. Schäcke. Manufacture of hydrate of potassium and hydrate of soda. March 2.

4761. Rademacher. Manufacture of a zinc salt of formaldehyde-sulphoxylic acid.* March 2.

4897. Dyes (Hempel). Manufacturing formates and oxalates. March 4

4974. Anderson and Hart. Manufacture of oxygen from air. March 4.

5011. Hodgkinson. *See under* I.

5067. Fallot. *See under* II.

5502. Goodwin and Burgess. Generation of ozone. March 11.

5623. Robertson. Manufacture of calcium carbide. March 13.

5657. Pallenberg. Saturator for use in the manufacture of ammonium sulphate.* March 13.

5685. Davey, Davey, and Davey. Treatment of brine, &c., to be concentrated, evaporated, or distilled and the manufacture of vegetable black. March 13.

Complete Specifications Accepted.

5783 (1907). Wallis. Hydrating, drying, and sifting lime, &c. March 18.

13,953 (1907). Raschen, Higgins, and United Alkali Co. Manufacture of formates. March 18.

20,647 (1907). Hartenstein. Manufacture of calcium carbide. March 11.

21,147 (1907). Cottrell. Manufacture of sulphuric acid. March 18.

VIII.—GLASS, POTTERY, AND ENAMELS.

Complete Specifications Accepted.

5123 (1907). Bloxam (Risler et Cie.). Manufacture of a ceramic mass and ware therefrom. March 11.

5879 (1907). Pilkington. Apparatus for making glass sheets or plates. March 18.

20,222 (1907). Marks (Colburn). Machines for drawing sheet glass. March 18.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Applications.

4732. Dondy. Manufacture of artificial marble or stone. March 2.

4929. Chateau and Merklen. Impregnating and preserving wood. March 4.

5051. Lorach. Preparing and preserving wood.* March 5.

Complete Specifications Accepted.

7037 (1907). Belloni. Coloration of marble. March 11.

8478 (1907). Auner. Producing a substitute for wood, rubber, &c. March 11.

X.—METALS AND METALLURGY.

Applications.

5038. Heinz. Recuperative spelter furnaces.* March 5.

5055. Nielsen. Soldering aluminium. [Appl. in Norway, March 9, 1907.]* March 5.

5177. Broadfoot, and Brand's Pure Spelter Co. Reducing emission of residual condensation gases in extracting or refining metals. March 7.

5244. Clinch-Jones. Annealing metals. March 9.

5261. Oebel. Extraction of zinc or spelter. March 9.

5398. Duke and Hawke. Extraction of gold from ores. March 10.

5451. Barraia. Silver-like alloy. [Ital. Appl., May 15, 1907.]* March 11.
5506. Debus and Debus. Smelting furnace.* March 11.
5512. Anderson. Treating refractory ores. March 11.
5515. Jones. Treatment of ores. [U.S. Appl., May 22, 1907.]* March 11.
5573. Goldschmidt. Manufacture of alloys of silicon. [Ger. Appl., May 18, 1907.]* March 12.
5680. British Thomson-Houston Co. (General Electric Co.). Reduction of metallic compounds. March 13.

Complete Specifications Accepted.

12 (1907). Holloway. Treatment of slags from tin-smelting furnaces. March 11.
86 (1907). Simpson. Uniting or welding metals. March 11.
5973 (1907). Lake (Soc. Anon. Le Carbone). Treatment of metals or alloys by agglomeration. March 18.
9924 (1907). Astruc. Welding metals. March 18.
18,707 (1907). Hadfield. Improving steel rails. March 11.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

Applications.

4895. Gibbs. Electrodeposition of metals. March 4.
4940. D'Várad and Meislinger-Meszlényi. Producing positive storage battery plates. March 4.
4947. Noodt. Producing insulating bodies. [Ger. Appl., April 16, 1907.]* March 4.
5214. Jungner. Depolarising galvanic batteries.* March 7.
5279. Ali-Cohen. Insulating materials.* March 9.

Complete Specifications Accepted.

9029 (1907). Borgnet. Electrolytic apparatus and galvanic batteries. March 11.
24,697 (1907). Viel. Electric furnace for fusing or refining. March 11.
28,542 (1907). Hiorth. Electric induction furnace. March 18.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

Application.

5423. Carmichael and Wild. Manufacture of soap. March 10.

Complete Specification Accepted.

15,213 (1907). McLay. Polishing soaps. March 18.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(*A.*)—Pigments, Paints.

Application.

5685. Davey, Davey, and Davey. *See under* VII.

Complete Specification Accepted.

6629 (1907). Strange and Pim. Manufacture of white lead. March 18.

(*B.*)—Resins, Varnishes.

Complete Specification Accepted.

25,216 (1907). Helm. Manufacture from aldehydes and phenols of substitutes for resins and gums. March 18.

(*C.*)—India-Rubber.

Application.

4714. Basler Chem. Fabr. Regeneration of caoutchouc. [Ger. Appl., March 4, 1907.]* March 2.

Complete Specification Accepted.

8478 (1907). Auner. *See under* IX.

XIV.—TANNING, LEATHER, GLUE, SIZE, &c.

Applications.

5087. Wetter (Knoll und Co.). Manufacture of casein derivatives or compounds.* March 6.
5377. Röhm. Preparation of hides in the manufacture of leather. [Ger. Appl., June 6, 1907.]* March 10.

XV.—MANURES, &c.

Application.

4753. Schäcke. Manufacture of manure from recent eruptive stones containing protoxide of potassium and compounds of lime. March 2.

XVI.—SUGAR, STARCH, GUM, &c.

Application.

5501. Eastick. Purification of sugar. March 11.

XVII.—BREWING, WINES, SPIRITS, &c.

Complete Specification Accepted.

5128 (1907). Lake (Pradel). Treatment of peat to produce alcoholic and other products. March 11.

XVIII.—FOODS; SANITATION, WATER PURIFICATION; AND DISINFECTANTS.

(*A.*)—Foods.

Applications.

5133. Frye. Producing a solid from milk.* March 6.
5155. Hogarth. Treating and conditioning cereals or their products. March 7.

Complete Specifications Accepted.

53 (1907). Hooker and Thew. Baking powder. March 11.
23,147 (1907). Meyer. Roasted food or medicated products containing sulphur. March 11.
28,024 (1907). Justice (Cooke). Obtaining butter fat. March 18.

(*B.*)—Sanitation; Water Purification.

Complete Specifications Accepted.

21,647 (1907). Pennink. Sand filters. March 18.
26,653 (1907). Nadein. Apparatus for separating liquid and solid matter in sewage. March 11.

(*C.*)—Disinfectants.

Application.

4855. Schneider. Producing formaldehyde vapours for disinfecting. [Ger. Appl., March 18, 1907.]* March 3.

XIX.—PAPER, PASTEBOARD, &c.

Application.

4804. Wallace. Manufacture of paper.* March 3.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

Applications.

4712. Busch. Manufacture of soluble compounds of hexamethylenetetramine and mercuric salts. March 2.

4936. Newton (Bayer und Co.). Manufacture of santalol ethers. March 4.

5316. Redfern (Basle Chem. Works). Manufacture of C.C-dialkyliminobarbituric acids.* March 9.

5404. Tompkins, and Clayton Aniline Co. Manufacture of dihalogen-acetyl chloride and bromide and derivatives. March 10.

5436. Robertson and Graham. Substitutes for camphor. March 11.

5513. Boult (Florizoone). Obtaining camphor from borneol or isoborneol.* March 11.

5604. Crawford. Preparation of ionone. March 12.

5632. Wellcome and Barger. Manufacture of derivatives of phenylchloracetic and phenylglycolic acids. March 13.

5674. Badische Anilin und Soda Fabrik. Manufacture of camphene. [Ger. Appl., April 3, 1907.]* March 13.

Complete Specifications Accepted.

13,599 (1907). Zimmermann (Chem. Fabr. auf Actien, vorm. E. Schering). Manufacture of 3.4-dioxyphenylglyoxime and 3.4-dioxyphenylalkylglyoximes. March 18.

15,987 (1907). Wellcome and Barger. Manufacture of compounds containing chlorine from methylene ethers of pyrogallol derivatives. March 11.

27,485 (1907). Meister, Lucius, und Brüning. Manufacture of 1-phenyl-2.3-dimethyl-4-dimethylamino-5-pyrazolone. March 18.

28,723 (1907). Nitritfabrik A.-G. Production of formins. March 11.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Application.

4745. Brasseur. Colour photography. [Ger. Appl., March 8, 1907.]* March 2.

XXII.—EXPLOSIVES, MATCHES, &c.

Complete Specifications Accepted.

19,565A (1907). Schultz. Manufacture of safety explosives from the nitro compounds of solvent naphtha. March 11.

23,112 (1907). Wadsworth. Apparatus for dividing gelatinous gunpowder into particles. March 11.

Journal of the Society of Chemical Industry.

No. 7, Vol. XXVII. APRIL 15, 1908. No. 7, Vol. XXVII.

Official Notice.

ANNUAL GENERAL MEETING.

The Annual General Meeting will be held in the Armstrong College, Newcastle-on-Tyne, on Wednesday, July 22nd, at 10 30 a.m. Full particulars will appear later.

Birmingham Section.

Meeting held at Birmingham University on Thursday, Jan. 23rd, 1908.

MR. HARRY SILVESTER IN THE CHAIR.

SOME NOVEL LABORATORY APPLIANCES AND FITTINGS.

BY J. E. STACEY JONES, B.SC.(LOND.).

The apparatus and fittings in a laboratory of a chemist are so important a part of his profession that I make no excuse for the following notes on such.

1. Fume Chambers.

These are usually considered a most important fixture by the metallurgical chemist, inasmuch as a very large proportion of the work in the analysis of metals, ores, etc. must be done in them if the atmosphere in which the chemist works is to be considered at all. Even with the most efficient of fume-chambers, however, it is very difficult to prevent much of the fumes from going into the laboratory. It is evident that the greater the efficiency of the fume-chamber the greater is the amount of time saved in cleaning, and the greater also is the comfort of the laboratory. In a metallurgical fume-chamber there are two things which I suppose are considered by nearly everyone who has occasion to have one put up:—1. The material of which it is to be made. 2. The method of arranging the flue pipe to get the best draught. To these I thought it necessary to add two more:—3. The more convenient arrangement of the hot-plate. 4. The escape of the burnt gases from the burners. Taking these headings seriatim, the following details seem to me to be worthy of notice.

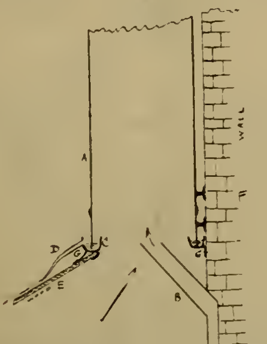


Fig. 1.

Section of flue pipe and seal, showing exhaust-gas outlet.

1. *Materials of construction.*—For the inside of the chamber the best materials are white glazed bricks or tiles for those against a wall, or all glass and wood for those in the centre of the room. When wood and glass are used for what may be called "island" fume-chambers, it is of course necessary to have all the wood well stained and varnished and kept periodically so. It is my experience that no white paints of any description may be used in the inside of these chambers. Lead paints are blackened in one day, and zinc paints do not last very long. Indeed paint of any description is very soon attacked by the fumes and rendered soppy: the wood or metal underneath is then attacked at once. I have found that a very good and cheap white back for a wall-chamber is ordinary window-glass painted white, and then put up with the white side to the wall. The glass is cut to size and fitted into picture-framing nailed to the back. It is fairly easy by means of putty to render the joint tight, and prevent fumes from getting to the back of the glass. If care be taken that this is so, the white glass seems a good and cheap substitute for tiles or bricks. The only disadvantage it has is its liability to fracture by the sudden accidental application of great heat, but if care be taken this is not a big risk. This glass is marked J in Diagram 2. The doors of a fume-chamber are usually made of wood and glass; the virtues of the sliding and front-opening variety must be left to individual taste. I personally prefer the former for all purposes.

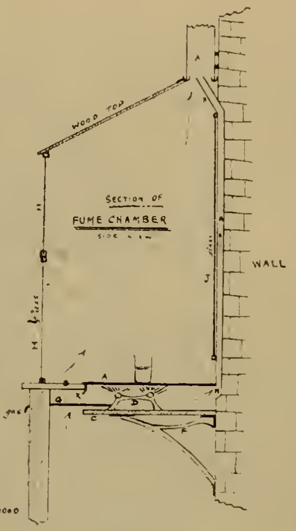


Fig. 2.

2. *Flue pipe.*—I think that the best flue pipe is conceded to be one of brick, opening horizontally into the top of the cupboard, and then being quite vertical. But this, as a rule, is only possible to be had when the fume-chamber is made specially and not adapted from an ordinary room. The next best thing is perhaps a vertical earthenware pipe, but these have the disadvantage that they are somewhat awkward to fix, and are very heavy, so that they cannot safely be allowed to rest on a wood top. I have tried ordinary sheet iron flue pipes—galvanised, lead-coated, and stove-enamelled. It is possible perhaps to prevent the outside of these rusting, but it is certainly impossible to do anything to the inside. In a short time I have always found the inside to be a mass of rust, either dry or wet, and it does not take long to eat quite through the metal. After a good deal of tribulation with such pipes, which have the virtue of cheapness alone, I fixed up an ordinary cast-iron soil pipe, six feet long, vertically from the top of the fume-chamber, through the roof. The fixture was made to the wall to take the weight. The pipe I use is coated inside with some tarry preparation, but it is possible to obtain them by ordering some time in advance with a coating of "glass-enamel." I should imagine that these would be better still, from the look of them.

To catch the slow dripping of acid, which always takes place, seemingly, even with the best regulated flue-pipes, I found it advisable, or even necessary, to run an annular gutter of lead under the bottom. This is shown in Diagram 1. A is the iron pipe, supported against the wall as shown. B is the pipe from which the exhaust gases from the burners flow, to help the draught, as noted later: C is the annular lead ring. This was made by hand by beating out lead sheet: it was soldered at the bottom on to another piece of sheet, G, which was secured to the wooden top, E, of the fume-chamber. A pipe, D, was also soldered on at a suitable height, to take off the drippings. I keep this gutter full of water when any work is going on: the acid drippings that come down mix with the water and the overflow is taken off by the pipe, D, to the sink direct. The sheet, G, is also continued on the under side of the gutter to form a tight joint all round the wood, and on the wall side this sheet lead is fixed to the wall. The whole arrangement is thus very nearly fume-tight, but even if there is no water in the gutter, there is no danger of fumes coming into the laboratory. The drippings from my pipe apparently proceed from the hygroscopic action of the air on iron salts formed by the acids on the pipe. At all events, I get drippings even in the ordinary dry weather. The gutter also stops rain coming in when the cowl on the top fails to prevent it, and the arrangement generally prevents any solid or liquid from interfering with chemical work in the fume-chamber.

3. *Hot plate.*—This is absolutely necessary in a metallurgical laboratory, and the best way of arranging it that I have found is flush with the front slab.

4. *The escape of the burnt gases* is allied with this, and the arrangements for both are seen in Diagrams 2 and 3. (lettering the same.) A is the hot plate, resting on nails driven into the wall on the one side, and on the front slab. In my own case this is made to extend over the whole of the bottom of the fume-chamber, up to about 4 inches from the inside of the glass doors, forming the bottom proper. It rests on the concrete slab, B, which is an ordinary artificial stone mantle-shelf. This can be made of any size, and the material is excellent for standing acids. I have indeed found it, if blackleaded, equally as good as slate, and a lot cheaper. It also stands a good heat without cracking. C is a wooden shelf, covered with sheet iron and asbestos-board, fixed under the hot plate, as shewn, to place the gas-burners on. It is supported to the wall in the centre by the bracket, F, and at the ends by the ledges of wood, E. D, D, are the burners, with independent gas supplies (of metal tubing) to taps on the wood support, G. H are the flue pipes from the burners, and these are made, as shewn, in three parts, uniting at the top to go into the flue pipe proper. They end just below the hot plate, and the centre one is made a little larger than the end ones to take the products of combustion from two burners. The flues in my case were made by cutting away the plaster from the wall as far as the brick, and to a suitable width, and covering with sheet iron first and asbestos board after. These were nailed to the wall. I are the front-opening, wood and glass doors, and J the white-painted glass against the back of the chamber as described. This glass must not touch the flue pipes. K is a small strip of asbestos board running all along the slab of concrete, to prevent as much heat as possible getting to it. The hydrogen sulphide apparatus is fixed underneath the fume-chamber, with an outlet as shewn.

General notes.—No gas fittings or metal work at all must be inside the fume-chamber; all taps to be outside. For an ordinary bunsen burner, those made of porcelain are the best for use in it.

The hot plate is best kept clean by a weekly application of a mixture of plumbago and oil.

The advantages of the fume-chamber as described are:—The more gas burners there are alight, which usually corresponds with the maximum amount of fumes, the better the draught. There is no water-vapour ever condensed on the glass doors: these are always dry and clean and do not get coated with ammonium salts, etc., so much as when the products of combustion from the burners go into the fume-chamber. It is very light and requires very little attention for cleaning. The flush hot-plate diminishes the breakages of beakers and other glass apparatus, as very hot things can be slid from the smooth plate on to beaker mats, and thus away. No fumes ever drip into the chamber at all when the gutter is in position.

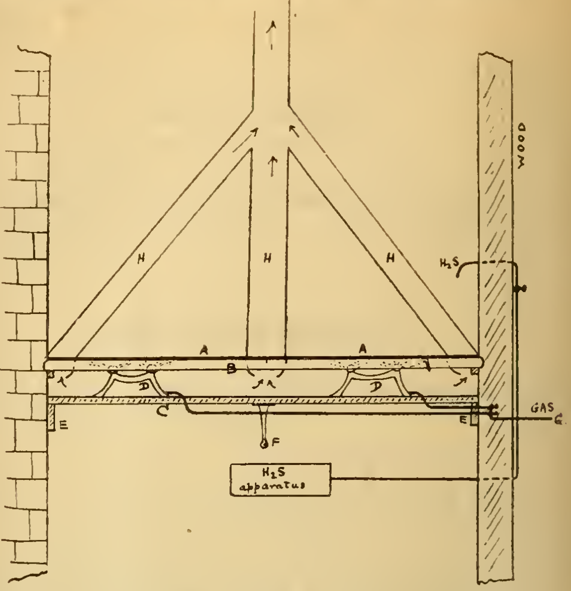


Fig. 3.

Section of fume chamber (front view), hot plate, flues, and burner.

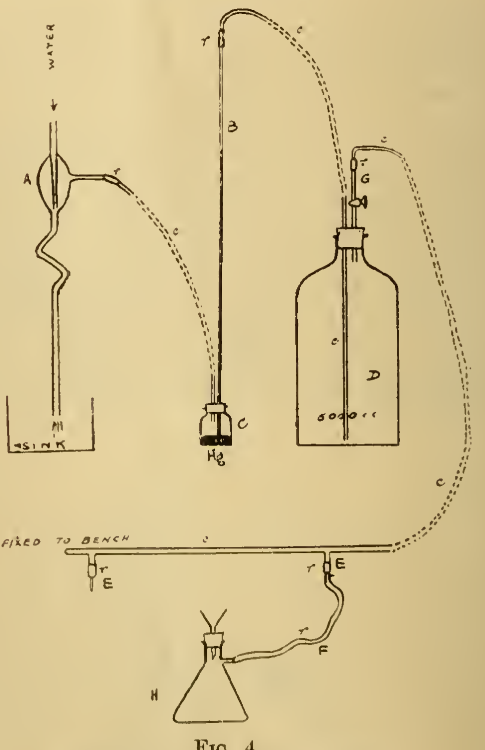


Fig. 4.

Diagram of vacuum filtration apparatus.

2. Vacuum Filtration.

Vacuum filtration is, of course, a common process in a metallurgical laboratory where speed is any consideration, and the reason I have for giving the diagrams 4 and 5, which illustrate the system I have myself fitted up, is that I have never seen any description of such a system.

Shortly, I exhaust a 5 litre bottle and conduct the vacuum to the laboratory bench by composition lead tubes. The two details in the apparatus that may be of some service to others are :—(1.) Arrangement of an automatic mercury valve and gauge in one. (2.) The valve used on the bench for connection to the flask. In Diagram 4, A is a water pump, in my case of Geissler pattern. This is connected by a small rubber joint with a long piece of compo. tubing of 3 mm. bore, leading to the top of a small 60 c.c. bottle in some convenient place. (All rubber tubes are marked "r" and all composition lead ones "c.") B is a long glass tube of small bore, dipping directly into mercury in the bottom of the bottle, C. This tube is likewise connected at the top by rubber with another compo. tube, which goes to the bottom of a 5 litre bottle through a rubber bung. Through the other hole in the bung passes a glass tube with a glass stop-cock in the centre, G, which is again connected by rubber with the end of a compo. tube extending to the working bench. At the bench are fixed the valves, E, described in Diagram 5, by which the vacuum is led by pressure tubing to the filter-flask, H. The mercury valve, as will be seen, stops all back suction when the water-tap is shut off, either accidentally or not. It also serves as an efficient tap to keep up the vacuum, as the mercury immediately rushes up the tube The height to which the mercury rises also gives at a glance the vacuum made. The Geissler pump gives a vacuum of 70 to 74 cm. of mercury after about an hour, with ordinary Coventry water-pressure, which is not great. The pump will keep two filtrations going at once with the vacuum very nearly at the maximum, or three with a continual drop. The vacuum will remain unimpaired for weeks if not used. The rubber joint at the top of the mercury tube has stood good for two years, without having to be touched. The great advantage of using such a reservoir is that one is independent of the water supply : and in my own case it was particularly useful in the summer of 1906, when the water supply in Coventry was shut off from my laboratory for whole days at a time. It is also an advantage to be able to put a good vacuum on a filter at once, without having to wait for the pump to suck out the air from a flask.

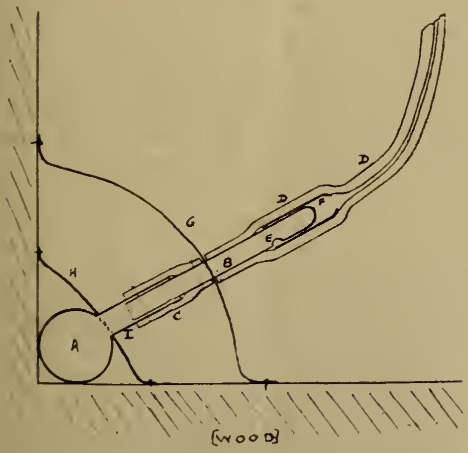


FIG. 5.

Section of glass-rubber valve for vacuum filtration, etc.

The valve I use for the bench connection is as shewn in Diagram 5, and its working is readily seen. A is the cross-section through the compo. tube running along the corner of the bench, with a T-piece, I, attached. A piece of glass tubing fits into this (B), and the joint is made good by rubber-pressure tubing, C. This glass is sealed at the end, and has an opening at the side nearly at the end. D is the piece of pressure tubing used to take the vacuum from the bench pipe, A, to the filter-flask, and into this is put at near its end a small piece of glass tubing, F. This is of such a size as to slip easily over the other thinner glass tube, and at its end (away from the compo.) it is slightly constricted, so as to go easily into the rubber. G is a piece of brass or other metal, with a hole for B to pass through, nailed to the bench above and below the valve, to keep it rigid and in position. H is a holdfast to do the same for the tube, A. The action of the valve, therefore as follows. When the rubber tube, D, is in the position shewn in the diagram, there is complete communication between A and the flask : but if the rubber is only pulled up a very little way, the hole, E, is closed and forms an efficient tap. I do not keep the rubber tube, D, on the glass when not in use, but when it is put on find it best to well wet it. The valve works then very easily, and lasts a long time without renewal. Only the best pressure tubing can be used, and I make the tube, F, at such a distance that to open the valve the rubber tube, D, requires to be pushed down just till it meets the metal arc, G, so that the very smallest movement upwards shuts the valve.

3. CONSTANT PRESSURE GAS-GOVERNOR.

This little apparatus, which can be made of the ordinary laboratory utensils, is very useful for use with air ovens when the gas pressure varies, and the temperature is required to be kept constant. At Coventry the pressure on my burners increases from about 50 to about 80 or 85 mm. of water at from 5.30 to 6 p.m., when most of the large works shut. In the night also the pressure drops very much, which is, I suppose, the case everywhere.

In Diagram 6, A is a 200 c.c. beaker, inverted inside a bell-jar, B, fitted with a two-hole bung. E is a little piece of a thin test-tube cemented on the top of the beaker with a gutta cement. The tube connections are made as shewn, H, I, and G being glass, and F, rubber. The whole of the arrangement, C, is shewn on a larger scale at the right of the diagram : this is fixed independently of the bell-jar by a clamp, D. C consists of two concentric glass tubes, the outside one with a side piece. They are connected by a piece of rubber, P, which enables the inner one bearing the gas to be adjusted to any height. The bottom of the cup, T (or E), is filled with a small amount of mercury. The action of the apparatus is as follows :—The outside tube, R, forms a gas-tight seal into the mercury, which is not altered. The inner tube only just touches the mercury, and allows the gas out at T. If we suppose the whole empty of gas, the water levels in A and B will be the same. As soon as the gas is turned on, with a greater pressure than required, the cup, E, will be at its lowest point and allow the gas to push up A with its full pressure. When this happens, the mercury immediately closes the gas supply and the beaker, A, falls again until more gas is let in. This action goes on successively, and it is of course evident that any pressure (less than that of the original pressure of the gas) can be got by using more or less mercury in the cup, to weight the beaker to the necessary extent. Care has to be taken that the distance of the bottom of the beaker from the bell-jar is very small : if this is so, no guides for the rise or full of the beaker are required, and the mercury in the cup always seals the gas off from escaping even when at its lowest point. This is got by adjusting the clamp, D. The actual pressure of the gas at its outlet, I, is given by the difference in level between the water in A and B. In actual working, one gets not a succession of jerks, but a continual vibratory motion of small amplitude at the surface of the mercury in the cup. This is not sufficient to make any appreciable difference to the gas flame.

4. CONSTANT FLOW COMBUSTION APPARATUS.

The combustion apparatus is a most important piece of furniture in a metallurgical analyst's laboratory, and consequently the more it can be rendered automatic, the greater the ease of working of a somewhat troublesome process. The present sketch of my apparatus shews an attempt to dispense with regulating cocks in the hydrostatic part of the apparatus, *i.e.*, the parts used to pull and push the air or oxygen through. In Diagram 7, A is a large aspirator fitted as shewn with a fall tube, B, and a test-tube, D. (This latter is merely used to catch the water that runs over the top tubes when the bottle, A, is very full and the bung is put in.) C is a continuation tube with a rubber attachment used as described later. This part of the apparatus is that for producing the vacuum. E is a large bottle inverted on a bracket with a hole in the

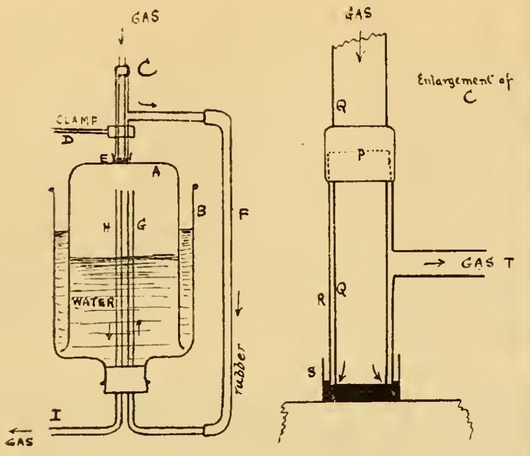


FIG. 6.

Diagram of automatic gas-governor for laboratory ovens, etc.

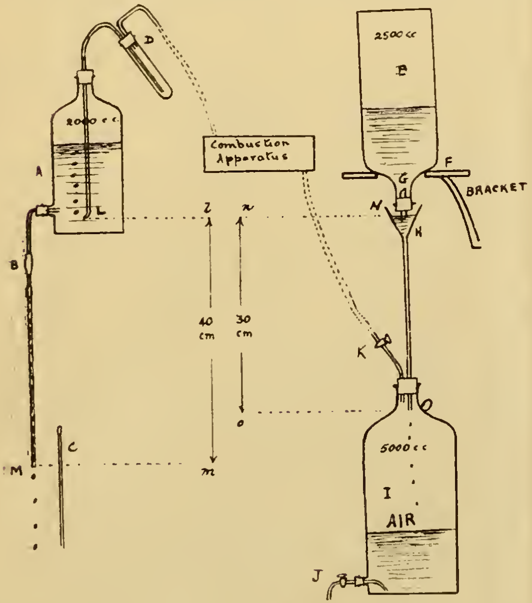


FIG. 7.

Diagram of combustion apparatus hydrostatic arrangements.

centre. It has fitted into it a bung with a short piece of large bore glass tube in it. The end of this tube goes into the centre of a funnel which has been fused on to a longer piece of tubing, passing into the bung of the aspirator, I. This aspirator, I, is also fitted with stopcocks, J and K, at bottom and top. K and D are connected to the combustion apparatus proper. B is a valve similar to that described already for the vacuum filtration apparatus. The vacuum produced in A by the fall of water is that due to the height from L to M. In the other side of the diagram, which is that of the pressure bottle, the pressure produced is that due to the fall from the level of water at N to the bottom of the tube at O. Using air, as I do, for the combustion, the action of the pressure bottle is as follows. The bottle, E, is filled with water and inverted over the funnel, the bottle, I, being emptied of water from previous combustions by the tap at J. The water runs down the funnel, and soon produces a constant pressure in I. This pressure never gets less as the water levels rise, because that at N is kept within a centimetre or two of constancy by the inverted bottle, E. There will be thus the pressure NO on the one side, and the vacuum LM on the other, these being in my apparatus about 30 and 40 cm. respectively. The difference is due to internal pressure in the combustion tube itself, and also to that of the purifying and absorption tubes. It is fairly easy to so adjust the length of the tube, B, that the water current and therefore also the air current, flows through the apparatus at a constant rate. The flow is constant when once started, and there is no annoying adjustment of taps every 5 minutes or so. In my own case, using air only, combustions are done in 45 min. at 40 c.c. per minute, = 1·8 litres for steels. And at the same rate for cast irons for one hour, = 2·4 litres. In the latter case I use the blast on the furnace. I use the gas on for only half the times above, the other half cold to draw off the carbon dioxide. Silica combustion tubes are very convenient for combustions, but it is not safe to allow the copper oxide to touch the glass. I use a thin lining of asbestos between.

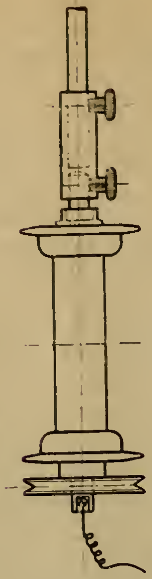
The tube, C, is put on B when a more rapid flow is required to clean the furnace tube from carbon dioxide before a combustion is put on.

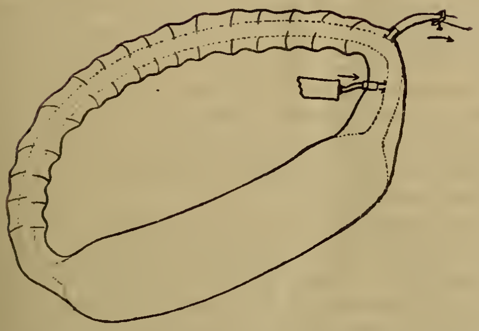
[The author of the paper also showed several forms of new apparatus, including the following:—1. Burette clips for attaching to the top of a burette for hanging from a rod. 2. Porcelain bunsen. 3. Porcelain filter triangle. 4. Porcelain ash tray for putting over the tube of a bunsen when dirty operations are in hand. 5. An elongator for putting on a bunsen to save propping up with wood blocks. 6. Pencil holder for a glass grease-pencil, for writing on beakers, etc. 7. Celluloid false pans for the balance. 8. Various forms of silica ware.]

DISCUSSION.

The CHAIRMAN said the paper was especially interesting to those who had to carry on their profession in offices which were difficult to adapt to chemical work in such a way as not to be a nuisance to the analyst's neighbours. In a metallurgical practice particularly an efficient fume chamber was most vital for the comfort of the worker, and from the illustrations they had seen to-night, and the accounts the author had given of the capabilities of his draught cupboard, he thought he was to be congratulated on the way in which he had solved this problem. The idea of having the burners outside and not permitting the products of combustion to pass over the plate was, he thought, a good one, as when estimating minute amounts of sulphur in steel or iron, and burning a sulphurous gas, it was quite possible to get results in excess of the truth, owing to absorption of sulphur from the burnt gas. The hot plate was a most valuable piece of plant in a laboratory. The best he had seen was designed by Messrs. Fletcher, Russell, & Co. It was rather an elaborate plate, and somewhat expensive. He had seen it used in some large metallurgical laboratories, where it rendered excellent service. The question of filtration was a vexed one. So many analysts, so many opinions on the matter. Generally speaking, he did not care for the filter pump, and thought it was quite possible to get through as much work without it as with it. More filtrations could be attended to at the same time without the pump than with the pump, and this balanced the extra speed when using suction. Had the author tried the direct method for the estimation of carbon in steel by combustion, and what was his experience? Personally he preferred oxygen to air, because one could be more certain of complete combustion. The speaker had also used porcelain combustion tubes for that work, and with tubes glazed inside and out had not experienced the trouble through cracking mentioned by the author. At the present time he was employing a porcelain tube which had regularly been used for several years for making combustions. He had also tried silica tubes, but with no particular advantage, as owing to the thicker walls they were not so readily got to a red heat.

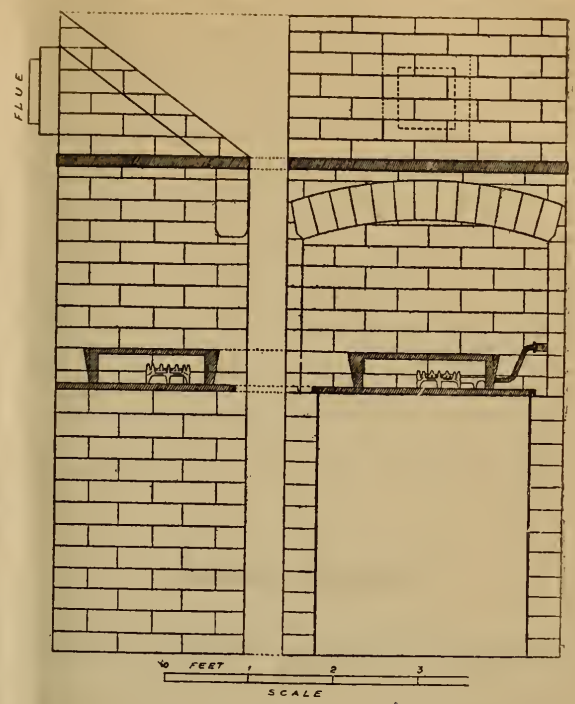
Mr. H. L. HEATHCOTE exhibited a hub for cycling, which, he said, could be used in all cases where rotation was required, as for instance in the stirring of liquids, or for suspending a revolving cathode for electro-deposition, which has become such an important method in laboratory practice. A second exhibit had reference to the use of an inner tube of a bicycle as an air reservoir. A second





valve should be inserted in the thick joint of the tube, and used as the air exit. The tube was enclosed in a long stocking of about 5 inches diameter to prevent it bursting, and it was capable of being dilated until the air content would measure about 10—20 litres at ordinary pressure. The third exhibit consisted of an interesting device for measuring the resistance to punctures of tyres (see photograph).

Professor Thomas Turner pointed out that fume cupboards were required for different purposes, and one type was not applicable for all uses. The ordinary chemical fume cupboards as provided at Mason College worked exceedingly well, and had worked so for a great number of years. They were lined with white tiles at the back, and had slate slabs at the bottom. In the metallurgical fume cupboard a hot plate was invariably required. Many difficulties arose on account of the heat and acid fumes. The cords, which supported the sliding doors, were affected, and consequently broke; the brass work was attacked, and the slate slab cracked easily from the heat. He thought the best type of fume cupboard was one in the laboratories of Mr. Stead, of Middlesbrough. With modifications, he (Prof. Turner) had adopted that cupboard in one of the laboratories of the University. It was built entirely of white glazed bricks, and entirely did away with doors and with glass. At the bottom of the fume cupboard, where there was a burner, he preferred a slab of cast iron, $\frac{3}{4}$ inch thick, placed in position, but not secured, so that it might be readily removed. It was not unduly attacked by acids and did not rust in ordinary use. The cupboard was faced with tiles, but there was no brass, glass, or sliding window (see figure).



Mr. E. A. Lewis stated that instead of painting and varnishing the woodwork of ordinary fume cupboards application of a solution of beeswax in turpentine would withstand the acid fumes very well. The lining of the sides, about one-third of the way up, with asbestos, would protect the wood from the heat.

Mr. Stacey Jones said he found pump filtration exceedingly handy when engaged in filtering soda solutions, zinc sulphides, &c. It was only by the use of a pump that certain things could be filtered at all easily or quickly. He had not had much experience of the direct combustion of carbon in steels, except purely experimentally, during the past five years. He had tried a number of wet combustions, and the results he got showed the wet combustions to give about the same degree of accuracy as the carbon by colour determination.

The Chairman: I meant by burning it with red lead.

Mr. Stacey Jones said he had in the past carried out many combustions with red lead, but the difficulty seemed to be that if one were not careful the liquid lead oxide ran over the sides of the boat and cracked the combustion tube. It was necessary to use boats of fairly large size so as to allow of a layer of asbestos. Good results were then obtained, provided one got a proper degree of fineness in the drillings. He found that unless porcelain tubes were cased with asbestos, there was the risk of cracking when heating and cooling. If by coating a tube with asbestos one was enabled to start a flame at once, and to cool quickly, a distinct advantage was gained. Contrary to the experience of the Chairman, he got a higher temperature with silica tube than a cased porcelain one. As to whether silica tube would be better than a bare porcelain one, he could not say. But with an ordinary Fletcher's combustion furnace it was sufficiently hot to burn off graphite in cast iron, using air. He was not a devotee of oxygen in combustions. In his opinion it was wholly unnecessary, and was inconvenient. He had not found any difference in the results when either oxygen or air were used. If he could do a combustion of the carbon in steel with 45 minutes', and of cast iron with one hour's. burning he was perfectly satisfied. Professor Turner's modification of Stead's fume cupboard seemed very good, though personally he did not like the raised hot plate on the top of the slab. He preferred the hot plate being at the lowest level at which one had to work.' He was in the position of having to convert into a laboratory ordinary offices, as economically as possible, and under those circumstances he had tried to get efficiency without causing much constructional work; but in a building which was designed as a laboratory, it was of course possible to improve on the fume chamber shown. With Professor Turner, he disliked sliding doors. Those on his cupboard were front-opening; that obviated any corrosion. White tiles could not be improved upon, though painted glass, which was much cheaper, served his purpose well.

Liverpool Section.

Meeting held at University on Wednesday, February 12, 1908.

DR. JAMES T. CONROY IN THE CHAIR.

THE EFFECT OF SUPERHEATED STEAM ON HYDROCARBON CYLINDER OILS.

BY G. W. WORRALL, M.SC., M.ENG., AND J. E. SOUTHCOMBE, M.SC.

The experiments described in the present paper were undertaken with a view to throwing some light on the problem of cylinder lubrication. It was deemed advisable to confine the investigation to the actual phenomena occurring within the cylinder and steam-pipe connected with it, during the passage of the oil. The paper deals with these phenomena, and records the results of a series of experiments undertaken for the purpose of ascertaining the effects of superheated steam upon hydrocarbon cylinder oils.

The twelve oils experimented on were typical samples of those in general use for cylinder lubrication; they were all of mineral origin, six of them were light in colour and six dark. In order that each oil might be subjected to similar conditions, and that those conditions might approximate those of practice with better facilities for examination, a special apparatus was designed (see Fig. 1). It consists of three chambers, A, B, and C, which are flanged and bolted together so that they may be readily taken apart for purposes of examination. Each chamber is furnished with a draw-off cock and a thermometer pocket, and between the chambers baffle plates are introduced. Each of these baffle plates has ten holes ¼ inch in diameter lying on the circumference of a circle 2½ inches in diameter, as shown at Fig. 1B. The steam enters at one end, and after passing through the three chambers and the baffle plates, passes out at the opposite end through a condenser, which latter consists of a straight brass tube about 12 feet long and 1 inch in diameter, surrounded by a cold water jacket and controlled by a stop valve near to the last chamber of the apparatus. The steam used for the experiments was generated and superheated by a flash boiler fired by gas. The oil was injected into the steam pipe through a small tube at right angles to the axis of the latter and protruding to its centre. The injector was a Manzel oil pump mechanically driven, and between it and the boiler a thermometer pocket and stop valve were placed. The entire apparatus, including the steam pipe, was heavily lagged. The temperature of the steam was measured by a mercury thermometer inserted in one or other of the pockets previously described. On the insertion of the thermometer in the pockets provided in the chambers of the apparatus, no drop of temperature was observed between the oil injector and the condenser. At the outset of each experiment the apparatus and connections were raised to the desired temperature by passing superheated steam through. With this temperature and a given pressure of steam, both constant, the oil pump was started and kept running for a given time. The flow of steam was adjusted by means of the stop cocks. The steam and oil which passed through the apparatus and issued from it in a condensed form were collected in a large shallow tray. Each of the oils experimented with was passed through with the steam at four different temperatures, *i.e.*, 400° F., 500° F., 600° F., and 700° F. (205° C., 260° C., 316° C., and 371° C.). Throughout the experiments the pressure of steam was maintained at 50 lb. per sq. in. above the atmosphere. Each experiment was repeated four times, the current of steam being passed for half an hour, and at the end of each the gas fire was extinguished, and the draw-off cocks opened, when any liquid oil in the chambers was forced out by the pressure of steam within. Again, since the chambers of the apparatus are separated by baffle plates, the oil given off by any draw cock was in a distinct stage of its progress through, so also was the oil that issued from the condenser, as well as any deposit found within any of the chambers separated from each other at the joints described. By this means were obtained samples of deposits such as are found in practice in the ports and passages leading to the cylinder of the steam engine, and samples of oil such as is found in practice to have passed these obstructions and to have made its way into the cylinder, or through the cylinder into the hotwell.

The oils drained from any of the chambers were somewhat darker and thicker than the original oil. All the deposits found in the chambers were similar in appearance, and consisted of a hard grit intimately mixed with a thick dark pitchy substance. The quantity of these deposits was always greatest when the temperature was highest, and, in the case of several of the oils experimented with, deposits were entirely absent when the temperature was lowest. The quantity was always greatest in Chamber A, less in Chamber B, and there was seldom any to be found in Chamber C. The samples obtained from the condenser consisted of an emulsion of water and oil, dark brown in colour, but the oil when separated from the water resembled the original oil, except that it was somewhat less viscous. From the appearance of the resultant samples generally, it was quite evident that the original oil had undergone a considerable change, and that the part that had passed through the baffle plates and had entered the condenser differed from the part which remained behind. It was also evident that the changes which took place in the various oils as they passed through the apparatus did not differ so much in character as in degree. The most notable effect, as it then appeared, was that a portion of each of the oils was changed into the gritty deposit, and this deposit served to indicate the behaviour of any given oil under superheated steam. Two of the six dark oils examined gave deposits only at 700° F. (371° C.), one of them at 600° F. (316° C.) and upwards, and the remainder at 400° F. (205° C.) and upwards. All the six pale oils gave deposits at 400° F. (205° C.) and upwards.

Before proceeding to examine the above-mentioned deposits, the original oils were investigated with a view to ascertaining whether any relationship existed between the composition and properties of the oil and the temperature at which it had deposited the gritty substance. To this end the original samples were examined for saponifiable matter, free acids, and unsaturated hydrocarbons. Nine of the oils, including those which had deposited grit at low temperatures, were quite free from saponifiable matter and free acids. The iodine absorption, determined by Hübl's method, gave figures varying from 11·2 to 14·9 grms., but, as the following table shows, there was no relationship between the iodine and the "depositing value" of the oil.

Lowest temperature at which deposit took place.	Grms. of iodine absorbed per 100 grms. of oil.
400° F. (205° C.)	11·2 to 13·94
600° F. (316° C.)	13·9
700° F. (371° C.)	12·21 to 14·9

The samples were free from sulphur and nitrogen, and combustions of two different oils showed them to be practically pure hydrocarbon oils :—

	I.	II.
Carbon, per cent.	86·06	86·58
Hydrogen, per cent.	13·90	13·44

The temperature of decomposition was then determined by dry distillation, and also in steam. When heated in a distilling flask at ordinary atmospheric pressure, it was found in general that no distillation or decomposition occurred befow 400° C. (752° F.), but above this temperature considerable "cracking" took place. Several samples were then submitted to distillation in a current of superheated steam, when it was found that the bulk of the oil distilled over undecomposed, even with steam heated to 350° C. (662° F.). From these results it was clear that no chemical reaction or decomposition of the oil took place in the apparatus shown in Fig. 1, since in no case was the temperature high enough to bring about such decomposition of the oil. Further, in the cylinder of the engine no decomposition of the oil can occur with steam below 400° C. (750° F.) in temperature.

At this stage it appeared desirable to approximately ascertain the molecular weights of the hydrocarbons contained in the oil. Accordingly 26·2 grms. were distilled in a vacuum of 18 mm. (0·7 in.) of mercury pressure. Distillation began at 250° C. (482° F.) and was continued up to 405° C. (761° F.), above which temperature decomposition occurred. By referring to a table of known boiling points, it was found that there were present in the sample hydrocarbons containing from 25 to 53 carbon atoms in the molecule. There remained 2·7 grms., *i.e.*, 10·3 per cent. of solid pitchy matter as a residue in the flask.

The gritty deposits were then examined. These were treated consecutively with chloroform, ether, and carbon bisulphide, filtering between the treatments The residue which remained insoluble was a black scaly powder of iron peroxide, Fe_3O_4.

	Calc. for Fe_3O_4.	Found.
Iron, per cent.	72·4	73·70
Oxygen, per cent.	27·6	25·44[*]

[*] Determined by combustion in hydrogen.

The ethereal and carbon bisulphide solutions were evaporated, when a pitchy residue remained. The gritty deposit was thus found to consist of small particles of this oxide of iron bound by a pitchy substance, its composition being, organic matter, 13·5 per cent. ; inorganic matter (Fe_3O_4), 86·5 per cent. No iron was found in the original oils except a slight trace in one of them. The experiments on the behaviour of the oil with superheated steam left no doubt that the presence of the oxide was influenced by the oil, but it was difficult to decide in what way the influence was exercised. It is well known that the oxide is produced by steam alone acting upon iron, and it was thought likely that some component of the oil might possibly have some accelerating or retarding effect upon the formation. Lindet (Comptes Rendus, **139**, 859)[*] has shown that the formation of this oxide by steam is accelerated by the presence of benzene, and accordingly the oils were examined for hydrocarbons of the benzene series. A small percentage was detected in all the oils examined, but no relationship was observed between the amount and the depositing value of the oil. This line, however, was pursued somewhat further, and the accelerating or retarding effect of other hydrocarbons existing in the oils was examined, but although one or other of these effects was observed, it was in most cases too slight to account for the variation in the quantities of the gritty deposits made by the various oils. The examination of the oils and the resultant samples had shown that in passing through the apparatus with the superheated steam the oils had undergone no chemical change, and appeared to have played no part in the formation of the oxide. Now since the oils distil in steam without decomposition, and the residue obtained from this distillation was similar to the pitchy substance found in the gritty desposit, it appeared probable that the residue simply bound together the particles of oxide, which were carried by the steam from the boiler tubes. In the first portion of the investigation a flash boiler was employed. One of the tubes of this boiler was cut through, and the interior was found to be thinly coated with the same oxide as that which constituted the gritty deposit. The oxide of the gritty deposits had a radius of curvature which approximately corresponded to that of the boiler tubes. This made it appear that the viscous residue of distillation of the oil caught and bound the particles of oxide, or that the oxide itself formed the nucleus for the condensation of the higher boiling fractions of the oil. This hypothesis accounted for the increase in the deposit at the higher temperatures, for at those temperatures distillation would be more complete and a more pitchy residue would remain. This view was confirmed in a very remarkable manner by the examination of a deposit obtained from a steam engine using superheated steam. The engine was of the vertical inverted type, and the deposit was found attached to the underneath side of the cylinder cover. The deposit consisted of about five thin layers, alternately of a black pitchy substance and oxide of iron ; the pitchy substance

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[*] This J., 1904, 1219.

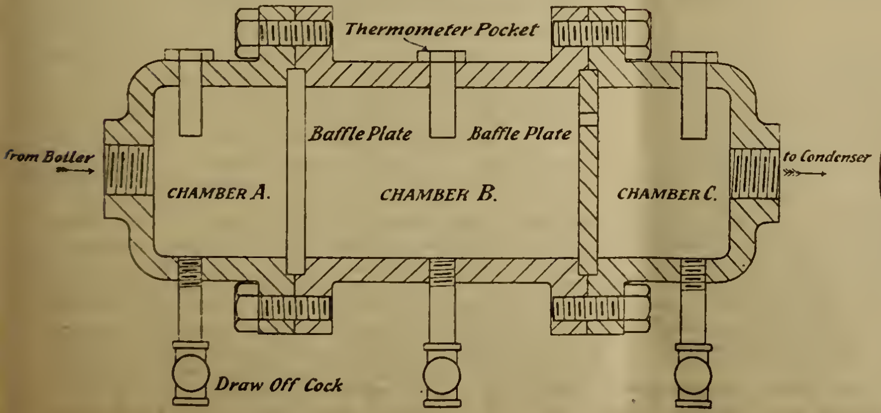

FIG. 1^{a}

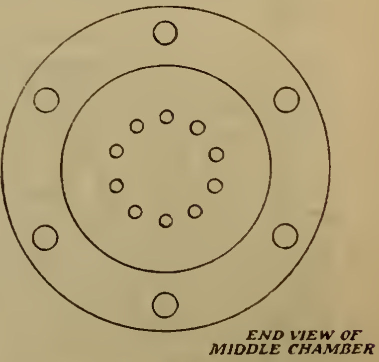

FIG. 1^{b}

was evidently a product of the oil, and the oxide was the same as that found in the gritty deposit in our experiments.

It is thus clear that the effect of superheated steam on lubricating oil is to fractionate it by distillation without decomposition, so long as the temperature is below 750° F. (400° C.). The lowest boiling fractions probably pass through the engines to the second or third cylinder or on to the hotwell, while the higher boiling fractions lubricate the first cylinder, and the highest, *i.e.*, the residue, if any, deposits in the passages of the engine and collects the oxide of iron which may be carried by the steam from the superheater.

The exact behaviour of a given oil in a steam engine depends upon the temperatures in the various parts through which it passes. Although the distillation of an oil primarily depends upon the temperature, the purity of the fractions depends to a large extent upon the shape of the vessel in which distillation takes place. This shape should be such as to cause the rising vapour to come into contact with the liquid; this is usually accomplished by causing some of the vapour to condense and drop back into the liquid, and thus come into contact with the other vapour as it ascends. This action might take place in the steam engine if a bend or pocket were formed in the steam pipe close to the point of inlet of the oil, and so produce eddies in the current of steam and cause the oil vapour to come into contact with the sides of the pipe or valve where some of the vapour would probably condense. In order to lubricate the cylinder, the oil vapour must condense on the cylinder walls; this would take place owing to the fall of temperature to which the cylinder is subject during the expansion of the steam. The present investigation shows the conditions which must be considered in selecting an oil, and suggests the possibility of producing an oil to suit any given set of conditions.

The authors have not in the present paper considered the question of the lubricating value of the distillation products, but this of course must be also taken into account in selecting an oil.

Summary of results.

1. No chemical change of the oil takes place in a cylinder using steam which is not heated up to 400° C. (750° F.).
2. The deposits consist chiefly of oxide of iron, which is formed independently of the oil.
3. The adhesion of the oxide producing deposits depends upon the pitchy constituent in the oil and the completeness of distillation.
4. The oil is fractionated by the steam, the shape of the cylinder and adjacent parts and the temperature influencing the quantity of pitchy matter remaining behind.

The authors desire to gratefully acknowledge the generosity of the Henry Wells Oil Co. in financially assisting the research, and also tender their best thanks to Dr. H. S. Hele-Shaw for his advice in connection with the steam experiments, when Professor of Engineering at the Liverpool University, and to Dr. A. W. Titherley, of the Organic Laboratories, for his advice in the chemical part of the work.

DISCUSSION.

Professor F. G. DONNAN did not consider that the authors had given sufficient chemical evidence to show that there was no cracking of the oil in the cylinder. Had the organic part of the deposit in the first part of the experimental cylinder the same chemical composition as the tarry deposit in the flask? He thought that the heated metal walls might have a catalytic effect on the oil. The authors maintained very ably that cracking played practically no part, and that the question is one of simple fractional distillation. He took it that the oil which would behave worst would be the oil which gave the greatest quantity of the tarry matter. He would have thought that a series of exhaustive fractional distillations of the different oils would have enabled them to test their view.

Mr. W. R. HARDWICK asked the authors whether, as the outcome of the investigation, they had any suggestions to make on the testing of cylinder oil commercially?

Mr. SCOTT TAGGART said he had had many deposits examined, and in many cases the greater percentage had consisted not of oxide of iron but of compounds of magnesium, calcium, sodium, and other substances, and he had had the water analysed which had been used in the boiler and had found practically identical results, proving that the priming of the boiler has carried over these substances, and they had formed nuclei for these deposits. Practically all oils were subject to it, and these substances that were brought over from the boiler were deposited just like the iron was. He did not think the oil passed through as a distillate and deposited on the walls of the cylinder. He was inclined to think that, from the methods in which the oil was admitted, it was split up into such extremely fine particles that it was carried through almost mechanically as globules, and it was that oil which was deposited on the cylinder walls.

Dr. J. TORREY said he took it that whatever magnetic oxide was formed was formed in the superheater. What was the distance from superheater to apparatus? Was the experiment continued long enough to get a deposit in any of the other compartments? Perhaps the arrangement of a chamber before the steam reached the superheater might prevent any deposits of magnetic oxide from being formed in the cylinder. For instance, something on the plan of the Stratton separator, where the steam was given centrifugal motion, would tend to trap the oxide and prevent it entering the cylinder.

Prof. WATKINSON thought it extremely fortunate that the superheater used was an old "flash" boiler, because he thought it likely that that superheater had become seriously oxidised before it was used for this experiment and while it was being used as a "flash" boiler. If this had not been the case very little, if any, oxide would have been carried into the cylinder and the most valuable result of the experiments would have been missed. In the case of a properly designed and properly worked superheater no perceptible internal oxidation should take place during many years of working, but, given the pitchy deposit, which had been described, within the cylinder of an engine, due to the action of superheated steam on the oil, then it was easy to imagine that during the working of the engine, some minute particles of metal would be scored off the cylinder, the piston rings, and valve, and these particles would adhere to the pitchy residue from the oil and cause cumulative scoring of the rubbing surfaces, which would seriously interfere with the working of the engine. He had had some experience in the use of superheated steam in engines, and he had often marvelled at the differences in the results. Engines which apparently did not differ greatly from those already at work might cause trouble from the beginning. These differences might be due, in view of the results of these experiments, entirely to the kind of oil used. If the oil left no pitchy residue there would be no trouble, but if it did leave a pitchy residue trouble might be caused in the way described. The authors had stated that some of these oils left no pitchy residue in the cylinder. Were any of those oils available, so that their lubricating properties with engines using superheaters might be tried? Presumably those oils would not cause any trouble in the engines providing they were not too thin.

Mr. HENRY M. WELLS said it had been shown conclusively that the temperature of the decomposition of oil is very much higher than the working temperature of steam engine cylinders in actual practice. Yet whenever a deposit of any kind was found anywhere inside an engine it is called "carbon deposit" and was stated to be due to the "carbonising of the oil." He did not think it had been shown before that cylinder oil could not undergo any chemical change until it had reached a temperature of 750° F., hence this proof that it did not undergo such change hitherto. It was contended by many with practical experience that it was no advantage to require either flash point or viscosity above a certain minimum. This contention appeared to be confirmed by the authors' conclusions in respect of the distillation points of the oils, *viz.*, that to insist on an oil with a high distillation point except for cylinders at high temperatures was a disadvantage.

Mr. Allmand suggested that the results observed might be perhaps partly due to catalytic decomposition of the oil by the magnetic oxide of iron. Sabatier had broken down hydrocarbons by means of finely divided nickel; iron oxide might well act as a powerful catalyser. He thought the authors should try the action of the oil alone on magnetic oxide at high temperatures.

Mr. W. Ramsay asked whether the oils experimented with were American or Russian? Russian oils, owing to their very complex nature, were very liable to change their properties under the action of light, heat, &c. He had examined some of the oil deposits spoken of by Mr. Southcombe, and while a few contained scaly particles of oxide of iron, the majority did not contain more than about 0·1 per cent., the remainder being almost wholly organic matter. These samples were taken from marine engines where the steam would be to some extent superheated. There were few oils which would stand heating to 100° C. for more than 4 or 5 days without considerable decomposition, or perhaps polymerisation, taking place.

Mr. Eustace Carey suggested that the formation of the deposits occurred through the quality of the steam itself. In other words, what did the steam bring with it? Sometimes when boiler feed water was not properly treated, the steam might contain carbon dioxide from bicarbonate of lime or hydrochloric acid from the decomposition of magnesium chloride.

Mr. Roberts asked if any of the distilled oil was used in the apparatus, and if so what was the nature and composition of the deposit in the Chamber A. Did it consist only of oxide of iron? In several cases the authors had passed an oil through the apparatus and found a large quantity of deposit. They had then passed the dried exhaust oil obtained from the experiment through again and found practically no deposit. In this case the oxide had been carried by the rush of steam right through the holes in the baffle plate to the condenser.

Mr. Southcombe, in reply to Prof. Donnan, said that the combustion values of the residues obtained by distillation and of the pitchy deposits obtained were practically the same. The temperatures in the apparatus were never high enough to justify the opinion that cracking could have taken place. The question as to a method which analytical chemists could use was matter for further investigation. Determination of the percentage of pitchy residue left after steam distillation of the oil would unquestionably be of some value. Two experiments which he had conducted shewed that the percentage of pitchy residue left differed, and the oils possibly could be correlated in value. He thought that one of the lines of investigation suggested from this work would be to obtain the various fractions of oil and investigate them with a view to analytically determining their value as lubricants. In reply to Mr. Scott Taggart, there must be distillation, because the portions going into the hot well were distinctly lower boiling fractions of the oil. They must have been separated by a process of distillation. With regard to the question asked by Dr. Torrey, the distance between the superheater and the apparatus was eighteen inches, a comparatively short distance. The whole point of the paper was that as soon as the steam and oil met and were driven into eddies, the more complete fractionation of the mixture was obtained. The only effect of prolonging the duration of the experiment would be to increase the amount of deposit in Chamber A. Prof. Watkinson had said that it is very seldom that a superheater gets any oxidation upon it, but it would appear to him that wherever a superheater was used a certain amount of oxidation was produced. They had broken through several tubes to confirm that view. A film of the oxide was almost invariably found inside a section of a tube. An oil of the type suggested by Prof. Watkinson could be produced, but did not seem to be an ideal lubricant. It seemed as though there was some substance in the oil other than that objectionable residue, which substance was removed at the same time as the pitchy residue.

In reply to Mr. Allmand, superheated steam and oil were passed over powdered iron and copper, but no decomposition of the oil was observed. The action of the iron oxide in the steam on the oil had not been investigated; a study of it would possibly lead to some interesting results, but there appeared to be no decomposition of the oil. The iron oxide particles were carried through by the steam until they were held and bound by the pitchy residue. The authors did not claim that deposits obtained from engines other than superheated steam engines would contain oxide of iron. In reply to Mr. Ramsay, all the oils used were Pennsylvanian. The oils used were of an exceedingly complex nature; they contained a considerable quantity of unsaturated hydrocarbons, and it was quite possible that these would polymerise, so causing darkening in colour. Whether that definitely influenced the presence of the pitchy residue was a question for further investigation.

New York Section.

Meeting held at Chemists' Club on Friday, Feb. 21, 1908.

MR. GEORGE C. STONE IN THE CHAIR.

THE INFLUENCE OF SUNLIGHT ON PAINTS AND VARNISHES.

BY MAXIMILIAN TOCH.

It may properly be said that direct sunlight has a very destructive action on paint and varnish films, and the author had noted as far back as 15 years ago that many of the paint materials that were perfectly waterproof in places where sunlight never reached, became permeable to water and disintegrated very rapidly when exposed to direct sunlight. As an example of this, it might be cited that pure asphaltum, when applied in a good continuous coat on cast iron pipes in a cellar, will last from three to four years, yet the same asphaltum when applied on the roof of a building, will show almost complete decomposition within 20 days. In order, therefore, to determine the cause, the first experiments with a series of bitumens were made as follows:—Sheets of clean steel and wood were painted with a variety of bitumen compounds and exposed to direct sunlight under various coloured glasses, finally reduced to the three colours, violet, green, and red; for obvious reasons these three served all purposes. It was found at the end of four weeks that the bitumens exposed under the blue rays showed marked signs of decomposition, those under the green showed some signs, and those under the red none whatever. The same experiments were tried again by cementing the glass to the painted surface, when little or no decomposition followed in any case. A large variety of experiments was then tried by mixing the bitumens with various pigments, and a preservative action was obtained in direct ratio to the pigment used, so much so that a sample of paint made to contain 80 per cent. of bitumen, 15 per cent. of linseed oil, and 5 per cent. of finely divided carbon, showed only slight deterioration at the end of six months; this was easily accounted for by the fact that the finely divided carbon prevented the absorption of many actinic rays. While these experiments were very conclusive, it was necessary to determine the cause, and to this end a large variety of experiments was conducted, all of which were productive of excellent results.

All asphaltums are bitumens, but all bitumens are not asphaltums, and it is necessary to look into the composition of the asphaltums which decompose in the sunlight and of those resins which do not. The difference between a resin and an asphaltic bitumen may generally be stated as follows:—Asphaltums and bitumens are composed principally of carbon and hydrogen, whereas the resins are semi-fossilised, and composed of carbon, hydrogen, and oxygen. Asphaltums, whether they be natural or artificial, consist largely of hydrocarbons of the series C_nH_{2n-2}, C_nH_{2n-4}, C_nH_{2n-8}, etc., and according to Clifford Richardson* and others, these hydrocarbons are probably polymethylenes. From a large number of combustion determinations made with bitumens, it may be safely stated that many of the bitumens are probably polymethylenes of various series, as above. There are, of course, substances in bitumens such as sulphur and nitrogen, which probably exert very little influence on the material from an actinic point of view. Assuming, therefore, that the hydrocarbons are of the character described, we should have under the combined action of the oxygen of the air and the actinic rays of the light, sometimes, in conjunction with moisture, a favourable condition where oxygen would combine with hydrogen, and carbon be set free. Therefore, if this reaction takes place, all bitumens in a short time ought to become carbonised and deposit relatively pure carbon on their surfaces, and this is exactly what takes place, the action of the sunlight probably resulting in a combination of the hydrogen with oxygen, and a deposit of what appears to be carbon takes place. If this, then, is the first lucid explanation of the decomposition of bitumens in sunlight, it is the explanation of the cause of the valuelessness of pure bitumens as protective paints for exterior purposes. Even the addition of a small amount of bitumen to a large percentage of otherwise good paint will result in the decomposition of this paint when exposed to the direct action of moisture and light.

We have no such action when materials are used which are glycerides of fatty acids, such as fish oil, Chinese wood oil, and linseed oil. Indeed, any one of these three oils are lightproof in a very large degree, and fish oil and Chinese wood oil are both heat proof and light proof. Linseed oil, however, unless prepared with fossil resins, is not waterproof, but fish oil is more waterproof, and Chinese wood oil most waterproof of all. At the same time, pure Chinese wood oil is less lightproof, next comes fish oil, while linseed oil is most lightproof, and there would appear to be an established ratio that a paint or varnish containing the least amount of oxygen is the least lightproof and the most waterproof, and the paint containing the largest amount of oxygen is most proof against light, and least waterproof.†

In conclusion, and as evidence of the correctness of these statements, if a sheet of metal or wood be painted with asphaltum or bitumen-paint and exposed to sunlight and air, the coating will be rapidly decomposed, and after a lapse of 20 days, probably carbon will be set free. At least, this is a deduction from the nature of the bitumens. Minute scrapings from the surface of exposed bitumens show that the principal constituent is carbon, and whereas the original material contains much less, the exposed bitumen shows over 95 per cent. of carbon, the remainder being principally hydrogen, with a small difference, which is evidently oxygen. This shows that the general reaction tends to produce carbon. The painting of concrete to preserve it against the action of moisture and frost is destined to become as large an industry as the painting of wood, and those who have tried asphaltum paints for this purpose have already found to their sorrow that disintegration takes place in a very short time, even though the material be perfectly proof against the alkaline action of the lime in the concrete, and as linseed oil paint is rapidly destroyed by concrete itself, owing to the interaction of the lime and the linseed oil, we have to look for other materials with which we can coat concrete in order to preserve not only its appearance, but the very structure itself.

Regarding the action of sunlight on pigments, it is well known that lithopone is rapidly acted upon by light, and direct sunlight turns it a dark gray, but frequently overnight the colour leaves it and it is brilliant white again in the morning. English vermillion (mercuric sulphide) is also acted upon by sunlight, and forms first a brown compound and then a black compound of mercury. This has been regarded as mercurous sulphide or as a sub-sulphide of mercury, but on this question the writer has doubts. Some of the oxides of iron, particularly the bright red ferric oxides, are affected by light, and a compound results which from bright red turns to brown, probably a change tending towards the formation of ferrous oxide.

We know that a large number of the organic dyestuffs tend to bleach in the sunlight, but sunlight alone is never very active regarding the decomposition of colours when air is excluded, for even mercury vermillion is regarded as permanent when it is covered by a coat of varnish. This is largely true of the organic lakes and finer colours used for coach painting. Linseed oil itself is bleached by sunlight, but this is a chemical change produced by the actinic rays in which the green chlorophyll is changed to pale yellow.

PREPARATION AND USES OF ANHYDROUS STANNIC CHLORIDE IN SILK DYEING.

BY ELMER A. SPERRY.

Stannic chloride, discovered in 1608 by Libavius, has a sp. gr. of about 2·3, and possesses wonderful fluidity; the pure liquid is described by various authorities as a yellow liquid, but it is, in fact, colourless and very brilliant owing to its high refractive index. It is extremely hygroscopic, having greater avidity for water than sulphuric acid, yet unlike other hygroscopic substances, it seems impossible to wet it, although its avidity for moisture is evident from the high degree of heat developed upon the addition of moisture or water. As fast as the water is added, stannic chloride hydrate is formed and separates out as a solid. This separated material constitutes the "butter of tin," or oxy-muriate of tin of commerce, but has not been prepared in this manner except in the laboratory, although this solid was discovered about 160 years after the work of Libavius. This heavy fuming liquid has been looked upon in the past as of no practical value, never having been used in the arts nor even as an analytical reagent. Its price has always been extremely high, and is at present about $100.00 per gallon.

At a comparatively recent date, a Dutch chemist discovered that cochineal was made to yield a permanent pigment of great brilliancy in the presence of a dilute stannic chloride solution. This solution was made by dissolving tin in hydrochloric acid, adding additional acid and oxidising the solution to stannic chloride. This discovery was quickly taken up by the dyeing industry, but the chloride solutions continued to be prepared as used, directly from tin as outlined above. The chlorates are usually used as oxidising agents, leaving chlorides as an impurity, which is added to the usual impurities encountered in the commercial acids employed. These solutions may be raised to a concentration of 50° and sometimes 60° B. for more economical shipping, and then again diluted by the dyer before being used. It has long been known that the mordanting and weighting of the fibre, employing tin chloride solutions, is accomplished only by the stannic chloride present therein, this being the only useful factor in the solution. It has been known for some time that to the impurities in solutions can be definitely traced tendencies to weaken the fibre and render light-sensitive the threads and fibres treated. It is also known that some of the impurities operate to bring about a gradual deterioration in the strength of the material, which is sometimes also hastened by exposure to light.

Without entering further into the discussion of this question, it will suffice to say that for all purposes of dyeing the problem is greatly simplified if only materials which are chemically pure can be employed, and the solutions freed entirely from the presence of any adulterants and deleterious or foreign bodies. The dyers' solution is active only in proportion to the amount of stannic chloride which the solution contains; furthermore, this is the only material which the silk requires, and many problems would receive a quick and easy solution could we but add from time to time just the anhydrous liquid which is taken up by the silk, leaving the water behind to receive more chloride, which again is passed to the fibre, continuing this simple process indefinitely.

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* *See* "The Modern Asphalt Pavement" and "Origin of Asphalt" by Clifford Richardson.

† Composition and Nature of Linseed Oil. *See* Toch's "Chemistry and Technology of Mixed Paints," p. 80.

Now that the author has perfected processes and apparatus by means of which perfectly pure stannic chloride can readily be prepared for purposes of addition directly to the treating vat, by starting with distilled water in the vat, it at once becomes possible to subject the delicate fibres and tissues of the silk to the weighting process, under conditions of entire absence of all foreign and deleterious bodies. The tin salts and compounds received into the tissues under these conditions possess several definite features of advantage. Not only is there decidedly more lustre and uniformity imparted to the sheen, but the chemical action is uniform and regular throughout the batch. There are no adulterants which have shielded part of the fibre and caused it to take on less action or a different degree of chemicalization than at other points in the skein, nor is the true chemical reaction sought perverted in any way or complicated by the presence of substances tending to produce new and unsought compounds of a more complex nature. These complex bodies and their secondary reaction products tend definitely to destroy the strength of the silk and to render it light sensitive and slowly deteriorant.

Fig. 1 shows a diagrammatic view of the plant used for the preparation of pure stannic chloride. Pure or impure tin-bearing material is placed in the receivers, 1; chlorine is admitted by the pipe, 2, and the product gradually accumulates in the receivers. For economical production of the material, gaseous chlorine in the form ordinarily produced, associated with more or less air and moisture, is employed, the chlorine being absorbed in the receivers. The air, which takes up some stannic chloride and also carries the sublimed hydrate due to the moisture in the gas, is received in pipe 5 and conducted to one or other of the condensers, 26, which serves the two-fold purpose of recovering nearly all the anhydrous stannic chloride contained in the vapours and air within pipe 5, and also of receiving such stannic chloride hydrate as may also be contained in these vapours. The latter is drawn off at 29, the former being received by pipe 28 at the bottom of the condenser. The pipe then proceeds to the tower, 30, where the vapours rise to the suction of fan 36, in opposition to the downwardly trickling stream of water entering at 32, a solution being readily formed and issuing from pipe 33. This solution is perfectly colourless; it has a density of about 60° B. About 4 per cent. of the total product may be represented by this solution.

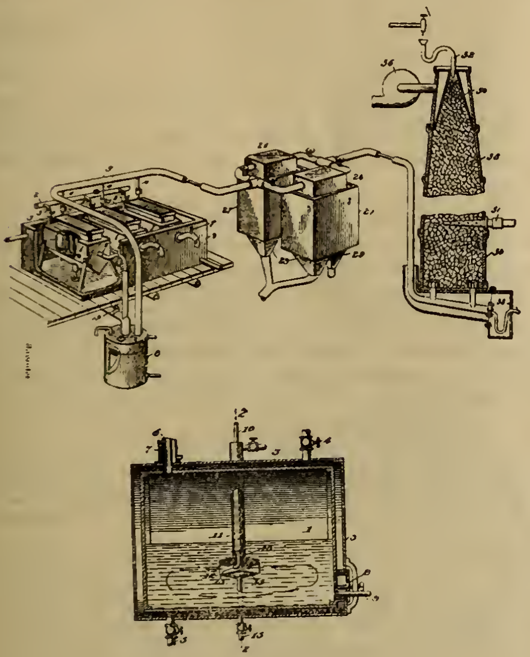


FIG. 1.

One of the peculiar advantages of the product, in that it consists of anhydrous tetrachloride, is that it possesses low specific heat and low latent heat, the vapour having a specific gravity of nearly 10, being probably the heaviest vapour known. The raw material may thus be readily treated by distillation as the second step in the process, whereby all the impurities are separated out, and left behind, only the chemically pure chloride being obtained.

One definite advance attained by the process is that this result is achieved even though extremely impure chlorine and impure tin are employed. Thus, cheap sources of both these materials are at once rendered available, which is in the greatest possible contrast to the usual methods of preparation of the solution, employing as they do only pure and highly refined tin.

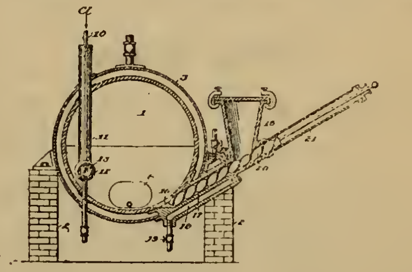


FIG. 2.

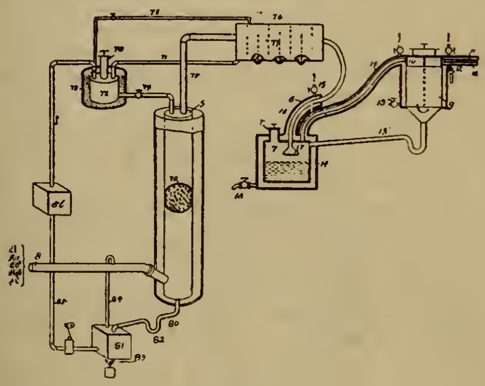


FIG. 3.

The product is shipped in steel drums. This material has been found to stand for upwards of three years in an ordinary black iron container without being in the slightest degree contaminated on the one hand, and without attacking the material of the drum upon the other. Fig. 2 represents a plant of larger capacity; the chlorine is introduced at 10, the tin bearing material being supplied from the hopper, 16, by the worm, 20. The capacity of this plant is about 500 lb. of stannic chloride hourly. Fig. 3 illustrates the chlorine drying plant. The necessity for this is brought about by the fact that by this means chlorine, which is considerably diluted with air and other gases, may be employed in the process. The chlorine together with its diluents is passed through the apparatus (Fig. 3), entering at pipe 8, passing upwards through the refrigerator, 5, where most of the moisture is deposited, running off at pipe 80; the brine or equivalent circulation is shown by pipe 85 and receiver 72. The gas next enters the defogging chamber, 76, where such moisture as may be carried over mechanically is deposited and next enters the receiver, 7, being preferably heated on its way, so as to make it more absorbent. In the vessel, 7, is placed anhydrous stannic chloride, *i.e.*, a small part of the product of the plant. As the gases pass through here, the last vestige of moisture is instantly seized upon by the chloride, the moisture being sublimed out of the chlorine; all the other gases pass next into the condenser, 9, where the gaseous chloride is trapped off and returned to the treating vessel, 7, the temperature of the jackets in condenser 9 being regulated so as to leave such gaseous stannic chloride in the gases as has been determined by practice. The jackets, 14, covering the piping are found to be a most effectual method of preventing deposit of hydrate and thus clogging passages, which without this precaution very soon become filled with the hydrate crystals. After months of operation with this jacket it has been found that the pipes were as free from deposit as when first installed.

The readiness with which this new material lends itself to the formation or commercial production of any of the tin compounds known or required by the silk dyer is only on a par with the extreme purity of all the compounds so derived—for instance the butter of tin produced from the product is brilliantly snow-white. The solutions are also always brilliantly water-white. The stannous chloride produced by splitting off the chlorine and returning it to the process is almost a new product, the crystals being practically of ultimate purity, and the oxide thrown out of solutions made from the essence is of course perfectly pure and of extreme whiteness and brilliancy.

Scottish Section.

Meeting held at Edinburgh on February 18th, 1908.

MR. JOHN S. MACARTHUR IN THE CHAIR.

SOME NOTES ON WIJS' SOLUTION.

BY HARRY INGLE, D.SC., PH.D.

In previous papers published in this Journal (1902, 587, and 1904, 422) I have endeavoured to elucidate the reactions taking place between unsaturated compounds and the "iodine" solutions usually employed in determining the "iodine value." It is now generally accepted that the first product of the reaction is the formation of an iodochloride and I further showed in these papers that this iodochloride is hydrolysed by the action of the water in the solution forming hydroxyl derivatives and halogen acid, and that it is reducable by the action of potassium iodide with the liberation of free iodine.

These observations led me to recommend a method of procedure in determining the "iodine value" which I fear has been misunderstood by several chemists. I stated that after doing the test in the ordinary way before adding the potassium iodide solution water should be run in so as to precipitate the chloroformic solution of the iodochlorides, thus removing them from the reducing action of the potassium iodide which should be immediately added after this separation takes place, since they are insoluble in water while potassium iodide is insoluble in chloroform. Harvey (this J., 1902, 1437) raises objections to this procedure, because he finds that when he adds water to the blank test before potassium iodide he gets a reduction in the titrable halogen. In a footnote to my second paper (*loc. cit.* 425) I briefly replied to this, but as since that was written Mr. Harvey (without having had the opportunity to peruse my reply) in the same issue, again calls this in question, I may be allowed to answer his objections at length, and at the same time clear up this point.

There is no advantage to be gained by adding water to the blank test before the potassium iodide, as there are no iodochlorides of unsaturated compounds present. Iodine chloride being soluble in both chloroform and water, is not removed from the sphere of action of either water or potassium iodide. Harvey's results with regard to the loss of titre in this case I confirmed, and stated that it was due to the decomposition of the hypoiodous acid formed by the action of the water on iodine chloride. That this takes place can be shown qualitatively by mixing Wijs' solution and water in equal parts. On standing, bubbles of gas can be seen to rise from the solution, which gradually becomes redder in colour owing to the separation of free iodine. The reactions taking place may be thus represented: (1) $ICl + H_2O = HOI + HCl$. (2) $4HOI = 2H_2O + 2I_2 + O_2$. No. 1 is a reversible reaction; if we increase the amount of hydrochloric acid present in the solution, then less hypoiodous acid is formed, and, consequently, there is less tendency for No. 2 to take place. To test this point, a quantity of Wijs' solution was saturated with hydrochloric acid gas. Two lots of 15 c.c. each were measured out, and to one 100 c.c. of water was added, and the mixture allowed to stand for 5 mins., then potassium iodide was added and thiosulphate run in as usual. To the other, potassium iodide solution was added at once. No difference was observed in the two titrations, the hydrochloric acid having prevented the formation of hypoiodous acid by reversing reaction No. 1. Attempts were made to collect the oxygen gas evolved by reaction No. 2, but the apparatus at my command was not sufficiently delicate to deal with the very small quantity evolved. The change of colour of the solution due to the separation of iodine and the fact that a gas is evolved seem to me to be sufficient evidence of the truth of this view. To test the matter further it was argued that, as the rate of decomposition of hypoiodous acid into iodine and oxygen must depend upon the concentration, if a small quantity of water were added to Wijs' solution the loss in titrable halogen should be greater than with a larger quantity. The following experiments were made to test this:—

(1) 15 c.c. of water was added to 18 c.c. of Wijs' solution. After 45 minutes, 10 c.c. of potassium iodide solution and 100 c.c. of water were added. Thiosulphate solution required = 27·95 c.c.

(2) 18 c.c. Wijs' solution and 100 c.c. of water, stood 40 mins. followed by 10 c.c. of potassium iodide. Thiosulphate required = 28·6 c.c.

(3) 18 c.c. of Wijs' solution. Blank test 10 c.c. of potassium iodide and 100 c.c. of water. Thiosulphate required = 29·2 c.c.

Nos. 1 and 2 reddened slightly immediately the water was added, and finally turned very red; little gas was evolved in either case. These results are in exact agreement with what the theory demands.

Harvey's contention that the reduction of titre in the blank test may be due to substitution in the acetic acid by the action of the free iodine and iodic acid does not appear to me to be sound, for it is impossible for iodic acid to exist in presence of hydrochloric or hydriodic acid, since the following reactions take place:

$$5HI + HIO_3 = 3H_2O + 3I_2;$$
$$10HCl + 2HIO_3 = 6H_2O + 2ICl + 4Cl_2.$$

Neither does it appear likely that any iodic acid can exist in Hübl's solution for the same reason.

The explanation of this loss of titre which I have given appears to me to meet the case.

Iodine value of turpentine.—In the Jahrbuch der Chemie (1904, p. 435) Dr. Lewkowitsch criticises the results I published in my 1904 paper for the iodine value of turpentine. On page 423 I gave the iodine value of American turpentine, pinene (b.p. 156—157°) by modified Hübl as 374, the theoretical value, and by modified Waller's solution as 242. On page 425, in the same paper, I recorded an iodine value by Wijs' method (water first), of 355 while adding potassium iodide first I obtained an iodine value of 253. I wish to here explain that the turpentines examined by Hübl's and by Wijs' solutions were not the same. In the first case, a redistilled pure turpentine was used, while in the latter a turpentine boiling between 157° and 180° C. and therefore not pure pinene, was employed. I unfortunately omitted to mention this, and in the table on page 425 the iodine value of pure pinene by modified Waller's solution was inserted. I take this opportunity of correcting this, and of certifying that I have also found that pure pinene American turpentine gives the same value, namely 374, by both modified Hübl's and Wijs' method. As some discussion has taken place as to the use of the iodine value in judging the purity of turpentine, the following iodine values obtained with Wijs' solution for various turpentine substitutes may be of interest:—

Scottish shale spirit, b p. 70°—150° C.	112
Coal tar spirit, b.p., 150°—190° C..................	94
Rosin spirit (crude)	263
Do. (refined)	151
Russian turpentine (crude)	234—294
Do. (refined)	292
Old sample of American turpentine	318

THE IODINE VALUES OF THE PHENOLS.

BY ERNEST WAKE AND HARRY INGLE, D.SC., PH.D.

In previous papers it has been shown (*loc. cit.*) that unsaturated compounds, when the ethylene bands are unprotected by the neighbourhood of negative groups, absorbed iodine chloride quantitatively from Wijs' and Hübl's solutions. One of the authors introduced a new solution in which the iodine chloride was held in a weak state of combination with hydrochloric acid, and showed that from this solution partially protected double linkages were unable to absorb any iodine chloride. Mention was also made of the behaviour of certain phenolic derivatives, and a paper on the iodine value of these substances promised. Press of other business has prevented the carrying out of these intentions to the full, and the present paper must be considered as only a partial study of the subject. With regard to previous work, the most exhaustive examination of the iodine value of the phenols has been carried out by Fahrion (Zeits. angew. Chem., 1901, 1226—7), where the following values are recorded :—

	Iodine value by Waller's method.	
Phenol	76·8	64·3 39·1
o-Cresol	143·8	128·5
m-Cresol	233·2	224·0
p-Cresol	62·1	38·4
Catechol	478·1	259·0
Resorcinol	549·7	544·6
Quinol	263·8	66·5
Pyrogallol	507	—
α-Naphthol	314·3	278·0
β-Naphthol	174·4	169·8
Anisol	0	—

From the above results he concludes that a determination of the iodine value of these substances is of no value. Now Waller's solution as used by Fahrion is not, as has been shown, a definite reagent, but a mixture of Hübl's solution with a solution containing the double compound, ICl.HCl, the presence of water, too, complicates the reactions. It is not surprising, therefore, that using such a reagent Fahrion comes to this conclusion. With the knowledge obtained in the examination of other unsaturated compounds we determined to examine these substances. The three solutions previously described were employed, and the haloid acid formed by the interaction with Hübl's reagent was in most cases determined and its character judged by the coloration obtained with Wijs' solution.

Reference has been made to the reducing action of potassium iodide upon iodochlorides in the previous papers ; with the phenols ample evidence of this is obtainable. Thus from α-naphthol, which by Hübl's method gives an iodine value of 264, by Wijs' method, adding potassium iodide first, iodine values of 200 and 195 were obtained in two experiments, while when water was added to the test so as to precipitate the iodochloride in the chloroform solution before adding the potassium iodide solution, an iodine value of 262 (3I=265) was obtained. Very striking is the result with phenol with Wijs' solution ; adding potassium iodide first gave an iodine value of 267 (2I=270), while when water was added before the potassium iodide the iodine value of 623 was the result. With modified Waller the iodine value is *nil.*

Another important result was obtained from this examination of the phenols. It was found that while the *ortho* and *para* poly-phenols liberated iodine from Wijs' solution, the *meta* derivatives did not do so. This may be used as a test to determine whether the hydroxyl groups are in the *meta* or in the *ortho* or *para*-positions, and to detect the presence of impurities in *meta* compounds. It may also be employed to distinguish α- from β-naphthol, the former liberating iodine from Wijs' solution, while the latter merely renders it lighter in shade. The test may be carried out as follows :—The substance is dissolved in a small quantity of chloroform or in glacial acetic acid in a test-tube. A quantity of Wijs' solution freshly prepared, and of the lightest possible shade is added. If any darkening of the solution results through liberation of free iodine then the substance under examination contains *ortho* or *para*-phenols or α-naphthol. Pure *meta*-phenols and β-naphthol liberate no iodine. The same test may be used to detect rosin in shellac, as rosin liberates iodine from Wijs' solution, as one of us has shown (this J., 1904, 425), while shellac does not (A. C. Langmuir, this J., 1905, 12). Turpentine and rosin spirit may be detected in mineral naphtha or coal-tar spirit, and rosin or rosin oil in linseed oil or mineral oil by the same reagent.

It is interesting to note that the *meta*-phenols and β-naphthol give iodine values which bear a definite atomic relationship corresponding to 6, 4, or 2 atoms of iodine per molecule. A determination of the iodine value could thus be used as a means of determining their purity. This might be applied to resorcinol, phloroglucinol, β-naphthol, carvacrol, and phenol.

The behaviour of the esters of the phenols is interesting, for while the free phenols absorb iodine in the ring, the esters (benzoates) do not. (Fahrion noticed that anisol

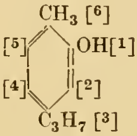
MONO-PHENOLS.

Substance.	Iodine value calculated.	Iodine value as determined by				
		Modified Hübl.	Wijs.	Modified Waller.	Acid formed, as I per cent.	Nature of acid.
Phenol	2I=270	410	623 and 267	nil	220	HCl
o-Cresol	2I=235	378	—	6·3	188	—
m-Cresol	,, ,,	465	—	20	233	—
p-Cresol	,, ,,	360	—	360	201	—
Carvacrol	2I=170	170	177	—	86	HCl
α-Naphthol	2I=177	264	262	120	187	HI
β-Naphthol	,, ,,	176	178	110	89	HCl
POLY-PHENOLS (ortho and para).						
Catechol	2I=230	508	232	49·5	—	HI
Guaiacol	2I=203	354	—	8·2	242	—
Eugenol	2I=154	445	—	151	—	HI
Quinol	2I=230	156 and 79	—	—	58 and 55	HI
Pyrogallol	6I=606	590	—	—	520	HI
(Meta.)						
Resorcinol	6I=692	690	—	408	395	HCl
Phloroglucinol	61=471	470	478	400	?	HCl

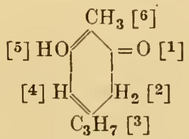
ESTERS OF THE PHENOLS.

Substance.	Iodine value calculated.	Modified Hübl.	Wijs.	Modified Waller.	Acid.	Nature of acid.
Phenylbenzoate	—	nil	—	—	—	—
α-Naphthyl benzoate	—	nil	—	—	—	—
β-Naphthyl benzoate	—	nil	—	—	—	—
Eugenyl benzoate	2I=95	94·5	95·1	93	23	HCl
Isoeugenyl benzoate	,, ,,	94·5	95·0	43	66	HI and HCl

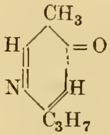
absorbed no iodine from Waller's solution.) This may perhaps be explained by assuming that the phenols are tautomeric substances existing on the one hand as cyclical ketones by the wandering of the H of the OH into the ring, and on the other as true aromatic ring compounds. The cyclical ketones as unsaturated aliphatic compounds can absorb halogen, but not the phenols. If then the phenol form is maintained by replacing the H of the OH by an alkyl or acyl radical, no such wandering of the hydrogen atom can take place; the compound retains its aromatic form and is no more capable of absorbing halogens from these solutions than benzene or naphthalene. The behaviour of carvacrol to the various iodine solutions is of interest. We have to assume in this case that the phenol form changes into that of the cyclical ketone:—



becomes



I.



II.

In I, the oxygen atom protects the linkage $\Delta_{5:6}$, but is unable to protect $\Delta_{3\cdot4}$; hence this form is capable of absorbing two atoms of iodine. In II, the protected group is $\Delta_{2\cdot3}$, and the unprotected $\Delta_{4\cdot5}$. Probably both forms exist.

In the case of the naphthols, to which allusion has already been made, it is difficult to understand why the α-form should absorb three atoms of iodine and liberate iodine, while the β-compound absorbs two atoms and liberates no iodine. The reaction product of Wijs' solution and β-naphthol was isolated. It forms feathery silky needles melting at 87° C., and is easily soluble in alcohol, ether, and alkaline solutions; a determination of the halogens gave numbers closely corresponding to the formula, $C_{10}H_7(OH)_2I$. No chlorine could be detected. It would therefore appear that the iodine chloride addition product had been hydrolysed by the water present in Wijs' solution with the production of a hydroxyl derivative and the liberation of hydrochloric acid.

Our thanks are due to the directors of Messrs. Barry, Ostlere and Shepherd, Ltd., Linoleum Manufacturers, Kirkcaldy, for the use of their laboratory in which the experimental work was carried out.

Yorkshire Section.

Meeting held at Queen's Hotel, Leeds, on Tuesday, February 25th, 1908.

MR. F. W. BRANSON IN THE CHAIR.

THE VALUE OF SEPTIC TANKS IN SEWAGE DISPOSAL.

BY JOHN T. THOMPSON, M.SC.

For the time, at any rate, observations on the septic treatment of sewage at the Knostrop Works, Leeds, must cease, for all the septic tanks, which treated about 2·75 million gallons of sewage per day, will in future be used for precipitation. Therefore, as this is an appropriate time to review the whole of our work on this subject, with the approval of the Sewage Engineer, Mr. G. A. Hart, this contribution is made with the twofold object of giving an opportunity for helpful discussion and also of placing the facts in a convenient form for reference by those who are interested in the sewage problem.

At the outset, I wish to express my gratitude to Col. T. W. Harding, J.P., whose unfailing enthusiasm was always a source of inspiration to us, for his permission to use the Leeds Report on Sewage Disposal of 1905, and also to Mr. W. H. Harrison, M.Sc., who, until he obtained an appointment under the Madras Government in the summer of 1906, skilfully supervised the experiments carried out at Knostrop; I am personally responsible for all analytical results since January, 1903, recorded in this paper.

The method of treating the sewage of any district is largely governed by local conditions; for instance, some authorities are able to use the head on the sewage at the outfall to drive the mechanical screens and for lighting purposes, whilst at Leeds the sewage reaches the works at the normal river level and has to be pumped before it can be purified. Again, the quantity of suitable filtering material, limestone, etc., available in the district, and the nature of the sewage are important factors, though this latter is the only one which need be considered on this occasion. Leeds has a population of about 470,000, and is sewered on the combined system; the present average dry-weather flow is 17¼ million gallons per day, of which about 1¼ millions is due to small streams and infiltration water. The volume varies from a minimum of 8½ million gallons in the early morning to a maximum of 29 million gallons about noon. A careful survey of the city has shown that 3½ million gallons per day of the total are discharged from the different industrial processes in the city.

Percentage composition of trades waste.

Class of trade.	Percentage of trades waste.
Piece and wool scouring, fellmongering, &c.	35·7
Dyeing	27·6
Leather trades	8·0
Chemical manufactures	4·5
Oil, tallow, candle and soap making	12·2
Brewing	3·6
Unclassified	8·4
	100·0

The domestic sewage of the city cannot exceed 10 million gallons per day; the source of the remainder of the flow is difficult to locate, but is largely due to water supply and water from borings used for trade purposes, but not contaminated sufficiently to be classed as trades waste proper. For some years manufacturers have been required to put down sufficient tanks to hold at least a day's supply, so that their discharge into the sewer, through a valve regulated by the Sewers' Inspector, is distributed fairly evenly over the 24 hours. Almost all the larger piece and wool-scouring firms find it profitable to extract the grease from their effluents in seak plants, hence we have no difficulty from this source in the subsequent treatment of the sewage. The amount of grease varies somewhat, but I have never found as much as 5 per cent. of grease in the pressed sludge cake.

A series of tests carried out during 1907 show that the normal sewage of the city contains on the average 6·9 grains per gallon iron, of which 1·4 grains per gallon are in solution; the major portion of the iron liquor is discharged from a copper-recovery process.

It will be convenient to give a historical account of the experiments carried out and afterwards discuss the results obtained. It must be remembered that this paper is strictly confined to the preliminary treatment of sewage in septic tanks as a means of removing suspended matter. A discussion of the final stages of purification must be reserved for a future occasion.

Description of experiments.—In 1897 the Leeds City Council, realising that the best biological process of purification could only be ascertained by experiment, very wisely made a grant for experimental work at Knostrop. At this time septic treatment seemed to promise a very large digestion of suspended matter; hence a complete installation was put down, constructed upon designs submitted by the Septic Tank Syndicate of Exeter, consisting of two rectangular tanks, 54 feet long by 10 feet broad and a depth of 9 feet at the deepest point. Both were covered in by brickwork arches. The mean water level in the tanks was about 6 feet 6 inches from the bottom of the tank. These tanks had a total capacity of 40,000 galls., and cost £531. Six filter beds, 4 ft. deep, with a total water capacity, when filled with material, of 31,000 gallons, were constructed at an additional cost of £395.

The closed septic tanks were filled with sewage on June 6th, 1899, and after 3 days they received a continuous supply of sewage, from which grit had been removed, at the rate of 40,000 gallons per day.

By June 18th septic conditions had developed, the effluent being dark in colour, whilst a large number of small bubbles were continuously arising from the liquid in the tank. The surface was covered with a thin frothy scum. These conditions became more and more developed until a maximum was obtained on Aug. 16th, 1899, and the surface became covered with a very thick layer of fibre, &c. This surface layer was similar in composition to that on the open tanks, but very light brown in colour. Periodic decreases in its thickness were coincident with heavy flushes of solids in the effluent. There was no appreciable change in the condition of the tanks until they were cleaned out in August, 1901, when they were found to be two-thirds full of sludge (83 per cent. water).

Average analyses for two years ending Aug., 1901.

Grains per gallon.	Free ammonia.	Alb. ammonia.	Oxygen absorbed in 4 hours at 80° F.	Solids.	
				Soluble.	Suspended.
Crude sewage	2·31	0·957	8·87	74·4	41·0
Effluent from closed septic tank........	1·88	0·406	4·63	63·5	12·7
Purification effected .	18·6%	57·5%	48·9%	14·6	69·0%

The sludge digestion for the above period amounted to 31·3 per cent. of the suspended matter in the crude sewage. Allowing for 5 grains per gallon grit removed from the crude sewage before it entered the septic tank, we get a more accurate estimate of 22 per cent. digestion.

On August 17th, 1901, sewage was again passed through the tank at the 24 hours' rate, 6 inches of sludge being left in the tank for inoculation purposes. In this case septic action was vigorous by the end of the week, but the scum never became very thick during this second period. By May, 1904, the tanks were so choked with undigested solids that we ceased to analyse samples of the effluent.

Average analyses from Aug., 1901, *to May*, 1904.

Grains per gallon.	Free ammonia.	Alb. ammonia.	Oxygen absorbed in 4 hours at 80° F.	Solids.	
				Soluble.	Suspended.
Crude sewage	2·05	0·607	7·72	74·3	44·0
Closed septic tank effluent	1·41	0·326	3·63	60·6	10·4
Purification effected .	31·2%	46·3%	52·9%	18·4%	76·3%

The cost of constructing closed septic tanks at Knostrop was £13,200 per million gallons capacity, as against £11,000* for open septic tanks in 1897. The experience of Leeds shows no advantage to compensate for this large difference of initial outlay; whatever results were obtained from the closed septic tanks were equally well obtained by the open. The scum which forms on septic tanks itself soon gives a cheap automatic roof, which is chiefly of value in preserving the heat in the sewage, the floating surface layer being a bad conductor.

A roofed-in septic tank is virtually a gas holder, and therefore is a source of danger to the men removing the sludge; it would also be very difficult to use the calorific power of the evolved gases profitably. Leeds sewage is diluted and mixed with trade effluents, but no doubt where strong domestic sewage is being treated, greater nuisance may arise, and the roofing become necessary. In appearance the effluents obtained from the open and closed septic tanks were identical, whilst from a chemical point of view, the difference is immaterial, though slightly in favour of closed tanks.

Average of all analyses of Nos. 1, 2, *and* 3 *open septic tanks: and also of closed septic tanks, from October*, 1899, *to May*, 1904 :—

Grains per gallon.	Free ammonia.	Alb. ammonia.	Oxygen absorbed in 4 hours at 80° F.	Solids.	
				Soluble.	Suspended.
Effluent from closed septic tank........	1·59	0·356	4·01	61·7	11·2
Effluent from open septic tanks	1·58	0·377	4·27	62·5	13·6

At the suggestion of the Royal Commission, during January and February, 1903, two series of tests were carried out in order to determine the action of septic tanks and contact beds on a specific pathogenic microbe, and to gain some knowledge as to the time which would elapse between the presence of a particular microbe in the crude sewage and the appearance of its progeny in the effluent after treatment. For this purpose the sewage on entering the closed septic tank was inoculated with *Bacillus pyocyaneus*, which is only exceptionally present in sewage, and samples of the effluents were taken every half-hour. *B. pyocyaneus* appeared in the septic tank liquor two hours after the start of the experiment, and 24 hours later was still present.

Each of the six contact beds contained *B. pyocyaneus* in the first emptying subsequent to the passage of this microbe through the septic tank, *i.e.*, at the earliest possible opportunity. On the fourth day, *B. pyocyaneus* was still present in the effluents. (Houston, Royal Commission on Sewage Disposal, Vol. III., 1904, p. 87). This experiment confirms the general belief that it is dangerous to discharge effluents from artificial processes into drinking water streams.

The effluent from the closed septic tank was passed through six filter beds. Four of the beds were filled with fine coke and two with fine clinker about half-inch diameter.

Of the six beds only five were in use each day, so that the beds were allowed to rest in rotation for one day in six. Eight beds were filled every 24 hours, three of the beds receiving two fillings, and two only one filling, during that period; so that taking the day's rest into account the beds average 1⅓ fillings per 24 hours. The process of filling and discharging was brought about by means of an ingenious automatic gear, actuated by an arrangement of buckets and syphons. The septic tank effluent was distributed over the beds by three channels running across the filter, and collected by drains laid on the bottom. These filters worked five years before requiring renewal of material, during this period the total capacity had fallen from 31,660 gallons to 12,870 gallons, a loss of 59·3 per cent. of the original capacity. The beds gave considerable purification, but not sufficiently good to pass the Rivers Board Provisional Standard. Single contact filtration of septic effluent was found insufficient to give a well oxidised result, but no doubt the addition of secondary beds would have made the resulting effluents excellent.

Open septic tanks.—Simultaneous with the above experiment, important observations were being made on open septic tanks. The first of these was started on February 27th, 1899. It was one of the old precipitation tanks and had an area of 6,000 sq. ft., an average depth of 7 ft. 7 in. and a capacity of 250,000 gallons. Sewage, absolutely crude, was sent into the tank by means of seven pipes, which delivered at a depth of 3 ft. below the surface. The effluent was withdrawn by means of six pipes, which drew off the liquid at a depth of 2 ft. below the surface. The flow of sewage through the tank was such that it would fill it in 24 hours,

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* This is a high price for the construction of tanks.

i.e., the sewage was allowed to flow through the tank at such a rate that each particle might be supposed to take 24 hours for the passage. At first an ordinary settlement of the suspended solids of the sewage took place, the effluent being in every respect similar to the effluent from the lime precipitation works. No real septic action took place in the tank until the end of April. Previous to this, only isolated and small bubbles were evolved, and no solid matters were brought to the surface.

From the end of April to the end of May, 1899, the evolution of gas became more evident, and at the same time, paper, wool fibre, matches, &c., rose to the surface, and collected in large floating patches, but no fine, black sediment could be seen. From May 30th to June 14th, 1899, in order to bring about septic conditions more rapidly, the flow was stopped, and the tank allowed to rest. During this rest it became much more actively septic. Black sooty matter rose from the bottom with a violent evolution of gas, and then spread over the surface of the tank, some of it floating to leeward, formed a scum at one side of the tank. It was noticed that the colour of the liquid in the tank changed to a dark hue owing to the formation of sulphides of iron. On restarting the flow, this violent action abated within the first day, and the tank remained only moderately septic until the warmer days, toward the middle of July, when a frothy scum appeared; this gradually increased in thickness until Sept. 1899, when it was nearly a foot thick. Towards the middle of Decr. 1899, the scum became much thinner, owing, no doubt, to the advent of cold weather. During the sharp frost from Feby. 2nd to Feby. 15th, 1900, this scum was frozen so hard at the outlet end of the tank as to easily bear the weight of a person walking upon it. Upon several occasions this frozen scum was raised up into a dome by the accumulation of gas beneath it. As the frost did not penetrate deeper than this scum, it would appear that this surface layer is a bad conductor of heat, and so to some extent would help to conserve the heat of the sewage during cold weather. During the month of Feby. 1900, the average amount of heat lost by the passage of the sewage through this tank was only 1·6° F. Since this last period of frost the scum became much thinner and not so coherent.

By the end of 1900 the effluent contained a large quantity of suspended matter, so the tank, now very full of sludge, was cleaned out. It was calculated that 28·1 per cent. of the suspended solids originally in the crude sewage had been digested.

Average of all analyses from Feby. 27th, 1899, *to Dec.* 10*th*, 1900.

Grains per gallon.	Free ammonia.	Alb. ammonia.	Oxygen absorbed in 4 hours at 80° F.	Solids.	
				Soluble.	Suspended.
Crude sewage	2·24	1·01	9·07	74·9	42·3
Effluent from septic tank (No. 1)	1·87	0·446	4·42	63·2	13·7
Percentage purification	16·5	56·1	51·2	15·6	67·6

This test was repeated under identical conditions from Jany. 1901 to Jany. 1903; the following table gives the average of analyses for that period:—

Grains per gallon.	Free ammonia.	Alb. ammonia.	Oxygen absorbed in 4 hours at 80° F.	Solids.	
				Soluble.	Suspended.
Crude sewage	2·46	0·741	8·07	77·1	42·5
Effluent from septic tank (No. 1)	1·85	0·385	4·52	63·1	15·2
Percentage Purification	24·8	48·0	43·9	18·1	64·2

A point of great importance to settle is the question as to which rate of flow through these tanks gives the best results. With the object of obtaining some data bearing on this subject, experiments were instituted with three tanks, similar in every respect, through which sewage was passed at rates which would fill the tanks in 12, 24, 48 and 72 hours respectively.

Throughout the year 1900 No. 1 Tank was working at the 24 hours rate, No. 2 Tank at the 48 hours rate and No. 3 Tank at the 12 hours rate.

The effluent from the latter tank was unsatisfactory and contained too much suspended matter, so No. 3 was emptied and worked at the 72 hours rate during 1901 and 1902; the crude sewage during 1901 and 1902 contained less oxidisable matter than in 1900.

Average of analyses referring to the effect of different rates of flow through open septic tanks.

Grains per gallon.	12 hours flow. (1900.)		24 hours flow. (1900.)		48 hours flow. (1900.)		72 hours flow. (1901–2.)	
	Analysis.	Purification.	Analysis.	Purification.	Analysis.	Purification.	Analysis.	Purification.
		Per cent.		Per cent.		Per cent.		Per cent.
Free ammonia	1·56	32·8	1·94	23·5	1·62	30·2	1·79	27·2
Alb. ammonia	0·540	44·4	0·465	52·2	0·387	60·2	0·343	53·9
Oxygen absorbed in 4 hours at 80° F.	5·21	41·5	4·83	45·8	4·30	51·9	3·59	55·5
Soluble solids	68·5	—	60·6	—	67·7	—	64·0	—
Suspended solids............	19·2	50·7	15·1	61·2	10·9	72·0	9·9	76·7

These results show that any increase of flow above what is sufficient to fill the tank in 24 hours is attended by a corresponding decrease in the quality of the effluent, whilst a reduction of speed to the 48 and 72 hours rate, gives very little advantage.

Sludge digestion.—In order to eliminate all possible errors in estimating sludge digestion, the three tanks Nos. 1, 2, and 3 were each worked at the 24 hours' rate throughout 1903 and 1904 with the intention of getting a joint estimation based on the combined data; samples were taken every hour, day and night throughout the whole period and these were averaged every 24 hours.

Average of analyses made from January 15*th*, 1903, *to December* 18*th*, 1904.

Grains per gallon.	Free ammonia.	Alb. ammonia.	Oxygen absorbed in 4 hours at 80° F.	Solids.	
				Soluble.	Suspended.
Sewage sent into tanks	1·62	0·434	5·79	66·3	33·2
Effluent from the tanks	0·926	0·303	4·18	62·6	12·7
Percentage purification	42·8	30·2	27·8	5·5	61·7

At the close of the period the tanks were all emptied.

Total volume of sludge in tanks, represented 299·4 tons dry solids
Dry solid matter removed as scum ... = 1·5 ,, ,,

Total undigested dry solids .... = 300·9
Deduct sludge left in for inoculation... = 15·3

Dry solids derived from sewage .... = 285·6

Total volume of sewage treated in the tanks .... = 470,300,000 gallons
At 33·2 grs. per gallon suspended solids, this .... = 996·0 tons dry solids
Effluent carried away 12·7 grs. per gallon = 381·0 ,, ,,

Dry solids deposited in tank .... = 615·0
Dry solids left in tank .... = 286·0

Solids digested by septic action .... = 329·0

This digestion amounts to 33·0 per cent. of solids originally in the sewage. Therefore septic tanks treating Leeds crude sewage at the 24 hours rate digest 33 per cent. of the solids originally in the sewage and 53 per cent. of what was deposited in the tank.

Tanks in series.—It is evident that only partial digestion takes place in septic tanks and some sludge must be removed from time to time, hence it is important to know whether it is better to use a number of tanks independently, or to work them all or part of them in series.

An experiment on a large scale was started in June, 1899, with four new tanks in series. Their collective capacity was 2,000,000 gallons, and the flow of sewage was regulated at 2,000,000 gallons per 24 hours, the whole flow passing through the first tank, and in succession through the series. The sewage was taken from Nos. 1 and 2 precipitation tanks, so that all the grit and some of the grosser solids were already removed from it.

It was anticipated that working in series, the greater part of the sludge would be retained by the earlier tanks, and that the effluent passing from the last tank would be more free from solids in suspension than the effluent from tanks acting independently. Work was started on June 12th, 1899, and before two months were completed the experiment was necessarily stopped on August 4th because the first tank of the series was absolutely choked with very heavy sludge, some of it rising in islands above the water level, leaving channels through which the sewage flowed forward to the other tanks. No septic action had commenced in the first tank. After stagnating for a month a slow septic fermentation developed, this was hastened by passing a small flow from an active septic tank through the choked tank. As a result, very active septic conditions set in, with violent evolutions of gas, and a thick scum was formed. After a fortnight the septic flow was replaced by 50,000 gallons of sewage per day. The resulting effluent was very offensive, large volumes of gas escaped, and the deposit gradually decreased. After a month the flow of sewage at the 24 hours rate was resumed, without removing sludge from any of the tanks. It was not necessary to clean out the first tank for 12 months; the rest of the series, receiving only the lighter suspended matter, were able to run for three years before removal of sludge became imperative.

The effluents obtained from this series of tanks were practically identical with those obtained from single tanks, hence no advantage was obtained in the direction of a clearer effluent, as had been hoped at first. Evidently the rising bubbles of gas cause an almost constant amount of fine suspended matter to be carried away in the effluent for a given flow and depth of tank. On the other hand there may be some gain in using tanks in series, especially if the first were in duplicate, because all the heavier sewage solids and the thickest scum will be confined to the first tank, which can be more easily and frequently cleaned out, the other tanks working continuously for several years.

Heated septic tanks.—Sir Wm. Ramsay, a member of the Royal Commission, having called attention to the activity of septic tanks he had noticed at Bombay, in a hot climate, the question arose, to what extent is it worth while to heat the sewage going into the tanks? It was thought likely that this would lead to such greater bacterial activity that a smaller area of tanks would be necessary—that is, that a more rapid rate of flow would be possible, and that the digestion of the settled matter would be much greater. Four small tanks were specially built, all of the same dimensions, and having a capacity of 5,837 gallons each. The sewage used was finely screened, and was delivered into the tanks in such a manner that no selective action occurred, each tank getting the same strength of sewage. The sewage sent into the first tank was not heated, that sent into the others was heated to 70° F., 85° F., and 100° F. respectively by means of the injection of steam. The experiment was started on April 24th, 1903, and continued until May 16th, 1904. Nothing more than a thin frothy scum was ever noticed on any of the tanks, and in every respect they behaved as ordinary septic tanks.

The following table gives the average of all analyses made from April, 1903, to May, 1904, and also the percentage purification brought about in each tank:—

Test. (Grains per gallon.)	Effluent from tank at normal temperature.		Effluent from tank at 70° F.		Effluent from tank at 85° F.		Effluent from tank at 100° F.		Sewage.
	Analysis	Percentage Purification.	Analysis.	Percentage Purification.	Analysis.	Percentage Purification.	Analysis.	Percentage Purification.	Analysis.
Free ammonia ...	0·928	41·2	0·920	41·0	0·913	41·4	0·894	42·7	1·56
Alb. ammonia ...	0·287	33·7	0·251	42·4	0·255	41·5	0·251	42·4	0·430
Oxygen absorbed in 4 hours at 80° F.	3·72	47·6	3·69	48·0	3·61	49·1	3·51	50·5	7·09
Soluble solids	63·5	7·0	61·6	9·8	61·7	9·6	60·8	10·9	68·3
Supended solids ..	10·5	71·2	10·8	69·6	9·4	74·2	8·6	76·4	36·5

The above analyses show rather better results from the heated tanks, but not such as would warrant the cost of heating.

The sludge digestion in the four tanks is as follows:—

Tank.	Solids in tank (undigested).	Solids in effluent (undigested).	Total undigested dry solids.	Dry solids entering tank with sewage.	Percentage digestion of sewage solids.
	lb.	lb.	lb.	lb.	
Normal	4939	2990	7929	10,393	23·7
70° F.	5536	3075	8611	10,393	17·1
85° F.	5452	2677	8129	10,393	21·8
100° F.	6507	2449	8956	10,393	13·8

It is evident from these figures that there is no increase in sludge digestion obtained by warming the sewage in the tanks, in fact, it seems probable that under normal atmospheric conditions, with a 24 hours flow, all matter is digested that is capable of digestion.

Septic tank gas.—In order to determine the rate of gas production during septic fermentation, Mr. Harrison conducted an interesting experiment with an iron tank of 1000 gallons capacity and 4 feet deep. Sewage was passed through the tank at the 24 hours rate and the gas estimated by measuring the proportion collected under an inverted funnel, 207 sq. inches in area. The tank, started on Dec. 28th, 1900, did not become septic until the middle of May, 1901. The evolution of gas was most active towards the end of August, when 3·6 cb. ft. of gas were evolved from every 100 gallons of sewage treated. The average gas production for the period, May to November, was 1·5 cb. ft.

per 100 gallons of sewage. The rate of gas production was found to vary directly with the temperature of the sewage; variations of barometric pressure did not appear to affect the rate.

In order to test the accuracy of these results for a large tank, during February and March, 1906, I carried out a series of observations with No. 1 Septic Tank (250,000 gallons capacity). The inverted funnel for collecting the gas was floated out on a raft about five yards from the side of the tank. The average volume of gas liberated during the two months was 1·33 cb. ft. per 100 gallons of sewage entering tank. The minimum result, namely 1·23 cb. ft. per 100 gallons of sewage was obtained during the first few days of February, when there was no scum on the tank; from this date, the escape of gas became more vigorous until by the end of March the leeward side of the tank was covered with a surface layer about four inches thick. Judging from the volumes of gas measured, it would be reasonable to assume that the average for a whole year would be a little over 1 cb. ft. per 100 gallons of sewage treated in septic tanks with a 24 hours flow. As might be anticipated from the quantity of iron in Leeds sewage, septic tank gas is free from hydrogen sulphide, mercaptans, etc., for I have passed as much as seven litres of the gas through potassium hydroxide solution containing a little bromine, but when acidified the liquid only gave a slight opalescence with barium chloride solution. Several attempts were made to estimate hydrogen in the gas by means of palladium asbestos, but no absorption was obtained that might not be due to errors of working.

The various samples of gas collected were analysed in Hempel's apparatus. Their composition was found to be remarkably constant, and the average result did not differ much from the analysis given below. During the analyses an absorption of gas by both acid and ammoniacal cuprous chloride took place, which amounted to from 0·2—0·6 per cent. of the volume treated. As it was obviously unsafe to draw any conclusion from this curious observation with regard to the presence of carbon monoxide, a sample of gas was analysed with Dittmar's apparatus very carefully. The average volume composition of the gas was:—Carbon monoxide, 0·6 per cent.; carbon dioxide, 5·7 per cent.; methane, 86·0 per cent.; nitrogen, 7·4 per cent. The blood test for carbon monoxide was carried out with various quantities of the gas. The most positive indications were obtained as follows:—2 c.c. of dilute blood (1 : 100) was shaken with 500 c.c. of gas for 15 minutes. The liquid assumed the characteristic pink tint, but on reduction with 12 drops ammonium sulphide the absorption bands were very faint; they disappeared entirely in the blank test with air. On repeating the test the absorption was sufficient to distinguish the two separate dark bands; with a more delicate spectroscope the results would have been more definite. In every case the blood solution shaken with septic tank gas developed a pink tint which distinguished it from the colour of the solution shaken with air. Unfortunately at this point the septic tanks were all emptied and the tests were stopped. The gas is reported as carbon monoxide because I cannot account for the above observations in any other way, but I propose to investigate further on the first favourable opportunity. In this connection it is interesting to note that Kinnicutt (Third Report of Connecticut Sewage Commission) records that an average of analyses for 15 months of the septic tank gas at Worcester (Mass.), demonstrated the presence of 0·34 per cent. of gas absorbed by ammoniacal cuprous chloride, but he failed to obtain the iodine pentoxide reaction or blood test for carbon monoxide; also an analysis of gas from the Lawrence Experimental Station (Massachusetts State Board of Health, 1899, p. 422) shows the presence of 0·6 per cent. of carbon monoxide. It is difficult to explain by what reaction carbon monoxide is evolved at the low temperature of a septic tank; possibly it may be the result of bacterial action.

Sludge Pressing.—The old system of lagooning has never been adequate to deal with the large volume of sludge produced from Leeds sewage; therefore, in order to obtain reliable data about sludge-pressing a unit of pressing plant was put down, the press was hand-closed and contained 45 cells formed with plates 32 inches square. It produced from 12 to 13 cwts. of cake per filling. The press was filled from a spherical ram by means of compressed air at 100 lbs. per square inch. The sludge entering the storage tank was screened through a steel plate perforated with inch holes to retain match stalks, hair, etc., which choked the feed pipe in the press and caused the plates to break, if not removed by screening. The first attempts to press septic sludge were made in March, 1907, with sludge containing 87·2 per cent. of water from No. 1 Tank. This tank had only been working about four months, hence the undigested fibre in it aided the formation of cake. At the beginning no lime was added to the sludge, the first pressing lasted 3·5 hours and produced a cake which was not formed properly in the centre of the plates, but the drier portions at the corners contained 67 per cent. of water. The other pressings gave similar results; the best cake contained 61 per cent. of water around the circumference. With the addition of 1 per cent. of lime to the wet sludge, the results did not improve much; sometimes the cakes were very soft in the middle after 3·5 hours' pressing. On the average the drier portions contained 62 per cent. of moisture. Increased quantities of lime did not appear to produce a corresponding improvement in the process, probably because the filter cloths became choked up. for it was extremely difficult to remove the cake completely. The pressing was most satisfactory when the proportion of grit and unaltered fibre was high.

In July, 1907, further trials were made with septic sludge from No. 4 Tank, which was almost free from fibrous material. Although the filter cloths were quite new the press was filled time after time without obtaining satisfactory cake. The addition of 1 per cent. of lime to the sludge did not improve matters, but with 2 per cent. fairly good cake was produced in 1·75 hours. With 3 per cent. of lime a good cake was consistently turned out in 1·25 hours. Here again there was the difficulty of removing the cake from the cloths; the hard scraping necessary for that purpose and the rotting action of the excess of lime in the press effluent would materially increase the cost of pressing septic sludge. The table below gives the average results for septic sludge pressed under the best conditions, and for comparison the average results of a very large number of pressings of settled sludge, free from precipitant, are given. It will thus be seen that with the unsepticised sludge it is easy to obtain good cake in less than an hour with 1 per cent. of lime. This cake does not adhere to the cloths and can be disposed of with minimum labour.

Sludge from—	Water in sludge.	Gallons of sludge pressed.	Lime added.	Cake produced.	Time pressing.	Water in cake.	Volatile matter.	Mineral residue.
	Per cent.		Per cent.	lb.	hours.	Per cent.	Per cent.	Per cent.
No. 1 septic	87·2	405	1	1310	2·7	61·8	13·9	24·3
No. 4 ,,	92·2	471	3	1306	1·25	58·9	11·3	29·8
Settling tank	92·1	513	1	1204	0·8	59·0	18·3	22·7

The following table gives the average of a series of analyses of septic and ordinary sludge cake :—

	No. of analyses.	Volatile matter.	Total carbon.	Fixed carbon.	Total nitrogen.	Phosphate. $Ca_3(PO_4)_2$	Mineral matter.	Water.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Septic sludge cake	7	13·4	6·43	2·10	0·94	—	25·6	61·0
Settled sludge cake	35	19·7	12·87	3·74	1·00	1·34	22·3	58·0

Calculating from the percentage of mineral matter in the two types of sludge cake, a digestion of 20 per cent. of the settled sludge would account for the changes in composition as it became septic.

A similar notable increase in the mineral constituent takes place in the sewage as it passes through the septic tank ; it is found that in crude sewage 82 per cent. of the soluble solids and 36 per cent. of the suspended solids are inorganic, whereas in septic effluent 83·2 per cent. of the soluble solids and as much as 51·8 per cent. of the suspended matter is mineral residue.

Bacteriological tests.—In recent years our knowledge of bacteriology has increased rapidly, and it is of practical importance to accumulate observations on the effect of sewage treatment upon those abundant organisms which are used as indicators of sewage contamination. At the same time, the bacteriological character of an effluents is of secondary importance to its chemical nature when it is discharged into a non-potable stream, for example, in the case of bacteria beds the oxidation of putrescible matter is so rapid that there is not a corresponding decrease in the number of putrefactive bacteria. On the other hand, in dealing with drinking water it is rather the bacteria associated with the organic matter, than the matter itself, which are the source of danger, hence the bacteriological tests are of more significance than the chemical analyses. The enumeration of the millions of bacteria in sewage and effluents is subject to grave limitations, and is of little value alone, for it only means that under the conditions of the test a certain number are able to multiply, but this number varies with the composition of the medium, time and temperature of incubation, etc.

The number of species of organisms in sewage is very large, and the relative numbers of the various groups has not yet been determined with sufficient thoroughness to make them useful as indicators of sewage pollution, except for *B. Coli*, *B. Enteriditis sporogenes* and *Streptococci.* Further prolonged investigation is necessary in this direction in order to find some bacterial standard which will harmonise with the chemical ones, in cases where the effluents enter a non-drinking water stream.

In view of the increasing importance of bacteriological knowledge to those who have to deal with the purification of sewage, a laboratory was established at Knostrop, but the results have not been very encouraging up to the present. The methods of examination used, are those indicated by Dr. Houston in the Second Report of the Royal Commission on Sewage Disposal, 1902, pages 135-153. The table given below is the result of the analyses of twenty sets of samples of sewage and septic effluent from April, 1906, to June, 1907 :—

Sample.	Total No. of bacteria. at 22° C.	Total No. of bacteria at 37° C.	Liquefying bateeria.	Spores of aerobic bacteria.	Indol test.	*Enteriditis sporogenes* test.	Bile salt broth test.
Crude sewage	3,886,000	1,190,000	156,000	7500	more than 100,000	1000 to 10,000	more than 100,000
Septic effluent	2,960,000	1,304,000	47,200	3900	10,000 to 100,000	100 to 1000	10,000 to 100,000

The "indol" and "bile salt broth" tests indicate that the passage of sewage through septic tanks causes considerable diminution in the number of non-sporing microbes of intestinal origin, chiefly of the *B. Coli* type. A similar decrease is also evident in the number of spores of *B. Enteriditis sporogenes* and allied anaerobic spores. The value of these tests for routine purposes is still a matter of discussion amongst bacteriologists.

Summary and conclusions.—The organic content of sewage is extremely complex ; the changes which take place during purification may be classed as hydrolysis and oxidation, yet both processes go on more or less simultaneously according to the method of purification employed. Speaking in general terms, the albuminoid substances (gelatin, fibrin, myosin, albumin, &c.), in sewage are broken down by the hydrolytic action of enzymes derived from bacteria and other fungi, into simpler bodies such as amino-acids (glycine, alanine, leucine, tyrosine) ureides, ptomaines, amines, &c., and certain aromatic compounds like phenol and indol. These are again transformed into fatty acids, ammonia, and its derivatives, urea, &c., which are finally oxidised. Of the carbohydrates present, sugars, starches and gums hydrolyse rapidly ; cellulose is digested much more slowly by the action of *B. Amylobacter* and other organisms. The fats in sewage are also decomposed by bacterial action into simpler fatty acids and glycerine, which finally yield carbonates and gaseous products. An accessory reaction to all these complicated changes is the formation of a humus substance, characterised by a high percentage of carbon and a low percentage of hydrogen, which is very stable.

It is important to remember that where a town is some miles from its outfall works, these hydrolytic changes, and also partial oxidation, take place to a large extent in the sewer itself ; the average velocity in the Leeds trunk sewer is 2·8 ft. per second, hence sewage takes about 1½ hours to reach the works from the centre of the city, consequently the solids are very largely disintegrated and a considerable amount has passed into solution before the sewage is treated in any way.

It is now no longer held that septic treatment is a necessary adjunct to successful sewage disposal, but it may be reasonably asked whether the changes which take place in the septic tank are not beneficial to the subsequent oxidation of the liquid on filter beds.

This point was tested both in the case of contact beds and percolating filters. Nos. 7 and 8 contact beds both contained clinker less than 1 inch diameter, and were 3½ feet deep. No. 7 bed was fed with effluent from lime precipitation (3 grains per gallon of lime) and No. 8 treated septic effluent, each at three fillings per day with 2 hours' contact. The capacity of both beds fell to about one-third of the original sewage capacity in six months.

A comparison of the results may be made for the following table :—

Average of analyses—March to October, 1899.

Grains per gallon.	Free ammonia.	Alb. ammonia.	Oxygen absorbed in 4 hours at 80° F.	Nitrogen as nitrates.	Suspended solids.
Crude sewage	2·22	1·05	9·09	—	44·1
Lime effluent	1·76	0·434	4·53	—	9·4
Filtrate from No. 7 Bed	1·25	0·165	1·02	0·05	4·5
Percentage purification effected on crude sewage	43	84	88	—	89
Septic tank effluent	1·83	0·445	4·18	—	13·0
Filtrates from No. 8 Bed	1·24	0·164	1·06	0·05	6·7
Percentage purification effected on crude sewage	44	84	88	—	84

It will be seen that for liquids of similar composition one septic and the other not, treated by single contact on similar filters, the purification effected is practically identical.

No. 2 percolating bed was filled with hard gas coke 1½ in. to 2 in. diameter to a depth of 9 ft. 6 in. It treated septic effluent containing 12·5 grains per gallon suspended matter at the rate of 200 gallons per sq. yard per day from September 1899 to the end of 1903. The bed was then thoroughly washed out and dosed with settled sewage at the same rate during 1904. It was intended to obtain a settled effluent containing about the same amount of suspended matter as the septic effluent, but even with a four hours flow the suspended solids separated out too rapidly for exact comparison.

Average analyses for No. 2 percolating bed.

Grains per gallon.	Free ammonia.	Alb. ammonia.	Oxygen absorbed in 4 hours at 80° F.	Nitrogen as nitrates.	Suspended solids.
Crude sewage	2·24	0·764	8·24	—	41·9
Septic effluent	1·66	0·379	4·25	—	12·5
Filtrate	0·434	0·125	1·12	0·76	8·0
Percentage purification effected on the sewage	80·6	84·9	86·4	—	80·9
Screened sewage ..	1·63	0·582	7·94	—	40·7
Settled sewage	1·48	0·338	3·90	—	8·5
Filtrate	0·262	0·115	1·11	0·90	8·5
Percentage purification effected on sewage..........	83·9	80·2	86·0	—	79·1

Therefore it would appear that an effluent from settling tanks is as readily oxidised on percolating beds as septic effluent is. Although the conditions in these two comparative experiments are not absolutely identical, yet the results are strong proof that preliminary septic treatment possesses no advantage over the other method of removing suspended matter with reference to the oxidation of the respective effluents.

Suspended matter in septic effluent.—It does not seem possible to reduce the suspended matter in sewage below 10—12 grains per gallon by septic treatment, an amount which is undesirably large; for such an effluent rapidly decreases the capacity of contact beds, and if oxidised on percolating beds, some system of settling tanks or straining filters must be employed to reduce suspended solids from the bed effluent to, say, 3—4 grains per gallon. At Blackburn the difficulty is overcome by precipitating the liquid from the septic tanks with a small quantity of lime before it enters the beds. It is also found that the scum on septic tanks is erratic in its behaviour and tends to produce inconvenient flushes of solids in the effluent, especially after heavy rain. This scum is not a necessity for septic action and it is an advantage to remove it by taking off a strip about 2 yards wide along the leeward side of the tank; the remaining scum then drifts in and can be gradually cleared off. When the surface of the tank is kept free from thick scum in this way the flushes of suspended matter are not serious.

Tankage.—One very grave disadvantage of a septic installation is that the capacity of the tanks is more than double that required for settlement or precipitation, where an 8 hours flow is sufficient.

The smell nuisance.—At Leeds, it has been previously pointed out that there is no serious objection to septic tanks themselves in this respect, but there would be great danger of nuisance if the effluent had to be sprayed over a large acreage of beds.

Storm water.—It is important that the method employed for clarifying sewage should be elastic with regard to the volume treated, so that it may deal with large volumes of storm water at intervals. It is clear that septic action does not fulfil this condition satisfactorily, for a sudden increase of flow would carry large quantities of solids on to the beds: probably the storm sewage would have to be treated by other means.

On the other hand precipitation tanks can readily cope with storm water, for the solids separate out more rapidly than from normal sewage.

Sludge digestion and treatment.—The pre-eminent advantage of the septic tank is, of course, the digestion of part of the sludge. From the early part of this paper it is apparent that the deposited solids are reduced to a minimum, comparatively quickly, beyond which no further digestion takes place. Various estimates have been given but it would not be safe to calculate on more than 30 per cent. digestion of the solids originally in Leeds sewage. Unfortunately this advantage is more apparent than real because of the nature of the residual sludge. Septic sludge usually contains 82—85 per cent. of water and it is so dense that it is necessary to dilute it and force it towards the sludge valves by manual labour. This process has to be continued in the culverts as well; here the gas liberated, as the men move about in this sludge, must be injurious to health and there is grave risk of an explosion. We have had men burned about the hands and face in this way, but the ignition of the gas has never taken place with explosive violence. At a works where the culverts could be built with considerable fall much of this disagreeable manual labour could be avoided. Although the decomposition of grease in the septic tank causes septic sludge to be less objectionable than ordinary sludge when drying in open lagoon, because of the absence of the disgusting smell of rancid fat, nevertheless it is most unsatisfactory to press. In fact the Leeds septic sludge cannot be pressed without excessive cost in lime, filter cloths and labour. Briefly the position at Leeds may be stated thus:—although the use of septic tanks offers a decided advantage from the point of view of sludge production, the process has been rejected for the following reasons:—

(1.) The capital cost in tankage would be more than double that of other systems.

(2.) The danger of nuisance from what is essentially a putrefactive decomposition giving rise to gases which are objectionable in both their hygienic and æsthetic aspect.

(3.) The inelasiticity of the system for dealing with sudden increases of volume due to storm water.

(4.) The sludge disposal difficulty.

(5.) The cost of providing a process for removing solids from the oxidised effluent.

Moreover, beyond the considerations just summarised, it is desirable that those who are responsible for the removal of the waste products of our great centres of population, without jeopardising the health of the community, should aim at a rapid method of sewage disposal. It is better to concentrate our attention on obtaining a system by which the suspended matter in sewage can be expeditiously removed and disposed of, and the liquid impurities quickly oxidised so that in a few hours sewage may be discharged into the river as a harmless non-putrefactive liquid, rather than adopt a process by which the sewage is allowed to putrefy at the works for many hours before it is rendered innocuous.

Finally, I wish to express my thanks to my assistant, Mr. Wood, for help in the preparation of this paper.

Discussion.

Mr. F. W. Branson asked if septic tank treatment would be suitable for small townships where only domestic sewage was dealt with.

Prof. W. M. Gardner was surprised at the result of the experiments, since he had understood that the septic tank treatment offered at any rate a partial solution of the sewage problem. From the point of view of expense, however, other methods were more satisfactory and also, it appeared, might have superior efficiency. The sewage of each town had to be treated as a separate problem. Bradford, for instance, had a sewage which required special treatment on account of the unusually large proportion of grease from the waste liquors of the wool-combing industry.

Mr. W. McD. Mackey thought the record of experiments given in the paper, like those conducted at Manchester, would provide valuable information for those interested in the sewage disposal problem. Since the paper seemed to throw doubt on the efficiency of the septic tank treatment of sewages from large manufacturing towns, he supposed precipitation processes would be resumed. Looking at the matter from a national standpoint, the whole subject of sewage disposal merited serious consideration, as it seemed a pity that valuable manurial material had to be destroyed when so much manure was imported annually.

Mr. J. H. Wright said that sewages varied greatly, the same sewage changing from hour to hour. It was difficult to devise methods of treatment unless the periodic variation was known. He would like to see a characteristic analysis of Leeds sewage. The figure for albuminoid ammonia was of value, since in septic tank treatment it showed to what extent the matter was being broken up. Precipitation and filtration over land were now generally employed in dealing with sewages from large cities like Leeds or Bradford, but septic tank treatment was suitable for small sewage farms. The oxygen absorption figure should be obtained for every operation which went on. He was surprised to see that the pressed cake contained so much water, and thought it would be a valuable manure from the high percentage of phosphates present. He also asked about the figure for nitrates, since this, in conjunction with the albuminoid ammonia figure, gave valuable information as regards the purification going on in the filter beds.

Mr. S. H. Davies asked for information with regard to the oxidising and nitrifying processes on the filters. Mr. Thompson did not appear to attach much importance to anaerobic conditions in the septic tank. He also asked if the scum formed on the contents of septic tanks had any value in securing anaerobic conditions. He suggested an experiment in the cultivation of various species of bacteria in sterilised sewage in small tanks, which could then be introduced into the larger septic tanks containing the crude sewage, with a view to establishing a predominant growth of those forms which would secure the best "digestion" of the sewage. Would the addition of sawdust be useful in obtaining the fibrous condition essential to the more complete pressing of septic sludge? Had the addition of lime any effect on the bacteria of the contact beds? In York, septic tank treatment followed by continuous filtration was adopted.

Mr. J. T. Thompson, in reply, said the sewage question was still unsolved. The value of sewage as a manure was not very great, and the sludge cake was little better than a rich soil but very useful for improving heavy clay land. It was not wise to generalise on the question, since sewages varied so much, but he should say that septic tank treatment would probably be satisfactory in dealing with domestic sewage, especially if the sludge could be disposed of without pressing. Full tables of analysis were given in the paper, from which it would be seen that Leeds sewage was more dilute than that of many other large towns. The processes described were only preliminary ones, and therefore he had not dealt with nitration or oxidation, which obviously could not take place in septic tanks. He thought the scum on the liquid would be of some value in maintaining anaerobic conditions. Mr. Davies' suggestion of cultivating one species of bacteria would no doubt be interesting as a laboratory experiment, but was impossible and indeed unnecessary on a large scale, for sewage teemed with useful bacteria. He had never tried mixing sawdust with septic sludge before pressing, but thought it would probably improve the process. Yet, even if good results were obtained, the addition of a quantity of sawdust to the enormous volume of sludge that Leeds produced would be unwise.

The use of precipitants, if care were taken that the tank effluent was not rendered appreciably alkaline thereby, was not detrimental to the subsequent oxidation on bacteria beds.

Journal and Patent Literature.

Patent Specifications may be obtained by post by remitting as follows:—

***English.*—8*d*. each, to the Comptroller of the Patent Office, C. N. Dalton, Esq., Southampton Buildings, Chancery Lane, London, W.C.**

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***French.*—1 fr. 25 c. each, to Belin et Cie, 56, Rue des Francs-Bourgeois, Paris (3e.).**

I.—PLANT, APPARATUS, AND MACHINERY

Patents.

Regenerative gas furnaces. F. C. Siemens, London. Eng. Pat. 13,804, June 14, 1907.

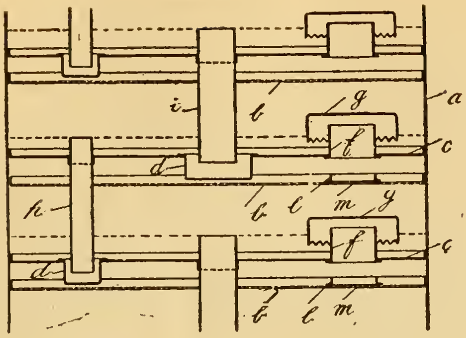
See Addition of Aug. 17, 1907, to Fr. Pat. 339,323 of 1904; this J., 1908, 113.—T. F. B.

Barrels and the like wooden receptacles; Process for rendering —— impermeable. L. Heim, Nimes, France. Eng. Pat. 16,150, July 13, 1907. Under Int. Conv., July 19, 1906.

A boiling solution of glue and potassium bichromate is introduced into the cask, which is then closed and well agitated. The steam creates a pressure which forces the solution into the pores of the wood, or, if desired, compressed air may be used to assist the penetration. The cask is afterwards opened and the excess of solution is allowed to drain out, after which a jet of steam is introduced into the cask through a perforated nozzle for the purpose of removing any scum and deposit, so that the interior surface of the cask is left smooth and clean. The bichromated glue is then rendered insoluble by the action of the light of an electric lamp which is introduced into the cask. Any excess of bichromate is finally eliminated by reduction with sulphurous acid or a sulphite.—W. H. C.

Rectifying column. T. Artmann, Vaals, Holland. Eng. Pat. 19,780, Sept. 4, 1907.

The claim is for the combination of "bell bottoms" with "sieve bottoms" in the segments forming the column. The "bell bottoms" are formed by solid partitions, *c*, which extend across the column casing, *a*, and which are each provided with several vapour pipes, *f*, covered by hoods, *g*. A short distance below the partitions, *c*, the "sieve bottoms," *b*, are placed, formed of perforated plates with vapour openings, *m*, provided with shallow

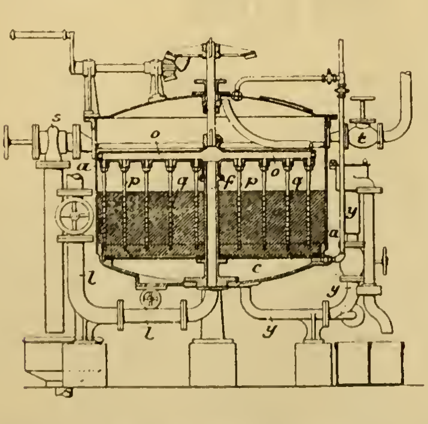


upstanding rims, *l*, immediately beneath the vapour pipes, *f*. The partitions, *c*, are provided with overflow pipes, *i*, and *h*, which dip into the cups, *d*, of the partition next below. These overflow pipes are placed alternately at the centre as at *i*, and at the periphery as at *h*. In the former case there is only one pipe, *i*, of large diameter, and in the latter there are several pipes, *h*, of smaller diameter, the sum of the cross-sections of the pipes, *h*, being made equal to that of the central pipe, *i*. The object of the arrangement is to cause the condensed liquid flowing down the column to pass alternately from the centre to the circumference and *vice versa*. The vapours rising from the still pass first through the perforations in the plate, *b*, and the opening, *m*, and then through the pipes, *f*, and under the hoods, *g*. They are thus first washed by the shallow layer of liquid on the plates, *b*, and then bubble through the layer of liquid on the plates, *c*. It is stated that the efficiency of a column constructed in this manner is very high.—W. H. C.

Filters; Recovery ——. M. Lamort, Paris. Eng. Pat. 22,732, Oct. 15, 1907. Under Int. Conv., Nov. 5, 1906.

The claim is for an improvement in the process of detaching the deposit from the metal gauze filter described in Eng. Pat. 11,925 of 1907 (this J., 1907, 999), and consists in replacing the mechanical beater by a blast of air, delivered from a vessel having a longitudinal slot extending across the whole width of the gauze.—W. H. C.

Filter. L. Hirt, Assignor to Maschinenfabrik Grevenbroich, Grevenbroich, Germany. U.S. Pat. 879,963, Feb. 25, 1908.



The vessel, *a*, has a perforated false bottom, *c*, on which the filtering medium is supported. The liquid to be filtered enters at *t*, and the filtrate passes away by the pipes, *y*. When it is necessary to cleanse the filtering medium, water is forced from the pipe, *l*, through the hollow, vertical, rotatable shaft, *f*, and passes through the hollow horizontal arms, *o*, into the perforated pipes, *p*, *q*, which depend into the filtering medium. The wash-water along with the impurities flows away through the pipe, *s*.—W. H. C.

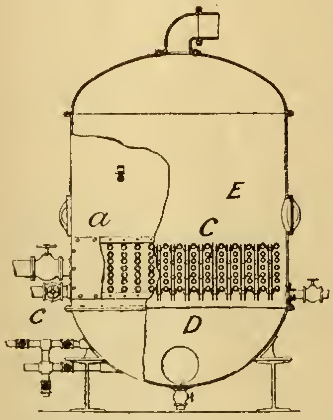
Filter and hydraulic press; Combined ——. M. A. Smith, New York. U.S. Pat. 880,588, March 3, 1908.

A filter-press having circular frames or rings covered with filter-cloth and a central feed aperture, has " heads " arranged between each pair of rings. When charged the material is compressed by a horizontal hydraulic ram, situated at one end of the press, which forces the " heads " together.—W. H. C.

Pump for corrosive fluids. E. Morterud, Torderöd, Norway. U.S. Pat. 879,484, Feb. 18, 1908.

The shaft near the pump wheel is surrounded by an annular space. A conduit containing a non-corrosive liquid connects this space with the pressure side of the pump; means are also provided for cooling the liquid in the conduit.—A. G. L.

Evaporator. P. G. Kaiser, Chicago. Ill. U.S. Pat. 880,080, Feb. 25, 1908.



The apparatus consists of a liquor-chamber, D, a vapour-chamber, E, and a tubular heater, C. The latter consists of a number of rows of superposed horizontal pipes, the ends of which pass through and are expanded into the side of the vessel where they are surrounded by the steamchest, *a'*. Vertical plates are arranged between each row of pipes to facilitate the circulation of the liquid.—W. H. C.

Evaporating apparatus. G. P. McArthur, Rockledge, Pa. U.S. Pat. 880,812, March 3, 1908.

Several evaporating vessels are connected together by movable jointed pipes so that they can be arranged to work in any order of succession desired.—W. H. C.

Vacuum-pan. A. P. Smith, Philadelphia, Pa. U.S. Pat. 881,351, March 10, 1908.

Each pan of the series consists of a chamber having in its lower portion a vertical tubular heater with a relatively large central return pipe. The steam enters the steam space of the heater at " quadrantal " points and the liquor to be evaporated enters by a pipe connected to a perforated ring fixed beneath the tubes, over which a perforated baffle-plate is placed. The concentrated liquor collects at the lowest portion of the pan, whence it is conducted by a pipe to the perforated ring of the next pan. —W. H. C.

Evaporation; Apparatus for continuous ——. H. Winter, Charlottenburg, Germany. U.S. Pat. 881,523, March 10, 1908.

Vertical tubular heaters having an oblique upper tube plate are arranged in pairs in a casing. The collecting chambers of each pair of heaters are connected at their lower extremities with the heating portion of the next pair.—W. H. C.

II.—FUEL, GAS, AND LIGHT.

Ignition temperatures of gaseous mixtures. K. G. Falk. J. Amer. Chem. Soc., 1907, 29, 1536—57.

It is stated that although much work has been done on the determination of the ignition temperatures of mixtures of hydrogen and oxygen, comparatively little has been done with mixtures of other gases. The new method consisted in instantaneously compressing the mixtures, enclosed in a suitable vessel. This compression raises the temperature of the gas, and if carried out with sufficient rapidity is adiabatic, no heat being lost by radiation or conduction. The rise in temperature of the mixture may then be calculated from the initial and final volumes of the gas, its initial temperature, and the ratio of the specific heats of the gas at constant pressure and constant volume.

The possible errors due (*a*) to the adiabatic law not being strictly true under the conditions of the experiments and (*b*) to incorrect determinations of the final volumes, are small and act in opposite directions. The determinations were made with the gases saturated with water vapour at the ordinary temperature, and a correction was introduced for the cooling effect of the water vapour. The average ignition temperatures (absolute) found were: $4H_2+O_2$, 878° C.; $2H_2+O_2$, 813°; H_2+O_2, 787°; H_2+2O_2, 803°; H_2+4O_2, 844°; $6CO+O_2$, 994°; $4CO+O_2$, 901°; $2CO+O_2$, 874°; $CO+O_2$, 904°; $H_2+O_2+N_2$, 820°; $H_2+O_2+2N_2$, 851°; $H_2+O_2+4N_2$, 910°; $2H_2+O_2+N_2$, 846°; $2H_2+O_2+4N_2$, 922°; $H_2+2O_2+N_2$, 837°; $H_2+2O_2+4N_2$, 914°; $2CO+O_2+N_2$, 917°; $2CO+O_2+2N_2$, 958°; $CO+O_2+N_2$, 979°; $CO+O_2+2N_2$, 1085°; $4CO+O_2+N_2$, 925°; $4CO+O_2+2N_2$, 940°; H_2+O_2+CO, 812°; H_2+O_2+2CO, 851°; H_2+O_2+4CO, 898°; $2H_2+O_2+2CO$, 877°; $2H_2+O_2+4CO$, 938°; H_2+2O_2+CO, 869°; H_2+2O_2+4CO, 888°; $2H_2+3O_2+2CO$, 825°. It is shown how the ignition temperature of any mixture of H_2, CO, O_2, and an inert gas, may be calculated by the aid of empirical equations obtained from these results. In the portion of the paper on the theory, assuming that the laws of kinetics for homogeneous media may be applied, the reaction between hydrogen and oxygen is shown to be bimolecular and that between carbon monoxide and oxygen to be trimolecular. Assuming the ignition temperature of a gaseous mixture to correspond to a definite reaction velocity, the effect of an inert gas may be predicted, since it reduces the concentration of each of the reacting substances, with the result that the ignition temperature is raised in order to attain the same velocity. From these data the velocity coefficient for 10° rise in temperature was calculated to be 1·31 at about 800°, and 1·13 at about 900° for the reaction between hydrogen and oxygen, 1·24 at about 900°, and 1·14 at about 1000° C. for the reaction between carbon monoxide and oxygen. The effect of the pressure was not taken into account but would show itself in decreasing these values somewhat. The reactions between hydrogen and oxygen in the presence of an excess of hydrogen and between carbon monoxide and oxygen in the presence of an excess of carbon monoxide do not follow the simple laws of chemical kinetics, when it is assumed that the gas present in excess, acts simply as an inert gas. Apparently contradictory features may in fact present themselves, in the ignition temperatures of such mixtures. For instance, the ignition temperature of a mixture of $6CO+O_2$, is 994° C., but replacing part of the carbon monoxide by nitrogen lowers the ignition temperature, so that for the mixture: $4CO+O_2+2N_2$, the value of 940° C. is found. An excess of carbon monoxide above a certain amount has a negative catalysing effect.

Gas and electric lighting; Relative hygienic values of ——. S. Rideal. J. Roy. Sanitary Institute, March, 1908. J. Gas Lighting, 1908, **101**, 613—614, 686—688.

In order to determine and compare the hygienic effects, direct and indirect, of gas and electricity in domestic lighting, the author studied: (1), the direct physiological effect of each light; (2), the indirect effect of the atmospheric changes caused by the light; and (3), the nature of these changes. The results obtained show that the products of combustion of gas, owing to the better ventilation induced, are not found in the air in anything like the proportion which might be expected; and the temperature and humidity in an occupied room are no greater with gas lighting than with electric lighting. Greater changes in the temperature and in the carbon dioxide and moisture contents of the air of a room are caused by the inmates than by the illuminant. It is concluded that neither in gas lighting nor electric lighting is there anything incompatible with the best hygienic conditions.—A. S.

Dessau vertical retorts; The four-metre and five-metre ——. H. G. Colman. J. Gas Lighting, 1908, **101**, 683—684.

In a recent paper (J. Gas Lighting, **101**, 97) Körting has published the results obtained by carbonising coal in the "Dessau" vertical retorts, using: (1), 4-metre retorts with addition of only small quantities of steam, and (2), 5-metre retorts with copious addition of steam, the chief figures obtained being given in the following table:—

	Cubic feet of gas per ton at 15° C. and 760 mm.	Illuminating power (Carpenter burner) at 15° C. and 760 mm.	Calorfic power, B.T.U. at 15° C. and 760 mm.
5-Metre retort	13478	10·80	546
4-Metre retort	11292	17·70	597
Difference ..	+2186	−6·90	−51

In discussing these results, the author of the present paper points out that the quantity of gas obtained per ton from the 5-metre retorts, and its calorific power, are almost exactly the same as would be obtained by adding about 20 per cent. of "blue" water-gas to the coal-gas obtained from the 4-metre retorts, and that, as would be expected, the increased production of gas in the former retorts is brought about substantially by the action of the larger quantity of steam on the coke in the retort. The illuminating power of the gas obtained from the 5-metre retorts is, however, reduced to a far greater extent than can be accounted for by the mere dilution of the coal-gas with 20 per cent. of water-gas, and it appears most probable that the addition of large quantities of steam to the retort, in addition to the production of water-gas, has brought about chemical changes in the coal-gas produced. The author attributes the reduction in the illuminating power to a partial decomposition of the "illuminants" and particularly of ethylene by the steam at high temperatures, the latter undergoing a partial conversion into hydrogen, carbon-monoxide and carbon dioxide.

$$C_2H_4+2H_2O=2CO+4H_2.$$
$$C_2H_4+4H_2O=2CO_2+6H_2.$$

Where it is desired to increase the make of gas from coal with only a moderate reduction of illuminating power, it is therefore advisable, if the above view is correct, to do so by dilution with "blue" water-gas made in a separate plant, rather than by producing the water-gas in the retort itself by addition of larger amounts of steam. Even where illuminating power is not required, and only the calorific power of the gas is important, the author, on the figures at present available, concludes that except in the case of small installations, the plan of diluting the gas from the 4-metre retorts with water-gas made in a separate plant will prove preferable both on the ground of more economical production, and also from the point of view of more readily obtaining gas of uniform quality.—H. G. C.

Patents.

Fuel; Artificial ——. A. V. Hassman and W. F. Puterbaugh, Elkhart, U.S.A. Eng. Pat. 9136, April 19, 1907.

See Fr. Pat. 376,874 of 1907; this J., 1907, 1041.—T. F. B.

Fuel; Preparation of ——. T. Parker. Addition, dated March 25, 1907, to Fr. Pat. 383,144, Dec. 27, 1906. Under Int. Conv., June 22, 1906.

See U.S. Pat. 865,724 of 1907; this J., 1907, 1078.—T.F.B.

Peat; Method of removing water from raw ——. N. A. Alexanderson, Stockholm, Sweden. Eng. Pat. 24,476, Nov. 5, 1907. Under Int. Conv., Dec. 24, 1906.

The peat is stacked in heaps and allowed to freeze and the ice formed melted. The freezing of the water in the peat so alters the structure of the peat cells that on subsequent compression, the greater part of the water is easily removed.—W. H. C.

Coke ; Manufacture of ——. J. H. Hillman, Pittsburg, Pa. U.S. Pat. 881,685, March 10, 1908.

THE claim is for the removal of the ashes and other light impurities from the surface of the coke produced in a longitudinal, or "Belgian" oven. When the charge is coked, the doors at either end of the oven are opened and a blast of air, introduced by a pipe through one of the openings, is directed across the surface of the coke before it is quenched. The blast of air carries the ashes and other impurities away with it through the opposite door.—W. H. C.

Retorts for the distillation of coal and other carbonaceous substances. T. Parker, London. Eng. Pat. 4067, Feb. 19, 1907.

SEE Fr. Pat. 380,017 of 1907 ; this J., 1907, 1271.—T. F. B.

Retorts for making oil gas. M. J. Keough, St. Louis, U.S.A. Eng. Pat. 8066, April 6, 1907. Under Int. Conv., April 9, 1906.

SEE U.S. Pat. 832,131 of 1906 ; this J., 1907, 42.—T. F. B.

Gas retorts. G. R. Love, Guildford, Surrey. Eng. Pat. 9859, April 27, 1907.

AN inclined retort is provided with a coal-charging and gas-tapping mouthpiece diminishing in diameter towards the charging end and inclined more steeply than the retort in order that the retort may be filled completely without the use of a shoot.—A. T. L.

Kiln or furnace with four or more retorts for coking peat, lignite, and wood. Oberbayerische Kokswerke und Fabr. Chem. Produkte, A.-G., Beuerberg, Germany. Eng. Pat. 23,097, Oct. 19, 1907. Under Int. Conv., Oct. 20, 1906.

SEE Fr. Pat. 382,742 of 1907 ; this J., 1908, 215.—T. F. B.

Generator for suction gas plant for use with bituminous or other coal. R. V. Farnham, Wemyss Bay, N.B. Eng. Pat. 5793, Mar. 11, 1907.

THE apparatus comprises a retort for the destructive distillation of the bituminous part of the coal and a generator for the gasification of the coke obtained. The generator consists of a brick-lined furnace which is preferably of the rotary type. A cylindrical retort is placed vertically inside the generator ; the coal is fed into the retort by means of a hopper and bell valve. The distillation gases are conveyed from the top of the retort into the bottom of the generator, the pipes being surrounded by water-jackets, in which steam is raised. This steam is superheated and passed into the generator. By a suitable arrangement, air is injected together with the steam. The coke made in the retort is dropped from time to time into the generator by opening a bell valve operated from outside. To start the generator, an initial charge of coke may be fed through a side hopper provided for the purpose.—R. L.

Gas-producers ; Method of operating —— *and producers therefor.* A. H. Lymn, Bromley, Kent, and J. H. Weil, London. Eng. Pat. 6491, March 18, 1907.

THE object of the invention is to obtain the gas as free from tar as possible. The air, or air and steam blast is supplied simultaneously at the top and at the bottom of the generator and the gas is taken off at an intermediate point. The gas produced in the upper part of the generator is withdrawn from a point just above the gas outlet by injectors and is re-introduced into the lower part of the lower half of the generator, or the gas may be withdrawn from a point just below the off-take and re-introduced near the top of the upper half of the generator. The gas may, if desired, be passed through a combustion chamber and be partly burnt, before its re-introduction into the producer.—W. H. C.

Gas for heating and illuminating purposes ; Apparatus for the manufacture of ——. C. B. Tully, London. Eng. Pat. 8293, April 9, 1907.

THIS invention relates to the valve mechanism in water-gas plant of the intermittent type, *i.e.*, where the hot blowing of the fuel alternates with the injection of steam for the generation of gas. The valves are of the sluice valve type ; they have a substantially vertical movement and are of sufficient weight to ensure a good fit in their seatings, when in the closed position, any dirt that may enter their casings being able to fall to the bottom without interfering with an effective closing. The snift or stack valve may be of this type or may be constructed as a hinged valve. To facilitate the opening of the blast and gas valves, these can be forced off their seats by levers preparatory to being fully opened by lifting. The valve mechanism is connected to the operating device of the air blower and gas exhauster respectively by means of pulleys and levers, and the action of the different valves may be timed through adjustable slip joints, with pin and slot, which will enable the valve to be positively moved in one direction and will allow it to move by gravity in the opposite direction at any desired moment. To prevent the presence of an explosive mixture in the blast main between the blower and the blast valve, this portion of the main is provided with a relief valve which allows its contents to escape into the atmosphere, previous to the opening of the blast valve.—R. L.

Gas-producer. H. I. Lea, Pittsburg, Pa., Assignor to The Westinghouse Machine Co. U.S. Pat. 881,100, March 3, 1908.

A VERTICAL tubular steam generator is arranged within the producer above the gas-producing chamber. The gases evolved in the latter pass through the tubes and, after vaporising the water, are collected in a hood at the top of the steam generator and conducted to the gas off-take. Fuel is charged from a hopper, and falls through the annular space between the hood and steam generator and the outer shell of the producer, into the gas-producing chamber, adjacent to the wall.—W. H. C.

Gas-producer. H. T. Newell, Wilkinsburg, Pa., Assignor to Newell Engineering Co., Pittsburg, Pa. U.S. Pat. 881,258, March 10, 1908.

THE grate of the producer consists of a central perforated arched portion and perforated side portions which slope downward at an angle from the base of the central arch to within a short distance of the walls of the generator. The air and steam are introduced by a pipe beneath the central arched grate.—W. H. C.

Ammoniacal compounds of the higher fatty acids ; Utilisation of —— *as illuminating and combustible materials.* C. F. Boehringer und Söhne. Fr. Pat. 383,531, Oct. 31, 1907. Under Int. Conv., Nov. 13, 1906.

THE fatty acid, oleic acid for instance, is dissolved in twice its volume of petroleum and the solution is saturated with ammonia. The ammoniacal compound formed is filtered off, and, after being washed with petroleum, is dried until no further loss of weight is observed. The compound obtained generally contains less ammonia than would correspond to a neutral soap, but the melting point of the product is from 20° to 40° C. higher than that of the fatty acid used. The bodies prepared in the above manner are found to burn without evolving ammonia or other deleterious gases, and may be used for the manufacture of candles, solidified alcohol, etc.
—W. H. C.

Photometer. Fr. Pat. 383,228. *See* XXIII.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

PATENT.

Destructive distillation of wood ; Process of ——. T. W. Pritchard, Wilmington, N.C., Assignor to H. MacRae, Washington, D.C., and H. M. Chase, Wilmington, N.C. U.S. Pat. 880,466, Feb. 25, 1908.

FOR the extraction of turpentine, wood is distilled in a closed retort, the heat being derived from a liquid which is circulated around the retort. The liquid must have a higher boiling point than the oil to be distilled and is maintained at a temperature of 400° F., when the turpentine is driven off, whilst the creosote and pyroligneous acid remain behind. After removal of all the turpentine, the temperature is raised by increasing the speed of circulation of the liquid, to recover the lighter oils. By further increasing the temperature the tar oils are distilled over.—R. L.

IV.—COLOURING MATTERS AND DYESTUFFS.

"Potash fusions" [of halogen-phenols, etc.]; Intramolecular atomic displacement in ——. J. J. Blanksma and S. Tijmstra. Chem. Weekblad, 1908, **5**, 93—101. Chem. Zentr., 1908, **1**, 1051—1052.

Catechol and quinol when fused with caustic potash do not yield resorcinol, hence the formation of resorcinol in the "potash fusion" of *o*- and *p*-halogen-phenols, and halogen- and hydroxybenzenesulphonic acids cannot be due to atomic displacement after substitution. *m*-Halogenphenols could never be detected among the reaction-products on fusing the *o*- and *p*-compounds with caustic potash. This can hardly be due to conversion of the *m*-compound into resorcinol as rapidly as it is formed, since experiments showed that *m*-chlorophenol does not react more readily than the *o*- and *p*-compounds in "potash-fusions," and moreover, when other catalytic agents were substituted for caustic potash, still no intermediate formation of *m*-halogen-phenols could be detected. When potassium carbonate is used in place of caustic potash, *o*- and *p*-halogen-phenols are converted smoothly into the corresponding dihydroxy compounds without any formation of resorcinol. It is concluded that in "potash fusions," the intramolecular atomic displacement proceeds simultaneously with the substitution.

—A. S.

Triphenylmethane dyestuffs; Bases of ——. E. Noelting and K. Phillip. Ber., 1908, **41**, 579—585.

Of the bases of the triphenylmethane dyestuffs, those containing di-substituted nitrogen have hitherto only been prepared in the colourless condition. The authors have now succeeded in obtaining a number of these bases in both the coloured and colourless modifications. *Naphtho-Blue*, prepared by condensing Michler's ketone and dimethyl-α-naphthylamine by means of phosphorus oxychloride (Ger. Pat. 27,789 of 1883) separates from xylene in dark green shining crystals melting at 260—261° C.; if, however, the base is repeatedly crystallised from ether it is obtained in quite white needles melting at 153° C. The salts of Naphtho-Blue are very soluble in water, and dye silk, wool or tannin-mordanted cotton in shades intermediate between those produced by Victoria Blue R and B. As Naphtho-Blue is decomposed by dilute sulphuric acid into Michler's ketone and dimethyl-α-naphthylamine, its constitution (as chloride) is

$$[(CH_3)_2N.C_6H_4]_2C : C_{10}H_6 : N(CH_3)_2Cl.$$

Victoria Blue R gives a coloured base,

$$[(CH_3)_2N.C_6H_4]_2C : C_{10}H_6 : N.C_2H_5,$$

when the hot alcoholic solution is treated with caustic potash drop by drop, ice added, and the precipitate filtered off. The pure base melts at 192·5° C. When the hot solution of the dyestuff is poured into excess of ammonia and boiled, the coloured precipitate becomes gray and when crystallised from ether is obtained in white needles which melt at 167—170° C. and contain one molecule of water more than the coloured base, thus agreeing with the carbinol formula.—J. C. C.

Dyestuff formation in the ultra-violet. C. Schall. J. prakt. Chem., 1908, **77**, 262—266.

If paper be soaked in an aqueous solution of *p*-phenylenediamine, then washed with nitric acid and dried, it rapidly turns blue when exposed to ultra-violet radiation. The author has prepared and crystallised the two salts, $C_6H_4(NH_2)_2,2HNO_3$ and $C_6H_4(NH_2)_2,HNO_3$. The former, if dry, turns yellow and then gradually deeper brown when exposed to the ultra-violet rays, but if damp it shows the blue colour, which, however, is more readily and intensely shown by paper soaked with the solution. The latter salt turns green or bluish-green under the rays, but paper soaked in its solution also turns blue. The cause of this is not due to the rendering "active" of the oxygen contained in the molecule, and it cannot be imitated by exposing the paper to active oxygen or ozone; it is probably due either to conversion into nitrite of the di-imine:

$$C_6H_4(NH_2)_2,HNO_3 = C_6H_4(NH)_2,HNO_2 + H_2O,$$

or simply to reduction of the diamine nitrate to nitrite. After exposure of the salt to ultra-violet rays, traces of nitrite were detected in it.—J. T. D.

Inks; Composition of English —— and their differentiation in handwriting. C. A. Mitchell. Analyst, 1908, **33**, 80—85.

The old type of iron-gall ink, in which partial oxidation was made to take place before bottling, has been practically superseded by unoxidised inks containing a "provisional" colouring matter to render the writing immediately visible, pending the formation of the insoluble iron tannate within the fibres of the paper. The following table includes specimens of chrome-logwood and aniline inks, in addition to iron-gall inks:—

Ink.	Sp. gr. at 15° C.	Water.	Total solids.	Mineral matter (ash).	Iron.
		Per cent.	Per cent.	Per cent.	Per cent.
Arnold's Blue-black	1·0216	96·35	3·65	0·94	0·25
Blackwood's Blue-black	—	96·82	3·18	0·77	0·28
,, Record	—	92·06	7·94	1·40	0·59
Carr's Blue-black	1·0220	96·01	3·99	1·07	0·29
,, Black	1·0244	95·84	4·16	1·39	0·48
Day and Martin's Blue-black	—	92·25	7·75	2·52	1·09
Draper's "Dichroic"	—	95·16	4·84	1·10	trace
Faber's Blue-black	1·0205	95·58	4·42	1·22	0·49
,, Black	1·0153	96·66	3·34	0·82	trace
Field's "Non-corrosive"	1·0121	97·55	2·45	0·64	0·28
Halsey's Blue-Black	1·0208	95·34	4·66	0·54	0·28
Lyon's Blue-black	1·0239	95·14	4·86	1·01	0·35
Mordan's "Azuryte"	—	95·94	4·06	0·86	0·29
,, Blue-black	1·0225	95·54	4·46	0·62	0·18
,, "Jet-black"	1·0256	94·04	5·96	0·99	0·21
Morrell's Blue-black	1·0276	95·16	4·84	1·66	0·56
Paul's Blue-black	—	96·12	3·88	0·97	0·33
,, Black	—	96·68	3·32	2·28	trace
Pridge's Blue-black	1·0499	92·22	7·88	1·88	0·84
,, Black	—	92·32	7·70	1·42	0·49
Stephen's Blue-black	1·0206	96·21	3·79	0·76	0·32
Vicker's "Penwing"	—	98·11	1·89	0·42	trace
Walkden's Blue-black	1·0221	95·58	4·42	0·72	0·22
,, Black	1·0293	94·39	5·61	1·12	0·36

No satisfactory method has been devised for the determination of gallotannic acid and allied substances in inks. Absorption with hide-powder does not determine the gallic acid, to which the colour is partially due, whilst the "provisional" colouring matter interferes with any colorimetric method of determining the two acids simultaneously. Deposits formed on exposing mixed solutions of ferrous sulphate and gallotannic acid to the air were found, when washed with cold water and dried at 100° C., to yield from 7·8 to 8·8 per cent. of ferric oxide, corresponding to 5·4 to 6·2 per cent. of iron. Of the known tannates that described by Wittstein and by Schiff agrees best with this proportion of iron. It has the formula, $(C_{14}H_5O_9)_3Fe.Fe(C_{14}H_9O_9)_3$, and contains 5·53 per cent. of iron. In the author's opinion it is probably this tannate which is formed when writing dries upon paper, and if so, any excess of ferrous sulphate or of gallotannic acid beyond the quantities required to form this compound are probably unnecessary, or even injurious to the permanence of the ink.

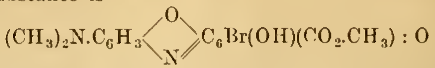
The differentiation of inks in handwriting is based mainly upon the fact that different manufacturers employ different dyestuffs (indigo, logwood, aniline dyes) for the provisional colouring matter. In some cases it is possible to distinguish the colours under the microscope months after the writing has attained its maximum intensity. For the purpose of comparison, it is advisable to prepare a colour scale of four washes, ranging from the faintest to the darkest possible tone, with the known or suspected ink, and to compare this under the microscope with the writing in question. When matched with the microscopical appearance of the writing, the broad surface of colour affords what is practically a magnified record. Lovibond's tintometer will also be found of use in matching different specimens of writing and comparing them with such colour scales. For the differentiation of the inks in handwriting by chemical methods, the following reagents are recommended:—(1) Hydrochloric acid, 5 per cent. solution; (2) Oxalic acid, 5 per cent. solution; (3) stannous chloride, 10 per cent. solution; (4) nascent hydrogen (50 per cent. HCl with zinc); (5) bromine (saturated aqueous solution); (6) bleaching powder (saturated solution); (7) titanous chloride (the impure commercial solution); and (8) potassium ferrocyanide (5 per cent. solution containing 1 per cent. of HCl.). Of these reagents the two first act mainly upon the iron tannate, leaving the provisional colouring matter. The third and fourth, bleach the iron tannate and reduce the provisional pigment, changing its colour. The fifth and sixth reagents may act on both pigments, causing more or less superficial bleaching. The titanous chloride solution acts as a powerful reducing agent towards both pigments, whilst the acidified ferrocyanide solution acts mainly upon the iron liberated from the iron tannate. A table is given showing the reactions obtained with the writing done with the different inks mentioned above.

It is as a rule possible to distinguish colorimetrically between freshly written and old writings made with the same ink, up to about the sixth day, after which the iron tannate has become completely oxidised, and no further differentiation is possible between writings of different age until such time (a year or more) as the provisional pigment in the older one has begun to fade. As a rule these pigments offer more resistance than the iron tannate to the action of chemical agents, but are much less stable to the action of light and air. The author has never met with a blue-black ink capable of resisting powerful bleaching agents, although the so-called "safety" inks containing finely-divided carbon in suspension are practically permanent in this respect. Still the evidence of old manuscripts shows that a well-made iron-gall ink is permanent for 8 or 10 centuries when exposed only to ordinary atmospheric influences, and the use of such inks is obligatory in Germany for all official documents.

—C. A. M.

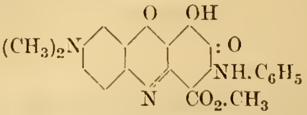
Prune-anilide. E. Grandmougin and E. Bodmer. Ber., 1908, **41**, 604—611. (Compare this J., 1907, 312.)

BY condensing nitrosodimethylaniline with methyl dibromogallate in methyl alcoholic solution, green crystals of "bromo-prune" are obtained. The constitution of this substance is

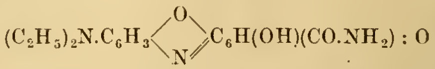


$$(CH_3)_2N.C_6H_3\langle\overset{O}{\underset{N}{}}\rangle C_6Br(OH)(CO_2.CH_3):O$$

and as this on treatment with aniline yields prune-anilide, the constitution of the latter must be



Similarly, Cœlestine Blue B or Correine RR yields an anilide of analogous constitution to that of prune, and hence the dyestuff has the constitution,



$$(C_2H_5)_2N.C_6H_3\langle\overset{O}{\underset{N}{}}\rangle C_6H(OH)(CO.NH_2):O$$

When prune-anilide is heated with acids, aniline is eliminated and "hydroxy prune" is formed. This gives a greenish-blue on chrome-mordanted cotton.—J. C. C.

PATENTS.

Vat [thioindigo] dyestuffs; Manufacture of ——. O. Imray, London. From Farbwerke vorm. Meister Lucius, und Brüning, Hoechst a/Main, Germany. Eng. Pat. 2769, Feb. 4, 1907.

SEE U.S. Pat. 877,743 of 1908; following.—T. F. B.

Vat [thioindigo] dyestuffs; Manufacture of brown —— Farbwerke vorm. Meister, Lucius, und Brüning, Hoechst a/Main, Germany. Eng. Pat. 15,607, July 6, 1907. Under Int. Conv., Feb. 23, 1907.

SEE Fr. Pat. 377,540 of 1907; this J., 1907, 1083.—T.F.B.

Vat dyestuffs; Violet —— and process of making the same. A. Schmidt and E. Bryk, Assignors to Farbwerke vorm. Meister, Lucius und Brüning, Hoechst a/Main, Germany. U.S. Pat. 877,743, Jan. 28, 1908.

NEW dyestuffs dyeing wool and cotton from an alkaline hydrosulphite vat in violet shades are prepared by treating phenylthioglycollic acids, methyl-substituted in the para position, and not substituted in one ortho position, with strong sulphuric acid. *Example.*—One part of *o*-chloro-*p*-tolylthioglycollic acid obtained from *o*-chloro-*p*-toluidine, is heated for some time in the water-bath with five times its weight of concentrated or monohydrate sulphuric acid. When the intensity of coloration and the formation of the dyestuff no longer increases, the reaction product is poured on to ice, filtered, washed with hot water, then with hot dilute caustic soda, to remove unattacked material, etc., again washed with hot water and finally with alcohol, until the filtrate runs off quite colourless. The purified dyestuff is insoluble in water and alkalis. The condensation may be accelerated and sulphonation reduced by adding substances such as boric acid, pyrosulphate or sulphur to the mass. These dyestuffs are substitution products of thioindigo.—A. B. S.

[Thioindigo] dyestuffs; Dark green-black, dark blue-violet, and red vat ——. K. Shirmacher, R. Leopold, B. Deicke, and A. Brunner, Assignors to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on the Maine, Germany. U.S. Pats. 881,157, 881,158, and 881,159, March 10, 1908.

SEE Eng. Pats. 1472 and 2592 of 1907; this J., 1907, 1235, and 1908, 71.—T. F. B.

Dyestuffs; Manufacture of vat [thioindigo] ——. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 383,515, Jan. 9, 1907.

SEE U.S. Pats. 867,679 and 868,295 of 1907; this J., 1907, 1194 and 1195.—T. F. B.

Sulphurised dyestuffs and manufacture thereof. A. G. Bloxam, London. From Act.-Ges. f. Anilinfabr., Berlin. Eng. Pat. 7148, March 25, 1907.

SEE U.S. Pat. 864,644 of 1907; this J., 1907, 1044.—T. F. B.

Azo-dyestuffs; Manufacture of new red ——. A. G. Bloxam, London. From Act.-Ges. f. Anilin-Fabr., Berlin. Eng. Pat. 8729. April 15, 1907.

The tetrazo-compound of a mono- or poly-sulphonic acid of *p.p*-diaminophenyl ether is diazotised and combined with β-naphthol. The products thus obtained dye unmordanted wool in an acid bath, producing red shades which are very fast to milling.—P. F. C.

Azo dyestuff; Red —— *and process of making same.* H. Geldermann, Gross-Lichterfelde-Ost, Assignor to Act.-Ges. f. Anilinfabr., Berlin. U.S. Pat. 880,292, Feb. 25, 1908.

See Eng. Pat. 8729 of 1907; preceding.—T. F. B.

Tetrazo dyestuff; Yellow —— *and process of making same.* H. Geldermann, Gross-Lichterfelde-Ost, Assignor to Act.-Ges. f. Anilinfabr., Berlin. U.S. Pat. 880,293, Feb. 25, 1908.

See Eng. Pat. 7147 of 1907; this J., 1908, 156.—T. F. B.

Indophenol-like condensation products; Manufacture of ——. Chem. Fabr. vorm. Weiler-ter Meer, Uerdingen a/Rhein, Germany. Eng. Pat. 13,428, June 10, 1907. Under Int. Conv., June 27, 1906.

See Fr. Pat. 378,655 of 1907; this J., 1907, 1135.—T. F. B.

Condensation products of gallocyanines with amines; Manufacture of ——. Farbwerke vorm. L. Durand, Hugenin und Co., Hüningen i/E., Germany. Eng. Pat. 15,138, July 1, 1907. Under Int. Conv., Nov. 19, 1906.

See Fr. Pat. 378,923 of 1907; this J., 1907, 1194.—T. F. B.

Azo colouring matters; Manufacture of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 19,479, Aug. 30, 1907.

See Fr. Pat. 381,107 of 1907; this J., 1908, 117.—T. F. B.

Anthraquinone derivatives; Production of ——. Badische Anilin und Soda Fabrik. Fr. Pat. 383,286, Oct. 25, 1907. Under Int. Conv., June 22, and Sept. 20, 1907.

When such anthraquinone derivatives as consist of two anthraquinone nuclei united by one or two imino-groups and containing at least one amino-group (free or mono-substituted) in the ortho-position with respect to a carbonyl group, are treated with glacial acetic acid or acetic anhydride in presence of fuming or concentrated sulphuric acid, dyestuffs are obtained which dye cotton from a hydrosulphite vat in blue shades.—J. C. C.

Tetrazo-dyestuff; Production of a ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 383,128, Oct. 19, 1907. Under Int. Conv., April 10, 1907.

m-Dichlorobenzidine is tetrazotised and combined with β-naphthol-3:6-disulphonic acid in alkaline solution. The dyestuff obtained gives red shades on wool which are very fast to milling and light.—J. C. C.

Monoazo-dyestuffs; Production of blue ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 383,169, Oct. 21, 1907. Under Int. Conv., April 16, 1907.

p-Amino-*m*-chlorodialkylanilines (in particular *p*-amino-*m*-chlorodimethylaniline, m.pt. 42° C., and *p*-amino-*m*-chlorodiethylaniline, b.pt. 285° C.) are diazotised and combined with chromotropic acid (1 : 8-dihydroxynaphthalene-3 : 6-disulphonic acid) in caustic alkaline solution. The monoazo-dyestuffs produced dye wool in pure blue shades fast to alkalis and light.—J. C. C.

Oxazine dyestuff; Production of a new ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 383,190, Oct. 22, 1907. Under Int. Conv., May 21, 1907.

p-Nitroso-*m*-chlorodiethylaniline is condensed with gallamic acid in alcoholic solution. The dyestuff produced is a black powder dissolving in concentrated sulphuric acid with a violet coloration. The leuco-compound is obtained by treatment with sodium bisulphite and produces pure greenish-blue shades on a chrome mordant.
—J. C. C.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

Silk weighting; Determination of ——. E. Ristenpart. Färber-Zeit., 1908, 19, 34—36, 53—56.

By treating the samples of weighted silk with a 10 per cent. solution of hydrochloric acid and *N*/1 solution of potassium hydroxide, organic weighting matter is stated to be quantitatively removed; the quantity of mineral matter applied to the silk is arrived at from the ash determinations. To ascertain the effect of the weighting, the strength and elasticity of the silk were measured after the different treatments. When freed from the foreign substances, the silk was found to regain its original elasticity.—S. H. H.

Carbonisation of rags. R. Schwarz. Färber-Zeit., 1908, **19**, 66—68, 87—91.

Sulphuric acid was first used to destroy the vegetable matter in rags in order to separate the wool; but during the last ten years a number of other carbonising agents have been introduced. The rags are cleansed mechanically by means of a shaker and sometimes washed with dilute soap solution and then with water. They are next steeped in sulphuric acid of from 4° to 5° B. contained in a lead-lined tank. They are left in the acid for 30 mins., drained, hydro-extracted, and placed in the carbonising stove; the material is left here for 30 mins. The carbonising vat is re-set by adding sulphuric acid; on account of the impurities which collect in the vat, the hydrometer cannot be used to indicate the strength of the solution. Sodium bisulphate is as good a carbonising agent as sulphuric acid for some purposes; it is cheaper than the acid, but has to be used in more concentrated solution and left a longer time in contact with the rags in order to ensure perfect penetration. Hydrochloric acid gas is also much used for carbonising; details and a sketch of an apparatus used for the purpose are given. Aluminium chloride is also used; in contact with water it gives off hydrochloric acid gas which at the temperature of the action is a strong carbonising agent. The wool, however, becomes coloured at a temperature of 130° C., which is required for the complete decomposition of the chloride, and the alumina produced in the action has to be removed from the wool by thoroughly washing in weak hydrochloric or sulphuric acid. Wool which has been treated in this manner is liable to be dyed unevenly. Magnesium chloride decomposes water at a temperature of 150° C., and has been used for carbonising. Magnesium oxychloride is produced during the action, but this salt is very soluble in water. Magnesium chloride, however, is more expensive to use as a carbonising agent than sulphuric acid. Other carbonising agents have been used, but the author recommends the use of sulphuric acid for small works, and hydrochloric acid gas for large works.
—S. H. H.

Tendering of wool during dyeing. v. Kapff. Färber-Zeit., 1908, **19**, 49—53, 69—74.

Loose wool was dyed in open pans both in the laboratory and on the large scale. Samples of the undyed wool and of that dyed with different dyestuffs were spun in the same machine, when it was found that the wool which had been treated with potassium bichromate could not be spun so fine as the other samples. The fineness to which the wool can be spun gives a good idea of the strength of the fibre. Yarns of the same counts were then made from the different samples of wool and their tearing strains determined. A table given shows that indigo-dyed wool is as strong as the original fibre, whereas the treatment with alkali bichromates causes a considerable tendering. This is said to be due to the oxidation of the wool and is particularly noticeable in cases where the wool has been after-chromed. By using formic acid instead of acetic or sulphuric acids along with the bichromate, the tendering is considerably decreased. Wool which had been chromed either before or after dyeing was found not to felt so well as the other samples did. In further experiments the author shows that, in many cases, woollen yarn dyed in open vessels is stronger than if dyed in machines. —S. H. H.

Adsorption ; Experimental examination of Gibb's theory of surface-concentration regarded as the basis of ——. *An application to the theory of dyeing.* W. C. M. Lewis. Phil. Mag. 1908, [vi.], 15, 499—526.

The author has measured the decrease of interfacial tension of aqueous solutions of Congo Red and Methyl Orange respectively used in conjunction with a hydrocarbon oil. The conclusion is drawn that substantive dyeing must be more or less an adsorptive process, and it is suggested that the actual mechanism of dyeing consists first in adsorption and afterwards coagulation, possibly due to "colloidal neutralisation." There may finally be some degree of chemical combination which varies from case to case.—J. C. C.

Indigo ; Discharging —— *by means of hydrosulphite-formaldehyde.* R. Aubert. Sealed note 1588, Dec. 23, 1905. Bull. Soc. Ind. Mulhouse, 1907, 77, 419—422.

The most simple method for discharging indigo with hydrosulphites is to print on a mixture of 6 parts of hydrosulphite-formaldehyde (*e.g.*, Hydrosulphite NF) and 4 parts of gum thickening. After printing, dry, age, and give a passage of one minute through a bath at 95° C. containing 10 grms. of caustic soda of 48° B. per litre, or through a boiling bath of sodium carbonate, then sour, wash, and soap at 95° C. A bath of sodium bisulphite may be interposed between the ageing and the alkaline bath. White discharges are also produced by printing with 40 parts of hydrosulphite powder (B.A.S.F.), 5 parts of caustic soda of 48° B., and 55 parts of a thickening prepared from 4 parts of British gum and 6 parts of a saturated solution of common salt. In this case steaming is omitted, the after-treatment consisting in a passage through a solution of sodium carbonate and a final washing in hot water. A third method is to print with a paste made from 20 parts of hydrosulphite NF conc. (M.L. and B.), 20 parts of gum thickening, 42 parts of zinc white or "snow white," and 18 parts of a saturated solution of bisulphite-acetone, the latter being prepared by adding slowly, in the cold, 250 parts of 90 per cent. acetone to 400 parts of commercial bisulphite. The after-treatment is the same as in the case of the hydrosulphite powder discharge.—R. B. B.

Thio-indigo red ; Discharging —— *by means of hydrosulphite-formaldehyde and caustic soda.* J. Frossard and H. Fleisher. Sealed note 1694, Jan. 4, 1907. Bull. Soc. Ind. Mulhouse, 1907, 77, 422—423.

The authors describe a method for discharging Thio-indigo Red or a combination of this colouring matter with indigo. A perfect white is produced by printing with hydrosulphite-formaldehyde with the addition of caustic soda, ageing for 3—4 minutes, passing through boiling water containing a small quantity of hydrosulphite-formaldehyde, and soaping at 65—75° C.—R. B. B.

Indigo and Thio-indigo Red ; Discharging —— *by means of hydrosulphite-formaldehyde.* (*Report on the above communications.*) M. Battegay. Bull. Soc. Ind. Mulhouse, 1907, 77, 423—426.

Sodium sulphoxylate-formaldehyde with or without the addition of bisulphite-acetone discharges indigo to a perfect white, but it is doubtful if the method offers any advantages over the chromate and chlorate discharges, since in these there is no necessity to take precautions against a possible re-formation of the blue. Hydrosulphite in powder possesses the disadvantage of tending to scratch the printing rollers. The author considers the hydrosulphite-formaldehyde discharge as likely to render excellent service in the case of Thio-indigo Red, which cannot be discharged by other methods ; he also finds the process applicable for discharging Thio-indigo Scarlet. Indanthrene colours and sulphur dyestuffs cannot be discharged in this way ; this may be attributed to the fact that their products of reduction have a much greater affinity for the fibre at a high temperature than those of indigo or Thio-indigo Red.—R. B. B.

Discharges ; Coloured —— *on azo grounds with sulphoxylate-formaldehyde and basic dyestuffs.* E. Justin-Müller. Sealed Note 1686, Dec. 18, 1906. Bull. Soc. Ind. Mulhouse, 1907, 77, 428—432.

The author has obtained better coloured discharges on diazotised or developed substantive colours or ice colours (Paranitraniline Red, etc.), by padding the dyed material in potassium ferrocyanide solution and subsequently adding a zinc compound to the hydrosulphite discharge paste. Even without the treatment with ferrocyanide, the addition of zinc oxide or sulphate to the discharge colour tends to fix the basic dyestuff, but faster colours result from the introduction of the prussiate bath. In most cases a strength of 20 grms. of ferrocyanide per litre suffices, and the discharge colour may contain up to 60 grms. of zinc sulphate crystals per litre ; an excess beyond this retards the action of the hydrosulphite. If zinc oxide be used, an excess has no unfavourable effect, but with the sulphate, the printing colour has a better consistency.—R. B. B.

Mud from hemp retting ; Manurial value of the ——. G. A. Calabresi. *See* XV.

Patents,

Textile products obtained with cotton or other celluloses treated in the form of fibres, yarns, or fabrics. C. F. Cross and J. F. Briggs, London. Eng. Pat. 5016, March 1, 1907.

See Fr. Pat. 383,064 of 1907 ; following.—T. F. B.

Textile products prepared from cotton or other cellulose substance treated either in the form of fibres, yarns, or fabric ; New ——. C. F. Cross and J. F. Briggs. Fr. Pat. 383,064, Sept. 27, 1907. Under Int. Conv., Mar. 1, 1907.

The cellulose is converted into its lower acetylated derivatives without appreciable alteration of its textile qualities. These products are not dyed by the direct cotton dyestuffs. *Process.*—To obtain an increase of weight of about 25 per cent., the completely dried cotton is treated with the following solution so as to absorb twice its own weight. Acetic anhydride, 42 parts by weight : acetyl chloride, 11·5 parts ; glacial acetic acid, 50 parts ; and calcined zinc oxide 6·5 parts. The saturated cellulose is then placed in a closed vessel and heated for 36—48 hours at a temperature of 35°—40° C. The cellulose is then washed with water to remove soluble substances.—A. B. S.

Artificial silk ; Manufacture of ,——. E. J. B. G. J. Huwart. Fr. Pat. 383,555, Jan. 10, 1907.

Nitrocellulose is dissolved in substances belonging to the class of acetals of the fatty series or in their chlorine or bromine derivatives, or in the aldehydes or ethers derived from these acetals. This class of substances is characterised by the presence of an aldehyde radical combined with two similar or different alkyl radicals, as for example in the compounds, $CH_2(OCH_3)_2$ and $C_2H_4(OCH_3)(OC_2H_5)$. These compounds may be employed alone or in methyl or ethyl alcohol solution. —A. B. S.

Flax lint ; Preparation of a textile material from ——. A. E. M. Rousseau. Fr. Pat. 383,062, Sept. 25, 1907. Under Int. Conv., Sept. 26, 1906.

The flax lint is first treated with a bleaching and degumming bath prepared as follows. 10 kilos. of chloride of lime are mixed with 100—120 litres of water and a solution of 12 kilos. of potassium carbonate in 20—40 litres of hot water is added. To prepare the bleaching bath, 5 litres of this solution of potassium hypochlorite are added to 100 litres of cold water. The flax is kept in this bath, the temperature of which should not exceed 75° C., until the bleaching appears to be finished, and then well rinsed in hot and cold water. It is next treated in a bath containing sufficient sodium sulphite to neutralise the chlorine of the last bath and with 30 per cent. (on the weight of material) of a soap prepared from 28 parts of margarine, 72 parts of oleine, 4 parts of sodium carbonate and 45·5 parts of water. After 1 hour's treatment in this bath at the ordinary temperature, the material is rinsed with boiling and cold water. It is then immersed for 2—4 hours in a solution containing 50 per cent. of its weight of the above soap and 3—5 per cent. of sodium carbonate and sodium thiosulphate at a temperature of 90°—95° C. After again rinsing in boiling and also in cold water, the material is treated at the ordinary temperature in another rather weaker soap bath containing 30 per cent. of soap, 3 per cent. of sodium bisulphite and 2 per cent. of sodium carbonate calculated on the weight of the material. After another rinsing the material is given a final treatment with water containing a little amyl acetate, which removes the remaining impurities and gives the fibre a brilliant lustre. It is then rinsed in cold water and dried. The fibre obtained can be spun to very fine counts.—A. B. S.

Cellulose in aqueous solutions; Manufacture of bodies from ——. L. Cuntz. Fr. Pat. 383,411, Oct. 29, 1907.

In forming solid products, such as artificial silk or horsehair, from solutions of cellulose in aqueous solvents, the cellulose solution is first caused to pass from the delivery orifices through a medium in which it may be moulded to the desired shape but not coagulated, and thence directly into a bath which rapidly solidifies the moulded cellulose. The moulding medium may be either gaseous, *e.g.*, the air, or a liquid, such as acetone, benzene, petroleum, carbon bisulphide, oil, turpentine, etc. This moulding liquid may be contained in the same vessel as the coagulating liquid, on which it floats as a superficial layer.—J. F. B.

Cellulose; Regeneration of liquids which have been used for the coagulation of —— [*Cuprammonium process*]. L. Cuntz. Fr. Pat. 383,412, Oct. 29, 1907.

In the manufacture of solid bodies from cellulose dissolved in cuprammonium, the coagulating bath, whether alkaline or saline, ultimately becomes charged with compounds of copper and ammonia and ceases to yield brilliant products. According to this invention the copper compounds may be removed from these baths by treating the liquid with a substance such as oil-seed cake, seed husks, cereal grains or their husks, fresh or dried fruit, any raw or manufactured product containing starch, or finally with starch itself. These substances rapidly absorb the copper from the liquid, which, after driving off the ammonia by ebullition, is regenerated for further use.—J. F. B.

Cellulose [*Cuprammonium solutions*]; *Precipitation of* —— *by means of saline solutions.* L. Cuntz. Fr. Pat. 383,413, Oct. 29, 1907.

In the manufacture of artificial silk from cuprammonium solutions of cellulose, specially favourable results as regards lustre and strength are obtained by the use of a coagulating bath consisting of a very concentrated solution of sodium hydroxide. According to this invention, results equally satisfactory are afforded by a coagulating bath containing only a small proportion of alkali hydroxide together with a large proportion of a chloride of an alkali or alkaline-earth metal. Suitable baths are prepared by dissolving 30 parts of sodium or calcium chloride and 3 parts of sodium hydroxide in 100 parts of water.—J. F. B.

Textile materials; The carbonising of ——. H. Schirp, Barmen, Germany. Eng. Pat. 18,156, Aug. 10, 1907.

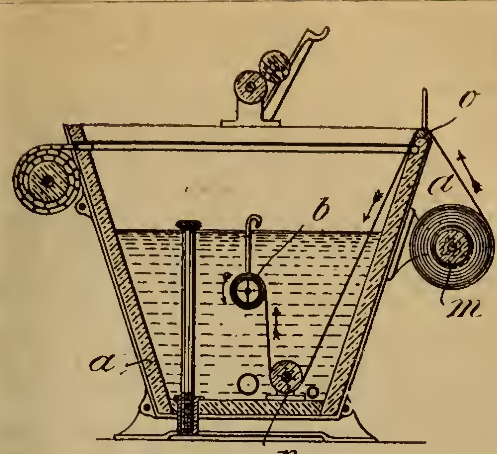
See Fr. Pat. 380,737 of 1907; this J., 1908, 69.—T. F. B.

Bleaching and scouring vegetable and animal fibres and fabric; Electrolytic apparatus for ——. A. Dassonville, Paris. Eng. Pat. 4910, Feb. 28, 1907.

See Fr. Pat. 363,866 of 1906: this J., 1906, 926.—T. F. B.

Scouring, bleaching, dyeing and the like treating spun or manufactured fibrous materials; Machine for ——. C. Hall, Eccles, and H. O. Brandt, Manchester. Eng. Pat. 4963, Mar. 1, 1907.

Inside a dye-vat, *a*, is arranged a hollow perforated rotary drum, *b*, one end of which is provided with a fast and loose pulley, whilst the other end is in connection with a centrifugal pump. From the beam, *m*, the material to be treated passes over an opener, *o*, then through the liquor in the vat, under one or more guide rollers, *p*, and is finally wound on the drum, *b*. The liquid contained in the vat is drawn through the material into the interior of the perforated drum, *b*, by the pump and is then redelivered into the vat. Screw-plugs are provided for closing those perforations in the surface of the drum which are not covered by the fabric under treatment.—P. F. C.



Bleaching cotton: Apparatus for ——. J. B. Brennan, Sherman, Tex. U.S. Pat. 880,005, Feb. 25, 1908.

The material to be treated is introduced into the upper part of a closed bleaching chamber, and falls on to the uppermost of a series of endless bands, each of which travels in an opposite direction to the adjacent ones. When it has been carried across the chamber, the cotton is automatically dropped on to the next lower carrier and so on until the last carrier leads it to "condensing rollers" which deliver it from the machine. The bleaching is effected by means of a gaseous bleaching agent which enters near to the bottom of the chamber.—P. F. C.

Mercerising processes; Concentration of diluted lyes in connection with ——. L. Wallach, Mülhausen, Germany. Eng. Pat. 18,312, Aug. 13, 1907.

Soda lye of 2° B. is run into an ordinary steam boiler of any construction and the boiler is worked in the usual way. The steam under pressure, which is thus generated, is used for ordinary purposes after having passed a steam separator. When the lye has reached a concentration of 15—30° B., it is run out of the boiler and used again for mercerising.—P. F. C.

Wool, woollen goods, mixed goods or union fabrics; Treatment of —— *with oxidising agents.* F. H. Kammerer, Höchst am Main, Germany. Eng. Pat. 5612, Mar. 8, 1907.

Wool, in the form of loose wool, woollen goods, or in union fabrics, is treated with a soluble permanganate or manganate in the presence of sufficient acid to prevent the formation of hydrated manganese peroxide. By this treatment the wool becomes less liable to felting and acquires an increased affinity for dyestuffs.—P. F. C.

Dyeing wool and woollen fabrics. J. Schneider, Galashiels, N.B. Eng. Pat. 6152, Mar. 14, 1907.

Yarns or fabrics, made of wool or any other animal fibre, are treated with a solution of caustic alkali, of not more than 32° T., at a temperature of 5°—10° C. The goods are then well washed and dyed in the ordinary manner. The caustic alkali may be replaced by sodium sulphide, sodium silicate, or potassium sulphide.—P. F. C.

Vegetable fibres; Treatment of —— to produce varying effects in dyeing. J. Schneider, Galashiels, N.B. Eng. Pat. 3645, Feb. 14, 1907.

VEGETABLE fibres are treated with a mixture of sulphuric and nitric acids, containing less than 25 per cent. of water. As a result of this treatment a nitrate of cellulose is formed which is capable of resisting direct cotton colours, but has an affinity for basic dyestuffs. If the acid mixture contains more than 25 per cent. of water, the action is reversed and a largely increased affinity for direct cotton dyestuffs is imparted to the fibres. The nitric acid in the acid mixtures may be replaced by any organic or inorganic acid which is not decomposed nor expelled from the solution by sulphuric acid.—P. F. C.

Cotton mixed with wool or silk; Dyeing —— with sulphurised dyestuffs. O. Imray, London. From Soc. Chem. Ind. in Basle, Switzerland. Eng. Pat. 13,948, June 17, 1907.

IN dyeing cotton piece goods with sulphurised dyestuffs at low temperatures, silk or woollen effect threads can be protected from the action of the dyestuff by the addition of blood or diastafor or mixtures of the two substances to the dye-bath. The process can be applied to the dyeing of half-woollen goods with sulphurised dyestuffs, and for this purpose the wool is first dyed in an acid bath with a suitable dyestuff, the cotton being afterwards dyed with a sulphurised dyestuff in a bath containing blood or diastafor.—P. F. C.

Dyeing apparatus. L. Destree, Haren, Belgium. U.S. Pat. 881,097, March 3, 1908.

SEE Eng. Pat. 17,240 of 1904; this J., 1904, 1087.—T. F. B.

Dyeing machine. J. Sulzbach. Fr. Pat. 383,432, Oct. 30, 1907.

SEE U.S. Pat. 871,376 of 1907; this J., 1908, 119.—T.F.B.

Acetylcellulose; Process for the dyeing of ——. Knoll und Co. Fr. Pat 383,636, Nov. 6, 1907.

THE absorptive power of acetylcellulose for dyestuffs is much increased if it be soaked for some time in solutions of various organic substances such as aqueous alcohol (50 per cent.) or diluted glacial acetic acid at the ordinary temperature. After this treatment the fibre is hydroextracted, rinsed, and dyed in the ordinary way. The fibre thus treated absorbs basic dyestuffs readily from an aqueous dye-bath and even slightly soluble dyestuffs such as those of the anthracene series. Acetylcellulose also has the power of taking up various amines and phenols or their derivatives from dilute aqueous solutions. The solid solutions thus obtained may be utilised to obtain various colours on the fibre. *Example.*—The acetylcellulose fibre is soaked for three hours in a 2 per cent. aqueous solution of aniline and then diazotised with an acidulated solution of nitrite, and developed with a 2 per cent. solution of sodium naphtholate, thus producing Soudan I on the fibre. Or, the impregnated material may be treated warm with a solution of bichromate and hydrochloric acid and Aniline Black produced. Paranitraniline Red can be produced on the acetylcellulose fibre either by soaking the fibre in a 0·5 per cent. solution of β-naphthol and then developing in a solution of diazotised paranitraniline, or by soaking in a solution of paranitraniline, rinsing, diazotising, and combining with β-naphthol.—A. B. S.

Dyeing or printing warps and yarns of all kinds, woven fabrics, and various other materials such for instance as felt and paper, by means of a vacuum; Processes of —— and apparatus for carrying out the process. O. Albert, Oelsnitz, Germany. Eng. Pat. 16,655, July 20, 1907.

SEE Fr. Pat. 381,120 of 1907; this J., 1908, 119.—T. F. B.

Sulphurised dyestuffs; Printing ——. O. Imray, London. From Soc. of Chem. Ind. in Basle, Switzerland. Eng. Pat. 24,978, Nov. 11, 1907.

THE general application of sulphide dyestuffs in printing has been difficult on account of the blackening of the printing rollers by the dyestuff. This difficulty can, it is claimed, be obviated by adding to the printing paste a concentrated solution of crystallised sodium sulphide or a very strong solution of caustic alkali. If the dyestuff contain polysulphides, it is advisable to add sodium hydrosulphite or sulphoxylate to the hot and strongly alkaline printing colour.—P. F. C.

Fabrics; Production of patterns, designs, or other similar markings in ——. C. W. Fulton, Paisley. U.S. Pat. 880,983, March 3, 1908.

SEE Fr. Pat. 356,188 of 1905; this J., 1906, 17.—T. F. B.

Indanthrene and sulphide dyestuffs; Process for printing with ——. Badische Anilin und Soda Fabrik. Fr. Pat. 383,533, Oct. 31, 1907. Under Int. Conv., Oct. 7, 1907.

IN the printing of the indanthrene or sulphide dyestuffs with tin salt or tin protoxide and an alkali, much better results are obtained if alcohol or an alcoholic solution of β-naphthol be added to the printing paste. *Example.*—100 grms. of Indanthrene S are made into a paste with 50 grms. of tin protoxide (50 per cent. paste), 50 grms. of glycerin are added, also 700 grms. of thickening T, and 100 grms of a 30 per cent. alcoholic solution of β-naphthol. This mixture is printed on the fabric, and the latter dried, steamed for 3—5 minutes in a steamer free from air, rinsed, and soaped. *Thickening T.* 320 grms. of dextrin thickening (3 : 2); 340 grms. of gum thickening (1 : 1), and 1 litre of caustic soda lye of 90° T.—A. B. S.

Sizing and drying cops; Apparatus for ——. W. Moeller-Holtkamp, Werden-on-Ruhr, Germany. Eng. Pat. 6309, Mar. 15, 1907.

THE cops are first placed on conical sieve-like sockets which are laterally mounted on a central pipe common to all. The pipe is then introduced into a casing or boiler which is connected with a tank containing size, with a vacuum vessel and with a heating boiler. The two latter can be placed in communication with an air-pump. By means of the pump, the size is drawn up the central pipe on which the cops are mounted, and then through the cops themselves. When the size has risen in the boiler above the level of the uppermost cops, the pump is reversed, and the size is forced through the cops from the outside to the inside. These two operations are alternately repeated until a completely uniform impregnation is ensured. The size is then finally run back into the reservoir and communication is established between the pump, the heating reservoir and the central casing containing the cops. Hot air is then circulated through this system until the cops are thoroughly dried.
—P. F. C.

Drying yarn and textile goods; Machine for ——. A. N. Marr, Thorner. U.S. Pat. 881,602, March 10, 1908.

SEE Eng. Pat. 19,508 of 1905; this J., 1906, 924.—T. F. B.

VI.—COLOURING WOOD, PAPER, LEATHER, &c.

PATENT.

Chrome leather; Process for dyeing —— black. W. Epstein. Ger. Pat. 189,468, March 11, 1906.

THE leather is treated with an acid solution of bichromate or chromic acid and "aniline salt" or salts of homologues of aniline, the latter being present in such excess over the theoretical quantity of 2 mols. to 1 mol. of bichromate, that notwithstanding the dilution of the bath during use, the formation of Aniline Black proceeds smoothly and the chromic acid is completely reduced.—A. S.

VII.—ACIDS, ALKALIS, AND SALTS, AND NON-METALLIC ELEMENTS.

Nitric oxide and oxygen ; Union of ——. A. Mandl and F. Russ. Z. angew. Chem., 1908, **21**, 486—491.

The authors describe experiments from the results of which they conclude that the direct union of nitric oxide and oxygen to nitrogen peroxide does not always proceed almost to completion, as is generally stated, but frequently stops far short of this. The differences observed are due not so much to the condition of dryness of the reacting gases as to the origin of the oxygen employed. With oxygen prepared from the air by Linde's method (fractional liquefaction and distillation), the reaction proceeds almost to completion (95·9—97·6 per cent.), but with oxygen prepared from barium peroxide only 31—41 per cent. of the nitric oxide is converted into nitrogen peroxide. With oxygen prepared by electrolysis of water, almost complete reaction takes place if the oxygen be first led over palladium-asbestos, but if this be not done, the percentage of nitric oxide oxidised is less. It is possible that the reaction is hindered by the presence of ozone in the oxygen prepared electrolytically or from barium peroxide, and direct experiments showed that the ozonisation of the oxygen used in the experiments caused the cessation of the reaction before completion.—A. S.

Sulphates ; New method for determining the vapour pressures of ——. L. Wöhler, W. Plüddemann and P. Wöhler. Ber., 1908, **41**, 703—717.

The method consists in heating a small quantity of the sulphate contained in a platinum tube placed inside a porcelain tube in an electric tube furnace. The porcelain tube communicates with a straight three-bulb tube heated by a steam-jacket, and the bulb-tube is connected by a T-piece with a pump and a manometer. The bulb-tube is first exhausted of air and then air is introduced until the pressure is somewhat below the vapour pressure of the sulphate at a given temperature. The sulphate is then heated to the given temperature, the porcelain tube put into communication for a moment with the bulb-tube, and the pressure observed on the manometer. The pressure in the bulb-tube is now slightly increased by introduction of air, and the operations repeated until there is no difference of pressure between the porcelain tube and the bulb-tube. The manometer reading then gives the vapour pressure of the sulphate at the temperature in question. By this method anhydrous ferric sulphate gave the following results :—

° C.	553	570	592	614	634	650
Pressure (mm.) .	23	33	45	70	113	149

° C.	660	680	690	699	707
Pressure (mm.) .	182	286	401	560	715

The results obtained with a partially decomposed sulphate of the composition, Fe_2O_3,SO_3, corresponded with those given above, showing that ferric sulphate decomposes directly into oxide and sulphur trioxide, without formation of a basic sulphate, and that solid solutions of the oxide in the undecomposed sulphate are not formed. With aluminium sulphate the results were :—

° C.	572	621	681	702	720	731	742	748
Pressure (mm.) ...	28	51	120	180	261	356	480	692

Here also no basic sulphate is formed, nor does the alumina form a solid solution with the undecomposed sulphate.

It was not found possible to prepare anhydrous normal chromium sulphate, but an anhydrous basic sulphate, $Cr_2O_3,2SO_3$, prepared by heating ordinary chromium sulphate in a current of carbon dioxide at 280° C., gave the following results :—

° C.	312	335	350	372	389	400	410	415
Pressure (mm.) ...	21	78	118	191	294	403	542	617

By heating the above-mentioned basic sulphate at 450°—460° C. a more basic sulphate, $2CrO_3$, $3SO_3$, was produced, which had the following vapour pressures :—

° C.	563	590	614	634	647	655	667	676
Pressure (mm.) ...	10	39	41	142	270	358	517	642

Anhydrous copper sulphate gave the following results :—

° C.	546	588	615	642	665	700	714	725	731
Pressure (mm.)	43	55	70	98	130	233	324	460	647

The vapour pressures of basic copper sulphate, $2CuO,SO_3$, were as follows :—

° C.	650	685	705	725	763	800
Pressure (mm.)	92	122	142	168	256	454

For ceric sulphate the values were :—

° C.	361	393	431	443	460	464	476	482
Pressure (mm.) ...	33	47	89	134	257	305	471	630

At 500° C. the vapour pressure was 1 atmosphere and analysis of the residue after heating a sample of the sulphate until the weight was constant, showed that cerous sulphate is formed :

$$2Ce(SO_4)_2=Ce_2(SO_4)_3+SO_3+O.$$

The vapour pressures of the cerous sulphate were :—

° C.	646	723	791	826	845
Pressure (mm.)	25	38	55	122	208

° C.	861	873	884	891	903
Pressure (mm.)	308	408	506	580	723

Thorium sulphate gave the following results :—

° C.	575	610	660	698	720	755	785
Pressure (mm.) .	16	32	44	80	144	198	344

The vapour pressures of basic titanium sulphate, TiO_2,SO_3, were :—

° C.	468	490	530	550	560	570	580
Pressure (mm.) .	13	14	28	85	238	448	>760

A more basic sulphate, $2TiO_2$, SO_3, gave the following results :—

° C.	524	574	580	590	600	610
Pressure (mm.)	15	60	86	214	394	592

From the vapour pressures of the different sulphates, the sulphur trioxide partial pressures may be calculated, and from these, the heats of dissociation of the sulphates. The difference in the vapour pressures of different sulphates may also be applied to the quantitative separation of metals. This method is applicable to the separation of iron, aluminium and chromium from nickel, cobalt or zinc. Zinc sulphate has the following vapour pressures :—

° C.	675	690	720	750	775	800
Pressure (mm.)	5	6	24	61	112	189

The weighed sulphates are heated at a temperature at which the vapour pressure of one amounts to 1 atmosphere or more, whilst the vapour pressure of the other is considerably below this. When constant weight is attained, the loss in weight gives the quantity of sulphur trioxide from the more easily decomposed sulphate, whilst from the residue the sulphate of the second metal can be dissolved out, and the metal determined by any suitable process.—A. S.

Borax ; Technical manufacture of ——. M. G. Levi. Gaz. chim. ital., 1907, **37**, II., 562—577.

After referring to the previous methods for the preparation of borax, the author describes his electrolytic process (Ital. Pat. 81,537). The method consists in the electrolysis of solutions of boric acid and sodium chloride separated from one another by a porous diaphragm. The boric acid is in the cathode compartment, and the sodium chloride in the anode compartment. On passing the current, the sodium ions migrate to the cathode and unite with the boric acid to form borax ; chlorine is evolved at the anode and hydrogen at the cathode. Lead cathodes and iron anodes are used, whilst the diaphragms consist of Puckal cells. In order to be able to work with stronger solutions of boric acid than would be possible at the ordinary temperature, the electrolysis is performed at 60°—70° C.—A. S.

Potassium chloride : Solubility of —— *in mixtures of pyridine and water.* J. Schroeder. J. prakt. Chem., 1908, **77**, 267—268.

Potassium chloride is practically insoluble in anhydrous pyridine ; and its solubility in mixtures of pyridine and water is proportional to the percentage of water in the mixture. The temperature of experiment was 10° C.
—J. T. D.

Metallic silicates ; Production of ——, in the wet way. E. Jordis. J. prakt. Chem., 1908, **77**, 226—237.

Sodium silicate and solutions of metallic salts ; Reactions between ——. E. Jordis and W. Henins. *Ibid.*, 238—261.

Cupric, ferrous, and ferric salts in aqueous solution do not react with sodium silicate according to the usual equations of double decomposition. When equivalent amounts of the reagents are mixed, an acid liquor containing silica is produced, and the filtrate also contains metal in varying proportion. Excess of either component increases the amount of that constituent in the filtrate. With ferric chloride especially, the filtrate needs a considerable amount of alkali to neutralise it, and considerably more must be added before alkaline reaction is produced —the amount is roughly proportional to the amount of silica present. By warming, neutralising, or adding salt to the filtrates, precipitates of very varying composition are thrown down. In many cases time exerts an influence on the reaction ; some of the freshly-formed precipitates, too, are soluble in dilute acids, whilst after standing some time they cease to be so. The filtrates run through always turbid at first, and only clear after a gelatinous layer has formed on the filter. Silicates from pure ferrous salts are bluish-grey, and pass, on oxidation, through green and brown to yellow. Cupric silicates are blue, becoming green when dehydrated. When heated with the supernatant liquid the precipitates are not altered. Solutions of sodium disilicate, $Na_2Si_2O_5$, behave exactly like those of sodium metasilicate, Na_2SiO_3.—J. T. D.

Zinc salts ; Action of hydrogen sulphide on alkaline solutions of ——. L. W. McCay. J. Amer. Chem. Soc. 1908, **30**, 376—378.

Zinc sulphide or zinc hydrosulphide precipitated from alkaline solutions by means of hydrogen sulphide is dissolved again if the action of the gas is continued for some time. Hence, in the separation of manganese from zinc by adding an excess of alkali hydroxide, filtering off the manganous hydroxide, and precipitating the zinc in the filtrate by means of hydrogen sulphide, the whole of the zinc sulphide may be redissolved in 15 to 20 minutes, by a rapid current of the gas, and may conceivably be overlooked.—C. A. M.

Sulphides and double sulphides. A. Ditte. Ann. Chim. Phys., 1907, [8], **12**, 229—277. Chem. Zentr., 1908, **1**, 799—804.

An account of the preparation and properties of mercuric, stannous, antimony, bismuth, copper, silver, and gold sulphides and of their double compounds with alkali sulphides, as also of stannous selenide and its double compounds with alkali sulphides and selenides. The mechanism of the technical preparation of cinnabar by the wet process is explained, as follows :—When black mercuric sulphide is digested with an alkali sulphide or polysulphide solution, a certain quantity of the double sulphide, $5HgS,K_2S,5H_2O$, is formed. As the temperature gradually rises, this is partially decomposed with separation of red crystalline mercuric sulphide. On now cooling, a further quantity of double sulphide is formed from the amorphous mercuric sulphide, and this again decomposes as the temperature rises. By treating excess of black mercuric sulphide with excess of a dilute solution of potassium sulphide, and allowing to stand in a closed vessel at the ordinary temperature, the variations in temperature during day and night suffice to gradually effect the solution of the whole of the mercuric sulphide and its separation in the crystalline form by means of the reactions just described. It is generally stated that stannous sulphide is soluble in alkali sulphides, and this is utilised for its separation from insoluble sulphides. Actually both the solution and the residue contain tin. In order to avoid error in such separations, it is best to use ammonium polysulphide instead of ammonium sulphide.—A. S.

Ferrous hydroxide ; Oxidation of —— by cupric hydroxide in presence of ammonia. H. R. Ellis and W. H. Collier. Chem. News, 1908, **97**, 121—122.

The results of these investigations upon the reaction between copper sulphate and ferrous sulphate in presence of ammonia go to show that the failure of the ammonia test for copper in solution is brought about by the ferrous sulphate present, which reduces the copper to cuprous compounds and becomes itself oxidised to the ferric state (compare F. Herrmann, this J., 1907, 406 ; also Ellis and Collier, Proc. Chem. Soc., **23**, 235). The precipitate in this reaction consists of ferric hydroxide, ferrous hydroxide and probably basic sulphates of copper and iron. Using equivalent quantities of copper sulphate and ferrous sulphate and varying quantities of ammonia, the authors find that on exclusion of air, the oxidation ceases after a time. With excess of ammonia and copper sulphate, the whole of the iron is oxidised in a few minutes. It is also found that the freshly precipitated ferric hydroxide is quite soluble in cold dilute sulphuric acid but becomes partially insoluble after prolonged boiling in water or drying at 120° C. The copper dissolves as cuprous compounds, and the ferrous and ferric hydroxides dissolve without the ferric sulphate being reduced. The reaction between iron salts and copper salts in presence of ammonia is different from the reaction in acid solution, for in the latter case "copper and cuprous salts will reduce ferric compounds on prolonged boiling."—W. S.

Hydrating power of salts in solution. Influence of one salt on another in the same solution. H. C. Jones and C. M. Stine. Amer. Chem. J., 1908, **39**, 313—402.

The authors have investigated the effect of one salt possessing hydrating power upon the hydrates of a second salt in the same solution by determinations of the freezing points, conductivities, and number of grams of solvent in a litre of solution of the various salt solutions employed. In the more concentrated solutions the freezing point was reached by means of a mixture of solid carbon dioxide and alcohol, the temperatures being determined with alcohol thermometers. For more dilute solutions, where freezing mixtures of ice and sodium chloride were used, the temperatures were read by means of Beckmann thermometers. Necessary corrections had to be made for the separation of ice and consequent increase in concentration. Large under-cooling was obviated by inoculating the solution with a minute particle of the solid phase of the solvent. Conductivities were measured by the method of Kohlrausch in Jones and Bingham conductivity cells (Amer. Chem. J., **34**, 481) for dilute solutions, and in Jones and Getman cells (Z. physik. Chem., 1903, **46**, 254) for more concentrated solutions. Formulæ are given for calculating from the experimental data the lowering of hydration in a binary mixture of electrolytes.

From these investigations the authors conclude that the complexity of the hydrates formed by a salt is a function of the amount of water present as solvent, and that when two salts are present in the same solution, the complexity of the hydrates is somewhat less than in separate solutions of these salts, each salt tending to dehydrate the other ; also that the dehydrating power of the molecules is, in some cases, probably greater than that of the ions into which these molecules dissociate. It is shown that the conductivity method is not an accurate measure of dissociation. The diminution in conductivity, when two electrolytes are mixed, is probably not only due to suppression of ionisation but also to a change in viscosity of the solvent and to a change in size of the ionic sphere due to an alteration in the amount of water which the ion must drag with it through the solution.—W. S.

Aluminium carbide ; Preparation of ——. C. Matignon. Bull. Soc. Chim., 1908, **3**, 355—361.

Aluminium carbide may be obtained by heating a mixture of the elements in a Perrot furnace. Carbon in the form of lampblack, is intimately mixed with excess of aluminium powder, together with some oil of turpentine. Reaction is complete after 20 minutes' heating. Excess of aluminium is removed by treating the fused mass for only a short time with hydrochloric acid, or with sodium hydroxide solution. When thus purified, the carbide furnishes, on contact with water, pure methane in almost theoretical proportions. Combination also takes place when the elements are intimately mixed, with aluminium in excess, and action is started, during heating, by a deflagrating charge, such as a mixture of barium dioxide and aluminium; and also when the mixture is heated in the oxy-acetylene blowpipe flame. Another method of production is by the action of the chlorides of carbon on metallic aluminium. Thus, when hexachlorbenzene, C_6Cl_6, is heated to 225° C. in a sealed tube with aluminium powder, combination takes place with explosive violence, aluminium chloride and carbide being formed.—J. O. B.

Vanadic acid; Reduction of —— by zinc and magnesium. F. A. Gooch and G. Edgar. Amer. J. Sci., 1908, **25**, 233—238.

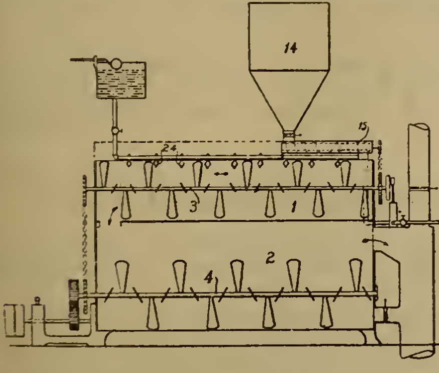
GLASSMANN'S method (this J., 1905, 250) of determining vanadium and molybdenum together, based on the differential reduction of vanadium by zinc and magnesium is inaccurate and useless; for magnesium does not reduce vanadic acid definitely to V_2O_3, but to a condition intermediate between V_2O_2 and V_2O_3 and varying greatly, whilst a vanadium solution reduced by zinc and exposed to air even for a short time as in Glassmann's process absorbs oxygen to a considerable and very irregular extent. Vanadic acid is reduced by zinc in the zinc reductor easily and accurately to V_2O_2; and the element can be accurately titrated by the method suggested by Randall for molybdenum (this J., 1907, 1164).—J. T. D.

PATENTS.

Sulphuric anhydride; Catalytic apparatus for making ——. G. Eschelmann and A. Harmuth, Assignors to Tov. Tentelevskago Ximichesk Zavoda, St. Petersburg. Reissue No. 12,759, dated March 10, 1908, of U.S. Pat. 792,205, June 13, 1905.

SEE Addition of Oct. 4, 1904, to Fr. Pat. 321,275 of 1902; this J., 1905, 277.—T. F. B.

Lime; Apparatus for hydrating ——. C. Ellis, New York. U.S. Pat. 878,619, Feb. 11, 1908.



CRUSHED lime is fed from a hopper, 14, by means of the device, 15, into the upper compartment, 1, of a closed chamber, and at its point of entry is mixed with a definite quantity of water supplied by means of a pump connected to the lime-feeding mechanism. The mixture is carried along the compartment, 1, by the conveyor, 3, and during its passage is mixed with more water delivered in the form of spray through the jets, 24. From the further end of 1, the mixture falls into the lower compartment, 2, wherein the hydration is completed. The hydrated lime is delivered from the apparatus by means of the conveyor, 4.—A. S.

Zinc liquors; Apparatus for the treatment of —— with sulphuretted hydrogen for the recovery of zinc therefrom. A. T. Hall and The Hull and Liverpool Red Oxide Co., Ltd., Hull. Eng. Pat. 10,225, May 2, 1907.

WASTE liquors containing zinc are treated with sulphuretted hydrogen, under pressure, in a closed tank, the gas being continuously pumped away from above the liquid through a pipe, and forced through the liquid again, until the reaction is complete. Waste of gas is thus prevented. Or, the liquid, instead of the gas, may be circulated by means of the pump by continuously spraying it in from above, until the zinc is all precipitated, a constant pressure of gas being maintained as before.—F. SODN.

Ammonia liquors; Treatment of ——. [Production of ferrocyanides.] J. Grossmann, Manchester. Eng. Pat. 19,988, Sept. 7, 1907.

THE cyanides contained in ammoniacal liquors may be converted wholly into soluble ferrocyanides by treatment with an excess of sulphide of iron, in the presence of considerable quantities of ammonium sulphide. The most effective quantity of iron sulphide is first ascertained by a laboratory experiment, and may amount to five times that required by calculation. The crude liquor is then agitated in a tank with the sulphide, until all the cyanide has been converted into ferrocyanide, access of air being avoided during the process. The clear liquors are next subjected to the usual distillation for the recovery of ammonia, the excess of iron sulphide being used for treating another batch of liquor. Then, after settling or filtration, the ferrocyanides are precipitated by adding iron or other suitable compounds, the liquid being acidified, if necessary. —F. SODN.

Calcium carbide; Manufacture of ——. H. L. Hartenstein, Duluth, Minn., U.S.A. Eng. Pat. 20,647, Sept. 17, 1907.

SEE Fr. Pat. 383,053 of 1907; this J., 1908, 281.—T. F. B.

Stannic oxide; Apparatus for making ——. H. Foersterling, Perth Amboy, N.J., Assignor to The Roessler and Hasslacher Chem. Co., New York. U.S. Pat. 880,873, March 3, 1908.

METALLIC tin is melted in a pan across which a wide horizontal flame of burning gas is directed. The air supply is heated above the temperature at which the dark-coloured lower oxide of tin is formed, and a portion is mixed with the gas supply for effecting combustion, whilst the remainder is forced directly up into the flame before the latter comes in contact with the tin.—A. S.

Lime and sulphur; Apparatus for boiling ——. F. O. Moburg, Omaha, Nebr. U.S. Pat. 881,434, March 10, 1908.

THE apparatus consists of a vat and a steam-supply pipe, to the lower end of which pipe is connected a transverse feed-pipe, decreasing in diameter from its junction with the supply pipe towards its ends. There is also provided a series of cross-pipes, perforated on their lower sides, and with ends terminating at points adjacent to the inner circumference of the vat.—A. G. L.

Kaolin; New substance replacing —— and its applications. A. Monin. Fr. Pat. 383,356, Oct. 26, 1907.

THE material consists of burnt gypsum (calcium sulphate) mixed with unburnt gypsum, and is intended to replace kaolin in loading paper, fabrics and india-rubber, for colour-making, etc.—A. G. L.

Hydrated magnesium carbonate; Process of making ——. G. Sisson. Fr. Pat. 383,407, Oct. 29, 1907. Under Int. Conv., Oct. 30, 1906.

SEE Eng. Pat. 24,134 of 1906; this J., 1908, 74.—T. F. B.

Barium carbonate; Process of obtaining ——. A. Gacon. Fr. Pat. 383,466, Oct. 31, 1907.

BARIUM sulphate is fused with an alkaline-earth chloride in presence of wood charcoal, the barium chloride formed is separated by lixiviation, and the solution is treated with alkali carbonates to precipitate barium carbonate. The alkali chloride produced as by-product is heated with calcium carbonate in order to obtain calcium chloride and alkali carbonate for use over again in the process.—A. S.

Liquefaction of air; Apparatus for the ——. G. Claude, Paris. U.S. Pat. 881,176, March 10, 1908.

SEE Fr. Pat. 352,856 of 1905; this J., 1905, 969.—T. F. B.

Bromine ; Process of removing chlorine from raw ——. K. Kubierschky, Brunswick, Germany. U.S. Pat. 881,806, March 10, 1908.

See Ger. Pat. 174,848 of 1905 ; this J., 1907, 824.—T. F. B.

Cadmium ; Separating —— from zinc sulphate. Eng. Pat. 1625. *See* XIA.

Acetates ; Electro-chemical manufacture of ——. Fr. Pat. 383,595. *See* XIA.

VIII.—GLASS, POTTERY, AND ENAMELS.

Pottery trade ; Hygiene of the ——. Shaw Lecture. W. Burton. J. Royal Soc. of Arts, 1908, 56, 494—509.

A monograph, with illustrations, in which the conclusions drawn, are :—(1) that the great bulk of such products as earthenware, china, tiles, electric fittings, etc., can only be satisfactorily glazed with glazes containing lead, so far as present knowledge and experience go, and (2), that in the use of lead compounds as much as in the use of clay or flint, the enemy is "dust."

Patents.

Ceramic mass ; Manufacture of a —— and of ware therefrom. A. G. Bloxam, London. From Risler und Co., Freiburg, Germany. Eng. Pat. 5123, March 2, 1907.

See Fr. Pat. 375,155 of 1907 ; this J., 1907, 873.—T. F. B.

Earthenware or pottery ; Process of decorating or finishing ——. A., J., and A. E. Lovatt, Derby. Eng. Pat. 8687, April 15, 1907.

For the decoration of earthenware the colouring matter and glaze are mixed together, with a vehicle, such as gum, to form a viscous printing medium. This is used for printing the design on unfired, biscuit, or fully fired ware, or on ware which has been previously dipped in "smear" or half glaze, or in full glaze, and then dried; a fully glazed design on a dead, half glazed or fully glazed ground is thus produced in one firing.—F. Sodn.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Lime [for lime-sand bricks] ; Experiments with ——. E. Cramer. Tonind. Zeit., 1908, 32, 222—224.

A sample of white lime, complained of as being unsuitable for making lime-sand bricks, though found of normal composition, on being slaked furnished a rather gritty powder, and the specimen bricks exhibited cracks and possessed low tensile strength. No improvement was obtained by finely grinding or levigating the lime. The only effective treatment consisted in subjecting the fine lime to a steam pressure of 8 atmospheres previous to mixing it with the sand. No explanation of this behaviour was obtained, the proportion of soluble silica in the bricks being normal ; but the microscopical examination of thin sections of the bricks showed less compactness of structure in the matrix surrounding the quartz granules in these bricks, than in the case of sound bricks. Two other samples of lime, one containing 95·32 per cent. of calcium oxide, from Thuringia, and another, of Russian origin, containing 99·04 per cent., also gave similar results.—C. S.

Patents.

Marble ; Process for the coloration of ——. E. L. Belloni, Milan, Italy. Eng. Pat. 7037, March 23, 1907. Under Int. Conv., June 21, 1906.

See U.S. Pat. 844,846 of 1907 ; this J., 1907, 410.—T.F.B.

Refractory materials ; Crucibles, bricks and other ——. A. and S. Seigle. Fr. Pat. 383,593, Jan. 12, 1907.

Articles of fire-clay are rendered more refractory by the addition of chromium sesquioxide or of chromites. This is effected by soaking the articles in solutions of gelatin, starch, etc., drying, and then immersing in a solution of chromic acid, or of a chromate. On again drying and heating, chromium sesquioxide or a chromite is left in the pores of the article. Or else, the article may be soaked first in the chromium solution, and then treated with ammonia gas, dried and heated.—A. G. L.

Wood for railway sleepers : Process of impregnating —— and material produced. J. Chateau and J. Merklen. Addition, dated Oct. 29, 1907, to Fr. Pat. 375,859, March 18, 1907 (this J., 1907, 926).

Instead of using auxiliary liquids to distribute the creosote in the interior of the wood, as claimed in the principal patent, the wood is treated with creosote in the presence of steam and compressed air. The steam in condensing raises the temperature to the required degree. Or else, the wood is simply immersed, without pressure, in a mixture of creosote and water heated to the required temperature.—A. G. L.

Wood ; Process for impregnating and waterproofing ——. R. Schubert and O. Wagler. Ger. Pats. 189,265, April 3, 1904, and 193,057, Nov. 13, 1906.

(1). The wood after being impregnated with suitable salts, is dried, and coated with a film of paraffin wax, wax, or stearic acid, or mixtures of these substances. (2). Before applying the coating of paraffin wax or the like, the salts near the surface of the wood are converted into insoluble compounds : *e.g.*, zinc chloride or magnesium chloride is converted into the hydroxide or oxychloride, or sulphates are treated with barium hydroxide solution.—A. S.

Wood ; Process for impregnating ——. C. Deditius. Ger. Pat. 188,613, April 20, 1906.

The wood is impregnated with a product obtained by distilling crude petroleum with sulphur, and removing the lighter constituents from the distillate.—A. S.

Cement from blast-furnace slag ; Process for making ——. S. O. Cowper-Coles, London. Eng. Pat. 4530, Feb. 23, 1907.

The slag, broken into pieces of about half an inch cube, is mixed with the requisite quantity of powdered chalk or lime, and passes continuously to an electric furnace, preferably of a form previously described (this J., 1907, 767), from which the molten slag is allowed to drop on to a revolving disc, where it is pulverised with the help of steam, with which it is simultaneously brought into contact. In this condition it forms an excellent cement. —F. Sodn.

X.—METALS AND METALLURGY.

Nitrogen in iron. N. Tschischewski. Stahl u. Eisen, 1908, 28, 397—399. (See also Braune, this J., 1904, 1114 ; 1907, 50 and 693.)

The nitrogen in a number of samples of iron and steel was determined by dissolving the metal in hydrochloric acid, diluting and distilling with slight excess of potassium hydroxide, and either titrating the distillate by means of *N*/100 sulphuric acid, potassium iodide and iodate, and sodium thiosulphate, or estimating the ammonia colorimetrically by Nessler's reagent. The latter method was found to give as a rule lower results than the former, probably because of the formation during solution and distillation, of amines, which tint Nessler's reagent less strongly than ammonia. The percentages of nitrogen found were in all cases very low :—in gray pig-irons, 0·001 to 0·003, in Siemens steel 0·003 to 0·005, Tropenas steel 0·0068 to 0·0075, Bessemer steel 0·013 to 0·015, and cementation steel 0·015. These percentages cannot, in the author's opinion, exert any sensible influence on the mechanical characters of the steel.—J. T. D.

Ferrovanadium for foundry purposes. R. Moldenke. Electroch. and Metall. Ind., 1908, 6, 127.

By addition of vanadium to grey or white pig-iron, the strength of the metal is greatly increased. Tests were made with scrapped railway carriage wheels and machinery gray pig, and also some on a burnt grey iron (burned grate-bars, etc.), to which was added, on remelting, sufficient ferromanganese to deoxidise it, and then the ferrovanadium. The modulus of rupture was increased to extents varying from 30 to 150 per cent. The ferrovanadium used contained 14·7 per cent. of carbon and 0·18 of silicon, and the vanadium-content of the metal as cast was about 0·05 per cent.—J. T. D.

Platinum ; Oxidation of ——. C. Marie. Compt. rend., 1908, **146**, 475—477. (Compare this J., 1907, 876.)

THE author finds that platinum is perceptibly oxidised by mere contact with oxidising agents. Pieces of platinum foil (both pure and containing different quantities of iridium) were placed in a solution composed of 10 grms. of potassium permanganate, 10 c.c. of sodium hydroxide solution and 200 c.c. of water, control pieces being placed in a similar alkaline solution containing no permanganate. After 24 hours at the ordinary temperature, the pieces of metal were thoroughly washed, and immersed in a hot hydrochloric acid solution of potassium iodide. After a few moments the solutions containing the pieces of metal which had been in contact with permanganate acquired the pink colour characteristic of dilute solutions of platinum to which an iodide has been added. The presence of dissolved platinum is also indicated by hydrogen sulphide, the depth of colour being comparable with that produced in an equal vol. of a solution containing 0·00004 grm. of platinum. Similar oxidation of platinum is effected by potassium persulphate, bichromate, chlorate, and permanganate in sulphuric acid solution and by potassium ferricyanide in alkaline solution. Ferric chloride in acid solution and hydrogen peroxide in acid or alkaline solution appear to be without action on platinum. Strong nitric acid has also a considerable oxidising action on platinum, especially when hot. So far as could be judged, pure platinum and 20 per cent. platinum-iridium were attacked more strongly than 1 per cent. platinum-iridium.—A. S.

Copper and magnesium ; Alloys of ——. G. Urasow. J. Russ. Phys.-Chem. Ges., 1908, **39**, 1566—1581. Chem. Zentr., 1908, **1**, 1038.

THE results of the thermometric examination of alloys of copper and magnesium were as follows :—

Atoms of copper per cent.	0	1·67	6·4	14·48	16·0
Solidification temp......	650°	634°	580°	500°	B
Eutectic temp..........	A	478°	480°	480°	480°
Atoms of copper per cent.	17·0	29·4	33·3	33·86	
Solidification temp......	494°	566°	570°	569°	
Eutectic temp..........	480°	480°	C	552°	
Atoms of copper per cent.	37·8	40·45	41·5	42·58	45·1
Solidification temp......	564°	557°	D	600°	661°
Eutectic temp..........	554°	555°	555°	555°	554°
Atoms of copper per cent.	50·37	60·0	65·4	66·6	
Solidification temp	721°	787°	798°	799°	
Eutectic temp..........	554°	554°	554°	E	
Atoms of copper per cent.	66·93	70·0	73·0	77·5	78·0
Solidification temp......	797°	786°	765°	728°	F
Eutectic temp..........	723°	725°	725°	725°	725°
Atoms of copper per cent.	79·8	85·7	90·0	100	
Solidification temp......	748°	861°	948°	1084°	
Eutectic temp..........	725°	725°	725°	G	

The cooling curve constructed from these results shows three eutectic points, B, D and F, and two distectic points, C and E, which latter correspond to the melting points of the compounds, Mg_2Cu and $MgCu_2$, respectively. No solid solutions are formed either of the two metals or of the metals and the compounds mentioned. These results are confirmed by the micro-structure of the alloys. No evidence was obtained of the existence of the compound, MgCu, mentioned by Boudouard (this J., 1902, 1456 ; 1903, 799) ; also the melting point of the compound, $MgCu_2$, is 799° C., not 915° C. as stated by Boudouard.—A. S.

Antimony and arsenic ; Determination of —— *in lead-antimony alloys.* G. M. Howard. J. Amer. Chem. Soc., 1908, **30**, 378—380.

THE method has the advantages of not requiring the removal of tin, and of not being affected by the presence of small quantities of iron and copper :—From 0·5 to 2 grms. of fine filings from the sample are heated with 60 to 70 c.c. of strong hydrochloric acid and 2 or 3 drops of nitric acid (sp. gr. 1·4) in an Erlenmeyer flask on a hot plate until solution is complete, after which the liquid is boiled until colourless (or till it is straw-coloured if iron is present), and saturated, while hot, with hydrogen sulphide. The excess of gas is then expelled by passing a current of air through the flask, the effect of which is to re-oxidise tin, copper, iron, etc., leaving only the antimony in the reduced state. The cold liquid is next treated with a little tartaric acid, diluted with water to twice its volume and filtered from the arsenic sulphide. The filtrate is nearly neutralised with powdered sodium carbonate, the neutralisation completed with sodium bicarbonate, of which a slight excess is added, and the antimony determined by titration with standard iodine solution. The precipitated lead carbonate does not interfere with the sharpness of the reading. If a determination of arsenic is not required, the liquid with the arsenious sulphide and free sulphur in suspension need not be filtered, but merely neutralised and titrated. Otherwise the filtered and washed precipitate is boiled with about 20 c.c. of water containing a few drops of sodium hydroxide solution, which dissolves only a small portion of the free sulphur, this treatment being repeated if the amount of precipitate is considerable. The alkaline filtrate containing the arsenic is oxidised by means of about 20 c.c. of a 3 per cent. solution of hydrogen peroxide, and concentrated to about 20 c.c. When cold, potassium iodide solution containing about 0·1 grm. of the salt is added, then 20 c.c. of strong hydrochloric acid, and after standing for 5 minutes the liquid is titrated with standard thiosulphate solution, three drops of starch solution being added as indicator towards the end. Difficulties sometimes experienced in obtaining a sharp reading in this titration are attributed to the use of too large an excess of potassium iodide and of too much starch.—C. A. M.

Metals ; Action of ammonium persulphate on —— J. W. Turrentine. J. of Phys. Chem., 1907, **11**, 623. (See also Hodgkinson, Eng. Pats. 3225 of 1905 and 717 of 1906. this J., 1905, 1309 ; 1907, 55.)

SULPHATE ions are discharged when persulphates are decomposed in aqueous solution. These ions behave analogously to sulphate ions produced electrolytically. Copper in ammonium persulphate solution behaves just as copper does when employed as the anode in the electrolysis of sulphates. Thus, a strip of pure copper in spiral form, was agitated for an hour with dilute aqueous ammonium persulphate solution. The copper dissolved without any evolution of gas. The loss of persulphate was equivalent to the loss of copper, after a correction was made for the solubility of the latter in the residual ammonium sulphate. The analogy is pointed out between this solution of copper and the action when copper is used as the anode in the electrolysis of a sulphate solution. This analogy applies also in the cases of nickel, cadmium, and aluminium. Iron is dissolved to form ferrous sulphate, which is partially oxidised to ferric sulphate. The hydrolysis of the latter leaves free acid, which reacts upon the iron with evolution of hydrogen, and ammonium persulphate may thus be regarded as acting as a catalytic agent in the reaction between iron and water.

Thorianite in Ceylon. Board of Trade J., March 26, 1908. [T.R.]

THE first shipments of thorianite were made from Ceylon in 1905, during which year 179 cwt., valued at Rs. 74,315, were exported. The supply has since diminished, and in 1906 the exports amounted to 52 cwt., valued at Rs. 25,199, whilst in 1907, only 10 cwt. was exported, of a value of Rs. 4750. (1R. = 1s. 4d.)

Mineral production of Canada in 1907. Eng. and Min. J., March 21, 1908. [T.R.]

The following table shows the mineral production of Canada in 1907 :—

Metallic.

		Quantity.	Value.
Antimony ore	tons	2,016	$65.000
Copper	lb.	57,381,746	11,478,644
Gold		—	8,264,765
Iron ore (exports)	tons	25,901	45,907
Pig iron from Canadian ore	,,	107,599	1,982,307
Lead	lb.	47,565,000	2,532,836
Nickel	,,	21,189,793	9,535,407
Silver	oz.	12,750,044	8,329,221
Cobalt, zinc, and other metallic products		—	200,000
Total metallic	..	—	$42,434.087
Non-metallic.			
Arsenic (refined)	lb.	660,080	36,210
Asbestos	short tons	62,018	2,482,984
Asbestic	,,	28,519	22,059
Chromite	,,	7,196	72,901
Coal	,,	10,510,961	24,560, 238
Peat	,,	50	200
Corundum	,,	1,892	177,922
Felspar	,,	12,584	29,809
Graphite	,,	579	16,000
Grindstones	,,	5,382	46,876
Gypsum	,,	475,508	642,470
Limestone for flux	,,	359,503	298,097
Mica	,,	—	333,022
Mineral pigments—Barytes	,,	2,016	4.500
,, ,, Ochres	,,	5,828	35,570
Mineral water	gal.	250,985	110,524
Natural gas		—	748.581
Petroleum	bbl.	788,872	1,057,088
Phosphate	tons	750	5,514
Pyrites	,,	39,133	189,353
Salt	,,	72,697	342,315
Talc	,,	1,534	4,602
Tripolite	,,	30	225
Total non-metallic	..	—	$31,217,060
Structural materials and clay products.			
Cement—natural rock	bbl.	5,775	4,043
,, Portland	,,	2,368,593	3,374,828
Flagstones	sq. yd.	3,000	2,550
Sands and gravels (exports)	tons	298,095	119,853
Sewer pipe		—	1,211,000
Slate	squares	4,335	20,056
Building material, including bricks, building stone, lime, &c., estimated on the basis of production in 1906		—	7,500,000
Total structural materials and clay products	..	..	$12,232,330
Estimated value of mineral products not returned	..	..	300,000
Total, 1907	..	..	$86,183,477

Patents.

Tin smelting furnaces ; Treatment of slags from——. G. T. Holloway, London. Eng. Pat. 12, Jan. 1, 1907.

The slag, which consists mainly of a small amount of metal together with silicates of iron, tin, calcium, etc., is smelted in an ordinary blast-furnace with the addition, if necessary, of some suitable flux. The iron content of the charge is so arranged that an iron-tin alloy is produced which contains the maximum amount of tin which can be obtained from the slag without undue loss of the metal. For this reason it may be necessary to mix the slag with a calculated quantity of some iron ore. The alloy, so obtained, is afterwards treated, electrolytically or otherwise, for the production of metallic tin.—C. A. W.

Welding of metals. W. S. Simpson, London. Eng. Pat. 86, Jan. 1, 1907.

A homogeneous metallic plate, shaft or tube may be built up by the welding together of two or more pieces of iron or steel by the interposition of a softer metal, such as copper, tin, zinc or some alloy of these, between the various parts. The whole, after being clamped together, is embedded in a non-oxidising material, such as powdered charcoal mixed with a binding agent, in a suitable receptacle and heated to a temperature sufficient to fuse the welding metal. In cases where a more refractory packing material has to be used, it is necessary to pass carbon monoxide from outside into the gas-tight receptacle. The process may be applied to the manufacture of armour plates or to any other process where the construction of a composite metal is required.—C. A. W.

Furnace ; Converting or cementation——. A. Senior and G. P. Wincott, Sheffield. Eng. Pat. 3598, Feb. 13, 1907.

The claim is for a gas regenerative converting furnace containing two pots placed side by side. The flues are so arranged that the hot gases pass under the bottom, up and down the sides and over the top of the pots, and gas is admitted in more than one place in order to give uniformity of heating.—O. F. H.

Furnaces ; Crucible——. P. J. Mallmann, London. Eng. Pat. 4912, Feb. 28, 1907.

The furnace is designed so that the top casing, containing the crucibles, can be swung clear of the furnace proper and carried to any part of the foundry. It can then be tilted by suitable mechanical means, *e.g.*, a screw and worm wheel, and the contents of the crucibles run directly into the mould through a single spout. The furnace itself may be heated either by electricity or by gas, in the latter case the heating arrangement in the lower part is constructed as a gas producer and the gases made to circulate round the crucibles, an air blast being introduced above the grate. A cover is provided for closing the passages in the bottom of the crucible chamber during its separation from the furnace proper.—C. A. W.

Reverberatory furnace. F. Cotton, Hornsby, New South Wales. U.S. Pat. 881,110, March 10, 1908.

See Eng. Pat. 1770 of 1906 ; this J., 1907, 206.—T. F. B.

Alloys ; Zinc and aluminium——. S. O. Cowper-Coles, London. Eng. Pat. 3981, Feb. 18, 1907.

The alloy consists essentially of : calcium, 1·5 ; zinc, 90 ; and aluminium or some aluminium alloy, 8·5 per cent. Since calcium alone does not alloy readily with zinc, a metal composed of : aluminium, 85, and calcium, 15 per cent. ; is first made up, and 10 parts of this added to 90 parts of zinc. The resulting alloy is claimed to be hard, tough and white with a close grain.—C. A. W.

Malleable iron castings ; Production of metal for use in the manufacture of——, *and production of such castings.* W. Galbraith, Sheffield. Eng. Pat. 8543, April 12, 1907.

The process described in Eng. Pat. 23,293 of 1906 (this J., 1907, 1202) is applied to the production of malleable iron castings in a small Bessemer converter from ordinary hematite iron. In the manufacture of these castings it is necessary to have an iron lower in silicon than is usual and it is found that, using small charges, the lower temperature causes a more rapid oxidation of the silicon in proportion to that of the carbon. As in the previous invention the converter is provided with two supplementary sets of tuyères placed above the surface of the metal ; through one of these sets Mond gas, under pressure, is blown. By blowing air through the other set, a very hot flame is produced and this gives the additional heat required to keep the metal molten.—C. A. W.

Iron ; Method of extracting —— *and apparatus therefor.* C. G. P. de Laval, Stockholm. Eng. Pat. 23,060, Oct. 18, 1907. Under Int. Conv., Oct. 20, 1906.

The finely pulverised charge is fed in a continuous stream into the upper part of a vertical shaft which is heated from the outside, and is caused to fall in a thin stream down the walls of the shaft by means of rotating vanes. —O. F. H.

Iron ; Process and apparatus for extracting——. C. G. P. de Laval. Fr. Pat. 382,916, Oct. 15, 1907. Under Int. Conv., Oct. 20, 1906.

See Eng. Pat. 23,060 of 1907 ; preceding.—T. F. B.

Steel rails ; Method of improving ——. R. A. Hadfield, Sheffield. Eng. Pat. 18,707, Aug. 19, 1907.

See U.S. Pat. 879,634 of 1908 ; this J., 1908, 286.—T. F. B.

Steel ; Manufacture of —— by the pneumatic process. A. Tropenas, Montelimar, France. U.S. Pat. 880,253, Feb. 25, 1908.

See Eng. Pat. 6484 of 1906 ; this J., 1906, 764.—T. F. B.

Sulphide ores ; Treatment of complex ——. G de Bechi, Assignor to R W. Rucker, London. U.S. Pat. 880,775, March 3, 1908.

See Eng. Pat. 9339 of 1906 ; this J., 1907, 618 —T. F. B.

Sulphurous ores and zinc ores ; Metallurgical treatment of —— by the precipitation process.—A. H. Imbert, Grand Montrouge, France. Eng. Pats. 12,591 and 12,592, May 30, 1907.

The patents relate to the employment of a dissolving bath for use in the precipitation method of treating sulphurous ores, in which the sulphide is reduced by some such metal as iron. In the reduction of zinc blende it is necessary to use a solvent giving a fluid residue which can easily be run from the retort. A suitable mixture consists of three parts of iron sulphide and one of ferric oxide ; this forms a very fluid bath at a temperature of 1000° C. The iron oxide may be replaced by oxides of manganese, lime, etc. ; moreover by forming the dissolving bath of the oxides and sulphides of the same metal which is employed as precipitating agent, the matte which is produced may be used over and over again, either as sulphide or, after roasting, as oxide. Since it is found in the case of zinc, that the success of the method is in no way dependent on the amount of sulphide contained in the ore, it is evident that the process can be extended to the treatment of zinc ores such as roasted calamine or the silicates, alone or mixed with blende, and this forms the subject of the second invention.—C. A. W.

Zinc ; Metallurgy of ores of ——, *and metallurgical furnace.* F. Meyer, Englewood, N.J., Assignor to Metallurgical Co. of America, New York. U.S. Pats. 879,482 and 879,483, Feb. 18, 1908.

Ore and fuel are fed in an upward direction through the active zone of an internally fired furnace by means of a vertical screw-conveyor placed in the lower part of the furnace, a horizontal conveyer feeding the charge to this conveyor from a hopper outside the furnace. The products of combustion and the volatilised zinc are withdrawn laterally, the zinc being condensed at a temperature above its melting-point. The clinker and ash fall from the top of the stack through a second stack, placed beside the first, into an ash-pit, and in so doing preheat air which enters the furnace through the ash-pit, passes upwards through the second stack, and then downwards through the active zone where it meets the charge.
—A. G. L.

Zinc-retort residues ; Process of treating ——. G. Stolzenwald, Valea Calugaresca, Roumania. U.S. Pat. 881,355, March 10, 1908.

See Eng. Pat. 18,134 of 1906 ; this J., 1906, 1224.—T. F. B.

Concentrating apparatus [*for ores*]. W. H. Coward, Bath. Eng. Pat. 13,501, June 11, 1907.

The apparatus consists of three vertical cylindrical chambers, communicating with each other through suitable air ducts, these last entering the respective chambers tangentially and leaving them vertically. Apertures are provided in the bottom of each cylinder for the removal of the graded ore. The current of air, which is provided by an exhausting fan placed between the first and second chambers, not only conveys the crushed ore through the system but also drives a horizontally rotating vane wheel in the first chamber. The heavier ground material impinging on this latter is thrown outward against the walls of the cylinder and falls to the bottom, a perforated plate preventing any material passing into the second chamber without having been subjected to its action. The air current, passing through the second chamber, finally impinges on the conical bottom of the third cylinder and, its motion being arrested, deposits the dust and lighter material carried over. It then escapes up a central vertical pipe which may be rotated and, being fitted with horizontal vanes, acts on the inflowing air in much the same manner as before.—C. A. W.

Metalliferous minerals from gangue ; Separation of ——. H. L. Sulman, H. F. K. Picard, and J. Ballot, London. U.S. Pat. 879,985, Feb. 25, 1908.

See Eng. Pat. 20,419 of 1903 ; this J., 1904. 1150.—T. F. B.

Metal plates or other articles ; Annealing and galvanising or tinning ——. S. O. Cowper-Coles, London. Eng. Pat. 19,696, Sept. 3, 1907.

The plates or other articles are annealed in a chamber filled with hydrogen in order to remove scale. The hydrogen chamber is heated in a suitable furnace and has an extension or cooling chamber which dips below the surface of the bath of zinc or tin. The plates are placed on a table in the hydrogen chamber, and when annealed, the table is raised and the top plate picked up by magnets which extend into the hydrogen chamber. A backward movement of the magnets causes the plate to pass between a pair of rolls, from which it is conveyed, by means of a roller slide, through the cooling chamber into the galvanising or tinning bath.—O. F. H.

Copper ores, residues, and the like ; Treatment of —— for obtaining copper. King's Norton Metal Co. and H. W. Brownsdon, London, and H. M. Smith, Abbey Wood, Kent. Eng. Pat. 21,595, Sept. 30, 1907. (See also Eng. Pats. 3225 of 1905, and 717 of 1906 ; this J., 1905, 1309 ; 1907, 55.)

A development of the method of oxidising copper sulphide by means of ammonium persulphate. (Eng. Pat. 13,297 of 1905 ; this J., 1906, 378.) In the treatment of copper sulphide ores by the wet method, the conversion to sulphate by roasting is not always complete, so that, on the subsequent extraction with an ammoniacal solvent, the whole of the copper from the ore is not obtained. It is proposed to employ a solvent containing 100 parts by weight of ammonia solution (sp. gr. 0·935) and 5 parts of ammonium persulphate or an equivalent amount of some other persulphate. With this solvent a preliminary roasting is unnecessary and the copper may afterwards be recovered from the solution by electrolysis, when, by reason of the persulphate present, a mixture of the metal and oxide is obtained. This mixture may be used for the anodes in electrolytic refining.
—C. A. W.

Ores ; Method of smelting ——. J. C. Hardie, Helena, Montana. U.S. Pat. 874, 336, Dec. 17, 1907.

Air is forced through a mass of incandescent fuel in a gas-producer. At the top of the producer the resulting carbon monoxide meets a blast of steam and air. The carbon dioxide formed, together with the steam, are then passed into a blast-furnace through tuyères, and effect reduction of the ore.—A. G. L.

Ores ; Method of reducing ——. J. T. Jones, Iron Mountain, Mich., Assignor to G. A. St. Clair, Duluth, Minn. U.S. Pat. 880,799, March 3, 1908.

The ore, in a finely powdered condition, is mixed with lumps of coke and the whole formed into a column, up which are passed the hot products of combustion of some carbonaceous fuel and, if desired, the hydrocarbons distilled therefrom. Air is excluded meanwhile and the temperature is not sufficient to fuse the ore. After cooling, the resulting gangue is treated for the separation of the reduced metal.—C. A. W.

Arsenical ores ; Process of reducing ——. G. M. Westman, New York. U.S. Pats. 879,931 and 879,932, Feb. 25, 1908.

Metallic arsenic is produced by subjecting the ores to the action of reducing gases, containing carbon monoxide and hydrogen, or carbon monoxide alone, and subsequently condensing the arsenical vapours in flues provided for the purpose. The reducing gases may be obtained by passing a mixture of air and steam through glowing coke or, with the same end in view, a mixture of coke, ore, and limestone may be heated to incandescence in the same chamber and air passed through the charge.—C. A. W.

Uranium and vanadium ; Process of extracting —— from ores. H. Fleck and W. G. Haldane, Golden, and E. L. White, Denver, Colo. U.S. Pat. 880,645, March 3, 1908.

The ores are treated with sulphuric acid, the acid solution produced being neutralised by contact with fresh ore. In this way the ore is enriched and may be subjected to fresh contact with an acid solvent. Before recovering the metals from the solutions, sulphur dioxide may be passed in and the metallic compounds reduced with the formation of sulphuric acid.—C. A. W.

[Antimony] Ores ; Process of treating ——. J. Patten and C. R. Barnett, Baltimore, Md. U.S. Pat. 880,752, March 3, 1908.

A heated solution of sodium sulphide is forced through the previously crushed antimony ore. Lime is added during the process to form insoluble compounds with the silica, arsenic, etc., which may have been dissolved. The sulphide solution is afterwards cooled by contact with a further portion of the solvent, the partially precipitated antimony sulphide separated, and the clarified solution used over again.—C. A. W.

Antimony ; Metallurgy of ——. G. Freydier-Dubreul. Fr. Pat. 383,143, Dec. 27, 1906.

Antimony ore is roasted, and the gases obtained are, when sufficiently cool, deprived of their content of finely-divided antimony oxide by passing them through chambers containing filters of metal wire, or of animal or vegetable fibres, these filters being automatically or continuously emptied.—A. G. L.

Extraction [of gold and silver] ; Process of ——. J. E. Porter, Syracuse, and A. L. Clark, New York, Assignors to The Just Mining and Extraction Co., New York. U.S. Pat. 880,821, March 3, 1908.

Ore and cyanide solution are heated to and kept at a temperature of 190° F., whilst air is forced through a number of vessels having porous walls and placed in the lower part of the mixture. When extraction is finished, the heating is stopped, and the cyanide solution is drawn off through a vessel with porous walls placed above the other vessels, through which air is still forced into the solution.—A. G. L.

Flux and process of making the same. F. J. Kovach, Assignor to J. C. Bassett, Cambridge, T. E. Parker, New Bedford, and H. F. Strout, Mount Vernon. U.S. Pat. 881,081, March 3, 1908.

See Fr. Pat. 377,168 of 1907 ; this J., 1907, 1053.—T.F.B.

[Bismuth] Ores ; Process of treating ——. S. C. C. Currie, Los Angeles, Cal. U.S. Pat. 881,101, March 3, 1908.

The bismuth ore is extracted with a hot solution of caustic alkali. Metals and metallic salts are precipitated from the cooled solution, which is then used over again. —A. G. L.

Lead ores ; Desulphurisation of ——. A. Richet. Fr. Pat. 383,451, Oct. 30, 1907.

Lead sulphide is mixed with (native) lead oxide, carbonate or sulphate, and the mixture is treated in a converter with an air-blast.—A. G. L.

Cement from blast-furnace slag, etc. Eng. Pat. 4530. *See* IX.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(A.)—ELECTRO-CHEMISTRY.

Electrolytic oxidations and their application to quantitative analysis. O. Gasparini. Gaz. chim. ital., 1907, 37, II., 426—461.

The author states that nitric acid when decomposed by the electric current forms the most energetic agent known for oxidation in the wet way. Its use is suitable for the detection and determination of mineral poisons in toxicological work, for the determination of sulphur and mercury in organic substances, for the analysis of rubber, leather, etc., and thiocyanogen compounds, for the determination of phosphoric acid, potassium, etc., in wines, fertilisers, seeds and other materials, and for the determination of sulphur in crude sulphur ores, and in inorganic sulphur compounds. The apparatus employed is constructed in three forms. The first (see Fig. 1) is intended for toxicological investigations, etc., where it is necessary to use large quantities of substance. The second (see Fig. 2) has two oxidation tubes and is used for the analysis of volatile substances, any vapour escaping from the first tube, being caught and oxidised in the second. The third form of apparatus is similar to the second, except that only one oxidation tube is used, this being connected directly to the inverted U-tube (with side funnel-tube) leading to the bulbs. The method is much simpler than that of Carius for the determination of sulphur in organic compounds ; such compounds as sulphonal and taurin can be oxidised in five hours at the most, whilst with more easily decomposable substances, ¼—1 hour is sufficient. A weighed quantity of the substance is introduced into the oxidation tube, nitric acid of sp. gr. 1·42 added, and a current of 3—4 ampères at about 8 volts passed through. When the oxidation is complete, the liquid in the oxidation tube is mixed with the washing liquid from the bulbs, evaporated to dryness, and the sulphur determined as barium sulphate. Good results have been obtained in the case of sulphobenzide, taurin, sulphonal, thiosalicylic acid, thiosinamine, thiourea, thialdine, thiobenzamide, sulphocarbanilide, thiosemicarbazide, thiophen, allyl sulphide, and mustard oil, but not with carbon bisulphide. Descriptions are given of the determination of sulphur in crude petroleum, mercury in mercury-diethyl, sulphur and mineral constituents in rubber and ebonite, and sulphur in leather; of the simultaneous determination of thiocyanic, hydrochloric and hydrocyanic acids; and of the examination of soils, cereals, flour, wine, beer, crude sulphur, and ores.

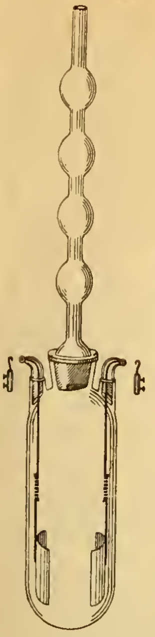


Fig. 1.

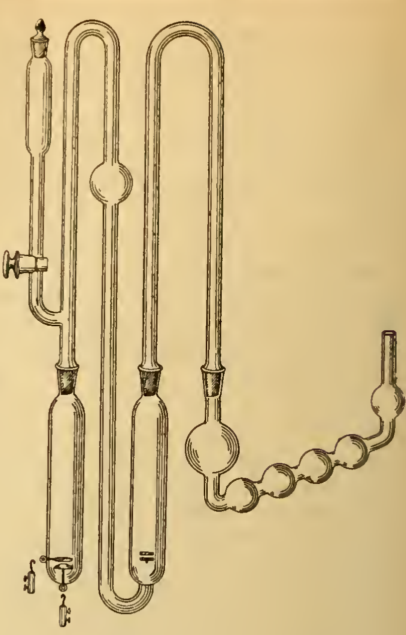


Fig. 2.

It is further pointed out that the nitric oxide produced by the electrolysis of nitric acid has strong reducing as well as oxidising properties. By making use of this reducing action it is possible to determine chlorates and bromates. The substance is subjected to electrolysis in presence of nitric acid with a current of 3—4 ampères at 8 volts. After 10—12 minutes, the chloride or bromide in the residue is determined volumetrically.—A. S.

Nitrogen oxides; Analysis of —— by means of their absorption spectra in the ultra red. E. Warburg and G. Leithäuser. *See* VII.

Patents.

Primary cell. P. G. Triquet, Paris. Eng. Pat. 5925, March 12, 1907.

See Fr. Pat. 373,098 of 1906; this J., 1907, 698.—T. F. B.

Accumulators; Electric ——. M. C. Thiellet and M. J. Denard, Lyons, France. Eng. Pat. 8284, April 9, 1907. Under Int. Conv., April 12, 1906.

The active mass consists of "oxide of lead agglutinated by an addition of bichromate of potash dissolved in gelatin swelled with water, and asbestos fibre treated with sulphuric acid and silicate of soda."—B. N.

Electrolytic apparatus and galvanic batteries. P. Borgnet, Liege, Belgium. Eng. Pat. 9029, April 18, 1907.

See Fr. Pat. 377,249 of 1907; this J., 1907, 1054.—T. F. B.

Pile or generator of electricity. L. P. Basset. Fr. Pat. 383,540, Oct. 31, 1907.

The patent relates to improvements in the apparatus described in Fr. Pats. 356,442 and 370,170 (this J., 1905, 1312, and 1907, 209). When solutions of nitric acid and sodium sulphide are employed in the positive and negative compartments, secondary reactions are set up and sulphur is deposited in the pores of the diaphragms. Hypochlorous acid, or some substance capable of dissolving the deposit, is therefore mixed with the nitric acid, and the sulphur dissolves on one side of the diaphragm forming polysulphides, while on the other the hypochlorous acid converts it into sulphuric acid. The sodium sulphide solution may also be maintained at a higher level, or under a greater pressure, in order to cause it to dissolve the sulphur by traversing the diaphragm. The solutions may also be separated by a third neutral liquid by means of porous diaphragms, thus avoiding the deposition of sulphur in the latter; the three liquids are kept in continuous circulation. Adjacent cells are separated by two walls of carbon, forming the electrodes, with an adhesive conducting mixture of graphite and paraffin, sulphur or celluloid between, or a single wall of carbon may be employed, the pores being stopped with a suitable substance, such as paraffin, sulphur or celluloid, in order to prevent the diffusion of the electrolytes.—B. N.

Electrodes; Method of making ——. E. W. Jungner, Kneippbaden, Assignor to Nya Ackumulator Aktiebolaget Jungner, Stockholm. U.S. Pat. 880,027, Feb. 25, 1908.

See Fr. Pat. 374,597 of 1907; this J., 1907, 876.—T. F. B.

Electrode for electrical bleaching apparatus; Carbon ——. P. Schoop, Nuremberg, Germany. U.S. Pat. 880,579, March 3, 1908.

See Fr. Pat. 370,162 of 1906; this J., 1907, 209.—T. F. B.

Transformer furnace [; Electric ——]. A. R. Lindblad and O. Stalhane, Ludvika, Sweden. U.S. Pat. 880,547, March 3, 1908.

See Fr. Pat. 370,583 of 1906; this J., 1907, 261.—T. F. B.

Electric resistances; Method of making —— by means of mixtures of good and bad conductors. Fabrik Elektrischer Zünder G.m.b.H. Fr. Pat. 383,359, Oct. 28, 1907.

Good conductors are mixed with bad conductors in the form of solutions or plastic or fused substances. The desired degree of resistance is given to the mixture by subjecting it to the action of electric waves or currents, as is done in the case of "coherers," and the mass is then allowed to harden in this condition, by evaporation, setting, or cooling.—A. G. L.

Cadmium; Separating —— [electrolytically] from sulphate of zinc in the manufacture of the same. F. A. E. Van Berckelaer, Brussels. Eng. Pat. 1625, Jan. 22, 1907.

Cadmium is separated, by electrolysis, in the form of a black powder on the cathode, from the liquor containing zinc sulphate.—B. N.

Gases and gas mixtures; Method of and apparatus for treating —— by means of voltaic arcs. A. J. Petersson, Alby, Sweden. U.S. Pats. 880,037 and 880,464, Feb. 25, 1908.

See Fr. Pat. 349,227 of 1904; this J., 1905, 679.—T. F. B.

Persulphates; Process for electrolytically producing ——. G. Teichner and P. Askenasy, Nuremberg, Germany. U.S. Pat. 880,599, March 3, 1908.

See Fr. Pat. 351,613 of 1905; this J., 1905, 896.—T. F. B.

Electric-furnace process. F. von Kügelgen and G. O. Seward, Holcombs Rock, Va., Assignors to Virginia Laboratory Co., New York. U.S. Pat. 880,743, March 3, 1908.

A current, sufficient to maintain the material in a molten condition, is passed, from a carbon electrode, through a "pyro-conductive" charge in an electric furnace. The electrode is chilled sufficiently to cause a portion of the charge to be solidified, thus forming a protective and conducting coating, which acts as a new working electrode.—B. N.

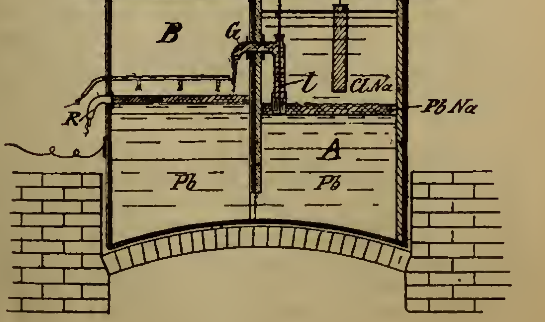
Electrolysis of brine; Apparatus for ——. C. F. Carrier, jun., Assignor to Elmira Electrochemical Co., Elmira, N.Y. U.S. Pat. 881,108, March 10, 1908.

Claim is made for an electrolytic cell having decomposing and oxidising compartments, means for circulating mercury through the cell and a distributing slot for mercury substantially centrally situated in the decomposing compartment. Retardation of the flow of amalgam in the decomposing compartment is prevented by means of triangular strips or blocks extending above the surface of the mercury and by intermediate channels diminishing in cross-sectional area in the direction of flow of the amalgam.—T. H. P.

Acetates; Electro-chemical manufacture of ——, especially sodium acetate. C. H. Jacob. Fr. Pat. 383,595, Jan. 12, 1907.

Alcohol is oxidised by allowing it to fall slowly over diaphragms supporting a mass of porous lead, produced by the electro-chemical action of aluminium on potassium plumbite. The liquid drops slowly into the positive compartment of an electrolytic vessel containing alkali, whereby acetic acid is produced and passes into the negative compartment where it forms sodium acetate. The heavy solution of sodium acetate passes away at the bottom of the electrolytic bath into a crystallising vessel, which is heated electrically.—B. N.

Caustic alkali; Apparatus for the production of —— by electrolysis of fused alkali chloride, using a lead cathode. C. L. Sagui. Ger. Pat. 189, 474, Oct. 23, 1906.



The electrolysis is carried out in the chamber, A, fresh sodium chloride being introduced through the hopper, I. The lead-sodium alloy produced is forced, by the superincumbent column of fused sodium chloride, through the pipe, G, into the decomposing chamber, B, from which caustic soda solution is discharged through the pipe, R. The pipe, G, can be closed by a valve connected to the spindle, *l*.—A. S.

(*B.*)—ELECTRO-METALLURGY.

Iron alloys low in carbon ; New method of producing ——. B. Neumann. Stahl u. Eisen, 1908, 28, 356—360.

The method consists in reducing the oxide or sulphide of the metal to be used, by means of silicon or ferrosilicon of high silicon percentage. The reaction cannot be carried out like the thermite process, but requires the aid of outside heat. A flux of lime and alumina (m. pt. 1300°—1500° C.) is melted in an electric furnace, and the mixture of silicon and metallic oxide added. The reduced metal sinks through the flux, and collects on the bottom of the furnace, which is made of magnesia or chromite bricks. In this way the author has produced from chromite, ferrochrome containing about 40 per cent. of chromium, 1 of carbon, and 2½ to 3 of silicon ; and from chromium oxide, alloys containing 5—7 per cent. of iron, 1 of carbon, 7—8 of silicon ; in no way could the percentage of silicon be brought down. Titanium or ferrotitanium produced by the process contained 3 per cent. of iron and 20 of silicon ; ferrotungsten, 5 per cent. of iron, 1 of carbon and 2 of silicon ; and ferromolybdenum, 6½ of iron, 0·6 of carbon and 3 of silicon. Probably the silicon-content of most of these alloys would not affect their application in making special steels. Sulphides are not completely reduced by silicon under the circumstances of these experiments.—J. T. D.

Patents.

Furnaces ; Induction ——. G. Gin. Eng. Pat. 28,638, Dec. 15, 1906.

A heating conductor, capable of acting chemically upon the material to be treated, is used as the secondary circuit. An application is described in which molten cast iron is used as the secondary, and by heating this with zinc sulphide, the zinc is liberated and volatilised into suitable condensing chambers. Reference is directed to Eng. Pats. 700 of 1887, 9219 of 1891, 23,707 of 1895, 17,027 of 1900, 23,964 and 28,805 of 1903, 8221, 17,178, and 21,060 of 1905, and 7597 of 1906 (this J., 1901, 367 ; 1904, 192, 549 ; 1906, 127, 766, 850, and 1152).—B. N.

Electric furnace for effecting fusion or for refining. E. Viel, Paris. Eng. Pat. 24,697, Nov. 7, 1907.

See Fr. Pat. 380,119 of 1907 ; this J., 1907, 1285.—T. F. B.

(1), (2), *Furnaces ; Electric* ——. (3), *Electrode-holder for electric smelting furnaces.* (4). *Electrode ; Sectional* —— *for electric furnaces.* C. E. Wilson, Ferris, W. Va. U.S. Pats. 881,517—881,520, March 10, 1908.

(1). The melting receptacle is provided with main electrodes at opposite sides, and an " exciting electrode," which may be inserted or withdrawn, is moved between them by means of an electric controlling device, the latter being connected with the exciting electrode. The receptacle may be tilted by means of a controlling device, actuated electrically, and connected with the receptacle, in order to prevent molten metal accumulating and making contact with one electrode. The desired resistance is thus maintained in the heat-generating material overlying the metal.

(2). The melting chamber is provided in its base with an electrode forming the lower terminal of an electric current supply, and, above the chamber, two suspended heads, which may be adjusted independently, are also separately connected with the electric supply. A battery of removable pencils is mounted in each head, these together forming the upper terminal of the current supply. The pencil electrodes in one head may thus be renewed whilst the current passes through the second suspended electrode. The melting chamber is provided with a cover, with holes for the passage of the pencils. Each pencil is formed of a number of sections, which may be readily joined together at their ends, and provided near their upper ends with perforations to receive supporting pins.

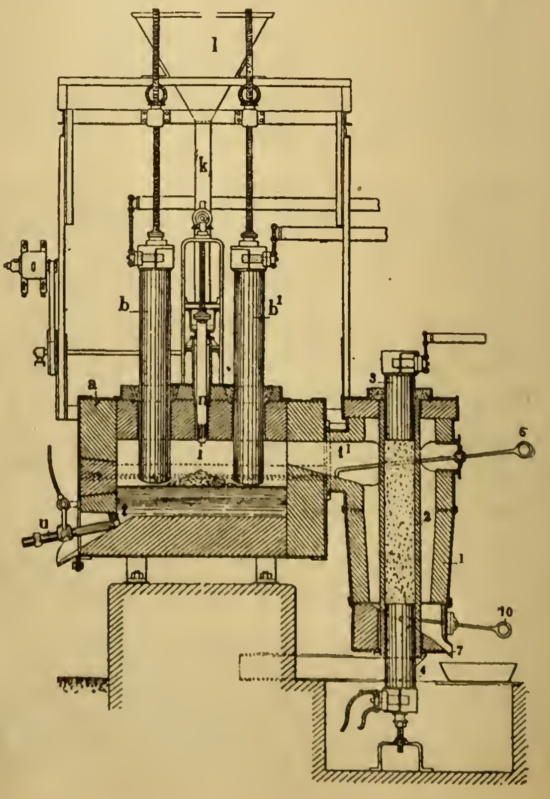
(3). The current-distributing holder, for supporting a number of " pencil " electrodes, comprises a water-jacketed head, with openings through it for receiving the pencils. The support for each pencil consists of a water-jacketed clamping device for releasing and engaging the pencil. The pencils consist of longitudinal sections fastened together at their ends, and passing through the openings in the head. Each opening is formed with a " segmental wall," against which the pencil fits at one side, and with an adjustable clamping block against which the pencil fits at the opposite side of the opening. Set-screws in the sides of the head engage with the blocks, so that each pencil may be fixed in position independently of the others.

(4). The " pencil " electrode is formed of a number of sections engaging together end-wise. Each section comprises a block of carbonaceous material formed of a number of longitudinal members fitting closely together. The ends of the blocks are dovetailed and perforated, so that, when they are fitted together, they may be fastened by a graphite bolt, which is passed through the registering perforations.—B. N.

Wall and ceiling covers ; Production of —— [*electrolytically*]. S. O. Cowper-Coles, London. Eng. Pat. 4984, March 1, 1907.

A film of metal is deposited electrolytically upon a drum, and a web of paper treated with mucilage is pressed into contact with the film, so as to wholly or partially remove the metal from the drum. The paper, canvas, or other material, may be treated in this manner one or more times, for the deposition of films of other metals, and the production of any desired pattern.—B. N.

Zinc ; Electric furnace for the continuous extraction of —— *from its ores.* E. F. Cote and P. R. Pierron, Lyons, France. Eng. Pat. 5100, March 2, 1907.



The furnace consists of a cylindrical body, *a*, of refractory material, with adjustable electrodes, *b*, *b'*, and may be heated by the arc or arcs produced, or by means of the resistance of the fused material in the bath. Roasted calamines are heated with reducing fuels and the necessary fluxes, or untreated blendes may be heated with scrap iron in the form of filings. The charge is supplied through the hopper, *l*, and the tube, *k*, into a horizontal tube, and carried through the latter, by means of an endless screw, into the charging tube, *i*. This is cleared from time to time by means of the rotating drill, *n*, which may also be raised or lowered. An auxiliary electrode, *u*, enables the tapping hole, *t*, to be cleared of pasty masses. Zinc is condensed into the liquid state by passing the vapour through the annular space in the condenser, 1, the temperature of which may be regulated. For this purpose a central tube, 2, is packed with resistance material between two electrodes, 3, and 4, and by regulating the position of these, the whole or a part of the condenser may be heated electrically, or the condenser may be heated by the production of an electric arc. The orifices, *t'*, and 7, may be cleared, if partially stopped by deposit, by the scrapers, 6, and 10, which are movable on swivel blocks in and out of the condenser, thus cleansing the parts without the admission of air. A modification is described, for the purpose of converting any carbon dioxide, mixed with the zinc vapour, into carbon monoxide, in order to avoid oxidation of the zinc. The vapours are passed through an incandescent mass of carbon, which forms the upper portion of the heating resistance of the condenser, before being passed through the condensing chamber.—B. N.

[Ore] Separators ; Electro-magnetic ——. W. Blackmore, London. Eng. Pat. 7982, April 5, 1907.

A conical table revolves between pole pieces, the edges of the latter being arranged concentrically with the edge of the table. The upper pole piece is made chisel-shaped, whilst the lower one is widened and is prolonged beyond the upper one in the direction of movement of the table. The latter is mounted upon rollers, through one or more of which the drive takes place. Ore is delivered in a wet state on to the table, and water pipes, provided with jets, are arranged in suitable positions, in order to : (1), check the passage of the whole charge through the magnetic field ; (2), wash the non-magnetic portion out of the magnetic field into a suitable receptacle ; (3), further wash the magnetic portion of the charge ; and (4), wash the cleaned magnetic portion, after it leaves the magnetic field, into a suitable receptacle.—B. N.

Tin ; Electrolytic refining of ——. E. A. Sperry, Brooklyn, New York. U.S. Pat. 874,707, Dec. 24, 1907.

The raw alloy is melted and treated by "poling," an oxidising agent, such as saltpetre, being added if necessary to assist in the oxidation of the impurities, which rise as a scum to the surface of the metal. Whilst the latter is at a high temperature, a small quantity of a "sliming or non-soluble" element, such as copper, is added, in order to aid the coagulation of the slimes in the subsequent process. The melt is allowed to cool to a predetermined point, and cast into anodes. These are dissolved in a suitable electrolyte, in a cell containing a diaphragm between the electrodes or surrounding one electrode. The electrolyte is heated and circulated within the cell, in order to facilitate the removal of the slimes, and prevent the accumulation of the same in the region of the anodes. The tin deposited on the cathode is of a high degree of purity. Periodically, portions of the electrolyte are withdrawn, and the tin precipitated, the precipitate being suitably concentrated to eliminate the impurities, and the purified tin returned to the process.—B. N.

Nickel ; Electrolytic process for refining ——. J. N. Pring, New York, Assignor to E. A. Sperry, Brooklyn, N.Y. U.S. Pat. 874,864, Dec. 24, 1907.

The nickel together with impurities, is obtained from crude nickel (copper refining waste) in the form of sulphate or other soluble salt in solution. From this solution such metals as copper, lead, bismuth, arsenic and antimony are precipitated by agitating with a small quantity of sodium sulphide, or freshly precipitated nickel sulphide obtained in a subsequent stage of the process. The precipitated sulphides are filtered off, and the filtrate digested with an alkali sulphide in order to precipitate nickel, cobalt, iron, zinc and manganese. The sulphides of iron, zinc and nickel are dissolved by hydrochloric acid, and the nickel sulphide, with or without previous separation of the cobalt is electrolysed in the presence of a chloride. Graphite plates are used as anodes, and are contained in porous cells into which the nickel sulphide is fed.—O. F. H.

Ores ; Furnace and process for desulphurising and agglomerating comminuted ——. A. J. Dull, Harrisburg, and J. Weatherby, jun., New Cumberland, Pa. U.S. Pats. 875,331 and 875,332, Dec. 31, 1907.

The finely-powdered ore is heated in a roasting furnace to a degree sufficient to burn out the larger portion of the sulphur, but insufficient to fuse the ore. After the removal of the major portion of the sulphur, the heated ore is exposed to the action of an electric arc, the electrodes of which are movable with respect to each other, so that the masses of cinder formed between two such poles become broken up and removed from the sphere of action of the arc. The agglomerated cinder may then be treated in a blast-furnace without fear of its being blown out by the blast. It is found that the electrical resistance of finely-powdered sulphurous ore is greatly decreased by heating. The roasting furnace employed may be of the upright type consisting of several floors over the surface of which iron rakes travel, the arc being formed on the lower floor between these rakes and electrodes provided ; or an ordinary revolving cement furnace may be modified by placing inside it, at its middle part, an annular electrode insulated by fire-brick. The arc is momentarily established between this ring and a series of circumferential studs as each severally reaches the lower side of the furnace.—C. A. W.

Electrodeposits ; Process for producing poreless and well-adhering ——. H. Schmidt, Cologne, Germany. U.S. Pat. 880,405, Feb. 25, 1908.

See Fr. Pat. 380,430 of 1907 ; this J., 1908, 28.—T. F. B.

Magnesium ; [Electrolytic] Process of producing ——. F. von Kügelgen and G. O. Seward, Holcombs Rock, Va., Assignors to Virginia Laboratory Co., New York. U.S. Pat. 880,489, Feb. 25, 1908.

Magnesium oxide is dissolved in a fused bath of magnesium fluoride, and one or more fluorides of metals, such as those of the alkalis, more electropositive than magnesium, the decomposition voltage of the bath being higher than that of the magnesium oxide. The liquid is subjected to electrolysis, and magnesium oxide supplied as required to replace that which is decomposed.—B. N.

Metals ; Producing —— by electrolysis. G. O. Seward and F. von Kügelgen, Holcombs Rock, Va., Assignors to Virginia Laboratory Co., New York. U.S. Pat. 880,760, March 3, 1908.

The metal is separated in a molten state at a submerged cathode, rising through the fused electrolyte, and accumulating and solidifying within a collecting ring at the top to form a protective cover in contact with the electrolyte. The under surface remains sufficiently soft for the rising globules of metal to adhere to it. The mass is gradually withdrawn from the electrolyte to form rods or blocks of the metal. (See U.S. Pat. 864,928, 1907, this J., 1907, 1056.)—B. N.

Aluminium and other metals ; Art of liberating —— *[electrolytically]*. H. S. Blackmore, Mount Vernon. N.Y. U.S. Pat. 881,049, March 3, 1908.

A mixture of aluminium oxide and fluoride is subjected to electrolysis, using an anode of "aluminium methid (Al_4C_3)." The metal of the aluminium oxide and fluoride is liberated, with "the concurrent combination of their electronegative constituents with the anode."—B. N.

Aluminium ; Manufacture of ——. H. Herrenschmidt. Fr. Pat. 383,554, Jan. 10, 1907.

Crude bauxite is powdered and dehydrated. The hot material is mixed with boric acid or a borate, preferably borax (about 8 per cent.), and a quantity of carbon (coke, charcoal, etc.) calculated to be sufficient for the reduction of the iron and silicon contained in the bauxite. The mixture is fused in an electric furnace, iron and silicon being reduced and forming compounds with boron, whilst the alumina is merely melted. The fused oxide is then run into a second furnace, or into another part of the first furnace, where it is reduced to aluminium as usual (after the addition of cryolite, etc.).—A. G. L.

Cobalt ores ; Process for treating —— and for refining cobalt from nickel, arsenical and silver-bearing ores. E. E. Armstrong, Niagara Falls, N.Y. U.S. Pat. 881,527, March 10, 1908.

Cobalt is precipitated as oxide by electrolysing a solution of cobalt in the presence of a metallic halide (chloride). —A. G. L.

Copper ; Method of recovering —— from ore or matte by electrolysis. H. K. Hess, Philadelphia, Pa. U.S. Pat. 881,580, March 10, 1908.

The comminuted ore is formed into a briquette by means of clay and vegetable fibre, and this is heated to destroy the latter and vitrify the clay, thus rendering the body porous. A lead conductor is attached to the porous body to form an electrode, and the whole immersed in a suitable electrolyte. On passing an electric current, the copper is deposited on a second electrode, without disintegration of the porous body.—B. N.

Lead and antimony ; Continuous extraction of —— from sulphide ores by means of an electric furnace. E. F. Côte and P. R. Pierron. Fr. Pat. 383,293, Jan. 3, 1907.

Galena or stibnite are mixed with metallic iron and fluxes, and subjected to the action of an electric arc in a furnace of the intermittent type, provided with two vertical electrodes. The lower electrode (negative) is fixed directly to the " brasquing " (carbonaceous cement) which constitutes the lining of the lower part of the furnace, whilst the upper electrode (positive) can be raised or lowered. The charge is dropped into the furnace from an annular hopper surrounding the upper electrode. Gases generated are led away through a pipe near the top of the furnace. To prevent obstructions in the tap-hole during discharge, a small movable electrode is introduced into the tap-hole whilst the furnace is being emptied.—A. G. L.

Steel and the like ; Process of and apparatus for making ——. Felten und Guilleaume- Lahmeyerwerke A.-G. Fr. Pat. 383,461, Oct. 31, 1907. Under Int. Conv., Nov. 1, 1906.

The ore is first reduced as usual in a blast- or hearth-furnace. The slag is then removed, the usual fluxes are added, and the furnace is completely closed, the refining of the metal, or conversion into steel, being accomplished by electrical means. The electrical apparatus which converts the furnace during this second stage into an arc, resistance, or induction furnace is preferably removed from contact with hot gases, etc., during the first stage. Electrical energy may be economised by effecting part of the heating during the second stage by the passage of hot gases through flues in the walls of the furnace, but without allowing these gases to enter the working part of the latter.—A. G. L.

Silver-, nickel-, or gold-plated articles ; Electrolytic process for removing the coating metal from ——. E. Harbeck. Ger. Pat. 189,876, Sept. 25, 1906.

The coating metal is removed from articles plated with silver, nickel or gold, by using them as anodes in an electrolyte consisting of sulphuric acid, having a sp. gr. of more than 1·53 (50° B.), to which hydrochloric acid or a chloride has been added. The silver, nickel, or gold is dissolved, and is deposited at the cathode. Iron, lead, tin, copper, brass, bronze, Britannia metal, etc., are scarcely acted upon under these conditions. The process is carried on at a temperature of 75°—100° C., with an E.M.F. of 2—6 volts.—A. S.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

Acetylene tetrachloride and its derivatives as solvents and extraction agents [*for fats, etc.*]. Chem. Fabr. Griesheim Elektron. Chem.-Zeit., 1908, **32**, 256—257.

Trichlorethylene (b. pt. 88° C.) suffers decomposition to the extent indicated by the following figures when heated for five days with an equal quantity of water in presence of the metals mentioned. Wrought iron, 0·04 ; cast iron, 0·04 ; copper, 0·03 ; lead, 0·015 per cent. Iron extraction vessels would therefore appear to be suitable for use with this solvent. The small amount of iron dissolved, however, imparts to oils and fats a dark brown coloration, which cannot be removed by boiling with acids. Also, on boiling trichlorethylene with alkalis or alkaline compounds in aqueous or alcoholic solution, hydrochloric acid is liberated, and gaseous products (probably dichloracetylene, and in presence of metals, monochloracetylene) are formed, which, in contact with air, may inflame or explode. Care must be taken when using trichlorethylene in open vessels, as it exerts a narcotic action many times stronger than that of carbon tetrachloride Dichlorethylene and perchlorethylene are about as resistant to the action of metals as trichlorethylene. Perchlorethylene would probably be a useful solvent for employment in open vessels. The ethane derivatives — symm. tetrachlorethane (b. pt. 147° C.) and pentachlorethane (b. pt. 159° C.) are much less resistant to the action of metals. Tetrachlorethane or acetylene tetrachloride is still more active physiologically than trichlorethylene. —A. S.

Soaps ; Physico-chemical researches on —— considered as colloids. A. Mayer, G. Schaeffer, and E. F. Terroine. Compt. rend., 1908, **146**, 484—487.

A general view of the structure of soaps in different media is given in the following table :—

Soaps.	Media.			
	Acid.	Neutral.	Aqueous alkaline.	Alcoholic alkaline.
Lower members of the series (including the valerate)......	Homogeneous solution	Homogeneous solution	Homogeneous solution	Homogeneous solution
Caproate, caprylate, laurate....	Suspension of microscopic particles, and precipitate	Suspension of ultramicroscopic particles	Suspension of ultramicroscopic particles, very viscous	Transparent jelly
Palmitate, oleate	Paste (agglomerate of granules and of crystals in a viscous medium)	Suspension of submicroscopic and microscopic particles	Typical jelly, liquefying by heat, re-solidifying on cooling	Jelly with ultramicroscopic particles
Stearate	Precipitate	Suspension of microscopic particles	Paste	Jelly enclosing crystals

All soaps in aqueous solution are electro-negative. Even the lower members of the series form absorption-compounds with salts of heavy metals, and complex colloids with electro-positive organic and inorganic colloids. It is known that fatty acids reduce the surface tension of water more than soaps do: the effect produced by soaps is enhanced as the fatty acid is displaced by a stronger acid, or as the soaps become hydrolysed. The addition of a strong acid has little influence on the viscosity of N/10 solutions of the lower members of the series of soaps (up to the valerate), but the addition of a base greatly increases the viscosity. The viscosity of a N/1 solution of the valerate is diminished by addition of an acid, and increased by addition of a base. Starting with the caproate, which is the first member of which the neutral aqueous solution is no longer homogeneous, the viscosity is increased by addition of either an acid or a base. The minimum on the viscosity curve is a critical point corresponding to the appearance of ultramicroscopic particles in the solution. In the case of the members of the series higher than the caproate, this critical point no longer coincides with the neutral point, but corresponds to a degree of alkalinity which is greater as the molecular weight of the fatty acid of the soap increases. The existence of this critical point allows of the subdivision of the soaps into those which always yield homogeneous solutions and those which are colloidal.—A. S.

Psylla wax. E. Sundwik. Z. physiol. Chem., 1908, **54**, 255; Apoth.-Zeit., 1908, **23**, 137.

Psylla wax is the secretion of an insect, *Psylla alni*, parasitic on trees of the genus *Alnus*, indigenous to Oana. It contains *psyllic acid*, $C_{33}H_{66}O_2$, which is sparingly or quite insoluble in most solvents and which forms insoluble salts. The alkali salts are obtained by saponification in boiling alcoholic solution. The silver salt is precipitated in a micro-crystalline condition by treating the hot alcoholic solution of the acid with silver nitrate.—J. O. B.

Transparent soap —— a supercooled solution. W. D. Richardson. J. Amer. Chem. Soc. 1908, **30**, 414—420.

The principle underlying the production of transparent soap is the addition of substances which will produce a jelly and retard crystallisation, and the formation of crystals within the mass cannot be attributed to any one cause. The crystals that form differ to some extent in physical behaviour from the transparent portion of the soap, and from the fact that the m. pt. of the fatty acids liberated from them is higher than that of the fatty acids from the rest of the soap (*e.g.*, 43—44° C. and 36°—38° C. respectively) it is concluded that they are probably composed of the saturated fatty acids. The experiments described show that the conditions affecting the formation of crystals are as follows:—(1). The soap is in a "supercooled" (supersaturated) condition, which presupposes a state of strain. (2). The absence of a sufficient quantity of the retarding substance. (3). In the case of soap which is not supersaturated when manufactured, desiccation is required to produce conditions favouring the formation of crystals. With the progress of desiccation, an increase in the strain is indicated by the appearance of the soap when viewed between crossed Nicols. (4). The main immediate cause of crystal formation is the presence of nuclei of soap crystals and possibly other substances. A single soap crystal introduced into a bar of transparent soap, will, in the absence of excess of solvents, cause a growth of radiating crystals, which will eventually spread throughout the whole mass. (5). Too great a viscosity, such as results when the soap is dried rapidly so as to form a tough surface-layer, may entirely prevent crystallisation, even in a supercooled soap. (6). Crystal formation is promoted by the shock given by blows or pressure, the crystallisation tending to follow the lines of strain produced by the stamping die.—C. A. M.

Patents.

Fat and oil preparations; Process for producing ——. K. Mann, Zurich, Switzerland. U.S. Pat. 880,316, Feb. 25, 1908.

See Eng. Pat. 15,311 of 1905; this J., 1905, 1027.—T. F. B.

Soap powder; Manufacture of ——. O. Lindemann, London. From Gebrüder Körting A.G., Linden, Germany. Eng. Pat. 25,276, Nov. 14, 1907.

A very dry soap powder, free from cakes or lumps, is obtained by introducing steam into a vessel containing liquid soap, below the level of the liquid, thereby heating the liquid to the temperature of the steam, and then blowing the hot liquid soap out of the vessel into a chamber where the powder is deposited, while continuously maintaining the pressure of the steam at the same height.

—E. W. L.

Soap; Dry superalkalinated —— in compressed cakes, and its manufacture. Soc. Franç. La Cremouline. Fr. Pat. 383,439, Jan. 7, 1907.

See Eng. Pat. 2519 of 1907; this J., 1907, 976.—T. F. B.

Glycerin; Process of distilling ——. F. J. Wood, Assignor to Marx and Rawolle, New York. U.S. Pat. 881,525, March 10, 1908.

A single current of steam is passed successively through a series of glycerin column stills. The steam and glycerol vapour from each still pass through a condenser where the glycerol only is condensed and the steam alone passes on to the next still, or column, where the process is repeated.—W. H. C.

Ammoniacal compounds of higher fatty acids, etc. Fr. Pat. 383,531. *See* II.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(*A.*)—PIGMENTS, PAINTS.

Iron oxide; Different colours of —— due to the size of the particles. L. Wöhler and C. Condrea. Z. angew. Chem., 1908, 21, 481—486.

The violet-coloured product obtained by heating ferric oxide with sodium chloride was found to consist of pure ferric oxide. A similar violet coloration can be produced by heating the oxide with sodium sulphate, calcium chloride, potassium chloride, borax, and other salts. The rate of cooling has no influence on the colour, at least, when small quantities are in question; the presence or absence of air is also without effect. The minimum quantity of any salt necessary for the production of the deepest colour was found to be 6 per cent., and the minimum temperature corresponds to the melting point of the salt added; with increasing temperature, the amount of added salt may be reduced. When the oxide contains some hygroscopic moisture or when the dry oxide is heated with a hydrous salt, the colour change takes place at a lower temperature. The results indicate that the production of the violet colour is due to increase of the size of the particles of the oxide caused by conglomeration and accelerated by the fluid medium consisting of the added salt in the fused state. This view is strengthened by the fact that the violet or brown products can be re-converted into the yellowish-red oxide by combined trituration and levigation. It is further pointed out that in the technical preparation of iron oxide colours, economy of fuel would be effected by the substitution of the lower-melting borax for the common salt usually employed.—A. S.

Patents.

Paint or varnish remover. P. T. Austen and F. J. Maywald, New York. Eng. Pat. 5238, March 4, 1907.

See U.S. Pat. 846,080 of 1907; this J., 1907, 477.—T. F. B.

White lead ; Method of manufacturing ——. W. Mills, London. U.S. Pat. 881,016, March 3, 1908.

See Fr. Pat. 374,495 of 1907 ; this J., 1907, 881.—T. F. B.

(*B.*)—RESINS, VARNISHES.

Long-leaf pine oil. J. E. Teeple. J. Amer. Chem. Soc., 1908, **30**, 412—414.

This oil is obtained as a by-product in the extraction of turpentine by the steam-distillation of the lightwood (*i.e.*, wood cut at least 3 years) of the long-leaf pine, *Pinus palustris.* It is an excellent solvent for varnish gums in the cold and for india-rubber, and can be added to a lacquer of nitrocellulose in amyl acetate without precipitating the nitrocellulose. It is frequently employed for coating insulating cables, as a substitute for camphor oil and benzine in the making of metal polishes, and by essence manufacturers and soap-makers as a cheap perfume. The commercial oil is colourless or faint yellow, and in the former case contains 3 or 4 per cent. of water in solution. Its specific gravity varies from 0·935 to 0·947 according to the proportion of terpenes of lower boiling-point which it contains. A good sample begins to distil at 206°—210° C., 75 per cent. passing over between 211° and 218° C., and 50 per cent. between 213° and 217° C. One sample (sp. gr. 0·945 at 15·5° C.) had a specific rotation of about $[\alpha]^{20°}_{D} = -11°$ and a refractive index of $n_D = 1{\cdot}4830$. The specific gravity of the distillates obtained by fractional distillation rises steadily with the temperature, becoming constant at about 0·947 at 217° C. From the physical constants, and the facts that the oil absorbs bromine in quantity corresponding to a dibromide, that it yields the nitrosochloride, nitropiperidide and nitranilide of terpineol, forms terpinene by dehydration, and readily gives a large yield of terpin hydrate, the author concludes that the main constituent is a terpineol, probably the optically-active lævo-modification of *α*-terpineol (Δ'-*p*-menthenol-8) of b. pt. 217°—218° C. The preparation of terpin hydrate from the oil is easily carried out by shaking the latter with 5 per cent. of sulphuric acid, with or without the addition of benzene, the reaction being complete in 3 or 4 days if the mixture is continually shaken. Or, if it is allowed to stand quietly, large crystals of the terpin hydrate are slowly formed, which melt without recrystallisation at 117°—118° C., and, after recrystallisation from ethyl acetate, at 118° C. The yield is about 60 per cent. of the theoretical amount, and in the author's opinion this method of preparing terpin hydrate will probably supersede the usual method of making it from turpentine.—C. A. M.

Turpentine ; Determination of petroleum naphtha in ——. H. C. Frey. J. Amer. Chem. Soc., 1908, **30**, 420.

Ten c.c. of the turpentine are mixed with 30 c.c. of anhydrous aniline in a 50 c.c. stoppered tube graduated in tenths of a c.c. The mixture is vigorously shaken for 5 minutes, and allowed to stand until clear. Any petroleum naphtha present will then be found as a layer on the surface, and its proportion may be read directly. —C. A. M.

Patent.

Turpentine ; Method of extracting —— from wood. J. G. Gardner, Assignor to Pure White Turpentine Co., Jacksonville, Fla. U.S. Pat. 881,787, Mar. 10, 1908.

Steam is forced downward through a dense mass of sawdust or ground wood, confined vertically, paths being opened in the mass for the passage of the steam.—T. H. P.

(*C.*)—INDIA-RUBBER, &c.

Rubber from dried rubber-plants ; Methods of obtaining ——. P. Alexander and K. Bing. Gummi-Zeit., 1908, **22**, 604—607.

The discovery of the Guayule shrub (*Parthenium argentatum*) has led to the development of a method of obtaining rubber, in which the latter is separated from the dried plant itself by some process, mechanical or chemical, of disintegrating the plant tissues, and so liberating the rubber which they contain. The authors discuss the possibility of applying this method generally to rubber-yielding species, and conclude that it is not likely to prove a paying method in the case of certain of these other species at least, on account of the low percentage of rubber obtainable from the dried tissues, as well as its low quality. Their experiments were carried out upon dried samples of various parts of trees of the two species *Kickxia elastica* and *Manihot Glaziovii.* Whereas dried *Parthenium argentatum* contains 10 per cent. of its weight of pure rubber substance (corresponding to 15 per cent. of the commercial product), the amount of benzol-extract obtained by the authors from the samples examined (26 in number) varied from about 0·1 per cent. in the wood of a 12-year old *Kickxia* tree to 6·4 per cent. in the leaves from 6-year old trees of the same species ; moreover of these benzol-soluble constituents, a considerable percentage—varying from 28 to 91 per cent. in different instances—was always soluble in acetone. The authors suggest, however, that experiments should be made with the alkali process upon as many rubber-species as possible, and that it may possibly prove that the two methods of obtaining rubber (*viz.*, from the latex and from the dried plant) can in some cases be worked, with advantage, side by side.—E. W. L.

Rubber ; A case of adulteration of so-called "Plantation Block" ——. D. Spence. Gummi-Zeit., 1908, **22**, 634.

The sample of "Straits Block Plantation Rubber" examined, was taken from a large block. It formed a black, compact mass, had a smell of creosote, was free from mechanical impurities, of poor "nerve" and low tensile strength, and was slightly tacky. The tackiness increased on warming, and also when the sample was left exposed to the air. The loss on washing was 2·8 per cent., and analysis of the washed and dried sample gave the following results :—Soluble in acetone, 4·8 ; sulphur in this, 0·73 ; rubber substance, 83·46 ; nitrogen, 0·405 (calc. as protein, 2·53) ; ash, 4·4 per cent. The coefficient of vulcanisation was 1·2, and the loss in weight of the portion insoluble in acetone when treated with alcoholic potash was 0·3 per cent. The ash contained lead, iron, aluminium, zinc, copper, strontium, barium, magnesium, silica, chlorine, and sulphates. The acetone extract contained saponifiable fats, coal-tar and sulphur. The rubber was estimated as tetrabromide by Budde's method (this J., 1907, 1057). The sample is apparently a mixture of raw rubber and reclaimed rubber.—E. W. L.

Patents.

[Raw] rubber ; Apparatus for treatment of ——. L. Norzagaray, London. Eng. Pat. 4510, Feb. 23, 1907.

The apparatus consists of a pair of corrugated or fluted rollers in combination with an iron box, in which the corrugated sheet of rubber, obtained by passing freshly coagulated rubber between the rollers and so removing most of the contained water, can be compressed by means of a screw passing through the lid of the box and attached to an iron plate at its lower end. The rubber is thus obtained in the form of a block. A hinged iron framework may be used as a mould in combination with the box-press, to enable the pressed block to be easily removed. —E. W. L.

Rubber, gutta-percha and analogous materials ; Apparatus for washing ——. F. Kempter. Fr. Pat. 383,410, Oct. 29, 1907.

See Eng. Pat. 13,908 of 1907 ; this J., 1907, 1207.—T. F. B.

Caoutchouc ; Process for extracting —— from pontianac, "besk," "gelotong" and other substances containing it. F. Boegel. Fr. Pat. 383,622, Nov. 5, 1907.

The material (pontianac, etc.) is cut into small pieces and filled into a perforated cylinder mounted in a steam-jacketed autoclave. An alcoholic solution of caustic soda is introduced into the autoclave, and the whole is heated for 1—2 hours at a pressure of 1—2 atmospheres The alkaline liquid is then run off, a mixture of alcohol and wood vinegar introduced, and the mixture again heated for 1—2 hours at the same pressure as before. The alcoholic liquid is now removed, and pure alcohol introduced, with which the material is heated as before. The final residue is stated to be pure caoutchouc.—A. S.

India-rubber ; Treatment [regeneration] of vulcanised ——. P. C. H. West, London. Eng. Pat. 4268, Feb. 20, 1907.

Finely-divided vulcanised rubber waste, which may have been previously freed from resinous matter and oxidation products of rubber by extraction with acetone or other suitable solvent, is treated in the cold with suitable halogen derivatives of the aromatic or fatty hydrocarbons (*e.g.*, chlorobenzene). The sticky mass may then be compressed in moulds, or heat may be applied, and the vulcanised rubber recovered from the solution so obtained by evaporating the solvent ; or the solution may be used for a variety of purposes such as impregnating fabrics, and in the manufacture of waterproof paint.
—E. W. L.

Rubber waste ; Process for the treatment of ——. J. Dupont. Fr. Pat. 383,669, Jan. 14, 1907.

The finely-divided waste rubber is heated with naphthol at about 130° C., and after cooling, the mass is extracted with denatured alcohol ; the alcoholic solution of naphthol formed dissolves out the sulphur. The residual caoutchouc is washed with an alcoholic solution of naphthol to remove the last traces of sulphur, then with alcohol, and finally boiled with water for some hours.—A. S.

Artificial caoutchouc ; Method of making ——. P. Beresin, St. Petersburg. U.S. Pat. 881,536, March 10, 1908.

See Fr. Pat. 365,047 of 1906 ; this J., 1906, 941.—T. F. B.

XIV.—TANNING, LEATHER, GLUE, SIZE.

Tanning analysis ; The international method of ——. U. J. Thuau. Collegium, 1908, 82—84.

The author compares the results obtained by the filter-bell and basic chloride shake methods of tannin analysis when used on the typical tanning materials, and calculates coefficients which enable results obtained by one method to be stated in terms of the other method.—H. G. B.

Acidity of tan liquors ; Proposed methods for the determination of ——. H. C. Reed. J. Amer. Leather Chem. Assoc., 1908, 3, 85—91.

The author proposes two new methods for the determination of free acid in tan liquors. (1). An alcoholic solution of gelatin is run into a suitable quantity of tan liquor, water added to bring up the total volume to 200 c.c., and after the addition of 15 grms. of kaolin and thorough shaking, the precipitate of tanno-gelatin is filtered off, and an aliquot portion of the filtrate titrated with *N*/10 caustic soda using hæmatin as indicator. (2). A basic dyestuff is substituted for the alcoholic solution of gelatin used in the first method, the precipitate with tannin being filtered off and the filtrate titrated in presence of hæmatin as before. The dyestuffs suitable for this method are : "lemon-yellow O," "thioflavine F," "methyl violet" and auramine. The second method was found to give somewhat higher results, but both methods are in fair agreement with Procter's lime-water method. The charcoal method is again condemned. The methods were tested on used tannery liquors, on liquors made from hemlock, oak, chestnut and quebracho extracts, and on freshly leached infusions of hemlock bark and oak bark. The acidities were determined before and after the addition of known amounts of acetic, lactic and gallic acids.—H. G. B.

Reactions in tanning ; Contribution to the knowledge of the ——. R. O. Herzog and J. Adler. Z. Chem. Ind. der Kolloide, 1908, 2, Suppl. Heft II., iii.—xi.

Assuming that hide substance is a mixture of proteid matters in the gel state and that the vegetable tannins are acids in colloidal solution, the authors investigate the nature of the tanning process from the standpoint of colloidal action, and point out the importance of adsorption phenomena. Experiments on comparative adsorption are recorded for mono-, di-, and trihydric phenols, acids, salts of heavy metals and other substances with respect to hide powder. The powder used was weakly chromed, containing 0·5 to 1·0 per cent. of chromic oxide. The results obtained indicate that adsorption due to hide powder is a variable equilibrium very little dependent upon the temperature, but considerably affected by constitutive influences, and that the equation $c=Ka^m$ is only applicable in a few cases. The influence of acids and alkalis is great, but that of moderate amounts of metallic salts is inappreciable. With sugar and albumin solutions, the hide powder only absorbed water and hence increased the strength of the outside solutions. The authors confirm the rule of Hardy that colloids with opposite electrical charges are adsorbed whilst those with similar charges are not.—H. G. B.

Gelatin ; Action of naphthols and mixtures of naphthols with formaldehyde on ——. A. Weinschenk. Chem.-Zeit., 1908, 32, 266—267.

In reply to statements that naphthol has no tanning properties, and that formaldehyde is the active agent in the process described by the author for tanning hides (this J., 1907, 1100), the latter states that it may be proved experimentally that naphthols actually combine with gelatin. For instance, if gelatin be dissolved in 5 per cent. sodium chloride solution, and to the latter be added 0·1 per cent. of formaldehyde, the mixture gelatinises when cold but gives a clear solution on warming. The subsequent addition of a small quantity of either α- or β-naphthol causes the formation of a precipitate, and within half an hour the whole, or greater part, of the gelatin is rendered insoluble. On treating the β-naphthol-gelatin solution with diazotised *p*-nitraniline, a bright red solution is produced, but no precipitate, whereas on similar treatment, free β-naphthol yields the insoluble *p*-nitraniline-azo-β-naphthol.—W. P. S.

Patents.

Leather, artificial ; Manufacture of ——. L. V. Guilleteau, Paris. Eng. Pat. 6216, Mar. 14, 1907.

The artificial leather is composed of ramie fibre fixed by an agglomerant, the essential part of which is formed by a mixture of dextrin, gelatin, and balata gum. 0·5 kilo. of balata gum dissolved in toluene, and 1·8 kilos. of dextrin are intimately mixed with 72 litres of water at 95° C. A mixture consisting of glycerin, 4·5 kilos. ; sodium silicate, 0·07 kilo. ; and gelatin, 18·13 kilos. is then added, and when dissolved, the whole is kneaded with 3 kilos. of ramie fibre in a steam-heated kneading machine. The resulting mass is poured into moulds, dried gradually at 80° C., and passed through a succession of presses heated at 100° C., the pressure applied being gradually increased. Finally the plates are immersed for 20 minutes in a bath of formaldehyde, and dried. The addition of an increased proportion of balata gives a stronger product. A composition particularly adapted to the manufacture of outer covers of pneumatic tyres is as follows : water, 47·5 ; dextrin, 1·8 ; glycerin, 4·5 ; sodium silicate, 0·07 ; gelatin, 18·13 ; balata gum and toluene, 25 ; and ramie fibre, 3 kilos.—E. W. L.

Tanning liquors ; Process for utilising "sapped" ——. G. W. Childs, New York. U.S. Pat. 881,094, March 3, 1908.

The process consists in impregnating leather with hot, concentrated, waste tanning liquor, whilst the leather is still moist from the tanning process.—A. S.

Leather ; Art of converting hides or skins into ——. A. E. Kelk, Louisville, Ky. U.S. Pat. 881,246, March 10, 1908.

See Eng. Pat. 24,189 of 1906 ; this J., 1907, 627.—T. F. B.

Albuminoids ; Method of treating ——, *and the composition of matter produced therefrom.* M. R. Isaacs, Philadelphia, Pa. U.S. Pat. 879,967, Feb. 25, 1908.

A proteid is prepared by precipitation from solution with hydrofluosilicic acid, or from milk by precipitating the curd by the same means. If it be desired to produce a glue or sizing from milk, the casein is precipitated by adding 0·5 per cent. of hydrofluosilicic acid, and after separation from the whey, is treated with an alkaline substance with or without water.—J. W. G.

Substitute for wood, horn, rubber, etc.; Production of ——. F. Auner, Siebenbuergen, Hungary. Eng. Pat. 8478, Sept. 26, 1907.

Sawdust, or other wood waste, is treated with size and afterwards with a 5—10 per cent. solution of alum, potassium bichromate or some similar salt. This has the effect of diminishing the absorptive power of the wood. The mass, after drying, is mixed with a binding agent which may consist of a solution of glue mixed with a small amount of potassium bichromate and some starchy material or gum substance such as linseed oil-cake. After being hardened by the addition of a mineral (*e.g.*, kieselguhr), and toughened by the admixture of fibrous matter, it is finally subjected to the action of heat in a closed vessel.—C. A. W.

XV.—MANURES, &c.

Mud from hemp retting; Manurial value of the ——. G. A. Calabresi. Staz. sperim. agrar. ital., 1906, **39**, 618. Biedermann's Zentralbl., 1908, **37**, 207.

In the hemp districts of Italy (Bologna and Ferrara), the mud produced in the retting of hemp has been used for a long time for manurial purposes. The composition of three samples of the mud, of different origin, is shown in the following table:—

	Wet mud.	Mud dried:	
		in the air.	at 100° C.
Water	51·73	12·23	—
Total nitrogen	0·351	0·524	0·278
Organic nitrogen	0·247	0·423	0·277
Ammoniacal ,,	0·107	0·100	0·116
*Nitrate ,,	0·112	0·109	0·133
Phosphoric anhydride	0·200	0·333	0·378
Potash	0·305	0·554	0·632

* Mean of results from two different samples.

—A. S.

Patent.

Paper-board [*from manure*]. U.S. Pat. 881,098. See XIX.

XVI.—SUGAR, STARCH, GUM, &c.

Sugar works; Employment of sulphurous acid in ——. G. Fouquet. Bull. Assoc. Chim. Sucr. et Dist., 1908, **25**, 733–756.

In the clarification of carbonated beetroot juice, the chief function of the clarifying agent consists in removing or altering certain organic substances, the presence of which, even in small quantity, is largely responsible for the viscosity of the juice; the amount of non-sugar removed is generally very small (sometimes, even, the non-sugar undergoes a slight increase). With respect to crystallisation, the decolorisation of the juice is only important in so far as it is correlated to a removal or alteration of the organic matter which causes viscosity. The author has made experiments on the action of sulphurous acid on carbonated juice containing very little or no free lime. This treatment was found to cause a very slight decrease in the apparent purity, and to decolorise the juice, part of the sulphurous acid being oxidised; during concentration of the sulphited juice, further decolorisation occurred and a precipitate was formed, more abundant and containing a higher proportion of organic matter than that obtained in the concentration of non-sulphited juice. Moreover, as a result of sulphitation, the concentration of the juice and the crystallisation of the sugar (owing to lessened viscosity) were accelerated. Hence, the author recommends sulphitation in the case of juice containing very little or no free lime (15 grms. of sulphur dioxide per hl. is sufficient to give appreciable results). The author has also shown that the sulphur dioxide treatment should be carried to, but not beyond, such a degree that all the alkali is converted into normal sulphite; the presence of bisulphites causes inversion of sugar during the heating of the juice prior to filtration. With regard to the mode of applying the sulphur dioxide, the following points must be considered:—The juice, owing to its dilution, is more readily sulphited than the syrup, and is free from decomposition-products present in the latter; again, sulphitation of the juice facilitates concentration and, during the latter process, the sulphites exert a beneficial effect. On the other hand, the juice should be left slightly alkaline to prevent danger of inversion, and since sulphurous acid is a stronger decolorising and reducing agent than sulphite, and there is necessarily some caramelisation during heating, the syrups and mother liquors should also be sulphited directly. Hence, the author recommends that half the sulphur dioxide required to produce neutrality should be applied to the juice and the remainder to the syrups and mother-liquors, the neutral point being reached with the last mother-liquor treated. Sulphitation of the juice has often been condemned on the ground that incrustation is formed during evaporation, but if the juice is practically free from lime, there is no danger of this. In the sulphitation of syrups and mother liquors, the author recommends the employment of Besson's aluminium alloy which facilitates the action of the sulphurous acid, and reacts with the latter to yield nascent hydrogen, and a precipitate of alumina which carries down colouring matter and colloids. With regard to the control of sulphitation, the decrease of alkalinity may be found by determining the alkalinity to litmus and the amount of sulphite (by iodine) before and after treatment. One grm. of sulphur dioxide in the form of normal sulphite possesses an alkalinity to litmus equivalent to 0·33 grm. of lime (CaO). The presence of bisulphite is indicated if $\frac{1}{3}$ of the sulphur dioxide content exceeds the apparent amount of alkali. The gas derived from liquid sulphur dioxide, though more costly than that obtained by burning sulphur, presents several important advantages for sulphitation. For non-continuous sulphitation, the total amount of liquid sulphur dioxide required for a charge of juice is run into a Pacottet sulphitometer, the latter is then disconnected from the sulphur dioxide holder, and the gas passes from the sulphitometer to the heater where it is distributed throughout the juice. In the continuous process, the liquid sulphur dioxide holder is connected with an expansion chamber which is slightly heated, a uniform flow of gas from the latter to the heater being maintained; the heater is divided into two compartments, the juice enters at the bottom of one of these, in which it is sulphited, and overflows into the other, whence it passes to the filters.—L. E.

Patents.

Erratum.

This J., 1908, page 32, col. 2, l. 12 from the top: *For* "hydrochloric acid on starch," *read* "acids on modified starch."

Sugar; Method of crystallising —— [*from molasses*]. H. C. Christianson, Fanwood, N.J. U.S. Pat. 880,629, Mar. 3, 1908.

Air is admitted into the lower portion of the molasses at the same temperature but at a slightly higher pressure than that of the molasses at the air inlet. As the crystallisation proceeds, the temperature of the air is reduced, before its admission, so as to correspond with the diminishing temperature of the molasses.—W. P. S.

Sugar-beets ; Process of treating ——. M. Weinrich, Yonkers, N.Y., Assignor to C. Portius, Halle-on-the-Saale, Germany. U.S. Pat. 881,641, Mar. 10, 1908.

This process is for the complete defecation, neutralisation and purification, in one continuous operation, of sugar beet juice before the latter is extracted and without the use of carbonation or filter-presses. It consists in reconducting some of the defecated and neutralised juice to "limed beet mush," with which the juice is mixed continuously for thinning purposes ; heating the mixture to 60—65° C., neutralising the excess of lime by means of phosphoric acid, heating further to 70—75° C. and extracting the defecated, neutralised and purified juice by pressure. The extracted juice is treated with a small proportion of lime, heated to boiling and finally neutralised and filtered.—T. H. P.

Beetroot rootlets ; Process for recovering sugar from——. F. P. Druelle. Fr. Pat. 383,608, Nov. 5, 1907.

The process relates to the extraction of sugar from the extreme ends of the beetroots, these portions being generally rejected as useless in sugar works. The stems are rasped or otherwise reduced to a pulp, which is pumped to a filter-press. The dilute juices obtained from the filter-press may be utilised for pulping further supplies of rasped stems.—W. P. S.

Sugar ; Manufacture and purification of invert or partially inverted ——, *and its applications.* J. J. Eastick Fr. Pat. 383,631, Nov. 5, 1907. Under Int. Conv. Nov. 10, 1906.

See Eng. Pat. 25,340 of 1906 ; this J., 1907, 980.—T. F. B.

Starch ; Process of, and apparatus for making thin boiling ——. T. E. Breyer, Waukegan, Ill. U.S. Pats. 881,104 and 881,105, Mar. 10, 1908.

A mixture of steam and air is injected into acidulated starch milk thereby raising the temperature of the latter sufficiently to promote the conversion thereof into thin boiling starch and at the same time keeping the starch in suspension. The current of air and steam is subsequently discontinued and compressed air passed into the starch milk to prevent the starch from settling. The apparatus consists of a tank, combined with which is a conduit extending into it and having a perforated portion adjacent to the bottom of the tank, means for delivering a mixture of steam and air through the conduit, a pipe for conveying compressed air to the conduit and a valve controlling the escape of the mixed air and steam.—T. H. P.

Starch ; Manufacture of modified or soluble ——. W. Thomson and J. A. Morrice. Fr. Pat. 383,499, Oct. 5, 1907.

See Eng. Pat. 21,973 of 1906 ; this J., 1907, 980.—T.F.B.

XVII.—BREWING, WINES, SPIRITS, &c.

Steeping with warm water and disinfection of barley in the steeping tank. Windisch. Woch. für Brau., 1908, **25**, 146—148.

In the light of Brown's researches (this J., 1908, 134) it seems probable that, when barley is treated with concentrated lime-water in the steeping tank, the lime does not penetrate the pericarp of the barley corn. When barley is steeped in warm water, the use of lime is indispensable, as without it the barley would rapidly become putrid and die. The author quotes the experiences of a distiller in the malting of last season's barleys, many of the corns of which became brown-ended or began to grow after reaping, whilst the sheaves became heated and both straw and corns assumed a musty odour. When malted in the ordinary way, this barley yielded an irregularly and badly grown malt with a dark appearance and unpleasant smell, while the grown corns became covered with a dark mould growth and many of the apparently healthy corns either did not grow at all or subsequently died. In order to get over these difficulties, the steeping was carried out at 21—25° C. (70—77° F.), the water being changed twice daily and the barley being left alternately under water and in the air for periods of six hours. In those cases where the barley began to heat when left in contact with air, cooler water was subsequently employed. To kill any bacteria present, the spores of which would have germinated by treatment with warm water, from 10 to 12 c.c. of 66 per cent. sulphuric acid per centner (110 lb.) of barley were diluted with water and added in a thin stream to the last steeping water, this being kept well stirred meanwhile. This procedure resulted in improved germination and if the growing barley was kept cool, the malt obtained was of good colour and quite free from mustiness. The author points out that it would be better to add the antiseptic, at the latest, to the second lot of steep-water and that, for brewing-malt, an alkaline antiseptic is to be preferred to an acid one as it removes from the barley unpleasant-tasting acid substances which are either insoluble or soluble with difficulty in pure water. With badly stained barley, it might be advisable to make use of sulphuric acid in the last steeping liquor, even in the preparation of malt for brewing purposes.—T. H. P.

Fermentation ; Influence of light and of copper on ——. J. E. Purvis and W. A. R. Wilks. Proc. Camb. Phil. Soc., 1907, **14**, 361—372.

The authors examined the effect of light rays of different wave lengths on alcoholic fermentation, the experiments being conducted in glass or copper vessels of which one side was formed of ordinary glass, red glass, or a glass vessel filled with copper sulphate solution, in front of which a source of white light was placed. Light under these circumstances was found to have no perceptible influence on fermentation in glass vessels, but further experiments with light of greater power (like that of the arc) will be needed in full confirmation. In the experiments in which a copper vessel was used, however, light had a considerable effect. For example, the development of bacteria in the fermenting liquid was retarded, especially by blue light ; consequently less acid was formed and less copper dissolved. The fermentation proceeded further in white and blue light than in red light and in the dark. Copper has an injurious action in fermentation, especially in the case of worts poor in sugar. The temperature of the fermenting liquid becomes usually somewhat higher in the dark and in red light than in blue light. (See also this J., 1907, 162.)—A. S.

Wines ; Alteration of the constituents during the determination of the extractives of ——. T. Roettgen. Z. Unters. Nahr. Genussm., 1908, **15**, 257—262.

The author has investigated the changes which the extractive matter of wine undergoes during the drying process. The results obtained indicate that the official method (this J., 1898, 277) can only give approximately accurate figures. The shape of the basin in which the wine is evaporated has an influence, and to obtain concordant results, basins of similar shape must be employed. The tartaric acid diminishes, during the drying, to the extent of over 50 per cent., whilst wines containing not more than 0·3 per cent. of sugar generally yield extracts free from sugar. The ratio between the quantity of other extractives to the amount of sugar present appears to have an influence on the decomposition of the sugar, as in a sweetened wine containing 14·15 per cent. of sugar, the loss amounted to only 0·45 per cent.—W.P.S.

Alcohol ; Refractive indices of mixtures of —— *with water.* L. W. Andrews. J. Amer. Chem. Soc., 1908, **30**, 353—360.

Absolute alcohol, dehydrated by means of lime freshly prepared from marble, and freed from aldehydes, was found to have the same specific gravity, refractive index and critical temperature of solution as alcohol dehydrated by means of magnesium amalgam or metallic calcium. Crismer's method of determining the critical temperature of solution of the alcohol in kerosene is regarded by the author as the most reliable test of the dryness of absolute alcohol. The following values were obtained with absolute alcohol :—Sp. gr. at 25°/4° C., 0·78510 ± 0·00001 ; Zeiss immersion refractometer at 25° C., 85·30° ± 0·02 ;

refractive index (μ) against air, 1·35941 ± 0·00001 at 25 C.; refractive power $\frac{n_D - 1}{d} = 0·45833$; $\frac{\mu_D - 1}{d} = 0·45779$. A table is given showing the refractive indices against air and the refractometer readings of mixtures of alcohol and water for each per cent. of the latter from 0 to 30, together with the approximate temperature coefficients of refraction. A mixture of 20·7 per cent. of water and 79·3 per cent. of alcohol gives the maximum refractive index (1·363315 at 25° C.), and it is noteworthy that this closely corresponds with the formula of a compound, $3C_2H_6O,2H_2O$, (containing 20·69 per cent. of water).
—C. A. M.

Patents.

Malt; Process for the preparation of ——. A. Heymann, Mannheim, Germany. Eng. Pat. 16,995, July 24, 1907,

See Fr. Pat. 381,149 of 1907; this J., 1908, 136.—T. F. B.

Malt; Preparation of green and kilned ——. A. Heymann. First Addition, dated Sept. 25, 1907, to Fr. Pat. 381,149, July 16, 1907 (this J., 1908, 136).

The decortication of the grains may be performed while the latter are in a moist condition, or during the kiln-drying, or after the drying, without further addition of moisture.—W. P. S.

Coating the surfaces of [fermenting] vessels; Process for ——. W. Ackermann, Wilmersdorf, Germany. U.S. Pat. 881,759, March 10, 1908.

See Eng. Pat. 12,454 of 1907; this J., 1907, 1290.—T. F. B.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, AND DISINFECTANTS.

(A.)—FOODS.

Proteins of maize, and gliadin from rye; Hydrolysis of the ——. T. B. Osborne and S. H. Clapp. Amer. J. Physiol., 1908, 20, 477—499. Chem. Zentr., 1908, 1, 1188—1189.

Zein was isolated from maize ("zea mays") by extracting the dried and ground grain with 85 per cent. (by vol.) alcohol, evaporating the alcoholic solution *in vacuo* to a syrup, and pouring this into ice-cold distilled water to which a trace of sodium chloride had been added. The precipitate of crude zein was dissolved in a small quantity of 95 per cent. alcohol, extracted with benzene to remove fat and colouring matter, and pure zein precipitated by pouring the solution into cold water containing sodium chloride. The alkali-soluble protein was isolated from the residue left after extracting the maize with alcohol, by treating it with large quantities of a 0·2 per cent. solution of sodium hydroxide, and precipitating the protein from the filtered solution by means of hydrochloric acid. Zein can also be obtained from gluten meal, a waste product from the manufacture of glucose. Gliadin was obtained from rye meal by extraction with 75 per cent. alcohol, evaporating the extract *in vacuo* to a syrup, and pouring the latter into ice-cold water. The crude protein thus obtained was dissolved in 85 per cent. alcohol and re-precipitated by absolute alcohol. Rye gliadin has the same composition and properties as wheat gliadin. On hydrolysis, these proteins gave the following results:—

	Maize.		Rye gliadin.		Maize.		Rye gliadin.
	Zein.	Alkali-soluble protein.			Zein.	Alkali-soluble protein.	
	per cent.	per cent.	per cent.		per cent.	per cent.	per cent.
Glycocoll	0·00	0·25	0·13	Serine	0·57	not isolated	0·06
Alanine	2·23	not isolated	1·33	Tyrosine	3·55	3·78	1·19
Valine	0·29	,, ,,	not isolated	Arginine	1·16	7·06	2·32
Leucine	18·60	6·22	6·30	Histidine	0·43	3·00	0·39
Proline	6·53	4·99	9·82	Lysine	0·00	2·93	0·00
Phenylalanine	4·87	1·74	2·70	Ammonia	3·61	2·12	5·11
Asparagine	1·41	0·63	0·25	Tryptophan	0·00	present	present
Glutamic acid	18·28	12·72	33·81	Cystine	—	—	not determined

—A. S.

Phosphoric acid; Loss of —— *in determining the ash in cereals.* S. Leavitt and J. A. LeClerc. J Amer. Chem. Soc., 1908, 30, 391—394.

The experiments described show that at temperatures below the fusion point there is little difference in the percentage of ash, but that there is a loss in the corresponding amount of phosphorus varying with the temperature. Thus, the average results obtained with seven samples were:—Ash at low redness, 2·02, and at redness, 1·99 per cent.; phosphoric acid (P_2O_5) at low redness, 0·74; and at redness, 0·40 per cent. In every case the differences in the amounts of ash obtained at the two temperatures were below 0·1 per cent., whereas the loss of phosphoric acid ranged from 39 to 53 per cent. Ignition at a very low temperature is necessary to prevent this loss. Thus the results obtained by igniting the ash for 5 hours in a muffle so that the dishes showed only a faint glow agreed closely with those obtained by igniting the ash in the presence of a known quantity of calcium acetate containing sufficient calcium to fix the whole of the phosphoric acid.—C. A. M.

Sulphurous acid and sulphites, as food preservatives; Influence of —— *on digestion and health.* H. W. Wiley. U.S. Dept. of Agricult. Bull. 84, part III., 1907, 761—1040.

From a careful consideration of the data in individual cases and the summaries of the results, it appears that the administration of sulphurous acid in solution or as sulphites, produces serious disturbances of the metabolic functions, and injury to digestion and health. As one marked result of this action, the assimilation of food materials containing organic phosphorus, is retarded, and a great burden is added to the already over worked kidneys, which now have to remove from the body nearly all the added sulphur, previously converted, in great part, into sulphuric acid. There is moreover marked tendency to albuminuria exhibited, and the blood also suffers impoverishment in regard to the number of red and white corpuscles therein. (See also this J., 1890, 404; 1904, 509; 1902, 633; 1900, 365.) "Every fact" elicited, "tends to accentuate the justness of the conclusion," "that the use of sulphurous acid in foods should be suppressed."

Patents.

Proteose preparation from fish; Process for the manufacture of a ——. K. Schwickerath, Bonn, Germany. Eng. Pat. 4436, Feb. 22, 1907.

See Fr. Pat. 375,028 of 1907; this J., 1907, 887.—T. F. B.

Food or medicated products containing sulphur; Manufacture of roasted ——. E. Meyer, Friedrichswerth, Germany. Eng. Pat. 23,147, Oct. 19, 1907.

See Fr. Pat. 383,151 of 1907; following.—T. F. B.

Cereal products containing sulphur compounds; Process of preparing ——. E. Meyer. Fr. Pat. 383,151, Oct. 19, 1907.

One hundred kilos. of grain, such as wheat, rye, barley and the like, are roasted until the grains begin to carbonise; the temperature is then lowered, and a heated mixture of 10 kilos. of sulphur and from 1 to 2 kilos. of calcium phosphate, iron oxide, or the like, is added. A product is formed, which, after cooling, is ground. The preliminary heating of the sulphur mixture must not be so high as to cause combination of the constituents to take place.
—W. P. S.

Flour; Electrical purification of ——. J. L. Lawson, Leith, Edinburgh. U.S. Pat. 880,891, March 3, 1908.

See Eng. Pat. 13,909 of 1905; this J., 1906, 231.—T. F. B.

Milk and other liquids; Apparatus for the desiccation of ——. A. Thisquen. Fr. Pat. 383,239, Oct. 23, 1907. Under Int. Conv., Oct. 24, 1906.

The apparatus consists of a vertical cylindrical chamber constructed of tin-plate. This is surrounded by a wall of masonry, leaving a space between the two, and a second wall of masonry is built around the whole. The liquid to be desiccated is sprayed through an atomiser into the top of the inner vessel, and, as it descends, meets a current of hot air. The air current is heated by means of a stove placed in the space between the masonry walls and is forced by suitable means into the space between the inner wall and the wall of the cylindrical vessel, entering the latter through openings situated at about three-fourths its height. The air leaves the vessel through tubes or passages reaching nearly to the bottom and extending upwards into a chamber above the vessel. The air is passed through linen sieves before leaving the apparatus. The dried material, collecting on the floor of the vessel, is removed by means of a scraper and allowed to fall into a receptacle below the floor.
—W. P. S.

Milk, dry milk powder and water, and skimmed milk and fat or oil; Process and apparatus for emulsifying and homogenising ——. M. Erfurt. Fr. Pat. 383,535, Oct. 31, 1907.

Milk, or a mixture of dry milk powder and water, is conducted through a pipe to a small chamber into which a jet of steam is introduced. Water or skimmed milk may be introduced into the small chamber through a separate pipe. The fine spray produced by the action of the jet of steam on the milk, etc., is collected in a suitable receiver connected with the atomiser. If desired, a condenser may be fitted between the atomiser and the receiver. The process is also applicable for making emulsions of skimmed milk with fat or oil.—W. P. S.

Foods; Preparation of nitrogenous vegetable ——. K. Okazaki and H. Yenjo. Addition, dated Nov. 2, 1907, to Fr. Pat. 376,373, April 4, 1907 (this J., 1907, 1025).

Certain details are given of the methods previously described. The fungus "Okazaki" is prepared from a mixture of 1 part of sawdust and 9 parts of rice bran which is moistened and steamed to gelatinise the starch, allowed to cool to 30° C., covered with a layer of straw and kept in a koji chamber at 28° C. to develope the fungus. For preparing fungus malt or "koji," a porous substance such as pumice stone or sponge is mixed with rice bran, bean cake or other similar material, the mixture being sparged with water, grated, and mixed with sterilised water in the proportion of about 1·5 litres per 4 kilos. of the mass; a culture of the "Okazaki" fungus is then transplanted on to the mixture, which is kept at 15—20° C. for 24 hours, at the end of which time it is distributed into koji boxes. For preparing a digestive nitrogenous food containing solid phosphates, and termed "digestine" or "diastaline," koji, prepared as described above, is intimately mixed with an equal quantity of water, dilute alcohol or glycerin, the pumice stone or sponge being removed; the mass is subsequently stirred, left at 45—50° C., evaporated to dryness, and the filtrate obtained mixed with two or three times its volume of strong alcohol; the precipitates produced are collected, dried and powdered, giving digestine or diastaline. To prepare the food termed "o-spar," a small quantity of digestine is added to a solution of gelatin in either warm milk or juice pressed from boiled beans at 40° C.; the solution is stirred several times, the o-spar, formed by the liquefaction of the gelatin and casein of the milk or vegetables by the digestine, being thus obtained.—T. H. P.

(*B.*)—SANITATION; WATER PURIFICATION.

Arsenical wall papers; Cause of poisoning by ——. B. Neppi. Scienza Practica, 1908, 1, 82-84.

The poisonous action of arsenical wall papers, usually attributed to the dry dust given off, has been shown by Gosio to be solely due to a volatile organic compound formed by certain specific mould fungi from arsenic compounds in the presence of carbohydrates (the paste by which the paper is attached to the wall). The following mould fungi arranged in the order of their decreasing activity, possess this property:—*Penicillium brevicaule, Aspergillus clavatus, A. fumigatus, A. glaucus, A. virens, Mucor mucedo,* and *A. candidus.* A certain degree of moisture is necessary; and hence, in the author's opinion, there is no risk of poisoning when the wall paper is absolutely dry. The optimum temperature is 20°-25° C. The action is attributed to direct vital phenomena of the mould fungi, and not to diastatic action. The gas evolved was found to be diethyl-arsine, $HAs(C_2H_5)_2$. When passed into an aqueous solution containing 20 per cent. of hydrochloric acid and 8 to 12 per cent. of mercuric chloride it yielded the compound $HAs(C_2H_5, HgCl_2)_2$.—C. A. M.

Gas and electric lighting; Relative hygienic values of ——. S. Rideal. *See* II.

Patents.

Water; Apparatus for the purification [softening] of ——. J. P. Lajoie. Fr. Pat. 383,266, Oct. 24, 1907.

The apparatus consists of a reagent tank, a mixing tank, and a series of filters. The water to be treated is conducted under pressure to the mixing tank, a definite portion of the supply being carried by a branch pipe to the reagent tank and then discharged into the mixing tank. The reagent tank is filled with "a solid reagent which is slowly soluble in water," and the quantity of water passed through it is regulated by taps on the inlet and outlet pipes. The treated water leaves the mixing tank, which also serves to a certain extent as a settling tank, at the top, and is led to the bottom of a vessel filled with granular particles. After passing upwards through this vessel, the water is conducted through a similar vessel before being collected for use.—W. P. S.

Water; [Settling tank for the] Purification of ——. E. L. Maris. Fr. Pat. 383,470, Oct. 31, 1907.

The water, treated previously with reagents such as milk of lime, hydrated iron oxide, and aluminium salts, is conducted to the settling tank. The walls of the latter widen out from the water inlet, whilst the bottom slopes upward towards the outlet. The water first enters a small basin, then passes over a partition and falls to the bottom of the main settling tank where it passes under a partition plate reaching nearly to the bottom of the tank. Baffle-plates are provided at the top of the tank at varying heights from the inclined bottom. The outlet for the water is at the opposite side of the tank to the inlet, and a sludge-cock is provided at the lowest part of the tank.—W. P. S.

Patent.

Formaldehyde ; Composition for generating ——. A. Eichengrün, Dusseldorf, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 880,204, Feb. 25, 1808.

See Fr. Pat. 366,605 of 1906 ; this J., 1906, 1063.—T. F. B.

XIX.—PAPER, PASTEBOARD, &c.

Paper ; Unequal colouring of the two sides of——. J. P. Korschilgen. Papier-Fabrikant, 1908, 6, 116-118.

In cases of unequal colouring of the two sides of the paper it is more frequently the top side which is darker than the wire side. Amongst the factors which influence the inequality are : the nature and condition of beating of the fibres, the sizing, the colouring matter employed, the manipulation of the machine and the glazing. Considering chiefly the pigment colours, the particles of which are suspended in the pulp, the tendency to sink to the wire side of the sheet will be greater the "freer" the condition of the stuff. With "wet"-beaten pulps, on the other hand, the fine fibrillæ and their gelatinous condition support the particles of pigment in suspension, so that when the paper comes to the suction boxes and wet-presses, colour is removed from the wire side, and the top surface consequently appears the darker. The rosin size, like "wet" beating, helps to prevent the sinking of the pigment, and whilst a certain sized paper may be darker on the top side, the same paper without size may be darker on the wire side. Unsized papers require more pigment to bring them up to a certain colour than sized papers, because much of the pigment which sinks to the wire side runs away with the water. The influence of the pigment itself varies of course with its degree of fineness, etc. ; this influence may often be controlled by combining suitable dyestuffs with the pigment colours. White mineral loadings, particularly barium sulphate, owing to their high density, tend to accumulate on the wire side of the sheet and act as diluents of the colour on that side. This tendency may be corrected by prolonging the beating and by stronger sizing. Thick papers and cards are particularly liable to have a darker top side. For these kinds it is necessary to select such fibres as will impart the required strength without much beating and to restrict the quantity of sizing materials to a minimum ; when possible, dyestuffs should be used rather than pigments. If the stuff be not beaten too "wet," the machine can generally be manipulated so as to equalise the colouring of the two sides. The suction boxes, couch-press and the first wet-press remove colour from the wire side of the paper, whilst the second press, provided its felt be sufficiently porous, removes colour from the top side. The pressure then may be distributed between the different presses according to requirements. As regards glazing, the rule is : the heavier the glazing the darker the colour. If the side of the paper which is the paler be subjected more to the glazing action of the iron bowls of the calender than the darker side, a certain amount of equalisation may take place.—J. F. B.

Parchment papers ; Neutralised——. C. Bartsch, Papier-Zeit., 1908, 33, 582.

Parchment papers, if not very carefully prepared, are liable to contain residues of free sulphuric acid. A residue of 0·1 per cent. and over is sufficient to bring about the destruction of the paper within a comparatively short time. The majority of these papers contain 0·02 to 0·06 per cent. of sulphuric acid, and it appears to be very difficult to eliminate the last traces of acid by washing with water alone. At the ordinary temperature and within a reasonable period, small traces of acid (up to 0·05 per cent.) have no appreciable influence on the quality of the paper in ordinary use. But if the papers are exposed to higher temperatures at any period of their storage or use, even these small proportions of acid may cause serious deterioration. It is better then, in such special cases, to neutralise the acidity of the paper by a final passage through a dilute solution of ammonia.—J. F. B.

Possibilities of paper pulp manufacture from Cape fibres. Board of Trade J., March 26, 1908. [T.R.]

The Cape of Good Hope "Agricultural Journal" for February publishes reports on Cape fibres and their possibilities for paper making, prepared in connection with the samples exhibited at the last South African Products Exhibition in London, from which the following particulars are extracted :—

A sample of Matjesgoed fibre was converted into paper pulp on being treated with caustic soda, the amount obtained being 35 per cent. of the raw material. The unbleached pulp is fairly strong, and could be used for some grades of paper : it would be worth about £6 to £7 per ton if found suitable for wrapping paper. When bleached and further treated, the pulp is much weaker and apparently not very suitable for the manufacture of white paper.

A sample of Palmiet fibre broke readily when handled and did not appear to be of much use, but it evidently did not fairly represent the normal condition of the plant, as the ordinary Palmiet leaf is very tough and strong. This material, when boiled with caustic soda under pressure in the usual way, gave an unsatisfactory pulp in consequence of the conditions of treatment, but the experiment could not be repeated owing to lack of further samples. The percentage of the paper-making fibre was 42 per cent., and the pulp obtained was tough, in spite of the fibres being short. It would be worth about £6 to £7 per ton, and could be used if blended with a small proportion of a long-fibred pulp.

A specimen of Papkuil fibre was readily converted into pulp on being treated with caustic soda, the amount obtained being about 30 per cent. If the moist stems of the plant are omitted, the yield is considerably higher. The pulp is of a good colour, and fairly tough, and could be used for the manufacture of paper, although bleaching reduces the strength. The value would be £6 to £7 per ton.

Patents.

Paper or paper board and the like ; Process of producing, ——. C. E. Nelson, Capac, Mich., Assignor to E. P. Metcalf, Providence, R.I., and A. Loewenthal and C. E. Dunn, New York. U.S. Pat. 879,888, Feb. 25, 1908.

Half-stuff, consisting of peat fibres and the naturally associated gelatinous matter, is heated to a temperature insufficient to coagulate the latter, and is then "run" into paper, board, etc.—J. W. G.

Paper-board [from manure]. M. B. Diskin, New York. U.S. Pat. 881,098, March 3, 1908.

Manure is first washed with the addition of a suitable deodorant, such as carbolic acid, the washed residuum is then subjected to the action of live steam under a high pressure, the product is treated with camphor and a suitable insecticide during the process of pulping, and the pulp is finally pressed into boards of any desired thickness.—J. F. B.

Esparto and similar plants ; Treatment of —— [*for paper making*]. C. Tanquerel. Fr. Pat. 383,099, Oct. 18, 1907.

In order to isolate the cellulose of esparto and similar plants, they are cleaned, sorted, freed from other plants and submitted to a preliminary drying in order to render the cellulose more resistant to the further treatment. The fibre is then placed in a tank with a false bottom formed of an iron grid which serves as the positive electrode for an electric current. When the vessel is filled with fibre, weakly acidulated water is run in so as to reach the negative electrodes placed in the upper part of the vessel. A current of 0·5 ampère at 2 volts is passed through the material and this considerably accelerates the action of the pectase on the pectoses present, the latter being converted into soluble "parapectin." Care should be taken to avoid any rise of temperature which would give rise to insoluble compounds. The material is then washed and treated in the same vessel with a weak caustic soda solution containing 0·5 kilos. of soda (Na_2O) per 100 kilos. of fibre, the electric current being turned off, and a current of air under pressure, introduced under the false bottom in order to agitate the liquid. This treatment removes the fatty and resinous matters, and also the chlorophyll. The material is well washed and then treated with an oxidising agent in order to convert the incrusting material and the compound celluloses into compounds soluble in alkalis. This is best carried out with chlorine prepared electrolytically. After this treatment the mass is well washed with water, then again with caustic soda, and finally with water, the residue consisting of almost chemically pure cellulose ready for paper-making.—A. B. S.

Cellulose esters; Manufacture of —— from cellulose or from products of transformation resembling cellulose. J. Wetter. London. From Knoll und Co., Ludwigshafen on Rhine, Germany. Eng. Pat. 2026, Jan. 26, 1907.

See Fr. Pat. 369,123 of 1906; this J., 1907, 91.—T. F. B.

Cellulose esters; Manufacture of —— from cellulose or from products of transformation resembling cellulose. J. Wetter, London. From Knoll und Co., Ludwigshafen on Rhine, Germany. Eng. Pats. 2026A and 2026B, Jan. 26, 1907.

See Fr. Pat. 373,994 of 1907; this J., 1907, 776.—T. F. B.

Plastic, transparent, imputrescible material of considerable resistance; Manufacture of a —— from a solution of cellulose. E. Crumière, Paris. Eng. Pat. 18,164, Aug. 10, 1907. Under Int. Conv., Sept. 3, 1906.

See Fr. Pat. 369,635 of 1906; this J., 1907, 112.—T. F. B.

Cellulose; Nitro derivative of ——, and process of making same. B. Herstein, Bayonne, N.J. U.S. Pat. 879,871, Feb. 25, 1908.

A structureless nitro derivative of cellulose containing less than 4½ per cent. of nitrogen, insoluble in ether, alcohol, acetone, or amyl acetate, and which is transformed into a transparent or translucent mass by caustic soda, is obtained by treating cellulose with a mixture consisting of 63 per cent. of sulphuric acid, about 10 per cent. of nitric acid, and 27 per cent. of an inert material. —J. W. G.

Celluloid substitute and process of making the same. E. A. L. Rouxeville, Paris. U.S. Pat. 881,827, March 10, 1908.

See Fr. Pat. 376,269 of 1906; this J., 1907, 988.—T. F. B

(1) *Cellulose in aqueous solutions, etc.;* (2) *Cellulose; Regeneration of liquids used for coagulation of ——.* (3) *Cellulose; Precipitation of ——.* L. Cuntz. Fr. Pats. 383,411, 383,412, and 383,413, Oct. 29, 1907. *See* V.

Celluloid; Borneol esters for manufacture of ——. Fr. Pat. 383,478. *See* XX.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

Atropine. R. Wolffenstein and L. Mamlock. Ber., 1908, **41**, 723—732.

Atropine can be produced by the condensation of tropine and tropic acid in the presence of dilute hydrochloric acid, but the yield is not satisfactory. The authors prepared tropic acid chloride by treating the acid with thionyl chloride. It could not be purified, as on distillation it passed into atropic acid chloride. But although tropic acid chloride was allowed to act on tropine under various conditions, no atropine was produced. β-Chlorhydrotropic acid chloride was next prepared by the action of thionyl chloride on β-chlorhydratropic acid. This was heated for a short time on the water-bath with tropine hydrochloride. The residue was dissolved in alcohol, and ether added, when a precipitate of chlorhydrotropyl-tropeïne hydrochloride, $C_{17}H_{22}NO_2Cl,HCl$, melting at 167°—170° C., was formed, which gave a picrate melting at 204° C., and a platinichloride softening at 60° C. On adding sodium carbonate the base separates as a yellowish oil. This base dissolves easily in ether, but when the solution is evaporated, a residue of apoatropine hydrochloride is left. β-Bromhydratropic acid bromide was prepared in an analogous manner, or by the action of phosphorus pentabromide on tropic acid, and allowed to act upon tropine. In this way bromhydrotropyl-tropeïne hydrobromide, $C_{17}H_{22}NO_2Br,HBr$, was produced, melting at 180° C. after crystallising from alcohol and ether, or hot water. The free base on evaporation is converted into apoatropine hydrobromide. Acetyltropic acid was made by treating tropic acid with excess of acetyl chloride; it is a yellow oil, setting to a white mass after a day's standing, and then melts at 88°—90° C. It was converted into acetyltropic acid chloride by means of thionyl chloride. When acetyltropic acid chloride is warmed with tropine hydrochloride, acetylatropine hydrochloride is formed. The free base is an oil, which cannot be solidified. When acetylatropine hydrochloride is warmed with water, and allowed to stand, the acetyl group is split off, and atropine is formed, the yield being about 80 per cent. of the theoretical. Both chlor- and bromhydrotropyltropeïne shew a mydriatic action.—F. Shdn.

Galenical preparations of leaves; Simple test to distinguish —— from preparations of roots, flowers or seeds. A. Richaud and Bidot. J. Pharm. Chim., 1908, **27**, 278—280.

A few drops of a liquid preparation are diluted with sufficient water to afford an almost colourless fluid. A small quantity of ammonia solution, or of any alkaline reagent, is floated on the surface of the liquid. If the preparation has been made from leaves, a yellowish-green ring will be formed, and on mixing, the whole solution will be similarly tinted. In the case of an extract, a little is dissolved in water, and then similarly tested. This colour-reaction of preparations from leaves is very distinctive, and totally different from that afforded by preparations from other parts of plants, except in the case of senega. This drug is the only root examined affording preparations which react with alkalis as if made from leaves.—J. O. B.

Essential oils. Ayapana oil (Eupatorium triplinerve). F. W. Semmler. Ber., 1908, **41**, 509—512.

The oil from *Eupatorium triplinerve* Vahl. had the following constants: sp. gr. 0·9622 at 20° C., $n_D=1·50882$, $a_D=+5°\ 45'$ in a 100 mm. tube. After fractionation and distillation over sodium, a fraction boiling at 118° C. at 12 mm., and with the sp. gr. 0·9671 at 20° C., and $n_D=1·51066$ was obtained as the principal constituent. This was oxidised with permanganate and the portion unattacked was found to be the dimethyl ether of thymoquinol, $C_{12}H_{18}O_2$, which boiled at 118° C. at 12 mm., and had sp. gr. 0·9913 at 20° C., $n_D=1·51339$, and $a_D=\pm 0$. The dimethyl ether of thymoquinol is present to the extent of about 75—80 per cent. in ayapana oil. (See this J., 1907, 714.—F. Shdn.

Melaleucas; Australian —— and their essential oils. R. T. Baker and H. G. Smith. J. and Proc. Roy. Soc., N.S.W., **40**, 60.

The melaleucas or "tea trees" are generally distributed throughout Australia but scarcely found elsewhere. The genus is less extensive, and contains fewer species than eucalyptus, but the essential oils apparently vary in a similar manner to eucalyptus oils in regard to composition and amount. It is recommended that in the commercial exploitation of melaleuca oils the products of the several species be kept distinct, and marketed under the species name as a guarantee of quality. (1) *M. thymifolia* Sm. Yield 2·28 per cent. from leaves with terminal branchlets; sp. gr. at 15° C. 0·9134; $n_{23}=1·4665$; $a^{23}_D=+2·1°$ (1 dm.). Distillation: 1 per cent. below 172°; 42 per cent. at 172—4° (sp. gr. 0·9093);

48 per cent. at 174—83° (sp. gr. 0·9144°); 6 per cent. at 183—214°. The phosphoric acid method gave 53 per cent. of cineol. The esterified oil had a saponification value of 33·6, indicating the presence of a fair amount of an alcohol. The crude oil required more than 10 vols. of 70 per cent. alcohol for solution, but the fraction distilling below 183° was soluble in 1·3 vols. and in all proportions in 80 per cent. and 90 per cent. alcohol. The crude oil dissolved in 0·5 vol. of 80 and 90 per cent. alcohol, but became very turbid with 1·5 vols. and did not clear again with 10 vols. These solubilities distinguish the crude oil of this species from any of the crude eucalyptus oils rich in eucalyptol, but the rectified oil resembles the better class of eucalyptus oils so closely that it might be substituted for, or mixed with, them without much probability of detection. (2) *M. linariifolia* Sm. Yield 1·214 per cent.; sp. gr. 0·9129; n=1·4741; $\alpha_D = +2·5°$. Distillation: below 172°, 1 c.c.; 172—5°. 17 c.c.; 175—83° 52 per cent. (sp. gr. 0·9003); 183—250°, 23 per cent. (sp. gr. = 0·9136); 250—8°, 4 per cent. (largely sesquiterpene). The phosphoric acid method gave 16 per cent. of cineol in the crude oil. The saponification value for the esters was 6·4; for the esterified oil 40·3. The crude oil was insoluble in 10 vols. of 70 per cent. alcohol, but soluble in 1 vol. of 80 per cent. alcohol and but slightly turbid with 10 vols. The oil is largely terpene; neither phellandrene nor pinene could be detected.

Abies sibirica; Phellandrene in essential oil of ——. J. Schindelmeiser. Chem.-Zeit., 1907, 759.

d-PHELLANDRENE has been isolated from the first fractions obtained by distilling the essential oil of *Abies sibirica* over sodium. The main constituent of these fractions was dipentene.—J. O. B.

Ocimum viride; Volatile oil of the leaves of ——. (Prel. note.) E. Goulding and R. G. Pelly. Chem. Soc. Proc., 1908, **24**, 63.

A CONSIGNMENT of the leaves of *Ocimum viride*, forwarded for examination to the Imperial Institute from Sierra Leone, has been examined with the following results:—On distillation with steam, the leaves yielded about 0·35 per cent. of an orange-yellow, volatile oil, which is very mobile, has an aromatic, thyme-like odour, a spicy, pungent taste, D^{15}_{15} 0·9115, $[\alpha]_D = +1°30'$ (approx.), and is soluble in all proportions in 90 per cent. alcohol. When distilled under the ordinary pressure, 100 c.c. of the oil yielded 25 c.c. boiling at 165—180°, with D^{15}_{15} 0·8614 and $[\alpha]_D = +0°33'$; 20 c.c. at 180—200°, with D^{15}_{15} 0·8804 and $[\alpha]_D = +1°40'$; 20 c.c. at 200—220°, with D^{15}_{15} 0·9164 and $[\alpha]_D = +2°38'$; 20 c.c. at 220—235°, with D^{15}_{15} 0·9548 and $[\alpha]_D = +3°38'$; and 10 c.c. at 235—250°, with D^{15}_{15} 0·9565 and $[\alpha]_D = +5°14'$. The composition of the oil is approximately as follows:—thymol, 32 per cent.; alcohols (calculated as $C_{10}H_{18}O$), 40 per cent.; esters (calculated as $C_{10}H_{17}{\cdot}C_2H_3O_2$), 2 per cent.; the remainder consists chiefly of a terpene (or mixture of terpenes), $C_{10}H_{16}$, which is a mobile, highly refractive liquid of pleasant, lemon-like odour, boiling at 160°—166° C. and having D^{15}_{15}=0·8456, and $[\alpha]_D = +0\ 10$.

Vanillin; New isomeride of —— occurring in the root of a species of Chlorocodon. (Prel. note.) E. Goulding and R. G. Pelly. Chem. Soc. Proc. 1908, **24**, 62.

A SAMPLE of the root of a species of *Chlorocodon* (probably *C. Whiteii*) was forwarded for examination to the Imperial Institute from Uganda, where the plant is known by the native name of "Murundo." This root has a pleasant odour, midway between those of vanillin and piperonal, and is said to be chewed by the natives for sweetening the breath. The powdered root, on distillation with steam, yields 0·5 per cent. of a crystalline substance, $C_7H_5O_2{\cdot}OCH_3$, which separates from the distillate in thin, lustrous, colourless plates, having the characteristic odour of the root. It melts at 41—42° and boils at 257—258°, a pale brown coloration being developed. The substance is readily soluble in most organic solvents, and fairly so in hot, but only sparingly so in cold, water. An aqueous solution gives a red or purplish-brown coloration with ferric chloride, and, on warming a solution with ammoniacal silver nitrate, the latter undergoes reduction with the separation of silver. It dissolves freely in dilute alkali hydroxide, and is reprecipitated by acids. The aqueous solution does not give a precipitate with lead acetate. The *oxime*, $OCH_3{\cdot}C_6H_3(OH){\cdot}CH{:}N{\cdot}OH$, crystallises in large, thin, lustrous, transparent plates, melting at 138°; it is almost odourless, and readily soluble in hot water but sparingly so in cold. The *phenylhydrazone*, $OCH_3{\cdot}C_6H_3(OH){\cdot}CH{:}N{\cdot}NHC_6H_5$, crystallises from hot alcohol in pale yellow, lustrous plates, and melts at 137—138°. The *sodium* derivative, $OCH_3{\cdot}C_6H_3(CHO){\cdot}ONa$, obtained by the addition of alcoholic sodium hydroxide to an alcoholic solution of the substance, separates in small, almost colourless, lustrous plates, and dissolves readily in water to form a pale yellow solution which is strongly alkaline. These results, together with the analytical data show that the odorous constituent of *Chlorocodon* root is a monomethylether of a dihydroxybenzaldehyde, $OCH_3{\cdot}C_6H_3(OH){\cdot}CHO$, which is not identical with vanillin or any of its known isomerides. Unfortunately, the amount of material available was so small that it has not been possible to carry out experiments with the object of ascertaining the relative positions of the hydroxy-, methoxy-, and aldehyde-groups, but the authors intend to continue the work in this direction as soon as a further supply of the root has been obtained.

Antipyrine phosphate and arsenate. P. Aubouy. Bull. Soc. Chim., 1908, **3**, 388—390.

WHEN one, two, or three molecular proportions of antipyrine are added to one molecular proportion of phosphoric or of arsenic acid, the respective dibasic salt is formed in all cases. *Diantipyrine phosphate*, $(C_{11}H_{12}N_2O_2)_2H_3PO_4$, forms crystals, m.pt. 156—160° C.; soluble in water and in alcohol; insoluble in ether. *Diantipyrine arsenate* $(C_{11}H_{12}N_2O_2)_2H_3AsO_4$, under like conditions, gives crystals of m.pt. 146—148° C. These salts give similar reactions for the base, and the characteristic ones for the respective acids.—J. O. B.

Salol-chloral, and compounds thereof, with menthol, camphor, salol [phenylsalicylate], benzoic acid, salicylic acid, boric acid and antipyrine [phenyldimethylpyrazolone]. Monteil. L'Union Pharm., 1908, **49**, 53—54.

BY heating together at 100° C., 214 grms. of salol and 147·5 grms. of chloral hydrate, an oily liquid is obtained, having the definite composition,

$$C_6H_4(COOC_6H_5)O.CH(OH).CCl_3.$$

This forms definite compounds with acids, phenols and aromatic amines which can saturate the free hydroxyl group. Thus, with menthol, a product having the formula $C_6H_4(COOC_6H_5)O.CH(OC_{10}H_{19})CCl_3$, is formed. With camphor a similar compound, but with 2 mols. of salol-chloral to one mol. of camphor, is formed. With salol, di-salol-chloral,

$$C_6H_4(COOC_6H_5)O.CH(O.C_6H_4.COOC_6H_5){\cdot}CCl_3,$$

is produced. Similar definite combinations are obtained with benzoic, salicylic and boric acids and with antipyrine. The oily liquids formed in all cases crystallise on cooling.—J. O. B.

Ethyl borosalicylate or boryl. Monteil. L'Union Pharm., 1908, **49**, 55.

BOROSALICYLIC acid is first prepared by boiling together 62 grms. of boric acid, 138 grms. of salicylic acid, and about 200 grms. of water; when the reaction is complete. 60 grms. of 95 per cent. alcohol and sufficient (about 40 grms.) of sulphuric acid are added, to effect esterification in the usual manner. Ethyl borosalicylate forms needle-shaped crystals, with a higher melting-point than that of ethyl salicylate, and therefore more convenient for medicinal use. It is known as "boryl."—J. O. B.

Zinc boropicrate or chrysyl. Monteil. L'Union Pharm., 1908, **49**, 55.

BOROPICRIC acid is first obtained by boiling together 349 grms. picric acid, 62 grms. of boric acid and about

400 grms. of water; this is then saturated with 82 grms. of zinc oxide. The yellow powder, zinc boropicrate, which results, is introduced as a medicinal antiseptic under the name of "chrysyl."—J. O. B.

Quinones; Direct hydrogenation of aromatic ——. P. Sabatier and A. Mailhe. Compt. rend., 1908, **146**, 457—458.

By the direct hydrogenation of quinone in presence of finely-divided nickel at about 190° C. an almost theoretical yield of quinol (hydroquinone) is obtained. At higher temperatures (220° C. and above), water, phenol and benzene, with traces only of quinol are produced. Under similar conditions, at 200° C., toluquinone, *p*-xyloquinone and thymoquinone yield the corresponding quinols. In these latter cases also, at higher temperatures (220°—250° C.), water, monohydric phenols and hydrocarbons are the chief products.—A. S.

Sulphur; New type of combination of —— with certain iodides. V. Auger. Compt. rend., 1908, **146**. 477—479.

The author describes some new addition compounds of iodides and sulphur. *Iodoform-sulphur*, $CHI_3,3S_8$. Iodoform and sulphur, the latter being in slight excess, are dissolved in carbon bisulphide with the aid of heat. On cooling, the addition compound separates in pale yellow prisms, which melt at 93° C., are not altered on exposure to air, but become red under the influence of light. *Tetra-iodoethylene-sulphur*, $CI_2:CI_2,4S_8$, large yellow tablets, m.pt. 97°—103° C., is obtained in a similar manner, except that an excess of the iodide should be taken. If an excess of sulphur be used, this, or a portion of it separates with the crystals of the addition compound without altering the appearance of the latter. *Arsenic tri-iodide-sulphur*, $AsI_3,3S_8$, orange prisms or tablets, m.pt. 105° C., is formed by mixing together the components in carbon bisulphide solution, the sulphur being present in excess to the extent of about 5 per cent. *Antimony tri-iodide-sulphur*, $SbI_3,3S_8$, long bright yellow, prismatic crystals, m.pt. 117° C., is obtained in a similar manner, but using four times the theoretical quantity of sulphur. Phosphorus tri-iodide and stannic iodide also yield addition compounds with sulphur, but bismuth tri-iodide does not.—A. S.

Persulphates; Pseudomorphs of organic ——. R. Wolffenstein and A. Wolff. Ber., 1908, **41**, 717—723.

Acid quinine persulphate, $C_{20}H_{24}N_2O_2.H_2S_2O_8$, was prepared by adding potassium or ammonium persulphate solution to a solution of quinine sulphate in dilute sulphuric acid, when large, pale-yellow prismatic crystals separated on standing. On heating carefully between 80° and 120° C. for 8 days, the crystals develop a fine ruby-red colour while preserving their original transparency and crystalline form. There is practically no loss of weight and the composition, as shown by analysis, remains unchanged. The crystals now, however, are very easily soluble, whilst the original substance was soluble with great difficulty in water. On suspending a crystal of the converted product in a saturated aqueous solution of the same, the crystal does not grow, and the saturated solution itself utterly refuses to crystallise. Moreover the oxidising action of the persulphate has entirely disappeared. The original crystals show double refraction, and the heated product has only single refraction. The pseudomorph was heated with water to 120° C., and fractionally precipitated with sodium carbonate. In this way a base, $C_{20}H_{24}N_2O_3$, was obtained, melting at 113°—115° C. Cinchonine acid persulphate, $C_{19}H_{22}N_2O,H_2S_2O_8,\frac{1}{2}H_2O$, is converted into a pseudomorph by heating to 60°—80° C. for 3—4 days. On dissolving the product in water and fractionally precipitating with sodium carbonate, a base, $C_7H_{11}NO_4$, was obtained, the picrate of which melted at 210° C. The effect of heat on these two persulphates is complicated; a portion of the quinine or cinchonine remains unchanged, another portion becomes oxidised, whilst the remainder is sulphonated. The peroxide oxygen disappears. Besides the above, normal quinine persulphate, $B_2,H_2S_2O_8$, and normal cinchonine persulphate, $B_2,H_2S_2O_8$, were prepared and converted into pseudomorphs.—F. Shdn.

Mercuric cyanide and pyridine; Compound of ——. J. Schroeder. J. prakt. Chem., 1908, **77**, 269—270.

Aqueous solutions of mercuric cyanide and pyridine do not react; but if the solid cyanide be left in anhydrous pyridine, crystals gradually form, having a composition corresponding to $Hg(CN)_2,2C_5H_5N$. The crystals are colourless, and give off pyridine in the air. They dissolve in water, but their molecular weight in water is only one-third of that required by the formula, so that they apparently are completely dissociated in solution into mercuric cyanide and pyridine.—J. T. D.

Bismuth subnitrate. E. J. Brown. Pharm. J., 1908, **80**, 378—379.

Believing that the difference in behaviour of heavy and light bismuth subnitrates towards potassium hydroxide solution was due to variations in the commercial products, the author determined their composition by a process which gave better results than the usual estimation of the metal as sulphide or oxide. The process depends upon the fact that bismuth subnitrate when boiled with a solution of sodium chloride is quantitatively converted into the insoluble oxychloride, BiOCl, permitting the filtrate to be used for the determination of the nitric radical by one of the ordinary methods. The results obtained indicate that heavy and light bismuth subnitrates are not chemically identical. The products vary in composition according to the relative proportions of the reacting substances; thus the basicity of the salt is regulated by the amount of water used in the precipitation of the solution of bismuth trinitrate. More water is used in the preparation of the heavy variety, known as B.P. bismuth subnitrate, which corresponds to the formula, $BiONO_3,H_2O$. The light variety of bismuth subnitrate conforms to the formula, Bi_2O_3,HNO_3, and is recognised as having advantages in dispensing over the heavy variety.—W. S.

Long-leaf pine oil. J. E. Teeple. *See* XIII*B*.

Patents.

Diazo and azo compounds of aromatic amides which contain the residue of arsenic acid; Preparation of ——. H. H. Lake, London. From Curatorium der G. and F. Speyerschen Studienstiftung, Frankfort-on-Maine, Germany. Eng. Pat. 3929, Feb. 16, 1907.

Atoxyl is first prepared by heating a mixture of aniline and an aqueous solution of arsenic acid, and the cooled aqueous solution of the product is diazotised by the addition of the theoretical quantities of dilute acid and sodium nitrite. The diazotised atoxyl may then be combined with amines, phenols and their substitution products, or with compounds which like acetic ester contain acid methylene groups (CH_2). The combination is effected in neutral, acid, or alkaline solution, according to the nature of the substance employed. The products possess therapeutic value.—P. F. C.

Organic aluminium salts; Process for manufacturing insoluble ——. Chem. Werke F. Friedlaender, Berlin. Eng. Pat. 8643, April 13, 1907. Under Int. Conv., Sept. 4, 1906.

See Fr. Pat. 379,547 of 1907; this J., 1907, 1254.—T. F. B.

Pyrocatechol derivatives; Manufacture of chlorine compounds from methylene ethers of ——. H. S. Wellcome, London, and G. Barger, Herne Hill. Eng. Pat. 15,987, July 11, 1907.

The methylene ethers of pyrocatechol derivatives can be converted into chlorine derivatives of their cyclic carbonates by heating them with thionyl chloride. Piperonylic acid when heated with thionyl chloride to 180°—200° C. for 7 hours, yields the carbonate of protocatechuic acid chloride, $OCO_2:C_6H_3.COCl$, which melts at 68° C., and boils at 166°—167° C. at 13 mm. Piperonyloïn under similar treatment yields a substance, $C_{16}H_6O_7Cl_2$, melting at 191°—192° C. Methylene- 3·4-dioxystyrene dibromide gives a compound, $C_9H_2O_3Cl_2S$, melting at 198° C. Piperonylacrylic acid gives a substance melting at 182°—183° C.—F. Shdn.

Formins ; Process for producing ——. Nitritfabrik Akt.-ges., Cöpenick, Germany. Eng. Pat. 28,723, Dec. 31, 1907. Under Int. Conv., Jan. 5, 1907.

Formin (formic acid glycerol ester) can be made by heating glycerol with 100 per cent. formic acid. At 100° C. dilute formic acid passes over, and at 140° C. formin is left behind.—F. Shdn.

Chlorides of carbon ; Production of ——. J. MacKaye, Cambridge, Mass., Assignor to Stone and Webster, Boston, Mass. U.S. Pat. 880,900, Mar. 3, 1908.

Chlorine and "gas" are mixed in the presence of a porous medium, such as granulated coke, at a regulated temperature. The mixture is led away from the coke and subjected to a higher temperature by electrical means, whereby reaction is brought about. The products of the reaction are then separated.—F. Shdn.

Borneol or isoborneol ethers ; Preparation of ——. A. Verley, E. Urbain, and A. Feige. Fr. Pat. 383,557, Jan. 10, 1907.

See Eng. Pat. 14,549 of 1907 ; this J., 1907, 1295.—T. F. B.

Camphor ; Oxidation of borneol or isoborneol for their conversion into ——. A. Verley, E. Urbain, and A. Feige. Fr. Pat. 383,558, Jan. 10, 1907.

See Eng. Pat. 14,550 of 1907 ; this J., 1907, 1162.—T. F. B.

Borneol from isoborneol ; Preparation of ——. Schmitz und Co. Fr. Pat. 383,419, Oct. 29, 1907.

Isoborneol or its esters can be converted into borneol by heating with an alkali metal or an alkaline-earth metal, or an alcoholate, in the presence of alcohol or an indifferent solvent, to a temperature above the boiling point of xylene.—F. Shdn.

Celluloid ; Preparation and use of borneol organic esters for the manufacture of ——. O. L. A. Dubosc. Fr. Pat. 383,478, Jan. 9, 1908. Under Int. Conv., Jan. 8, 1907.

When pinene hydrochloride is treated with a formate, stearate, acetate, or phenate in the presence of an excess of the corresponding acid at the boiling point of the acid in question, borneol esters are produced. These esters when mixed with alcohol can be used to dissolve nitrocellulose for the manufacture of celluloid.—F. Shdn.

XXII.—EXPLOSIVES, MATCHES, &c.

Combustion of gas and inflammable powders ; Action of alkaline salts with a fixed base on the ——. Dautriche. Compt. rend., 1908, **146**, 535–538.

The effect of adding alkali salts with a fixed base to explosives with the object of rendering them flameless has been studied by the author as follows :—30 grms. of the explosive were fired in a closed chamber of 10 cb. m. capacity and full of air. From the pressure obtained after correction for cooling, the heat of combustion was calculated. Experiments, details of which are given, were carried out with : (*a*), decanitrocellulose ; (*b*), enneanitrocellulose ; (*c*), trinitrotoluene, mixed with from ½—10 per cent. of salts, chiefly alkali nitrates and carbonates. It was concluded from these that to avoid the combustion of detonation products, or of gas or dust, in the neighbourhood of charges in coal mines, small quantities of sodium or potassium salts added to the explosive were necessary and sufficient, and that the employment of this class of explosive should not therefore be rejected on *a priori* grounds. Salts of the alkaline-earths have only a partial restraining action. Two further series of experiments were made with mixtures of : (*a*), decanitrocellulose (30 per cent.), and ammonium nitrate (70 per cent.) ; (*b*), trinitrotoluene (12—22 per cent.), ammonium nitrate (88—75 per cent.), with 3—6 per cent. of potassium nitrate. These were detonated in an atmosphere of ordinary air with from 10—11 per cent. of coal gas. These experiments showed that the replacement of a small amount of the ammonium nitrate by potassium nitrate had no effect on the detonation temperature, but that the addition of potassium nitrate to the explosive had the same effect as if the temperature had been lowered by 300° C., and that the gaseous mixture was not inflamed.—J. W. G.

Patents.

Dinitroglycerin, etc. ; Process of obtaining ——. F. J du Pont, Assignor to The E. I. du Pont de Nemours Powder Co., Wilmington, Del. U.S. Pat. 879,899, Feb. 25, 1908.

Glycerin is nitrated with nitric acid to obtain dinitroglycerin, and ammonia is then sprayed into the mixture until the excess of nitric acid is neutralised, the temperature meanwhile being kept below the decomposition point of dinitroglycerin. Water is removed from the product by heating under a pressure sufficiently reduced to maintain the temperature of evaporation below the decomposition point of dinitroglycerin.—J. W. G.

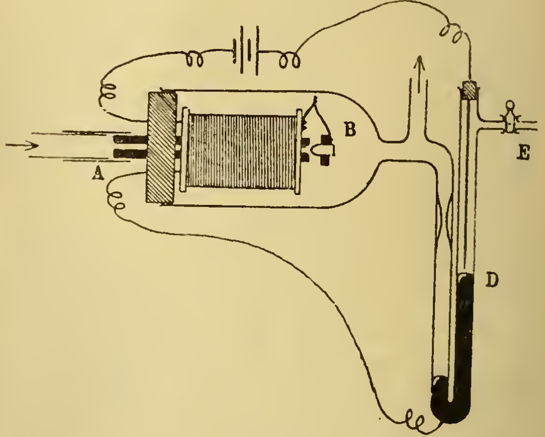
Nitroglycerin ; Process for accelerating the separation of ——from acids. R. Escales and M. Nowak, Munich, Germany. U.S. Pat. 880,373, Feb. 25, 1908.

See Eng. Pat. 18,597 of 1907 ; this J., 1907, 1296.—T.F.B.

XXIII.—ANALYTICAL CHEMISTRY.

APPARATUS.

Pressure-regulator for gas currents. F. M. G. Johnson and K. Buch. Ber., 1908, **41**, 640-641.



The device is shown in the accompanying diagram. The gas enters at A through an iron tube into a glass bell-jar connected to a manometer, in which the mercury rises until it makes contact with the wire, D, from a battery. The current produced flows through an induction coil surrounding the iron tube, and the latter thus becomes magnetised and attracts the iron disc, B, which is provided with a rubber plug for closing the iron tube gas-tight. The entry of gas is thus stopped until the pressure falls so far that the contact at D is broken. The effects of variations in the atmospheric pressure are avoided by closing the tap, E.—A. S.

Patents.

Gases ; Apparatus for analysis of ——. H. J. Westover, New York. Eng. Pat. 5244, March 4, 1907. Under Int. Conv., April 4, 1906.

See U.S. Pat. 833,274 of 1906 ; this J., 1907, 115.—T.F.B.

Photometer. G. H. Delmas-Azema. Fr. Pat. 383,228, Oct. 23, 1907.

A prism having white or silvered surfaces is mounted on a graduated disc on which it can be inclined according to the position of the light: the prism is situated opposite an opening or objective and is supported on a shaft having an alternative circular movement derived from suitable means, such as a motor driven by the standard flame. The apparatus is mounted on a movable slide so that the two sources of light can be rendered of equal intensity on the opposite surfaces of the oscillating prism and observed in the objective as a fixed illumination, in spite of the movements of the prism. The distance of the prism from the two sources of light permits the relative intensity of the two to be compared. The appliance may be fitted to the photometers of Dumas and Regnault, and Bunsen.—W. P. S.

INORGANIC—QUALITATIVE.

Nitrogen oxides; Analysis of —— by means of their absorption spectra in the ultra-red. E. Warburg and G. Leithäuser. *See* VII.

Zinc salts; Action of hydrogen sulphide on alkaline solutions of ——. L. W. McCay. *See* VII.

Sulphides and double sulphides. A. Ditte. *See* VII.

INORGANIC—QUANTITATIVE.

Indicators used in acidimetry; Constitution of ——. J. T. Hewitt. Analyst, 1908, **33**, 85-90.

In the author's opinion the ionic and chemical theories on the constitution of indicators are complementary. The ion formed by the indicator must have a different constitution to the parent substance, which is thus a *pseudo*-acid or a *pseudo*-base. To act as an indicator it appears that a substance must be capable of tautomerism, have weak acid or basic functions, and its configuration must show a marked difference from that of its ions as regards the number of conjugate double linkages. A monosulphonic acid of *p*-nitrobenzeneazo-*a*-naphthol gives very sharp results as an indicator, the acid and its monobasic salts giving pale yellow solutions, which become purple on the addition of excess of alkali. This substance may be used as a substitute for phenolphthalein, and has the advantage that the purple coloration is not affected by alcohol, even in the presence of a large excess of alkali.—C. A. M.

Thiosulphuric acid; Behaviour and application of —— in volumetric analysis. Determination of bromic and iodic acids. A. Casolari. Gaz. chim. ital., 1907, **37**, II., 601—618.

The author's experiments show that thiosulphuric acid begins to decompose from the moment when it is liberated from its salts. In very dilute solutions, decomposition proceeds slowly. The opalescence observed in such solutions is due to the presence of very small quantities of free sulphur. This opalescence disappears, owing to reformation of thiosulphuric acid, on addition of SO_2-ions to, or withdrawal of hydrogen ions from, the solution. It is stated that bromic and iodic acids can be determined volumetrically in acid solution by means of sodium thiosulphate, the excess of the latter being titrated with iodine. The reaction is: $6H_2S_2O_3 + HIO_3 = 3H_2S_4O_6 + HI + 3H_2O$.

The following secondary reaction, however, always occurs to a small extent: $H_2S_4O_6 + HIO_3 + 3H_2O = 3H_2SO_4 + HI + H_2S$.

A polythionate containing m atoms of sulphur gives on addition of hydrogen peroxide and sodium hydroxide, m-1 mols. of sulphuric acid:

$$Na_2S_mO_6 + (3m\text{-}5)H_2SO_2 + (m\text{-}1)H_2O =$$
$$Na_2SO_4 + (m\text{-}1)H_2SO_4 + (3m\text{-}5)H_2O.$$

In applying this reaction to the determination of a thionic acid, the solution of the latter is neutralised, treated with hydrogen peroxide, neutralised, a known volume of *N*/10 sodium hydroxide added, and after heating for about half an hour on the water-bath, the excess of alkali titrated with acid.—A. S.

Sulphates; New method for determining the vapour pressures of ——. L. Wöhler and others. *See* VII.

Vanadic acid; Reduction of —— by zinc and magnesium. F. A. Gooch and G. Edgar. *See* VII.

Antimony and arsenic; Determination of —— in lead-antimony alloys. G. M. Howard. *See* X.

Electrolytic oxidations and their application to quantitative analysis. O. Gasparini. *See* XIA.

ORGANIC—QUALITATIVE.

Galenical preparations of leaves; Simple test to distinguish ——from preparations of roots, flowers or seeds. A. Richaud and Bidot. *See* XX.

Nitro-cotton; Falsification of —— with mercuric chloride, and its detection. J. Moir. *See* XXII.

Analysis; New observations on simplified elementary —— M. Dennstedt. Ber., 1908, **41**, 600—604.

The author gives minute directions for the combustion of substances which burn with difficulty when his method is used. In cases where the amount of water found is too high, this is often traceable to impure calcium chloride used as the drying agent. The soda-lime used for absorbing carbon dioxide must be slightly moist, otherwise it absorbs badly. The boat of unglazed porcelain may, under certain conditions, absorb sulphur (as sulphuric acid) in the case of substances containing this element. In this event the combustion tube and boat must be rinsed with hot water and the rinsings added to the alkaline extracts from the lead peroxide.—J. C. C.

Tobacco; Determination of the volatile organic acids in ——. J. Tóth. Chem.-Zeit., 1908, **32**, 242—244.

The author has found that when tobacco is distilled with steam after being acidified with tartaric acid, the distillate is alkaline. Moreover, malic, citric, and oxalic acids in aqueous solution give distillates having an acid reaction. To avoid error due to these causes, the following method has been adopted. 3 grms. of dried and finely powdered tobacco are mixed with 3 c.c. of dilute sulphuric acid (1 : 5), and sufficient plaster of Paris added to make the mass apparently dry. This is transferred to a stoppered cylinder with 150 c.c. of dry ether, and shaken frequently during 48 hours. 50 c.c. of the ether are withdrawn, mixed with 20—40 c.c. of water and the total acid, reckoned as oxalic acid, determined by titration with *N*/2 alkali, using phenolphthalein as indicator; the amount of actual oxalic acid in this liquid is then determined in the usual way. Another 50 c.c. of the ethereal solution are evaporated, 50 c.c. of distilled water added, and the liquid evaporated on the water-bath. The residue is taken up with a little water and titrated as before. The difference between the titrations gives the amount of volatile organic acid and the oxalic acid, for both disappear during the evaporation with water. From this, the amount of volatile acid can be calculated. —F. Shdn.

Electrolytic oxidations and their application to quantitative analysis. O. Gasparini. *See* XIA.

Petroleum naphtha; Determination of —— in turpentine. H. C. Frey. *See* XIIIB.

Tanning analysis; The international method of ——. U. J. Thuau. *See* XIV.

Acidity of tan liquors; Proposed methods for the determination of ——. H. C. Reed. *See* XIV.

Wines; Alteration of the constituents during the determination of the extractives of ——. T. Roettgen. *See* XVII.

Phosphoric acid; Loss of —— in determining the ash in cereals. S. Leavitt and J. A. Le Clerc. *See* XVIIIA.

Patent.

Tobacco and the like ; Testing [Determination] of moisture in ——. J. R. Hodge. Glasgow. Eng. Pat. 5927, March 12, 1907.

The quantity of moisture present in tobacco is determined by measuring the electrical resistance between the ends of a sample of bar, cake or roll tobacco, or between electrodes at opposite ends of a glass vessel into which a known weight of loose tobacco is compressed.—A. T. L.

XXIV.—SCIENTIFIC & TECHNICAL NOTES.

Sodium ; Finely-divided —— and its employment as a drying agent for gases. C. Matignon. Bull. Soc. Chim., 1908, **3**, 353—355.

Sodium may be readily reduced to a fine state of division by rubbing down in a mortar with any neutral anhydrous salt, such as fused sodium chloride. When a definite quantity of sodium is required in the mixture, the disintegration must be performed in an atmosphere of dry carbon dioxide or in a mortar covered with a rubber sheet perforated to take the handle of the pestle. There is no risk of inflammation of the metal during powdering by this method, but obviously the presence of oxidizing salts, such as nitrates or chlorates, must be avoided. The other and more inflammable alkali metals may be powdered in a similar manner. A relatively larger quantity of the disintegrating salt must be employed, and hard pressure or concussion with the pestle avoided.

Sodium in this fine state of division with salt is an excellent material for drying gases. For packing in the desiccator tube, it may be conveniently mixed with coarsely crushed glass. The column of drying material thus formed, is readily permeated by gas, and with proper care, continues efficient for a long time.—J. O. B.

Cholesterol VI. O. Diels and K. Linn. Ber., 1908, **41**, 544—550.

It has been shown by Diels and Abderhalden (Ber., **39**, 884) that cholesterol and cholestenone are converted by treatment with amyl alcohol and sodium into compounds (cholestanols) having the same composition, $C_{27}H_{48}O$. Further experiments have shown that these compounds are not identical, for on conversion into the corresponding cholestyl chlorides and reduction of these by means of amyl alcohol and sodium, the respective hydrocarbons formed (α- and β-cholestan, $C_{27}H_{48}$) melted at 72° and 80° C. The α-cholestyl chloride from cholesterol melted at 116° C., whilst the β-cholestyl chloride from cholestenone began to melt at 89° C., yielded a turbid fluid at 92° C., and a clear liquid at 100° C. Windaus (this J., 1907, 782) showed that cholesterol was transformed into α-cholestanol not only by sodium and amyl alcohol but also by sodium amylate, and attributed the reaction, not to reduction but to cyclic transformation into an isomeric substance. In the authors' opinon if this assumption is correct, cholesterol should also be converted into α-cholestanol by the action of sodium ethylate ; but this was found not to be the case. Moreover the assumption would be more convincing if it were the case that a solution of sodium in amyl alcohol never acted as a powerful reducing agent ; whilst on the other hand, there is proof that a solution of sodium amylate does in certain cases have a strong reducing action. Cholestenone treated with sodium amylate is converted into α-cholestanol, which whether it be a cyclic transformation product of cholesterol or not, must be regarded as a reduction compound of cholestenone. Hence cholesterol and cholestenone are converted by sodium and amyl alcohol into two distinct compounds, but by sodium amylate into one and the same compound, α-cholestanol. Similar phenomena of phytosterol have been recorded by Windaus (this J., 1907, 1150), and the authors therefore consider that the view of Windaus with regard to the conversion of cholesterol into cholestanol needs enlarging to admit the possibility of reduction in addition to cyclic transformation.—C. A. M.

Cholesterol. A. Windaus. Arch. Pharm., 1908, **246**, 117—149.

A monograph on the present position of our knowledge of cholesterol and its derivatives. The subject is treated under the following headings :—Occurrence ; importance of cholesterol for the organism ; fate (formation and behaviour) of cholesterol in the organism ; physical properties ; detection of cholesterol ; detection of cholesterol and cholesterol esters in presence of each other ; separation of cholesterol and phystosterol ; formula ; hydroxyl groups and double linkage ; cholestenone ; action of fuming nitric acid on cholesterol and its derivatives ; action of chromic acid on cholesterol ; action of alkaline permanganate solution on cholesterol ; and action of potassium hypobromite on cholesterol—the acid, $C_{27}H_{44}O_4$, and its oxidation products.—A. S.

New Books.

Introduction to Metallography. By Paul Goerens, Dr.-Ing. Translated by Fred. Ibbotson, B.Sc., Lecturer in Metallurgy, The University, Sheffield. Longmans, Green, and Co., 39, Paternoster Row, London. 1908. Price 7s. 6d. net. New York, Bombay, and Calcutta.

8vo volume, containing 210 pages of subject matter with 158 illustrations, and alphabetical indexes of authors and subjects. The text is subdivided as follows :—I. Physical Properties of Matter.—(1) Allotropy. (2) Cooling curves. II. The Physical Mixture.—(1) Aqueous solutions. (2) Fused salts. (3) Alloys. III. Practical Microscopy of Metals.—(1) Preparation of the section. (2) Development of the structure. (3) The microscope. (4) Photography. IV. Special Metallography of Iron-Carbon Alloys.—(1) Freezing point diagram of iron-carbon alloys. (2) Constituents of iron-carbon alloys.

Leather Trades Chemistry. Practical Manual on the Analysis of Materials and Finished Products. By S. R. Trotman, M.A., Public Analyst and Agricult. Analyst for the City of Nottingham, etc. Chas. Griffin and Company, Ltd., Exeter Street, Strand, London. 1908. Price 15s. net.

8vo volume, containing 284 pages of subject matter, a glossary of technical terms, and an index of subjects. There are 48 illustrations, and Green's tables of tests for distinguishing the dyestuffs quoted from this Journal, 1905, 1035, also Procter's tables for the qualitative recognition of the tannins, etc. The text is subject to the following classification :—I, Analysis of fuel. II, Nitrogen determination. III, Preparation of standard solutions. IV, Water. V, Effluents. VI, Depilation. VII, Deliming. VIII, Detection of tannins. IX, Analysis of tanning materials. X, Common vegetable tannins. XI, Mineral tannages. XII, Analysis of spent liquors and tans. XIII, Oils. XIV, Soap. XV, Varnishes. XVI, Skins. XVII, Analysis of leather. XVIII, Fleshings and scutch. XIX, Glue. XX, "Benzine" (Benzol). XXI, Dyestuffs. XXII, Disinfectants, and antiseptics.

Air Conditioning. Short Treatise on the Humidification, Ventilation, Cooling, and the Hygiene of Textile Factories—especially with relation to the United States of America. By G. B. Wilson. John Wiley and Sons. New York. Chapman and Hall, Limited, London. 1908. Price 6s. 6d. net.

Small 8vo volume, containing 138 pages of subject matter, 14 illustrations, and the alphabetical index. The work is divided into five parts, as follows :—I. Influence of suitable atmospheric conditions. Importance of ventilation in the textile industries. Effect of humidity. Interdependence of humidity and temperature, etc. II. Theory of regain. Standards. Tables of degrees of humidity and temperature for various textile industries. III. Conditions in various districts, both in

America, England and elsewhere. IV. Cotton Cloth Act. "Head" type of humidifiers, etc. V. Application of up-to-date practice to American conditions. VI. "Conditioning" and "hygrometry."

Analysis of Mixed Paints, Colour Pigments, and Varnishes. By Clifford Dyer Holley, Ph.D., &c., and E. F. Ladd, B.S., Professors of Chemistry and Industrial Chemistry North Dakota Agric. College. John Wiley and Sons, New York, U.S.A. (First edition.) Chapman and Hall, Limited, London. 1908. Price 10s. 6d. net.

8vo volume, containing frontispiece, 232 pages of subject matter, with 11 illustrations, and the alphabetical index. The text is classified as follows:—I, Ready mixed paints. II, Analysis of mixed paints; of the vehicle, and the volatile oils. Special methods of oil analysis. Analysis of white lead; of sublimed lead, zinc oxides, and zinc-lead pigments. Of zinc sulphide whites, and inert pigments. III, Determination of fineness, covering power, and tinting strength of pigments, etc. Analysis of white paints; of Indian reds and Venetian reds, etc.; of black, brown, and blue pigments and paints. Analysis of yellow, orange, and red chrome leads, and of vermilions; of Chrome greens, and Emerald greens. IV, Exercises in colour making. V, Analysis of japans and driers; of shellac and spirit varnishes; of oil varnishes. VI, The practical testing of varnishes.

Modern Pigments, and their Vehicles. Their Properties and Uses, considered mainly from the practical side and to make tints from them. By Frederick Maire. John Wiley and Sons, New York. 1908. Price 8s. 6d. net. Chapman and Hall, Limited, London.

First edition of the work, as a small 8vo volume of 255 pages, with alphabetical index. The subject matter is sub-divided and classified according to the following plan:—I, Definition of "pigment." II, White pigments. III, Yellow, red, green, blue, brown, and black pigments. IV, Synonyms. V, Vehicles used in grinding pigments, and in applying them. VI, Correctives and binders. VII, Substances used to bind pigments in connection with vehicles. VIII, Driers and siccatives. IX, Compounding of pigments. X, List of principal tints and of pigments required to make them.

Sugar. Board of Trade Return No. 334. Wyman and Sons, Fetter Lane, London, E.C. Price 5½d.

This return shows, as far as possible, for each of the years 1887 to 1906, inclusive, the estimated production of cane and beet sugar, respectively, in the various producing countries of the world; the imports and exports of raw and refined sugar, distinguishing beet and other sorts, into and from the United Kingdom, France, Germany, Austria-Hungary, Belgium, Holland, the United States, Canada and Australia, from and to the principal countries of origin and destination; the total consumption and consumption per head of the population of each of the above-named countries; and the exports of sugar of domestic production, from each of the principal British Colonies and Possessions, together with the average declared import value of raw and refined sugar for the United Kingdom.

East India (Trade). Tables relating to the Trade of British India with British Possessions and Foreign Countries, 1902-3 to 1906-7. [Cd. 3969.] Wyman and Sons, Fetter Lane, London, E.C. Price 1s. 4d.

This return contains statistics of the foreign trade of British India during the last five financial years. In 1906–7 the total value of the imports of merchandise (exclusive of Government stores) into British India by sea was 72,205,055*l*., as compared with 68,722,713*l*. in 1905–6, whilst the total value of the exports of merchandise of Indian produce and manufactures (exclusive of Government stores) was 115,388,249*l*., as against 105,459,482*l*. in the preceding financial year. The total of the imports into, and the exports from, British India, by land and sea (inclusive of Government stores and treasure) amounted in 1906–7 to 241,264,293*l*., as compared with 225,217,046*l*. in 1905–6.

Mineral Resources of the United States. 1906. U.S. Geological Survey, Washington.

Large 8vo volume containing 1275 pages of letterpress, together with a subject index of 31 pages. Commencing with an introduction by David T. Day and E. W. Parker, and a summary of the mineral production of the United States in 1906, the work is continued in detail, under the following headings:—Metals; fuels; structural materials; abrasive materials; chemical materials; miscellaneous. Curves are given showing the American production of iron ore, pig iron, and steel from 1870 to 1906, and a comparison of Portland cement and pig iron production from 1890 to 1906.

Patent List.

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

Applications.

5830. Ridgway. Filtering machines.* March 16.

5943. Feix. Frame filter presses.* March 17.

5944. Feix. Filter press frames.* March 17.

5969. Cottrell. Separating suspended particles from gaseous bodies.* March 17.

6036. Boult (D'Arleux). Furnaces, kilns, &c.* March 18.

6249. Papineau. Extracting liquid from viscous or pasty compounds. March 20.

6396. McDougall. Pot stills. March 23.

6404. Arthur and Thatcher. Preparations for applying to the interior of casks, &c. March 23.

Complete Specifications Accepted.

13,598 (1907). Mazza. Apparatus for separating the constituents of gaseous mixtures. March 25.

14,024 (1907). Suzuki. Evaporators. April 1.

17,784 (1907). Kestner. Apparatus for atomising liquids. April 1.

18,549 (1907). Bévenot. Apparatus for extracting and drying the solids in fluids, especially milk and saccharine juices. March 25.

20,003 (1907). Dunn and Dunn. Apparatus for condensing, evaporating, concentrating, distilling, &c. April 1.

20,677 (1907). Jäger. Filtering. April 1.

25,339 (1907). Holzer. Centrifugal separators. March 25.

26,314 (1907). McDonald and Nickle. Evaporating apparatus. March 25.

3290 (1908). Tiemann. Filters. April 1.

II.—FUEL, GAS, AND LIGHT.

Applications.

5983. Cooper. Underfed gas producer. March 18.

6026. Ross. Manufacture of incandescent gas mantles.* March 18.

6047. Coke Ovens and By-Products Co., and Wellington. Coke ovens. March 18.

6191. King and Workman. Gas producer plant. March 20.

6204. Stewart. Gas producers. March 20.

6223. Coke Ovens and By-Products Co., and Wellington. Coke ovens. March 20.

6243. Teasdale, Le Maitre, and Greaves. Gas producer or suction plant apparatus. March 20.

6250. Hicks. Apparatus for producing gas from light hydrocarbons.* March 20.

6495. Jones, and Kynoch, Ltd. Gas producers. March 24.

6575. Von Bauer. Coke ovens.* March 24.

6816. Meikle and Duncan. Condensing or extracting tarry or other matter from coal or producer gas. March 27.

Complete Specifications Accepted.

6828 (1907). Buhlmann. Manufacture of incandescent mantles. April 1.

7805 (1907). Lorin. Gas generators. March 25.

20,372 (1907). Scholz. *See under* X.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

Complete Specification Accepted.

7615 (1907). Craig. Manufacture of pitch. April 1.

IV.—COLOURING MATTERS AND DYESTUFFS.

Applications.

5840. Imray (Basle Chemical Works). Manufacture of indoxyl, its homologues and derivatives.* March 16.

6153. Ges. f. Chem. Ind. in Basel. Manufacture of tri- and tetrabromo derivatives of indigo. [Ger. Appl., Nov. 2, 1907.]* March 19.

6154. Ges. f. Chem. Ind. in Basel. Manufacture of chlorine derivatives of indigo. [Ger. Appl., Oct. 31, 1907].* March 19.

Complete Specifications Accepted.

13,148 (1907). Imray (Soc. Chem. Ind. in Basle). Manufacture of monochloromonobromo derivatives of indigo. April 1.

14,746 (1907). Bloxam (Act.-Ges. f. Anilinfabr.). Manufacture of brown sulphurised dyestuffs. April 1.

15,420 (1907). Newton (Bayer und Co.). Preparation of azoxy and azo compounds of the benzene series. April 1.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

Applications.

6183. Birkett. Skein or hank dyeing machine. March 20.

6475. Vittenet. Manufacture of artificial silk. March 23.

6532. Rossi. Microbiological retting process by pectic aerobic microbes in a gas current.* March 24.

6766. Crumière. Manufacture of artificial horsehair and ribbons of cellulose. [Fr. Appl., April 23, 1907.]* March 26.

6893. Kershaw, Abell, and Leach. Dyeing, scouring, and analogous machines. March 28.

Complete Specifications Accepted.

7306 (1907). Quern. Bleaching or dyeing flax, hemp, or like yarns. April 1.

13,567 (1907). Beer. Printing on woven fabric or paper. March 25.

23,130 (1907). Denison and Preussner. Rendering the finish on textiles permanent. March 25.

VI.—COLOURING WOOD, PAPER, LEATHER, &c.

Application.

6538. Brincker. *See under* IX.

VII.—ACIDS, ALKALIS, AND SALTS.

Applications.

6105. Siemens Bros. and Co. (Siemens und Halske A.-G.). Ozonising air.* March 19.

6155. Naville, Guye, and Guye. Recovery of oxides of nitrogen diluted with air. [Fr. Appl., March 20, 1907.]* March 19.

6218. British Cyanides Co., and Chance. Manufacture of sulphocyanides.* March 20.

6259. Krupp, A.-G. Grusonwerk. Decomposing ground phosphates. [Ger. Appl., May 4, 1907.]* March 20.

6265. Norske Kvaelstofkompagni. Manufacture of nitric acid and nitrites. [Appl. in Norway, March 22, 1907.]* March 20.

6366. Naville, Guye, and Guye. Recovery of oxides of nitrogen diluted with air or inert gases. [Fr. Appl., March 22, 1907.]* March 21.

6449. Morris. *See under* XI.

6453. Jirotka. Production of ozone. [Ger. Appl., March 25, 1907]* March 23.

6655. Gouthiere et Cie. Manufacture of sodium nitrite. [Ger. Appl., March 27, 1907].* March 25.

6804. Ashworth and Anselm. Production of reducing agents. March 27.

6919. Arndts. Manufacture of durable solutions of hydrogen peroxide.* March 28.

Complete Specifications Accepted.

6626 (1907). Thompson (Wadman). Treating ores containing lithia. March 25.

7034 (1907). McGhie and Barton. *See under* X.

7035 (1907). McGhie and Barton. Separation of salts of cobalt and nickel. March 25.

7932 (1907). Grossmann. Treatment of effluents from ammonia stills. March 25.

13,954 (1907). Johnson (Chem. Fabr. Griesheim-Elektron). Manufacture of catalytic bodies especially for use in making nitric acid. April 1.

16,885 (1907). Norske Aktieselskab f. Elektrokemisk Ind., and Halvorsen. Absorption of dilute nitrous gases. April 1.

20,649 (1907). Hartenstein. Manufacture of carbide. April 1.

VIII.—GLASS, POTTERY, AND ENAMELS.

Applications.

5866. Sulman and Picard. Ornamentation of china, earthenware, porcelain, &c. March 16.

6560. Onslow. Manufacture of glass and apparatus therefor. March 24.

6794. Gaved. Recovering china clay or china stone from decomposed granite, and separating the clay, mica, and quartz. March 27.

Complete Specifications Accepted.

9394 (1907). Schöfl, Trautmann, and Mayer. Manufacture of fire-resisting porcelain. April 1.

17,653 (1907). Craig. Manufacture of glazed tiles. March 25.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Applications.

6230. Barnett. Cement.* March 20.

6256. Sundell. Manufacture of imitation marble and stone. March 20.

6538. Brincker. Colouring and impregnating wood. March 24.

Complete Specifications Accepted.

6070 (1907). Hales. Substitute for builders' sand. March 25.

6396 (1907). Stanley. Manufacture of bricks &c., from powdered clay. March 25.

9375 (1907). Flynt. Substitute for natural rock asphalt. March 25.

16,865 (1907). Brookes (Asbestos Wood Co.). *See under* XI.

26,594 (1907). Ries. Bricks for use in constructing furnaces, retorts, &c. April 1.

X.—METALS AND METALLURGY.

APPLICATIONS.

5841. Serbillot and Mauclaire. Extracting gold from its ores. March 16.

5900. Willmott. Soldering and tinning aluminium and its alloys. March 17.

6029. Bismarckhütte. *See under* XI.

6050 and 6051. Siemens und Halske A.-G. Process for hardening tantalum. [Ger. Appl., March 26, 1907.]* March 18.

6148. Lockwood and Samuel. Treatment of ores. March 19.

6214. Moeller (Rosalt). Extracting metals from ores by a wet process. March 20.

6305. Griffiths. Refining zinc during extraction by distillation. March 21.

6324. Hodgkinson and Matthews. Manufacture of steel. [Addition to No. 19,493 of 1906.] March 21.

6462. Winterbauer, Kneffel, and Wachwitz. Alloying steel or iron surfaces.* March 23.

6511. Hommel, and Metals Extraction Corporation, Ltd. Treatment of sulphide ores or products. March 24.

6561. Pritchard, and United Alkali Co., Ltd. Production of iron from finely divided ores. March 24.

6665. Pim and Matthews. Manufacture of steel. March 25.

6888. Troeller. Extracting zinc and other metals as volatile oxides from ores and products.* March 28

COMPLETE SPECIFICATIONS ACCEPTED.

6337 (1907). Raschen, Taylor, and United Alkali Co. Recovery of iron, copper, and zinc from liquors. March 25.

6554 (1907). Churchward. Production of steel alloys. March 25.

7034 (1907). McGhie and Barton. Treatment of ores containing arsenic. April 1.

7223 and 7223A (1907). New Delaville Spelter Co., and Shortman. Extraction of zinc. April 1.

20,372 (1907). Scholz. Manufacture of metal filaments from colloidal metals. March 25.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

APPLICATIONS.

6029. Bismarckhütte. Refining steel in electric furnaces. [Ger. Appl., Sept. 16, 1907.]* March 18.

6449. Morris. Electrolytic production of aluminium oxide.* March 23.

COMPLETE SPECIFICATIONS ACCEPTED.

7742 (1907). Cowper-Coles. Electric furnaces. March 25.

13,342 (1907). Richardson and Vaughan. Electrical treatment of gases or vapours to produce ozone. April 1.

16,865 (1907). Brookes (Asbestos Wood Co.). Insulating and waterproof materials. April 1.

18,480 (1907). Schmidt. Electroplating metals. April 1.

25,126 (1907.) Cowper-Coles. Apparatus for the electrodeposition of metals. April 1.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

APPLICATIONS.

5817. Oyler. Soap. March 16.

6083. Irving. Manufacture of soaps or washing compounds. March 19.

6304. Irving. Manufacture of washing compounds or soaps. March 21.

6701. Kendrick. Increasing the power of light and durability of candles. March 26.

6822. Walker. Cleansing powder. March 27.

COMPLETE SPECIFICATIONS ACCEPTED.

7561 (1907). Mason, Geldart, and Fryer. Treating fatty or waxy bodies to facilitate saponification by alkalis. April 1.

9766 (1907). Dreymann. Treatment of oils. March 25.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(*A.*)—PIGMENTS, PAINTS.

APPLICATION.

6584. Hannay and Wilson. Manufacture of a white lead sulphate pigment. March 24.

(*B.*)—RESINS, VARNISHES.

COMPLETE SPECIFICATIONS ACCEPTED.

6831 (1907). Pope and Clark. Extracting products from wood. April 1.

16,245 (1907). Johnson (Badische Anilin und Soda Fabrik). Manufacture of products resembling resin. April 1.

25,459 (1907). Chem. Fabr. Dr. Elkeles und Co. Production of resins adapted to polishing purposes. April 1.

(*C.*)—INDIA-RUBBER.

APPLICATIONS.

5868. Durham. Treatment or preparation of rubber. March 16.

6300. British Vulcanized Fibre Co., and Briggs. Vulcanised fibre. March 21.

COMPLETE SPECIFICATION ACCEPTED.

8150 (1907). Radclyffe and Olsson-Seffer. Preparation of rubber. March 25.

XIV.—TANNING, LEATHER, GLUE, SIZE, &c.

APPLICATIONS.

6131. Lake (Fiber Products Co.). Manufacture of artificial leather.* March 19.

6142. Marter. Substitute for ivory, bone, &c. March 19.

6227. Knoll, Knoll, and Knoll. *See under* XX.

6247. Baechler. Manufacture of casein.* March 20.

6573. Wiechmann. Treatment of vegetable albumen and products therefrom.* March 24.

COMPLETE SPECIFICATIONS ACCEPTED.

18,281 (1907). Lewis. Regenerating waste or scrap leather. April 1.

21,906 (1907). Feldmann and Feldmann. Manufacture of many coloured varnished leather. April 1.

28,743 (1907). Pianko and Knaster. Manufacture from split leather of a waterproof fast-coloured leather of equal value with upper grain leather. April 1.

XV.—MANURES, &c.

APPLICATION.

5999. Goeckeler. Treatment of manure. [U.S. Appl., March 18, 1907.]* March 18.

XVI.—SUGAR, STARCH, GUM, &c.

COMPLETE SPECIFICATION ACCEPTED.

18,549 (1907). Bévenot. *See under* I.

XVII.—BREWING, WINES, SPIRITS. &c.

Application.

6396. McDougall. *See under* I.

Complete Specification Accepted.

27,601 (1907). Hartley. Aerating beer, stout, &c., in barrels or casks. March 25.

XVIII.—FOODS; SANITATION, WATER PURIFICATION; AND DISINFECTANTS.

(*A.*)—Foods.

Applications.

5810. Schou. Butter manufacture.* March 16.
6077. Willis. Production of animal albumen. March 18.
6444. Frye. Manufacture of butter.* March 23.

Complete Specifications Accepted.

7500 (1907). Boult (American Farm Products Co.). Manufacture of renovated or process butter. April 1.
18,549 (1907). Bévenot. *See under* I.
27,036 (1907). Haddan (De Mattia). Treatment of coffee. April 1.

(*B.*)—Sanitation; Water Purification.

Applications.

5857. Eilertsen. Sterilisation of water. [Fr. Appl., March 15, 1907.]* March 16.
6374. Douzal. Purification of sewage and other foul waters, waste material, &c.* March 21.
6797. Thomson. Treatment of air for breathing. March 27.
6887. Grossmann. Distillation of sea water. March 28.

(*C.*)—Disinfectants.

Application.

6783. Dame. Solid disinfectant soluble in water. [Fr. Appl., March 26, 1907.]* March 26.

XIX.—PAPER, PASTEBOARD, &c.

Application.

5963. Pidelaserra y Brias. Manufacture of copying paper.* March 17.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

Applications.

6019. Wetter (Knoll und Co.). Pharmaceutic preparations from digitalis leaves.* March 18.
6179. Wülfing and Fischer. Obtaining a pure, neutral sodium salt of lactalbumen.* March 19.
6227. Knoll. Knoll, and Knoll. Manufacture of a pharmaceutical compound from casein. [Ger. Appl., March 28, 1907.]* March 20.
6336. Monroe, and Kingsway Synd., Ltd. Radioactive substances. March 21.
6439. Johnson (Verein. Chininfabr. Zimmer und Co.). Manufacture of pharmaceutical products. March 23.
6632. Wellcome and Pyman. Manufacture of substances for pharmaceutical purposes. March 25.

Complete Specifications Accepted.

13,600 (1907). Zimmermann (Chem. Fabr. auf Actien, vorm. E. Schering). Manufacture of substances useful in therapeutics. April 1.
4359 (1908). Lüdy und Co. Manufacture of the borneol and menthol esters of α-bromoisovalerianic acid. March 25.

XXII.—EXPLOSIVES, MATCHES, &c.

Application.

5957. Galy. Matches.* March 17.

XXIII.—GENERAL ANALYTICAL CHEMISTRY.

Application.

6798. Thomson. Estimation of carbon dioxide in air.

Journal of the Society of Chemical Industry.

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Official Notice.

ANNUAL GENERAL MEETING.

The Annual General Meeting will be held in the Armstrong College, Newcastle-on-Tyne, on Wednesday, July 22nd, at 10.30 a.m. Full particulars will appear later.

In accordance with the provisions of By-law 18 of the Society of 1881, notice is hereby given that those members whose names are printed in *italics* in the list of Council (see p. 363) will retire from their respective offices at the forthcoming Annual Meeting.

Prof. R. Meldola, F.R.S., has been nominated to the office of President under By-law 8; Dr. J. T. Dunn, Mr. A. R. Ling, Mr. George C. Stone, and Mr. R. C. Woodcock, have been nominated Vice-Presidents under By-law 8; Sir Boverton Redwood has been nominated a Vice-President under By-law 11; and Dr. T. B. Wagner has been nominated a Vice-President under By-law 26. Prof. P. Phillips Bedson and Mr. H. Van der Linde have been nominated Ordinary Members of Council under By-law 26; and Mr. Thomas Tyrer and Dr. Ludwig Mond, F.R.S., have been nominated Hon. Treasurer and Hon. Foreign Secretary respectively under By-law 9.

Members are hereby invited to nominate fit and proper persons to fill four vacancies among the Ordinary Members of Council. Forms for this purpose can be obtained from the General Secretary.

Extract from By-law 18.—"No such nomination shall be valid unless it be signed by at least ten members of the Society, who are not in arrear with their subscriptions, and by the nominee, nor unless it be received by the General Secretary, at the Society's office, not later than the last day of May prior to the commencement of the Annual General Meeting, at which the election to which the nomination refers is to take place. Nor shall any such nomination be valid if the person nominated be ineligible for election under By-laws 12 or 15. No member shall sign more than one nomination form."

By order of the Council,

Charles G. Cresswell, Secretary.

Birmingham Section.

Meeting held at Birmingham on Thursday, February 13, 1908.

MR. HARRY SILVESTER, B.SC., F.I.C., IN THE CHAIR.

THE REACTIONS OF COPPER, BISMUTH, AND SILVER WITH NITRIC ACID.

BY J. H. STANSBIE, B.SC. (LOND.), F.I.C.

In previous papers (this J., 1906, 45, 1071) the reactions of nitric acid with copper and some of its alloys were considered, and it was pointed out that the whole of the acid used in an experiment could not be traced by the method adopted. The apparatus was then modified so that more control could be exercised over the reactions, and this led to the detection of the chief cause of the disappearance of acid in the former experiments. The aim now is to trace, as far as the limits of this modified apparatus will admit, the various changes taking place when pure copper, silver, and bismuth are dissolved in a solution of pure nitric acid of sp. gr. 1·2, at 65° C.

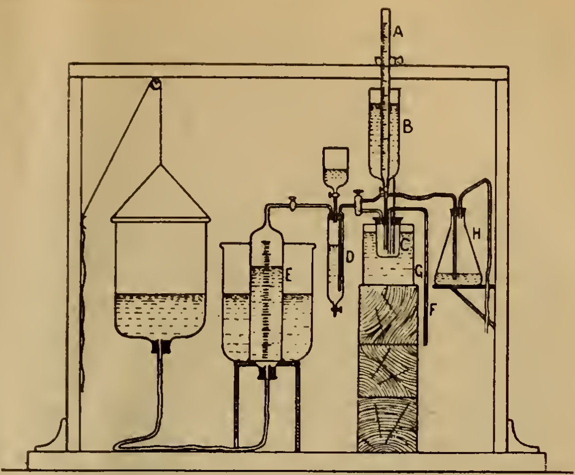

Fig. 1 is a diagram of the apparatus used. The acid solution is measured in the burette, A, and heated by hot water in the water jacket, B. The weighed quantity of the metal in the form of sifted filings is put into the beaker, C, which is connected with the absorption tube, D, by a two-way tap. The absorption tube contains a measured solution of sodium hydroxide of known strength, and is connected with the measuring cylinder, E. When the parts of the apparatus are in position, a steady stream of hydrogen, collected over the ordinary alkaline solution of pyrogallol, is passed through the beaker and absorption tube by way of the syphon tube, F, until the whole of the air has been displaced. D is then connected with E, and the syphon tube closed. Hot water is now poured into the jacket, B, and the water bath, G, placed in position. The acid solution is run slowly into the beaker from the burette, and when the metal is dissolved water is allowed to enter from the burette, and the remaining gas thus displaced to the two-way tap, which is then closed. The whole of the acid solution is thus contained in this part of the apparatus. The soda solution is then run from D into a 250 c.c. flask, and the tube washed with water run in from the tap funnel above. Water is forced from the flask, H, through the second channel of the tap to clear the connecting tube of gas, the whole of which is then driven into the measuring cylinder, E. The parts of the apparatus are now separated, and the solution in the beaker run through the syphon tube into a 500 c.c. flask containing 6 grms. of sodium carbonate in solution. The parts are well washed and the washings added to the flask, the burette being filled and emptied twice. The flask is well shaken, filled to the mark, and set aside for two days to allow the basic carbonate to separate completely. The gas in E is measured, its temperature taken, and the height of the barometer noted. 150 c.c. of oxygen is then added, the residual gas allowed to stand for fifteen minutes, and its volume noted. The volumes of the absorbed and residual gas are corrected for temperature, pressure, and water vapour.

The weight of acid in the solution run from the burette was determined in the carbonate solution obtained from a blank experiment, every care being taken to ensure uniform working. The hydroxide and carbonate solutions are titrated with standard permanganate solution for nitrous acid, and with standard acid solution for excess of alkali, using methyl orange as indicator.

Pure copper (*electrolytic*).—Directly the acid comes into contact with the metal, nitric peroxide appears in the atmosphere of hydrogen in the beaker, and the evolution of this red gas seems to go on steadily during the whole of the dissolution. It is completely absorbed by the hydroxide solution in the absorption tube, and the insoluble gas passes on to the measuring cylinder.

Pure bismuth.—Similar changes are noticed during the dissolution of bismuth, but the evolution of the red gas is not so marked as with copper. It appears directly the acid is admitted, and is liberated steadily until the metal is dissolved.

Pure silver.—Nitric peroxide is not noticed in the beaker until towards the end of the reaction, and a smaller volume of the gas is liberated than in the case with either copper or bismuth.

According to Divers (J. Chem. Soc., 1899, 86), the mixed gases, nitric oxide and peroxide, obtained by heating a mixture of arsenious oxide and nitric acid of sp. gr. 1·35, when passed into a solution of sodium hydroxide react with the alkali and sodium nitrite is formed. This is borne out in the above experiments by the examination of the alkaline solution from the absorption tube. Thus, in the copper experiment, the solution was found to contain 28·4 mgrms. of nitrous acid by titration with permanganate solution, while the quantity of alkali neutralised indicated 29·3 mgrms. Similar results were obtained with the bismuth and silver. It is also interesting to note that the reactions are of the same order when water replaces the alkaline solution in the absorption tube. The aqueous solution was run from the absorption tube into a measured solution of sodium hydroxide, and the nitrous acid determined as before. The test gave 12·1 and 13·2 mgrms. of nitrous acid respectively. The smaller quantity of acid found in the aqueous solution is no doubt due to its partial decomposition according to the equation, $3HNO_2 = HNO_3 + 2NO + H_2O$, which may take place, and this would account, in part at least, for the excess of alkali neutralised. The almost exclusive formation of nitrous acid in both the aqueous and alkaline solutions is not difficult to account for if, as is most probably the case, the mixed gases contain a small quantity of nitrogen trioxide. This would react to form either the nitrite or the acid, and its removal from the mixture of gases would cause more to form, so that its formation and absorption would go on continuously until the whole of the nitric peroxide and an equal volume of nitric oxide had been converted into nitrous acid. It is, therefore, possible to calculate the weight and volume of nitric peroxide liberated from the solution during the dissolution of the metal, and this has been done. The results of the experiments described above are given in the following table :—

Weight of metal = 1 grm.	Weight of acid used.	Weight of acid traced.	Volume of nitric oxide liberated.	Volume of nitric peroxide liberated.	Weight of nitric peroxide liberated.	Volume of nitrogen liberated.	Weight of nitrous acid in the carbonate solution.	Weight of nitrous acid in the hydroxide solution.	Weight of nitrous acid formed from nitric peroxide.	Weight of nitrous acid formed from nitric oxide.
Cu	5883	5866	162·3	6·75	13·9	13·9	135·6	28·4	14·2	14·2
Bi.......	5883	5882	75·7	1·85	3·82	3·7	66·9	7·7	3·9	3·9
Ag	5883	5847	43·9	1·1	2·25	—	82·1	4·6	2·3	2·3

The weights are given in milligrams, and the volumes in cubic centimetres.

In the following table the equivalent weights of the metals are taken, so that the same weight of acid is used in each case for the formation of nitrates and nitrites. In this way the significance of the results is more clearly brought out :—

Weight of metal.	Volume of nitric oxide.	Volume of nitric peroxide.	Volume of nitrogen.	Weight of nitrous acid in carbonate solution.	Weight of nitrous acid in hydroxide solution.
Copper, 1 grm.	162·3	6·7	13·9	135·6	28·4
Bismuth, 2·2 grms.	166·5	4·1	8·1	147·2	17·2
Silver, 3·43 grms.	150·6	3·8	—	281·6	15·8

The weights are given in milligrams, and the volumes in cubic centimetres.

A glance at the table makes it clear that the reactions for the three metals are of the same order, and so agree with the theory of the action of metals on nitric acid advanced by Divers (J. Chem. Soc., **43**, 443). He divides the metals into two groups with respect to their reactions with nitric acid, and his views are supported by the researches of Russell, Rây, Veley, and others. Silver is given as the type for one group, and zinc for the other. In the silver group, to which copper and bismuth belong, the metals do not react with nitric acid unless nitrous acid is present to act as a catalyser, but in its presence the metal is converted into molecular quantities of nitrate and nitrite, thus: $2Ag + 2HNO_3 = AgNO_3 + AgNO_2 + H_2O$. But the temperature, and degree of dilution of the acid must be regulated so that the quantity of the nitrous acid catalyser keeps constant. If the conditions are such that free nitrous acid accumulates in the solution, then secondary changes take place, and gases are liberated. This is what happens when the conditions with regard to concentration and temperature are such as obtained in the experiments described above.

On reference to the last table it will be noticed that nitrous acid accumulates in the main solution, and is no doubt at first largely in the form of metallic nitrite, but it is also probable that the nitrite undergoes more or less decomposition, or reacts with free nitric acid and nitrate to produce secondary reactions. This depends upon the stability of the particular nitrite at the temperature of the experiment, and no doubt explains the difference noticed between copper and silver with regard to the liberation of nitric peroxide. Copper and bismuth nitrites evidently do not differ very much in this respect, but silver nitrite seems to be much more stable. Also, the general reactions of silver appear to be somewhat simpler than those of the other two metals, for no nitrogen is liberated.

The nitric acid solution used for the experiments was prepared from the double distilled acid, and contains 2 mgrms. of nitrous acid per litre.

DISCUSSION.

Dr. T. S. **PRICE** said the author had stated that when nitric oxide passed through a solution of sodium hydroxide containing sodium nitrite and nitrate it was oxidised to nitrous acid ; moreover a fair amount appeared to be oxidised. He was always under the impression that in order to oxidise nitric oxide to nitrous acid by means of nitric acid it was necessary to have an excess of nitric acid present. He believed that Veley stated that 9 molecules of nitric acid to one of nitrous acid were necessary, in order to obtain equilibrium. He could not follow Mr. Stansbie regarding Divers' explanation of the action of nitric acid on silver. His recollection was that Divers stated that the nitric oxide and the nitrogen peroxide were formed by secondary reactions. The first reaction was the action of the nitric acid on the silver to form silver nitrate and nitrite. As soon as they were formed secondary reactions occurred. The nitric acid acted on the silver nitrite and liberated nitrous acid. The way in which this acid would decompose depended on the concentration of the nitric acid remaining in the solution. If the nitric acid was weak the nitrous acid decomposes in the ordinary way, giving nitric acid and nitric oxide.

Mr. A. E. **TUCKER** pointed out that the results obtained by the author would be largely influenced by the temperatures at which the various reactions took place. for if experiments were made, on the one hand, at say even five degrees above, and, on the other, at five degrees below the temperature used by Mr. Stansbie, the figures would be materially modified.

Mr. **STANSBIE**, in reply, said, with regard to the use of the caustic soda solution mentioned by Dr. Price, he could only say that he had given the actual results of the experiments. The nitrous acid neutralised the caustic soda in the solution. Probably, however, some of the conclusions he had arrived at would have to be modified after a little more experience. At present he failed to see any other explanation than the one he had given, namely, that nitric oxide was converted into nitrous acid in that solution; and that the solution contained sodium nitrite. It was a dilute solution, but he could not escape from the conclusion that nitrous acid was present in it. With regard to the reactions referred to as given by Dr. Divers, he said he had alluded to the first reaction; and any other reactions which took place were secondary in character. He would give careful consideration to the other matter referred to by Dr. Price. He had made some of the experiments described in Dr. Divers' paper, but some of his conclusions did not altogether agree with those. That was a matter he expected would come forward in any discussion on the subject. On the question of temperature referred to by Mr. Tucker, he mentioned in his last paper that some of the experiments were made at temperatures varying from 25° to 95°. He could get different results with different temperatures. When working with nitric acid one needed to watch carefully the temperature. It should not vary more than one or two degrees. In his experiments it did not vary more than 1° on either side of the 65°. It was only by doing that that concordant results were to be obtained. The whole subject was an extremely large one, and involved experimental research amounting to what might be regarded almost as a life's work.

Liverpool Section.

Meeting held at University, on Wednesday, January 15th, 1908.

DR. JAMES T. CONROY IN THE CHAIR.

CERTAIN DEPOSITS OF IRON SALTS.

BY J. T. CONROY, B.SC., PH.D.

I. *Ferrous sulphate.*—The first deposit is a case of ferrous sulphate occurring in an unusual form and condition. The samples were obtained from the bottoms of the crystallising vessels into which was run the slightly acid concentrated solution of ferrous sulphate resulting from the pickling of iron plates in vitriol. The deposit appears as a very hard and close-textured mass of pale green colour and is disposed in several closely adhering layers, each about half-an-inch thick, corresponding to successive depositions. The whole set very hard on the bottom of the crystallising vessels and was only removed with difficulty. Analysis shows it to be ferrous sulphate associated with 5 molecules of water (FeO = 29·5 per cent.; SO_3 = 33·2 per cent.; H_2O = 37·5 per cent.). On treatment with water the lump appears to suffer simultaneous solution and disintegration, a heavy white powder forming on the surface of the crystal and dropping to the bottom of the beaker. I have made attempts to isolate this powder but have been unsuccessful, as by the time it has been got on to the filter and washed with water to remove adhering ferrous sulphate, only a comparatively small precipitate of ferrous hydroxide remains. It is apparently a ferrous sulphate in a sparingly soluble form. A sample of the original deposit has been exposed to the air for some months, and a considerable portion of the surface has been converted to a fine white powder, extending in places to a quarter of an inch depth. In many places the white has appeared in spots which have the appearance of a fungoid growth, but even in these cases the white material extends into the mass to form pockets. This powder behaves like the white powder obtained by treating the deposit with water, dissolving very slowly in cold and more rapidly in warm water to leave in either case a small amount of ferrous hydroxide. Analysis shows a total iron content of 29·26 per cent. of which all but 0·28 per cent. is soluble in water.

		Calc. for $FeSO_4,2H_2O$.
	per cent.	per cent.
FeO	37·4	38·29
SO_3	42·3	42·55
H_2O (by diff.)	20·3	19·16
	100·0	100·00

The ordinary crystallised ferrous sulphate as is well known contains $7H_2O$,* but according to the text books salts with 1, 2, 3, 4, and 5 molecules of crystal water are also known. The crystals with 5 mols. of water, isomeric with $CuSO_4,5H_2O$, are obtained by evaporating *in vacuo* a solution of the ordinary crystals to which excess of sulphuric acid has been added. The crystals with four mols. of water are also obtained under the same conditions; they are further formed at 80° C. in ordinary ferrous sulphate liquors and by adding acid to a concentrated solution of the salt. The di- and tri-hydrated salts are also formed under similar conditions.

It is impossible to give the exact conditions under which the present salt was produced. From my observation, the actual production of the salt appeared to take place in the pickling bath and only when the bath was nearly spent. The temperature at this stage was high, over 50° C., and the liquor very strong. Acid was added to the bath from time to time to maintain the pickling at its normal rate so that acid was always present in excess. The conditions of the bath thus approached those given above for the formation of the di-, tri-, and tetra-hydrated salts and it is quite possible that the present deposit is not a true penta-hydrated salt but a mixture of the lower hydrated salts cemented together with ordinary $FeSO_4,7H_2O$. The appearance of the salt is against this view as is also the close agreement between the analytical figures and those calculated for $FeSO_4,5H_2O$ which figures, I may say, have been confirmed by samples taken at different dates. On the other hand the behaviour on solution would almost indicate the presence of two salts, one easily and the second difficultly soluble. I incline to the view that it is a single salt. The nature of the deposit, its composition and behaviour on exposure are all abnormal and for these reasons I have thought the foregoing of interest.

II. *Ferrous chloride.*—The second deposit is one of ferrous chloride, and was found in the superheater of a Deacon decomposer. These superheaters are built of iron pipes and serve to heat the mixture of hydrochloric acid and air travelling to the contact material of copper salts in the decomposer proper. The chloride formed a deposit some 2 in. thick on certain parts of the pipe system, and had the appearance of having been produced from vapour or in other words by sublimation. In appearance the mass is strikingly like a micaceous mineral possessing the characteristic lustre and splitting into scales in the same fashion. On exposure to the air it first becomes dull, and later acquires a rusty appearance due to oxidation. On analysis the salt gave :—

		Calc. for $FeCl_2$.
	per cent.	per cent.
Iron†	44·94	44·1
Chlorine	48·00	55·9

† Of which 0·56 per cent. ferric.

From the chlorine figure, the percentage of ferrous chloride works out to 85·9 per cent. Treatment with water shows the compound to be basic and to contain about 10 per cent. of ferrous oxide by measuring the acid necessary to dissolve the oxide and produce a neutral solution. The material contains about 0·3 per cent. of insoluble matter and is free from alumina and sulphuric acid. This form of the salt was new to me, but it is evidently the same form as that obtained by Liebig and

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* According to some authorities the ordinary crystals are stated to effloresce to a white mass, and according to others the anhydrous salt will take up water to re-form the hepta-hydrated salt.

Wöhler by passing hydrochloric acid gas over red hot iron filings, a method referred to in the various dictionaries. I have not heard of similar deposits having been found in the Deacon plant before.

III. *Hexachlorobenzene.*—A third deposit, also occurring on the Deacon plant, is of unusual interest since it is organic. It is hexachlorobenzene, C_6Cl_6, as is shown by its melting point, behaviour towards solvents, and general properties. The present sample recrystallised from chloroform had a melting point of 228° C. The melting point for hexachlorobenzene is given as 226° C. It was found in the mains and at the top of the condenser through which the mixture of chlorine and undecomposed hydrochloric acid from the decomposer travels, and its formation is to be ascribed to the action of the chlorine in the gases on the tarry matters in the pipes, hexachlorobenzene being the final product of chlorination of aromatic substances. Confirmation of this view is to be found in the fact that, so far as I can ascertain, the product is mostly found in new ranges of pipes or in repaired lengths where freshly tarred pipes are introduced.

London Section.

Meeting held at Burlington House on Monday, April 6, 1908.

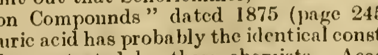
DR. J. LEWKOWITSCH IN THE CHAIR.

MUREXIDE; A ONCE USED DYESTUFF AND PRINTING COLOUR.

BY WATSON SMITH.

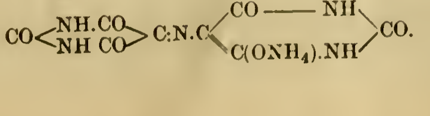
A specimen of commercial murexide as put upon the market about 1863 was exhibited, and also a sample of calico printed with it about that period, and before magenta had made its way to the front. The uric acid, necessary for its preparation, was obtained from guano and the first to import Peruvian guano largely for this purpose was the late Robt. Rumney of Manchester. He made about 12 cwt. of murexide weekly, and the cost of it then in the form of paste, was 30s. per lb. The advent of magenta soon destroyed this business. (See Thorpe's Dictionary of Applied Chemistry and Crookes' Dyeing and Calico Printing, 1874, 169.) One of Mr. Rumney's partners gave me these specimens forty years ago, and by keeping the printed calico specimen continually in the dark, I have succeeded in preserving the rose-red tint of the murexide. In the present sample of cloth, exhibited, the murexide pattern has evidently been printed upon a lead mordanted ground.

Purpuric acid is of course the mother substance of murexide, and it was for long of doubtful constitution, but in our Journal 1904, 656 and 818, there are abstracts of papers by Slimmer and Stieglitz (Amer. Chem. J. 1904, 31, 661) and Möhlau (Ber., 1904, **37**, 2686) wherein they work out the constitution of purpuric acid as



$$\mathrm{CO}\Big<\begin{matrix}\mathrm{NH.CO}\\\mathrm{NH.CO}\end{matrix}\Big>\mathrm{CH.N{:}C}\Big<\begin{matrix}\mathrm{CO.NH}\\\mathrm{CO.NH}\end{matrix}\Big>\mathrm{CO}$$

I may point out that Schorlemmer, in his "Chemistry of the Carbon Compounds" dated 1875 (page 245), states that purpuric acid has probably the identical constitutional formula demonstrated by these chemists. According to Slimmer and Stieglitz, murexide may be represented as follows:—



$$\mathrm{CO}\Big<\begin{matrix}\mathrm{NH.CO}\\\mathrm{NH\ CO}\end{matrix}\Big>\mathrm{C{:}N.C}\Big<\begin{matrix}\mathrm{CO} - \mathrm{NH}\\\mathrm{C(ONH_4).NH}\end{matrix}\Big>\mathrm{CO.}$$

CONSIDERATIONS AFFECTING THE "STRENGTH" OF WHEAT FLOURS.

BY JULIAN L. BAKER, F.I.C., AND H. F. E. HULTON.

During the last two years a series of interesting and valuable investigations, largely of a pioneer character, has been published by Humphries, Biffen and Wood, in the Journal of Agricultural Science relating to the highly important question of the "Strength of Flours." The present position of our knowledge has been ably summed up by T. B. Wood (J. Agric. Sc., 1907, 2, 140—160 and 267—277; this J., 1907, 1290 and 1908, 175). Not a little confusion attaches to the meaning of the term "strength." Humphries and Biffen have discussed this matter (*ibid.*, 1, 1) and after careful consideration, Humphries defines "strength" as the capacity for making large well-piled loaves.

It is customary to express the "strength" of flours in terms of the above definition by awarding marks, the ideal flour being taken as 100. Since Humphries formulated his conception of "strength," H. B. Wood has made many attempts to find a chemical means of measuring this property, and has correlated his analytical results with the empirical "Bakers' marks." But on reflection it does not seem to us possible that the estimation of one constituent or the determination of one physical property will enable the chemist to affix a baking value to a flour, when this value is the resultant of more than one factor. It appears from T. B. Wood's recent researches (*ibid.*, 1907, 2, 141), that he recognises this, for he points out that no one has succeeded in suggesting a generally satisfactory chemical or physical explanation of "strength," and no one working on chemical or physical lines has used a definition of the term which does not include two distinct properties. Humphries' definition includes two qualities, size and shape of loaf, which are quite likely to be chemically and physically entirely independent, and for each of which a separate explanation must be sought. The definition is obviously not of a scientific character, nor is it a final one, but it has afforded a useful working basis for purposes of comparison, and it sets forth the two factors believed to be of pre-eminent importance.

It seems to us that advances might be made if the baker would apportion marks independently for size and shape of the loaf. If this were done, the results of certain analytical and physical investigations on flours could be compared with the dual system of marking. We believe that the reference of any further analytical data to marks obtained on the present system of expressing the baking value is somewhat futile, and a most necessary reform is the adoption of separate marking for each factor.

Notwithstanding the very considerable amount of work which has been done on this subject, the chemist is not yet in a position to state definitely that one flour is stronger than another, consequently the baking of the dough under more or less standard conditions is the only useful test on which the baker can rely. In this connection may be mentioned a paper by R. W. Thatcher (J. Amer. Chem. Soc., 1907, 29, 910), who has carried out a most elaborate series of experiments comparing the various methods, physical and chemical, of estimating the baking value of flour. This investigator carefully avoids the comparison of his results with any empirical system of marking or definition of "strength," but refers all his determinations to the specific gravity of the loaf baked from each flour under standard conditions. His conclusions, which are mainly negative, are as follows:—"From the results of these comparative tests we must conclude that no single test which was tried is capable of giving conclusive evidence as to the baking quality of flour. Any of the processes which have yet been suggested for testing flour must be supplemented by a baking test if final and accurate conclusions are to be reached."

T. B. Wood in his last paper (J. Agric. Sci., 1907, 2, 267—277), has made some very interesting observations bearing on the effect of acids and salts on the physical character of glutens. Although his results cannot be correlated with

Bakers' marks, we feel sure it is in this direction that further light will be thrown on that gluten-character which, in our opinion, forms one of the two or three essentials concerned in "strength."

In view of the negative results so far obtained by the many investigators who have studied the problem, it seemed to us worth while to make an attempt to break fresh ground, and a study of the enzymic activities of flour appeared likely to furnish results of interest. It is well-known that wheat, like other cereals, possesses a starch transforming enzyme which we will discuss later. Gluten in the grain of wheat, apart from its interest to the baker, exists primarily as a reserve of nitrogenous food material for the young embryo, and proteolytic enzymes are consequently secreted to render this reserve available on germination. Such well-known facts as the destruction of wheat for flour making purposes by sprouting, of the presence of sulphurous acid, as in the holds of vessels, the marked improvement by holding over flours, and the grading of flours of different origin to improve their baking value, may alike be due to an alteration of the proteolytic as well as the diastatic enzyme. At the meeting of the British Association, held at Leicester last year, we pointed out that the appearance of white of egg when treated in presence of toluene with an aqueous extract of flour was considerably altered, the albumen being disintegrated and the solution becoming milky. On attempting to measure the amount of nitrogen, if any, rendered soluble, the analytical results showed that there was no increase of soluble nitrogen in aqueous flour extract after digestion for four hours at 30° C. in the presence of white of egg. This was confirmed by the absence of the tryptophane reaction when flour water and egg albumen were kept at 37° C. for sixteen hours. When flour extract was allowed to act on its separated gluten for 18 hours at 37° C., there was practically no evidence of solution and no alteration in the appearance of the gluten. Since these and other experiments demonstrated the absence of a soluble proteolytic enzyme capable of degrading albumen or gluten we directed our attention to the presence of other proteolytic enzymes. Our knowledge of these enzymes in plants is largely due to Vines' work, and prior to his last paper he had shown (Annal. of Bot., 1906, **20**, 113) that ungerminated seeds contain (*a*) a protease that acts at once on Witte peptone, and (*b*) one or more proteases that act more or less slowly on the reserve proteids of the seed; also that all germinating seeds contain a fibrin dissolving enzyme. In his last paper (*ibid.*, Jan., 1908.) he has succeeded in isolating a protease essentially peptic in character, digesting fibrin to albumose or peptone but without further action on either these products or Witte peptone. This plant pepsin appears always to be associated with an erepsin, that is to say an enzyme capable of degrading still further Witte peptone and the products of pepsin hydrolysis, and characterised by the production of tryptophane among other bodies, and this tryptophane is conveniently identified by the pink-red colour it produces with chlorine or bromine water. It has been shown by Vines (*ibid.*, 1903, **17**, 237, 597) that wheat germs contain an erepsin, but since in flour the germs have been removed, it appeared to be of interest to ascertain if the flour itself contains any. Accordingly 10 grms. of flour were digested with 50 c.c. of chloroform water for 20 hours at 37° C., filtered, and the filtrate tested for tryptophane in the usual manner. Nine flours of varying strengths were examined, four showed no reaction, four a slight and one a strong reaction. It was possible that the negative and slight results obtained might be due to the absence in the flour of peptones and albumoses of a character degradable by an erepsin. We, therefore, repeated the previous experiments with the addition of some Witte peptone, and in all cases obtained a distinct reaction. This shows that flour undoubtedly contains an erepsin, but it is apparently in most cases destitute of protein upon which it can act. Since the "strength" of the flour is probably largely dependent on the character of the gluten, and erepsin being without action on insoluble proteins we must look further for the cause of any possible gluten hydrolysis, which if it occurred during the doughing or baking process would almost certainly affect the size or shape of the loaf. It may be worth noting, in this connection, the great deterioration in baking quality already alluded to of flour made from sprouted wheat, for on germination there is a notable increase of the peptic or gluten-dissolving enzyme.

This leads us to a consideration of the *rôle* played by the enzymes of the yeast which is used in bread making. Vines (*ibid.*, 1905, **19**, 178) has shown that yeast undoubtedly possesses enzymes which can dissolve fibrin and produce the tryptophane reaction. This fibrin-dissolving enzyme, if capable of effecting even the earlier stages of gluten hydrolysis, will probably play an important part as a "strength" factor, since the gluten will be under its influence during doughing for several hours at a favourable temperature. That gluten is attacked by yeast enzymes is shown by the following experiments:—A quantity of flour was made into a dough with its own weight of water containing 5 per cent. of bakers' yeast. The dough was left for four hours at 37° C., and the soluble nitrogen expressed as protein was found to be 2·7 per cent., calculated on the flour after corrections for possible autodigestion of the yeast had been made. The same flour treated as above but without yeast was found to yield only 1·9 per cent. of soluble nitrogen as protein. This increase of nearly 1 per cent. must obviously be due to an enzyme other than erepsin since as we have already shown the latter, although present in yeast is without action on gluten. It is probable that the physical character of the gluten may be much modified during the early stages of enzyme action without the production in large quantity of soluble decomposition products. In this connection may be noted the profound change in the viscosity of a starch paste under the influence of a trace of liquefying diastase before any maltose is produced.

Diastatic enzymes in flours.—The fact that flour contains an amylolytic enzyme, although known, appears to have received but little attention as one of the considerations associated with "strength." It is certain that some of the carbon dioxide concerned in the rise of bread especially in the later stages of doughing and the early period of baking is formed from the fermentation of the maltose produced by the action of the diastase on the flour starch. To prove that maltose is the sugar formed, doughs were prepared (i.) with water and (ii.) with $N/50$ alkali, to prevent diastatic action. After standing for four hours at 40° C., the masses were extracted with water and alkali respectively, and the difference in the reducing power between the filtrates noted. Usually there is an increase in reducing sugar of $\frac{1}{2}$ to 2 per cent. on the weight of the flour when flour is doughed with water. The filtrates were evaporated to syrups, precipitated with alcohol, the solutions freed from alcohol and submitted to the osazone test. Glucosazone only was found in the alkaline solution, but glucosazone and maltosazone in the aqueous extraction.

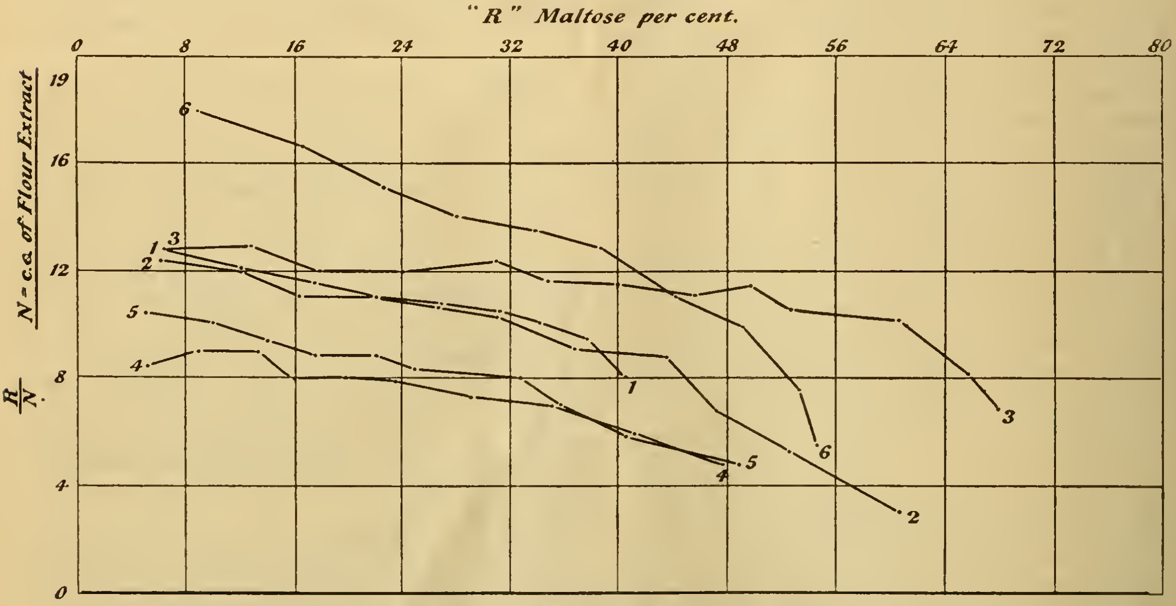
Before measuring the amylolytic power in the terms of Lintner's method, it was necessary to investigate the nature of the action of flour diastase on soluble potato starch to determine if Kjeldahl's law of proportionality held good; that is to say whether the amount of maltose produced under certain defined conditions is proportional to the amount of enzyme present. (Comptes rend. des travaux du laboratoire de Carlsberg, 1879, **1**, 109—157) *vide* also Ling (J. Fed. Inst. Brew., 1896, **2**, 335; this J., 1896, 621). When working with malt diastase Kjeldahl found that, if the production of maltose does not exceed 45 per cent. of the starch used, this maltose may be taken as a measure of the diastatic activity of the solution. Careful work on the validity of this law as regards malt diastase shows that while approximately true it is not absolutely so, and in the case of wheat flour diastase still less so. This is well shown on the accompanying table (Table I.) where the maltose (R) produced by increasing volumes of the flour extract acting on a constant quantity of soluble starch is set against the quotient R/N, N being the number of c.c. of flour extract used. It is obvious that if Kjeldahl's law holds with flour extracts, R/N should be constant up to R = 40 to 48. But it is not so.

TABLE I.

C.c. of 5 per cent. aqueous extract of wheat flour added to 50 c.c of 2 per cent. soluble starch. = N.	Percentage of maltose on solids. = R.	R / N.	Amylolytic power, Lintner.
0·5	5·16	10·32	—
1·0	10·06	10·06	24·0°
1·5	14·00	9·33	—
2·0	17·60	8·80	21·5°
2·5	21·90	8·76	—
3·0	24·70	8·23	—
4·0	32·50	8·12	19·5°
5·0	35·3	7·06	—
7·0	40·60	5·80	—
10·0	48·00	4·80	—

The smaller the proportion of maltose formed (R) the more nearly does the resulting diastase figure approach the maximum. Therefore in any work in which the diastatic powers of wheats or flours are recorded the R. at which the experiment was conducted should be defined. Throughout this paper these values were determined in solutions having an R of 17 to 20 per cent.

These curves show by their departure from the horizontal the extent to which the materials employed fail to conform to Kjeldahl's law of proportionality. A typical malt, a wheat, and four flours were experimented with. It is interesting to note how close is the correspondence between the Kurrachee wheat and the flour prepared from it.



1. Kurrachee wheat. 2. Flour from Kurrachee Wheat. 3. English malt. 4. Flour No. 1. 5. Flour No. 3 6. Flour No. 2.

The products of the amylolytic action of flour diastase on wheat starch resemble very closely, as might be expected, those which one of us showed were obtained by the action of barley diastase on starch (J. L. Baker, J. Chem. Soc., 1902, **81**, 1177; this J., 1902, 1087.) This will have some bearing when the chemical composition of baked bread comes under consideration. We have also observed that the diastase of some flours contains a liquefying enzyme, in others this is either absent or is unable to exert its influence. Attempts to measure the activity of the liquefying enzyme by comparative viscosity tests were not conclusive, all that we can definitely state is that under similar conditions one flour paste loses its viscosity quicker than another. The significance of the presence or absence of a liquefying enzyme will be discussed later. We are aware that in quoting diastatic powers on the Lintner scale we are recording values which by no means represent the total quantity of enzyme, but when these determinations were made it was not realised how great was the proportion of enzyme that escaped measurement. It might be supposed that the flour having the higher diastatic capacity would be able to produce more maltose and therefore more carbon dioxide in a given time, and would be the stronger, but no such direct relation can be traced (*see* Table III.), another proof that gas retention rather than gas production is the more important factor.

TABLE III.

Flour.	Amylolytic power, Degrees Lintner.	Bakers' marks.
*4.	57·0	90
Z.	40·0	90
X.	34·0	40
2.	32·0	78
3.	30·0	80
V.	27·0	90
U.	26·0	91
Y.	25·5	95
T.	25·5	80
W.	25·5	76
1.	25·0	45

* The wheat of Flour 4 in this series was damped and dried before grinding.

It is well-known that wheats and also the flours made from them will often improve in bread making value on keeping. The results recorded in Table IV. show that a marked alteration has been effected by storage in so far as the enzymic activity is concerned.

TABLE IV.

Flour.	Date.	Amylolytic power, Lintner.	Date.	Amylolytic power, Lintner.
Fife	1907. Mar.	31·0	1907. July	22
Hard Manitoba	„	35·0	„	21
Kurrachee—				
Dry	May	23·0	„	36
Damped	„	22·0	„	34
Damped and dried	„	17·5	„	30
Flour 1............	Sept.	20·5	1908. Mar.	32
„ 3............	„	24·5	„	34

In the present state of our knowledge it is not possible to correlate these differences with the behaviour in the bake house, but they indicate that internal changes take place. It is well-known that enzyme-containing tissues exhibit a greater activity than when extracts from them are used. Ford and Guthrie (J. Fed. Inst. Brew., 1908, **14**, 61 ; this J., 1908, 239) in an extremely suggestive paper, have made use of this fact in studying the diastatic power of barleys. These chemists have announced their intention of reading a paper to this Society on the amylolytic enzymes of wheat flours and their relationship to "baking value."* They state that flours as a rule yield little amylase to solution on aqueous extraction, though the amount present in the "insoluble" condition is very considerable. Not only can we confirm the additional diastatic activity observable when the flour itself is allowed to act on soluble starch but we have made in addition the interesting observation that doughs display even a greater diastatic activity. Our method of experimenting was as follows :—0·4 grms. of a dough made by mixing flour with its own weight of water was at once mixed with 200 c.c. of soluble starch and allowed to stand for 1 hour at 15·5° C. The same determination was repeated after another portion of the original dough had stood for 2 hours in a moist atmosphere. The activity of the dry flour was measured at the same time. The following results were obtained :—

TABLE V.

Flour.	Aqueous extract.	Diastatic power in degrees Lintner.			Bakers' marks.
		Dry flour.	Dough at once.	Dough after 2 hours.	
1.	25	36	44	55	45
2.	32	37	46	54	78
3.	30	36	47	57	80
4.	57	64	75	96	90

On comparing these figures, the increase in diastatic power in the doughs after the stand of 2 hours is very marked. An obvious extension of this experiment was to ascertain if this increase was maintained in the case of dough made with yeast. This was found to be the case. It is remarkable that the diastatic activities of doughs vary in proportion to the amount of water used. The dough immediately after preparation was intimately mixed with soluble starch and the diastatic power determined as in Lintner's method.

	Diastatic power.
Flour doughed with its own weight of water	55
The same flour doughed with 5 times its weight of water	53
,, ,, ,, 50 ,, ,,	49
,, ,, ,, 250 ,, ,,	34
,, ,, ,, 500 ,, ,,	29

The ordinary Lintner figure, using the aqueous extract of the flour, was 29. It would be outside the province of the present communication to discuss more fully the bearing of the above observation.

Signification of gas production and its relation to "strength."—In a paper recently published by T. B. Wood (J. Agric. Sc. 1907, 2, 139—160; this J., 1907, 1290) the whole subject of gas evolution is summarised, and the results of previous workers discussed. He attempts to correlate size of loaf and gas production, and shows that, with a few exceptions, "strength" as measured by bakers' marks is proportional to the volume of gas evolved. He assumes that the size of the loaf depends in the first instance "on the amount of sugar contained in the flour together with that formed in the dough by diastatic action." This inference is, no doubt, substantially correct, but as he did not investigate the amount of diastase present and what proportion of gas owed its origin to the maltose formed by this diastase, it seemed desirable to ascertain what relation, if any, exists between diastatic capacity, gas production, and bakers' marks. The amount of gas evolved from a flour mixed with water and yeast according to the conditions laid down by Wood was determined for a number of flours. The carbon dioxide was collected over saturated brine, and the volumes recorded at half-hourly intervals for three hours. The accompanying curves illustrate the gas liberation of four typical flours.

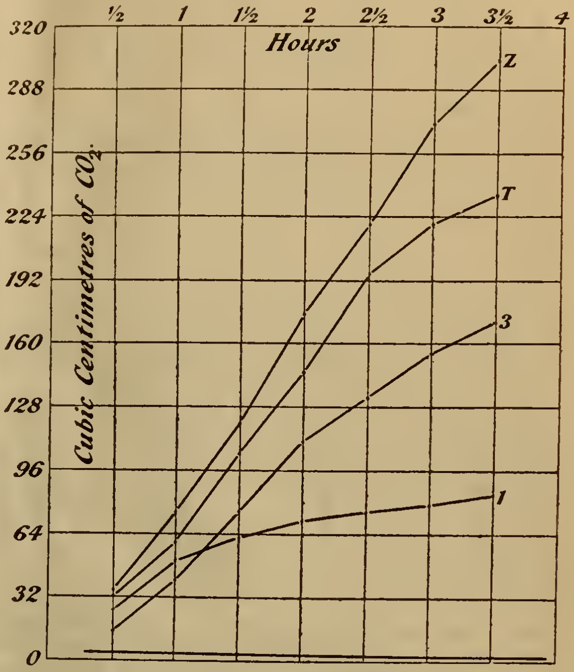


TABLE VI.

Flour.	Bakers' marks.	Diastatic power in degrees Lintner.	Volume of carbon dioxide in cub. cen. after 3 hours at 40° C.	Ratio of diastase to carbon dioxide.
X.	40	34·0	84	1 : 2·4
1.	45	25·0	78	1 : 3·1
W.	76	25·5	145	1 : 5·6
2.	78	32·0	175	1 : 5·4
3.	80	30·0	155	1 : 5·1
T.	80	25·5	220	1 : 8·6
V.	90	27·0	217	1 : 8·0
4.*	90	57·0	193	1 : 3·4*
Z.	90	40·0	270	1 : 6·7
U.	91	26·0	230	1 : 8·9
Y.	95	25·5	164	1 : 6·4

* NOTE.—It should be borne in mind that Flour 4 was submitted to a special treatment of damping and drying before milling, the result being to accentuate its saccharifying capacity out of proportion to the volume of gas evolved.

Roughly, the total volumes of gas increase as the bakers' marks, but a weak flour may have a diastatic power as high as or even higher than a strong flour. Thus it appears that gas production is not a function of diastase, as is obvious from the last column ; but, as the following figures show, there is a connection between the gas volume and the additional matter rendered soluble during the process of doughing. The cold water soluble extract in a series of flours was estimated and also the soluble matter in their doughs, which had been kept at 40° C. for three hours. Both sets of estimations were corrected for soluble nitrogenous substances present. The increase, measured by subtracting one from the other, can only be due to maltose formed by the action of diastase.

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* This paper appears at p. 389 of this issue.

TABLE VII.

Flour.	Per cent. of matter soluble in water at 15·5° C.	Per cent. of matter soluble in dough when kept at 40° C. for 3 hours.	Difference =maltose formed during doughing.	Volume of gas obtained from dough in 3 hours.	Bakers' marks.
1.	2·12	3·60	1·48	78	45
X.	2·03	4·41	1·38	84	40
W.	2·83	5·38	2·53	145	76
3.	2·49	5·53	3·04	155	80
Y.	2·69	6·57	3·88	164	95
2.	3·19	6·66	3·45	175	78
4.	4·19	10·95	6·75	193	90
V.	2·83	8·26	5·42	217	90
T.	2·84	7·66	4·82	220	80
U.	2·65	7·68	5·02	230	91
Z.	3·54	11·65	8·11	270	90

A study of this table shows that gas production follows fairly closely the maltose formed during doughing. In some cases the maltose formed is an appreciable figure, and this fact, in conjunction with the observation, made in an earlier portion of the paper, that some flours have a liquefying enzyme, would naturally suggest that low strength flours were deficient in the latter. It should not be forgotten that diastase, estimated in degrees Lintner, is solely saccharifying diastase, since soluble starch is the material acted upon, and the figure so obtained provides no measure of any liquefying enzyme. Flours with the diastatic powers recorded in this paper are comparable with brewing malts in so far as their saccharifying action on soluble starch is concerned. This being so, there is an ample amount of saccharifying diastase present to deal with any material rendered soluble had more liquefying diastase been present.

It is well known that malt extract is frequently employed by bakers, presumably with the object of increasing the amount of sugar available for gas production. This, in our opinion, it does by providing a starch liquefying enzyme, the flours' own diastase being adequate for saccharification. This is supported by the following evidence. A weak flour (bakers' marks, 45) was tested for gas production by itself, and with the addition of a trace of liquefying enzyme, powdered malt being added for this purpose.

TABLE VIII.

Time.	Flour alone.	0·25 per cent. of malt.	1 per cent. of malt.
Hours.	c.c. carbon dioxide.	c.c. carbon dioxide.	c.c. carbon dioxide.
½	28	30	32
1	47	66	69
1½	55	101	115
14	113	245	362

0·25 per cent. of malt on the 20 grms. of flour used is only 50 mgrms., an amount which does not materially increase the saccharifying diastase present and supplies no fresh sugar. The results indicate, we think, most conclusively that the low gas production of this flour arises from an inadequate supply of starch liquefying enzyme. We have already shown (Table VI.) that the gas : diastase ratio is higher on the whole in strong flours, and it seemed probable, in view of the last experiment, that we might establish a connection between strength and the relative amount of a starch liquefying enzyme in a flour. If the gas production from weak flours (which is usually smaller than in strong ones) were relatively increased in a greater proportion by the addition of a trace of liquefying diastase, than in the case of flours with large gas productions, then we should have established the point that gas : diastase ratio, total volume of gas, and, incidentally therefore, to some extent strength were functions of this liquefying enzyme. The following results justify this conclusion :—

TABLE IX.

Flour.	Bakers' marks.	Diastatic power.	Gas : diastase ratio.	Gas production in 3 hours. c.c. of carbon dioxide.	Gas production in 3 hours in presence of 0·25 per cent. malt. c.c. of carbon dioxide.	Percentage increase due to added malt.
X.	40	34·0	1 : 2·4	84	158	88·0
1.	45	25·0	1 : 3·1	78	145	86·0
W.	76	25·5	1 : 5·6	145	194	34·0
2.	78	32·0	1 : 5·4	175	207	18·0
T.	80	25·5	1 : 8·6	220	230	4·5
Z.	90	40·0	1 : 6·7	270	250	nil.
U.	91	26·0	1 : 8·9	230	248	8·0
Y.	95	25·5	1 : 6·4	164	235	49·0

This table shows that the percentage increase in gas volume due to the presence of liquefying diastase follows inversely the amount of gas originally liberated by the dough *per se*. The percentage increase is also inversely proportional to the bakers' marks, with the exception of Y. This flour, although highly marked, yields little gas, and it is of especial interest to note that, as might have been expected, its capacity for increase in presence of malt is considerable, thereby bringing it into line with other flours yielding small volumes of gas. In the case of Z, a flour giving the largest gas production of all, there is no increase in the volume of gas obtained by the addition of malt, and presumably, therefore, there is already present liquefying enzyme in such quantity as not to be capable of serious augmentation by such a trace of malt as we have used.

Lange (this J., 1907, 1104) has shown that wheat flour and aqueous extracts prepared from it under certain conditions are poisonous to top fermentation, distillery and pressed yeasts. This poisonous action is only exhibited in the presence of fermentable sugar and in the absence of certain salts; it manifests itself in the form of decreased fermentative power and the drying off of the cells. Lange's work appeared to us to possess some importance in our enquiry, for under the conditions of doughing and early baking, the toxic effect of different flours on yeast might be a factor influencing strength. We find that the number of dead cells of *saccharomyces cerevisiæ* is apparently increased in presence of aqueous flour extracts but as the following experiments show the toxic action if exerted does not influence strength.

1. Thus, if a yeast is subjected to the toxic action of different flour extracts, the fermentative energy would be lessened in proportion to the toxicity of the flour employed. To establish this point, some yeast was kept for three hours in presence of the undermentioned flours and water, and a known volume of the mixture was then used to ferment a saccharine solution.

TABLE X.

Time.	Bakers' marks, 40.	Baker's marks, 95.
Hours.	Volume of gas. c.c.	Volume of gas. c.c.
1.	9	14
3.	65	73
5.	125	146
19.	472	486

The weaker flour has thus proved no more deadly to the yeast than the stronger.

2. Should a toxic action be exerted on a yeast by flour, a dough at the end of its four hours' fermentation would contain its yeast in a weakened form. That this is not so we proved by adding a further quantity of flour to the dough at this stage, and noted that the gas production was vigorously continued.

Relation of gluten to "strength."—It is obvious that the strength of a flour must be closely connected with the gluten, although, no doubt, the presence of enzymes, soluble carbohydrates, and mineral constituents all play a part.

Gluten as isolated from flour consists of a mixture of proteins of which glutenin and gliadin are the principal constituents. T. B. Wood (*loc. cit.*, p. 139) has proved that the chemical composition of the gliadin and glutenin of strong and weak flours is identical. It has long been thought that the "strength" of a flour depends upon the ratio in which these two substances, gliadin and glutenin, are combined. The fact that the former can be separated from gluten or flour by treatment with 70 per cent. alcohol served as a basis for the estimation of the gliadin : glutenin ratio. The results of individual workers have been contradictory, and A. D. Hall (Report of the Home Grown Wheat Committee 1906, 2) states that the gliadin-glutenin ratio fails to indicate whether a flour is weak or strong. Continental and American chemists still attach importance to this ratio, and it is not improbable that the English idea of "strength" would require modification in countries where the loaves have a shape different from ours, and where this factor would consequently differ.

The formation of gluten.—Gluten itself having a physical character so different from either of its constituents suggests the idea that it is most likely some kind of loose compound whose formation is due either to enzymic activity analogous to a coagulase, or to hydration. If gluten could be washed out from a flour which had been made into dough with water containing a substance inhibiting enzymic activity, the first possibility would be eliminated. Portions of a flour were doughed with water containing 1 per cent. of copper sulphate, 0·25 per cent. of mercuric chloride, and $N/10$ hydrochloric acid, each piece of dough being allowed to stand 36 hours. At the expiration of this time the gluten was easily obtained, and it did not materially differ in physical properties from the gluten separated from an untreated dough. There is thus a strong presumption that gluten is formed by the combination of glutenin and gliadin in the presence of water. Gluten is not a definite hydrate, since the water content of glutens from different flours varies considerably. We have found in a series of determinations that dry gluten will absorb from 1·5 to 2·0 times its weight of water. Thatcher (J. Amer. Chem. Soc. 1907, **29**, 910) has recorded values lying between 1·69 and 2·38. The water absorbed by dry gluten appears to bear no relation to "strength."

We thought it would be of interest to try and build up gluten from its constituents. A sample of flour was thoroughly extracted with 70 per cent. alcohol. The residue, consisting of starch and glutenin, after being washed out with 70 per cent. alcohol, was drained and dried. The alcohol was removed from the solution of gliadin by distilling under diminished pressure at a temperature not exceeding 40° C. The gliadin was then thoroughly incorporated with the glutenin and starch, dried *in vacuo*, powdered and made into dough. From this dough gluten could be separated although it was not so coherent and elastic, or in such quantity as the gluten prepared from the flour in the ordinary way. We were able to repeat this experiment with several flours. The weakening of the gluten formed in this manner was, no doubt, due to the alcohol, for if a flour be doughed with even 10 per cent. alcohol, the gluten yielded has a less degree of elasticity than if it were prepared in the ordinary way.

Diastase in gluten.—Reychler (Ber., 1889, **22**, 414; this J., 1889, 407) showed that by treating wheat gluten with dilute acids and salts he obtained solutions which possessed diastatic power. This statement has been contradicted by other workers, but Ford (J. Fed. Inst. Brewing 1908, **14**, 77; this J., 1908, 239) points out that the failure to obtain an active enzyme was due either to a difference in the method of preparing gluten or to the use of an excessive amount of acid. Reychler's conditions were so arranged that the amount of acid he used was probably completely neutralised. We have examined several specimens of gluten and have invariably found that they readily hydrolysed soluble starch with the formation of reducing sugar. We next studied the distribution of diastase in gluten after thoroughly extracting a sample of flour with 70 per cent. alcohol, and to remove the gliadin the alcoholic solution was evaporated under diminished pressure at a temperature of 35° to 40° C., to remove the alcohol, but the matter which was in solution was without effect on soluble starch. The residue, consisting of glutenin and starch, possessed a relatively strong diastatic power. Having proved that the amylolytic enzymes will resist alcohol of 70 per cent. strength by digesting flour with such alcohol and then finding that its diastatic power was unaffected, there is strong presumptive evidence that the glutenin portion of the gluten molecule is that which possesses enzymic activity.

We desire to thank Mr. A. E. Humphries for his kind assistance in supplying the samples of flours mentioned in this investigation and for information relating to their milling and origin, also to Mr. F. Day for analytical assistance.

DISCUSSION.

Mr. A. E. HUMPHRIES said there was no standard marking of flours, but the marks used in the Reports of the Home Grown Wheat Committee, by Mr. A. D. Hall of Rothamsted, by Prof. Wood, by the authors of to-night's paper, and by Messrs. Ford and Guthrie in their recent work, had all emanated from him; which at any rate meant that the results recorded by them were comparable. This marking was a convenient method of expressing an opinion on the relative values of flours when many were being tested, but it was empirical. The authors wanted marks for shape as well as for size, but he was not at all sure that was necessary. Baking was not a precise science, and the most careful operator was sometimes in doubt as to whether he had used the right temperatures and followed the right process, or whether certain flours wanted some form of "yeast food" or not. He had in some fifty or sixty cases awarded marks in the usual method, and then measured the loaves. He found that the marks indicated volume within a small percentage of error. Almost all the flours referred to in the paper were well known and thoroughly tested, and the bakers' marks awarded indicated with reasonable accuracy the opinions which capable bakers, working on commercial lines, would entertain as to their relative strengths. As regarded shape, that was largely in the control of the baker, provided he had the advantage of repeated bakings to find out the best method possible, or if he could make laboratory experiments to ascertain beforehand the proper method of treating the flours in the bakehouse. In the paper which he read before the British Association at Leicester last year, he said that of the two points gas making and gas retention the latter was by far the more important. He was inclined now to say that it was all-important. He had, by water displacement, measured 2 lbs. 3 ozs. of fermented dough, moulded into the shape of a loaf as it entered the oven, and a piece of unfermented dough of the same weight, made from the same proportion of flour and water, similarly moulded; and had found, on the supposition that the difference in size represented the gas contained in the dough, that it was less than one per cent. of the total gas that the flour was capable of evolving by fermentation in the laboratory under standard conditions, reproducing bakehouse conditions. Not long ago he conceived the notion that, instead of taking either the total nitrogen, or the nitrogen less the soluble nitrogen, or the percentage of dry gluten, or the gas-making capacity, a true index of a flour's strength might be obtained by multiplying total nitrogen by c.c.'s of gas evolved under standard conditions; the idea being that the total nitrogen might represent roughly the gas-retaining power of the flour. He found that this worked fairly well but with a very big "if." The methods adopted by the authors were open to criticism so long as they wanted to make their results comparable with bakers' marks, thus:—If 5 per cent. of yeast, no salt, and a temperature of 40° C. were employed, a totally different result would be obtained as compared with bakehouse practice, viz.:—½ per cent. yeast, say 1 per cent. salt, and a temperature of say 25° to 30° C. He had taken a series of eight flours and fermented them under standard conditions at 30° C. and then at a temperature of 24° C. Two cases would illustrate his point. A flour, which in the first case was 3 in order of gas-making capacity, became 7; and, alternatively, a flour which, was No. 7 at 30° C., became No. 4 at 24° C. He had asked himself why, if gas were of so little importance, he should not try to make bread in an hour. A baker knew perfectly well that the maximum sized loaf could not be made in one or two hours, but for experiment he had tried to do so, using a flour which had yielded a maximum sized loaf only after about 12 hours' fermentation. At the end of 2 hours. much more gas had been evolved than was required to blow it up to its full size, but when the loaf came out of the oven it was quite small. To sum up, the gluten had to be got ready for distension, gas was needed at every stage of the fermentation, and the regularity with which it was given off was more important than the quantity. With the exception of one class of wheat, he believed that flour made from any wheat which millers handled, would give more than sufficient gas for all practical purposes, and weak flours evolved as much gas as strong ones; so that they were driven to consider more than ever the question of gas retention. His idea as to obtaining an index of strength by multiplying nitrogen by gas worked very fairly well for some time, but he came across a flour which made a most extraordinary quantity of gas and the percentage of nitrogen was good. The gluten extracted before fermentation was not bad, yet that loaf was a miserable loaf in all respects. Mr. J. S. Ford, who had recently read a paper before the Scottish Section of the Society, discovered that some flours contain a proteolytic enzyme which shows a distinct effect when used in the ordinary gelatine test. He would like to emphasise the point that nature, in making wheat, was more concerned with the reproduction of its kind than in feeding human beings. Man had discovered that wheat yielded a particularly good food, but, in so using it, he perverted it from its original use. One heard a great deal about wholemeal bread, but in that bread one ate the husk, an indigestible woody fibrous material, which nature provided as a protection for the food of the baby plant underground. So these ferments were there to make the kernel of the wheat available as food for the young plant. They might do good for that purpose, but they might be bad in the hands of the baker.

Dr. J. A. **Voelcker** pointed out the importance of the subject to agriculturists, as well as to millers. It was well known that certain wheats, grown under particular conditions, produced grain which was of decidedly glutenous nature and were generally termed "strong" wheats; whilst other kinds were more starchy in character and produced "weak" flours. The object of the agriculturist was to combine with the production of a "strong" wheat a sufficiently large yield to be remunerative to the grower, and in this lay the real difficulty. It might be, as the authors had stated, that a kind of wheat had been found which retained, when grown in this country, its characteristics of strength; but it had not yet been shown that the yield was sufficiently large to enable the crop to pay the farmer to grow.

The paper contributed by the authors covered a wide field, and contained the record of much work upon the chemistry of this intricate subject. Notwithstanding this, and also the excellent work done by Prof. Wood, of Cambridge, he (Dr. Voelcker) could not help feeling that they were still a considerable way from the real solution of the question.

When they examined the tables put before them, he thought they could not come to a satisfactory conclusion as to the points on which the "strength" of flour really depended. It did not seem that either in the "diastatic power" or in the "maltose-yielding capacity" was the full explanation found.

The truth was that the authors, as also Prof. Wood, had dealt, in their contributions, with the flour after it had been produced, rather than with the conditions which caused it to be what it was. In dealing with the differences produced by keeping the flour, by the relative amounts of water used in the doughing, by the presence of salts, and by the use of yeast, one was inclined to ask whether the varying results obtained were not the outcome of different ways of manipulation rather than the consequence of original and inherent differences in the grain itself, according as whether it was "hard" or "soft."

He (Dr. Voelcker) was more inclined to go further back and to lay emphasis upon those external conditions which were known to exercise an influence on the grain, and to, in great measure, determine its characteristics. He proceeded to instance these, illustrating them by the results of experiments at the Woburn Experimental Farm. Among these conditions were those of soil, maturity, season, climate, and, to a certain extent, manuring. He instanced, in particular, the effect of a hot, dry climate as seen in the universally "hard" character of Indian wheat, and asked, in view of the authors' researches, whether one was to conclude that Indian wheat contained more of the desirable enzymes than did English wheat, or if there was in it more of those constituents which gave a high "diastatic power" or produced much maltose. He argued that the real differences were in the grain itself and had been impressed upon it, probably from the early period of germination, by varying soil constituents and modified subsequently by external conditions.

In conclusion, he instanced a recent experiment at the Woburn Experimental Farm, in which he had shown that the addition of magnesium oxide (MgO) in increasing quantities to the ordinary soil of the farm (a light sandy loam, poor in lime) was able to gradually change the character of the wheat grain from starchy to quite glutenous. This did not, however, happen with all compounds of magnesium, the sulphate, for instance, producing no such effect.

Mr. A. C. **Chapman** said that there could be very little doubt that the physical condition of the gluten was an important, if not the most important, factor connection with the "strength" of flour, and that this was largely affected by the nature of the soluble matters present in the wheat. Prof. Wood had studied the question from this point of view, and it would probably be found, as Dr. Voelcker had hinted, that the influence of soil on the strength of wheat was referable to the influence which certain mineral constituents, taken up by the grain, exerted on the physical character of the gluten. The effect which salts in solution exerted on gliadin was extraordinary, and the same was true of certain other proteins. The bearing of this on the important question of gas retention was obvious, and in his opinion, the question of "strength" was much more closely connected with gas retention, than with gas production. Mr. Humphreys had referred to the important question of the regularity of gas production. The authors had made considerable reference in their paper to the question of diastatic activity and to the formation of maltose during doughing, but no reference had been made to the specific character of the yeast employed. It was known that this had a very marked influence on the character of panary fermentation; he was engaged in the investigation of a number of different species and races of yeast from that point of view. In some cases the fermentation started almost immediately and proceeded regularly, whilst in others the commence- of fermentation was relatively very slow, but of a very vigorous and rapid character when once it had started. He hoped at a later date to be able to bring before the Society some information on this aspect of the matter.

Mr. Grant Hooper said that the paper presented a comparison of analytical results with what might be called a practical or empirical standard, and he should like to know what degree of uniformity in bakers' marks would be attained by different workers, or in other words, what was the margin of error as regards these marks? It would probably be agreed that, close as able practical men might get in such a valuation of a particular loaf, yet there must be appreciable variations in the time and temperature of baking, the activity of the yeast, etc. These variations would result in differences in the production of gas which would largely influence the result. Turning to the question of "strength," he suggested that the modification of the albumenoid constituents of the grain which determined whether the flour would be strong or weak depended on the history of the wheat. If grown in a hot climate and harvested under favourable circumstances, it seemed to him that the grain would not have been in a condition in which any modification of the albumenoid constituents would be likely to occur, but in other cases at a comparatively early stage and perhaps throughout the history of the harvested grain the moisture might be such as permitted changes in the character of the albumenoids; and so, as such changes occurred or were precluded by the conditions, might it be expected that, other things being equal, a strong or weak flour resulted.

Dr. E. F. Armstrong remarked that some of Prof. Wood's conclusions and possibly his numerical results were invalidated, because the conditions under which he worked were not the same as those which the baker used in practice. The degree of strength as determined by baking test was not a factor of such accuracy as they could wish when comparing it with chemical results. So far, workers in this field had had the advantage of Mr. Humphries' judgment to obtain baking marks; it was to be feared that if the flours were tested by anyone else different results might be obtained. An important point, which the authors recognised, was that some flours changed very much with age. Their experiments had extended over a considerable period, and he should like to ask if the bakers' marks quoted were arrived at within three months of the time of the experiment, because if the authors had relied on the baking figure supplied by Mr. Humphries six months before, the present baking figures might be very different, and invalidate the accuracy of some of their conclusions. In bread-making a series of enzymes were at work which symbiotically acted and gradually degraded wheat starch down to the glucose which was fermented to gas by the yeast. The novel point in the authors' paper was to draw attention to the presence of a liquefying enzyme. There was always a large excess of gas produced during fermentation and it was the gas retention which was of greatest importance. Prof. Wood, basing his work on Prof. Hardy's well-known investigation of colloids, pointed out the enormous influence that small quantities of salts and acids had on gluten. Long before, it had been known to workers in the field of enzymes that small quantities of acids and salts had an extraordinary effect on enzymic action. The point was such a difficult one practically that it had been taken as one of the burdens which workers in this field had to bear, and was more or less silently passed over in the published work. Now, enzymes were to be regarded as colloids, and if that was the case, their activity might be modified by the presence of salts and acids. Accordingly, the quantity and nature of the crystalloid bodies present in flour would very materially modify the character of the gluten, and the activity of the enzymes, and bring about variations in the gas production, also in the structure of the gluten, and in its power to retain gas.

Mr. W. H. Rawles said that, so far as "strength" was concerned, flour had to be valued by the practical baker's method of baking a loaf, no chemical method at present known being reliable.

The hypothesis advanced by the authors in their paper, in which only single flours were considered, that variations in strength were due to differences in enzymic activity did not appear to him to agree with the results obtained by blending flours. If it were so, the product obtained by mixing equal quantities of a weak with a strong flour would have the mean strength of its two components, since diastatic activity apparently only varied in degree, not kind; whereas he had always found both in the laboratory and in the factory, in connection with biscuit-manufacture that the "strength" of a blend was far greater than the mean of its components, and in some cases practically as strong as the strongest flour in the mixture. This did not seem to be accounted for by this enzymic hypothesis, but to be due more to a chemical combination of the gluten constituents. Had the authors investigated blends of flour, having due regard to the values obtained with their individual components?

Dr. L. T. Thorne said that in carrying out experiments on this subject he had noticed, as Mr. Chapman said, the influence of the different races of yeast, but he also noticed very markedly the effect of the state of activity of the yeast and especially of its state of aeration. Where yeasts were properly active and sufficiently aerated there was a more regular evolution of gas, accompanied at the same time with a more efficient result from the bakers' point of view.

Mr. A. Gordon Salamon wrote that he had made a number of experiments which proved that the fatty matter of the flour exercised an enormous influence upon the size of the loaf. Also that the *viscosity* of the fatty matter varied within very wide limits with the age and the variety of the wheat flour. The fatty matter of wheat flour was very uniformly diffused throughout, and, although it amounted to so small a proportion by weight, its presence materially affected the process of panification. He had treated large samples of flour with ether in order to extract this fatty matter, and if a loaf from wheat flour free from the fatty matter were made in the same manner as a similar loaf containing the fatty matter, the one from which the fatty matter had been extracted was very much larger, and the vesicles also were very much larger than the fat-containing flour loaf. It was easy to understand the resistance offered to the passage of gas by a fatty menstruum. This resistance would, of course, vary with the viscosity of the fatty matter.

The Authors, in reply to Mr. Humphries, said that the method for measuring the gas formed during doughing was substantially the same as that described by Professor Wood. The yeast rate was 2½ per cent.; not 5 per cent. It would be impossible to reproduce bakehouse conditions in the laboratory. Temperature and the amount of yeast added would obviously influence gas production, but the authors' object was to obtain results that compared with one another, and upon which they could base conclusions. If the marks assigned by Mr. Humphries were based on the behaviour of each flour under its own optimum conditions as to temperature and yeast rate, etc., etc., then no laboratory experiments could ever be comparable with these marks when a series of flours were treated side by side under standardised conditions as must necessarily be the case in work of this kind. Their experimental results showed that they by no means claimed that gas production followed bakers' marks.

Dr. Voelcker raised several points of interest. As an agricultural chemist he would naturally attach great importance to soil and climatic conditions. He asked whether such conditions were not connected with those differences which constitute the distinction between weak and strong flours. This was not within the scope of the authors' investigation; all they had attempted was to take certain flours which had specific characteristics and to find data which could be correlated with their behaviour in the bake-house. Before, however, that could be done it was necessary to ascertain what chemical and physical properties of flours were capable of measurement. Whilst fully aware that different races of yeasts possess varying fermentative energies, the authors thought it desirable to use the ordinary baker's yeast. The same yeast had been used in all their experiments and its constancy of fermentative energy had been checked and verified. The baking marks were apportioned by Mr. Humphries some time before the gas production experiments were carried out. It had not been possible to have them redetermined except in one case and in this the value was unaltered. This point would be borne in mind in the continuation of their work. The laboratory behaviour of blends of flours had not been studied although the authors were quite aware that the bakehouse results when working with mixtures did not agree with the mean values that might be expected. They submitted that so far from this being against the enzyme theory, it was a result that was only explicable by assuming the truth of that theory. Mere physical qualities of mixed flours would average out to a mean resultant, but, taking into consideration the characteristic nature of enzymes, what was to be expected would be the great modification of one flour by a mere trace of a suitable enzyme contained in another.

New York Section.

Meeting held at Chemists' Club on March 20, 1908.

MR. GEORGE C. STONE IN THE CHAIR.

CITY REFUSE AND ITS DISPOSAL.

BY H. DE B. PARSONS.

City-waste materials may be divided into three parts: sewage; city refuse; and trade refuse. These may be further subdivided as in Table I.

TABLE I.

Classification of city wastes.

- Sewage
    - Liquid and Semi-liquid Refuse
        - House sewage.
        - Street, roof, and area drainage.
        - Night-soil.
- City Refuse
    - Household Refuse
        - Garbage
            - Animal matter.
            - Vegetable matter.
            - Meat and bones.
            - Fruit.
        - Ashes
            - Steam ashes.
            - Household ashes.
        - Rubbish
            - Paper.
            - Wood.
            - Rags and bedding.
            - Leather and rubber.
            - Metals.
            - Bottles, glass, and crockery.
            - Sweepings from buildings.
    - Street Refuse
        - Street Sweepings
            - Animal manure.
            - Pavement dirt.
            - Droppings from carts.
            - Materials from building construction.
            - Rubbish and leaves.
        - Dead Animals
        - Snow
- Trade Refuse
    - Cellar excavations.
    - Materials from building construction.
    - Stable manure.
    - Market offal
    - Slaughter-house offal.
    - Dead animals.

The total refuse, excluding snow and dead animals, collected in the year 1906 by city and permit carts from the five boroughs of Greater New York amounted to 3,159,182 tons. The average quantities of refuse collected yearly per capita in Greater New York are given in Table II.

TABLE II.

Average yearly collection of refuse per capita.

	Pounds.	Yards.	Percentages.	
			By weight.	By volume.
Garbage	181	0·163	12·31	8·45
Ashes............	936	0·862	63·68	44·64
Rubbish	93	0·650	6·33	33·65
Street-sweepings ..	260	0·256	17·68	13·26
Total refuse .	1470	1·931	100·00	100·00

The average weights of the different classes of refuse, as collected in the Boroughs of Manhattan and the Bronx, City of New York, are: Garbage, 1110 lb. per cubic yard; ashes, 1086 lb. per cubic yard; rubbish, 143 lb. per cubic yard; street-sweepings, 1016 lb. per cubic yard. The weights per cubic yard of these materials as collected in the other boroughs vary to some extent. The greatest difference is noted in the unit weight of street-sweepings, which from macadam roads are heavier than those from asphalt or stone block pavements.

Methods of disposal.—There are six generally recognised ways for disposal of refuse, some of which are limited to one or more of the subdivisions of Table I. These are:—

Methods.	*Applicable to*
1. Dumping on land.	All subdivisions.
2. Dumping into water.	All subdivisions.
3. Ploughing into soil.	Garbage and street-sweepings.
4. Feeding to swine.	Garbage.
5. Reduction process.	Garbage.
6. Incineration.	All subdivisions (except steam ashes).

1. *Dumping on land.*—Where primary separation is in force, ashes, with or without street-sweepings, can be used to reclaim land where a combined collection would be decidedly objectionable. In such case, the garbage, rubbish, and sweepings have to be dealt with separately.

2 *Dumping into water.*—All classes of refuse could be dumped into water provided that the water is large enough in volume to dilute and scatter those portions which float, and deep enough to permit the heavier portions to sink without interfering with channels or navigation. Unless there be an almost uniform current away from the neighbouring shores, this method cannot be recommended, and, where in use, efforts are made to abandon it in favour of some other.

3. *Ploughing into soil.*—This method is only applicable to garbage, and possibly to street-sweepings. The soil should be sandy and the farm area large. The hauls will be necessarily long, and it requires the primary separation system for collection. It is inapplicable to cold climates where the ground freezes.

4. *Feeding to swine.*—This is a method only applicable to fresh garbage, unmixed with other refuse. It is seldom considered for large cities.

5. *Reduction.*—These processes consist of some method of "rendering" the garbage, by which the oil and grease are extracted, leaving a residue called "tankage." It is only applicable to garbage practically freed from rubbish, and can only be adopted by large cities, for, unless there be sufficient garbage, the first cost is prohibitive. Furthermore, it is only profitable when the garbage is rich in grease, which is one reason why it has not been more generally adopted by the southern cities of the United States. The best known systems are the Arnold, using live steam for melting and cooking; the Merz and the Simonin, using a solvent like naphtha and benzine.

The oil and grease are sold at a price varying from 2 to 4½ cents per pound. The crude oil is refined by the purchasers and used for commercial purposes. Its chief constituents are glycerin, stearine, and red oil.

The tankage, when dried and ground, is odourless and dark brown in colour It is sold as a base for the manufacture of commercial fertilizers, and the principal market is in the Southern States. The price is based on the "units" of ammonia which it contains and its freedom from grease, and is variable. The tailings, or discarded tankage, are generally burned in the plant for fuel.

An approximate average working analysis of a reduction works is:—

	Per cent. by weight.
Water and factory losses	85
Grease (and oil)	3
Tankage	9
Tailings	3
	100

The first cost of a reduction plant is large, on account of the expensive machinery required; and the cost of operation and maintenance is high, because of the labour, fuel, wear and tear on the machinery and the corrosive action of the acetic and other acids produced during certain stages of the process. In general, reduction plants are not self-supporting, even if the garbage is delivered free at the works. In Cleveland, Ohio, a reduction plant is used by the municipality, and it is the only plant for which the financial details are available. The works are about self-supporting when the garbage is delivered to the plant without charge and when grease can be sold for at least 4 cents per pound. In cities where such works are successfully worked by contract, a bonus is paid for the reduction.

The advantages of reduction are:—

1. The organic or putrescible matter of the garbage is converted into grease and tankage, which are harmless. Therefore, the garbage can be cared for in a sanitary manner.

2. It saves components which have a commercial value.

3. With a properly designed and carefully worked plant, the process need not be a nuisance, and its adoption adds a manufacturing industry to the city.

The disadvantages are:—

1. Expensive machinery and apparatus with large costs for renewals and repairs.

2. The offensive odours that are apt to be given off require expense to prevent an annoyance.

3. As the works have to be situated at some distance from the city, haulage is an important factor.

4. Requiring skilled labour, there is some danger of strikes.

5. The garbage must be separately collected. There will always be some foreign material, tin cans and the like, which requires sorting out at the works.

6. There is usually but one plant, as a number of small plants would not pay. The whole system, therefore, would be crippled by fire or by any other cause that would stop the plant.

7. The process provides for the garbage only, leaving the remaining refuse to be treated otherwise.

Incineration.—Garbage cannot be incinerated alone unless previously dried or unless a fuel is used. It requires about one pound of average coal (10,000 B.t.u.) to incinerate eight pounds of raw New York garbage. There is no advantage in incinerating ash collections alone, as the expense would probably exceed the gain. It may be practicable at some future time to separate the coal and cinders, and such a process has been proposed but not tried on a sufficiently large scale to warrant any predictions as to success. Rubbish burns readily and produces great heat. Some difficulties have been experienced by the production of slag. Street-sweepings from the better paved and centrally located streets will burn, as ordinarily collected, without the addition of other fuel, particularly as they contain a large amount of rubbish. When different classes of refuse are mixed, the aggregate is self-combustible, the coal and cinder in the ashes and the rubbish supplying the fuel required to dry the garbage and street-sweepings.

Sanitary incineration requires a high temperature not only to destroy offensive matter but to make the escaping gases innocuous. The average temperature in the combustion chamber should be at least 1,500° F.

The residue from incineration of mixed refuse amounts on an average to about 33 per cent. by weight, or 60 per cent. by volume. The volume at the destructor is large on account of the spaces between the clinkers, but when placed in a dump the volume is less, as the fine ash and dust work into the spaces. The heat may be utilised for power, and the clinker and ashes for brick-making, concrete-mixing, and for filling. It would be possible to press crude garbage and drain off some 15 per cent. of the water beforehand, but this would add complications and might not pay in some places. On the other hand, it might render incineration possible in places where the other classes of refuse are not fully collected or not found in quantity. In order to obtain high temperatures in the furnace, artificial draught should be used. One of the advantages of the plenum system for artificial draught over any form of induced or vacuum draught is the preventing of an inrush of cold air to chill the furnace when the doors are opened for firing, and the use of loose-fitting fire doors, which are more easy to operate than tight-fitting doors required for the induced systems. The draught pressure varies from ½-inch to 3 inches of water pressure, but should not be too great, as holes are apt to be burned in the fuel-bed and the stoking requires too constant attention. Probably a 1 or 1½ inch pressure is sufficient, but the best pressure should be determined by experience for each locality. The air supply in the blast should be about 46 cubic feet, or 3½ pounds per pound of average mixed refuse.* Many furnace designers prefer a steam jet to an air blast, and both systems have their advantages.

In America the failures have been chiefly due to incorrect designs of furnaces, large grates, slow combustion, low temperatures, too much reliance on stoking, and inexperienced firemen. Unless high temperatures are generated in the furnace cell, the garbage mass will be subjected to frying rather than to cremation, and odours are sure to be discharged from the stack. The furnace should be designed only after careful study of successful plants. Owing to the high temperatures maintained, the fire-brick work should be laid up with freedom for expansion. The fire-bricks, according to the experience of George Watson,* should be laid with very close joints, and consist of from 60 to 70 per cent. of silica, with 30 to 40 per cent. of alumina. While a little iron is harmless, potash and soda tend to act as a flux, and should be present only in small quantities.

The advantages of incineration are:—

1. When properly worked, it destroys all organic matter and offensive gases and reduces to ash all garbage, ashes, rubbish and street-sweepings.

2. The collections of ashes, rubbish and street-sweepings furnish the fuel. Garbage will also burn after drying.

3. Some revenue can be obtained from the heat generated through its conversion into power.

4. The system is sanitary, as fire is a sure destroyer of all germ life.

5. The hauls can be short, as a number of incinerators can be built and worked to advantage.

6. Civic authorities can work these plants better than reduction works, as they are more simple and less commercial.

7. No necessity for separate collections.

8. As a number of plants can be built, the risk of interference by fire or other causes of stoppage is reduced.

The disadvantages are:—

1. The necessity of having expert firemen, and of exercising great care to make the incineration satisfactory.

2. When not properly designed or worked, incineration plants emit objectionable odours and dust.

Fuel values.—Table III. gives approximate calorific values for the different classes of refuse, as collected in New York, and may be taken as representative of a large American city in the Northern States.

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* George Watson, Trans. Amer. Soc. M. E., 25, 1904.

TABLE III.

Approximate calorific values of refuse in B. t. u. per pound.

	Dry material.	Material as collected including water.
Garbage	8,700	1,800
Ashes	3,000	1,800
Rubbish	7,500	6,500
Street-sweepings	7,000	3,600

In a mixed collection, these classes are found in about the following proportion, so that the combined calorific value would be approximately determined by the following calculation.

	Percentage collected by weight.	Calorific value. B.t.u.
Garbage	12·3	221
Ashes	63·7	1646
Rubbish	6·3	409
Street-sweepings	17·7	637
Total	100·0	2913

This calorific value is about one quarter of that of coal. If a ton of coal is worth, say, $3.00, then the mixed refuse would be worth about $0.75 per ton, less the additional cost of the handling of the refuse. One cubic yard of mixed refuse weighs about 960 pounds and of coal about 1300 pounds, that is, the bulk of the refuse is about one-third more than that of coal for equal weights. In the same way the efficiency of the furnace for burning refuse is less than that for coal, when considered as a heat generator. Rubbish collections in New York have been burned on a large scale and accurate data obtained. (See Transactions, American Society of Civil Engineers, **57**, 1906.) Trials were made in December, 1905, to determine the rate of evaporation of water per pound of rubbish burned, and the results were an equivalent from and at 212° F. of 1·64 pounds and 2·16 pounds. Subsequently, other trials were made by different observers, which gave equivalent water evaporations of 2·28 pounds, 2·29 pounds and 2·17 pounds, respectively, per pound of rubbish.

The Borough of Westmount, Canada, has a mixed refuse destructor plant, which is worked in connection with the municipal electric lighting station. The average result, extending over a period of eight months, was that 2,000 pounds of refuse were equivalent to 283 pounds of coal. An evaporation trial, made in May, 1906, gave an average equivalent evaporation of 1·36 pounds of water per pound of refuse. The equivalent evaporation as reported by J. T. Fetherston for eighteen European destructor plants, were, maximum 2·66 pounds, minimum 0·88 pounds, and average 1·62 pounds of water per pound of refuse. These are gross evaporations, and in order to obtain the net useful steam produced for power purposes it is necessary to deduct that used for the forced draught apparatus.

Disposal.—The costs of incineration are not easily obtainable, because the figures are not always reported, and when reported are not on the same basis and are, therefore, not comparable. Furthermore, there are very few high temperature incinerating plants in America. The heat generated is unquestionably a valuable asset, but it should always be treated as a by-product. The object of an incinerating plant should be primarily to destroy the combustible portion of the refuse, and to reduce the several kinds to ash, thus leaving but one grade of material to be handled for final disposition, which is suitable for land filling and other purposes.

Closely associated with economy is the question of haulage. If the collection carts have long hauls to the central receiving stations, it means the maintenance of a large staff of men, horses and carts. The hauls, therefore, should be as short as possible, which can be secured by dividing the municipality into districts and placing in each district a receiving station. The ideal system would treat the material in these receiving stations, simply leaving the removal of the residue to the place for final disposition.

Garbage could not be treated by the reduction process in this way, as the reduction plants are not economical in small units, and are liable to be offensive. Where the reduction process is adopted, a system of primary separation allows the garbage alone to have the long haul to the reduction works, while other refuse could be delivered to the central stations and have the benefit of the short haul.

In comparing methods on a basis of costs of maintenance and working, it is proper to include in the costs the disposal of all the city refuse. Some methods can treat one, two, or more of the subdivisions, while other can handle but one.

The following items of cost will be found of interest.

Cost of collection, City of New York, 1906.

Garbage, ashes, rubbish and street sweepings.

	Manhattan and The Bronx.	Brooklyn.
Total cost	$1,744,300	$772,900
City cart loads	1,747,871	630,000
Cost per cart load	$0·999	$1·225

Cost of final disposition, City of New York., 1906.

Garbage, ashes, rubbish and street-sweepings.

	Manhattan and The Bronx.	Brooklyn.
Total cost	$815,300	$468,800
Cart loads	2,313,286	738,056
Cost per cart load	$0·352	$0·635

Manhattan and The Bronx.

	Garbage.	Ashes, rubbish and street-sweepings.
Total cost	$218,300	$582,200
Cart loads	250,260	2,043,724
Cost per cart load	$0·873	$0·285

Cost of incineration, mixed refuse, Westmount, Canada. Including operation, repairs, rents and taxes, 1907.

	Sinking Fund and Depreciation.	
	Without.	With.
	$	$
Incineration, one ton	1·08	1·34
Revenue from steam	0·58	0·58
Net cost of incineration	0·50	0·76

COLLECTION AND FINAL DISPOSITION OF CITY WASTES BY THE NEW YORK DEPARTMENT OF STREET CLEANING.

BY EDWARD D. VERY.

The work of the Department of Street Cleaning, so far as it applies to the wastes of the city, is described in section 534 of the Charter of the Greater City, as follows: "The Commissioner of Street Cleaning shall have cognizance and control: 1. Of the sweeping and cleaning of the streets of the Boroughs of Manhattan, The Bronx and Brooklyn, and of the removal, or other disposition, as often as the public health and the use of the streets require, of ashes, street sweepings, garbage, and other light refuse and rubbish . . . ."

The Department serves a population of approximately 4,200,000, covering an area of 140 square miles; cleans 1,282 miles of streets having a surface of approximately 23,471,839 square yards, and in the year 1907 the wastes collected and finally disposed of were: 2,483,659 cartloads of ashes, approximately 2,500,000 tons; 314,484 cartloads of garbage, 321,500 tons; and 314,455 cartloads of rubbish, 157,250 tons. For the collection and street cleaning service, the Borough of Manhattan is divided into 59 sections, having a Foreman and Assistant Foreman in charge, and these sections are grouped into 11 districts, each under the charge of a District Superintendent; the Borough of The Bronx has 6 sections and 2 districts similarly officered; and the Borough of Brooklyn 40 sections and 8 districts. Over all this work there is a General Superintendent and an Assistant General Superintendent.

The paved and macadamized streets of the three boroughs, excepting such as are under the jurisdiction of the Department of Parks and the Department of Docks and Ferries, are cleaned by the uniformed force of the Department. The material collected consists of manure, traffic detritus, soot, dust, and miscellaneous litter. The larger part of the work is done by 2800 sweepers, who collect the material for the ash carts. Horse propelled machine brooms have now been added and when used, in conjunction with sprinkling wagons in gangs of three, following each other and overlapping each other's path, give a result fairly effective.

Hose washing is resorted to in certain streets where necessary. Recently, nine flushing machines, which deliver water at the proper angle and under pressure, have been adopted by the Department for night work. As water is admitted to be the best vehicle for cleaning the pavements, a system of flushing machines in conjunction with hand collection, seems to be the solution of the problem, and is being studied carefully by the Commissioner.

Collection of ashes, street sweepings and garbage are made by the Department force of 1600 drivers, in carts constructed of steel with canvas cover, and containing 1·55 cubic yards water measure, which carry 2 cubic yards with sideboards on, excepting when snow impedes the traffic. Collection of garbage is made daily for sanitary reasons; of ashes daily or as often as possible, subject to the ability of the force to perform the work. Rubbish is collected by carts specially constructed for the purpose and holding 7½ cubic yards, which carts call on notice, given by the householder exposing a card. Materials to be collected are by the ordinance commanded to be placed without the building and within the stoop or area line, for the reason that where collectors are allowed to enter residences for this purpose delay is caused for various reasons, and the collecting of gratuities is not so probable where the collector is in the open.

In the Boroughs of Manhattan and The Bronx the materials collected are ridden to water front dumps on the East and North Rivers, which are distant from each other from ¾ of mile to 1¾ miles, except in the case of the upper west side of Manhattan, where the distance is 4⅓ miles, made necessary from a prohibitory law concerning this section, passed at the request of a local association which objected to the dumps as unsightly structures. At these dumps the materials are dumped upon scows—the ashes, street sweepings and rubbish on one scow, and the garbage upon another. The scows for ashes and rubbish are owned or hired by the City of New York. The garbage scows are the property of the Contractor for Final Disposition of Garbage.

In Brooklyn the ashes, street sweepings and rubbish are ridden to inland stations provided by the Contractor for final disposition, and there are dumped into large cans holding approximately 9¼ cubic yards. These stations are situated so as to make a maximum haul of 1¼ miles. Garbage in Brooklyn is taken to three water front dumps situated at the Wallabout, 6th Street, and the Gowanus Canal, and at Coney Island. From the time these materials reach the dumps and inland stations, the work is under the direction of the Bureau of Final Disposition, which is officered as follows: Each dump is manned by a Dump Inspector and Assistant Dump Inspector, and a Boardman; the whole under the supervision and control of the Superintendent of Final Disposition, who is seconded by an Assistant Superintendent of Final Disposition. At these dumps the ashes, street sweepings and rubbish are picked over in the operation of trimming the scows, and the merchantable articles, such as paper, rags, bottles, tin cans, etc., are reclaimed under an agreement which clears a fair profit to the City, and provides the labour of trimming without cost to the Department. These scows are towed to points for final disposition and there unloaded by various machines and spread and levelled on lands intended to be reclaimed. Sea dumping is now resorted to only in extreme cases, the garbage drivers' strike being about the only occasion arising in 1907. The City has for some time been filling at Riker's Island, and has brought the original island up to its intended level, a bulkhead line of lands under water has been constructed, enclosing about 160 acres, which the Department will commence filling shortly, and which will take about seven years to fill, allowing 50% of the material to be used for the purpose. The other 50% is sent to various other points where low meadow land is to be reclaimed.

The Department has tried incineration of the rubbish for the utilization of the heat generated, but the result has not been such as to make the method a fixed policy.

The ashes and rubbish of Brooklyn are conveyed in specially constructed cars over the tracks of the Brooklyn Rapid Transit and the materials are placed in land fills, principally in the low lying meadows in the vicinity of Coney Island.

The garbage of these Boroughs is towed to the reduction plant at Barran Island in Jamaica Bay. Here it is forked on to an outboard conveyor and is then conveyed to the second story of the plant and passes through chutes to the digesters. Its reduction is then accomplished by the Arnold-Egerton process, which is performed purely by mechanical means. The digesters are large tanks holding approximately eight tons. When filled they are sealed by a cap, which is held by bolts. Steam is introduced into the digesters at 80 lb. pressure, and the mass is cooked for a variable time, depending on the material, which varies from season to season. The vapour escaping through the vent is condensed by a jet condenser, and thence passes to a sewer. From the digester the material, which is now a pulpy mass, is removed to a tank which has the capacity of four digesters for the purpose of facilitating the work. From the tanks it is run into forms made of sacking and racks, and there put under a hydraulic press. Pressure is then applied and the water and grease are expressed. The water and grease go to a perforated trough, and thence by pipes to a settling basin where, by flotation, the grease is separated and then taken off and barreled. The residue from the press, known as tankage, is carried by conveyor to a direct heat dryer, where the remaining moisture is driven off, and from the dryer passes to a screen where the material is ground and screened. From the screen the material falls through chutes into hoppers and thence to bags for shipment. The average garbage received at the plant contains: water, 71%; rubbish, 6%; tankage, 20%; grease, 3%. The grease is of a low grade and of dark brown colour. It is largely used in making soap and candles. The greater portion is shipped abroad. Tankage is the solid, fibrous matter, and is used as a fertilizer base or filler. It contains small percentages of nitrogen, ammonia, phosphoric acid, and potash. The liquor from the grease basins has no value, as it contains very small percentages of ammonia.

The wastes of New York City are, on the average, proportioned as: Household ash, 47·5%; steam ash, 18·0%; street sweepings, 18·5%; rubbish, 6·0%; garbage, 10·0%; and the cost of collection and final disposition of this material is approximately $1.50 per capita per annum.

FINAL DISPOSAL OF REFUSE IN AMERICAN CITIES.

BY RUDOLPH HERING.

The burning of garbage has been practised in America for some 20 years, the first furnace being erected on Gouvernors Island, New York, in 1885, by Lieut. Riley. In 1887 the first municipal furnace was built in Des Moines, Ia., and was called the Engle crematory. It had a large horizontal grate upon which the garbage was delivered from the top, to be first dried, then partially burned by a coal or oil fire kept going at one end, and finally completely burned together with the fumes at the other end of the furnace and then discharged up the chimney. About ten such furnaces are still in use. The best example of the Engle furnace was at the Chicago World's Fair in 1893, where the refuse was destroyed by natural gas. Another furnace was introduced in 1893, and is known as the Dixon crematory. The best example was at the St. Louis World's Fair in 1904. The first municipal Dixon furnace was built in Ellwood, Ind. At present there are about 40 in use. In design it is very similar to the Engle crematory, but there were improvements for ridding the garbage of some of its moisture and other minor advantages. As the large amount of moisture in the garbage was the chief objection to any method of incineration, several crematories were proposed to give a better preliminary drying. The most successful of these was the Decarie furnace, brought out in 1901. The first municipal plant was erected in Minneapolis. This furnace receives the garbage in a crate which is suspended over the fire, and thereby effects the preliminary drying. In order to make the furnace more durable than any of those previously built, water jackets of steel were used. The disadvantage of such jacketing is the keeping down of the temperature in the furnace by the comparatively low temperature necessitated by the water jacket.

Reduction, another method of garbage disposal, has been developed during the last 20 years, and is practised only because American garbage yields about 3 per cent. of a superior grease which fetches from two to four cents a pound. There are two methods of extracting grease: one introduced by Merz in Buffalo about 1885, involving the use of naphtha, where after separating the solution and the water from the tankage by pressure, the solution is cooled to regain the naphtha, leaving the grease to be barreled for sale. The other, introduced later by Arnold, is more economical, and involves cooking the garbage with steam, which separates it into three parts, tankage, water and grease. The latter two are separated from the tankage by pressure, and the grease is separated from the water by gravity. This process is now carried on in most large cities by private enterprise, except in Cleveland, Ohio, where there is a municipal reduction plant.

The separation of grease and water from the tankage by pressure is not always perfect, and the residual grease lowers the value of the tankage as a fertilizer. Therefore, so long as the price of grease is high, it has been found economical to treat the tankage subsequently with naphtha to extract the remaining grease.

Rubbish.—Rubbish is still, even in New York City, to a large extent used for filling up vacant ground, an objectionable method on sanitary grounds. In a few of the larger cities the rubbish is burned, before which it is usually picked over for anything valuable, in a building which also serves for an incinerator, and the heat is utilised for various purposes.

Ashes.—Ashes collected separately are unobjectionable for filling in low ground, and for road making.

Street sweepings.—Sweepings from cities not only have manurial value, but they can also often be burnt in an incinerator.

There is at present no city in the United States where all the city refuse is mixed and properly incinerated. There is one incinerator at work at Westmount, Canada, and one has just been completed at West Brighton, Borough of Richmond, where mixed refuse will be incinerated. There has not existed in America the same necessity for destroying it, as more land has been available for dumping. Further, the larger quantities of grease found in American garbage has developed an industry which was not practicable in Europe. This industry separated garbage from the rest of the refuse and dealt with it, but did not dispose of the remainder. The value of ashes when mixed with garbage consisted in its contents of unburned coal remaining, which in Europe effectively burns the mixture. When not mixed with garbage it could be dumped for filling. Rubbish also burns itself very readily. Ashes and rubbish have therefore been mixed only where their fuel value was required to assist the burning of garbage.

Analysis of the refuse and recognition of the necessity for evaporating the water contained in the greater quantity of garbage *per capita* than in Europe, shows that complete incineration of refuse should be obtained in American cities without addition of fuel. September is the only doubtful month, owing to the large consumption of fruit, though no positive evidence exists that even then fuel must be added.

Another difference between America and Europe, is the use of anthracite coal, which has more fine ash, which tends to obstruct the necessary draught and retards combustion. Given garbage with more water, more combustible refuse, and coal with more ash, it remains to be seen what effect these differences with have on the burning of mixed refuse in America. Incineration properly worked may be carried on in the midst of cities, as abundantly evidenced in Europe; and, though the cost of such incineration may exceed that of other methods, yet, it may be more economical than a cheaper disposal at a greater distance. Even in New York efficient incineration at numerous points along the East and Hudson rivers, with short hauls, may prove both economical and satisfactory.

THE FINAL DISPOSITION OF CITY REFUSE BY MIXED REFUSE DESTRUCTION, AND THE FINAL DISPOSITION OF REFUSE IN GREAT BRITAIN.

BY J. T. FETHERSTON, ASSOC. M. AM. SOC. C.E.

In 1906, about 8,000,000 cubic yards of waste, consisting of ashes, garbage, rubbish and street sweepings were collected in Greater New York. Each inhabitant of the city contributed on an average about 1470 pounds of refuse per annum, according to a recent report by Messrs. Parsons, Hering and Whinery. About 30% of this refuse contains organic matter, mainly found in the garbage and street sweepings. To collect and dispose of this mass of material without creating a nuisance and with a reasonable degree of economy is a problem, the difficulties of which are now being appreciated in the United States. The organic matter in the waste is the main source of trouble from the sanitary standpoint. The transmission of disease from infected wastes to food, by means of the common house-fly, has recently received some attention, and in the future it is quite possible that further investigations concerning flies as carriers of disease germs, may have an important bearing on the choice between scientific methods

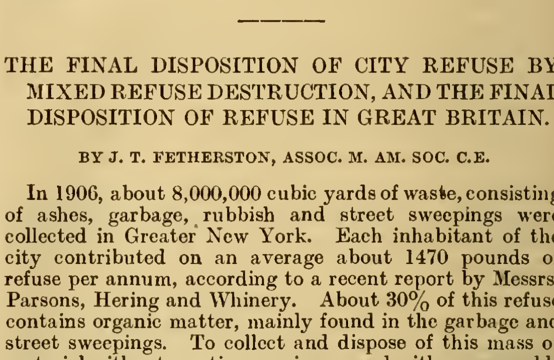

FIG. 1.

Comparative Diagram showing amount of refuse removed per person, per year, in New York City.

of waste disposal. The value of the classes of refuse shown on Fig. 1 consists of the grease and fertilizer or tankage from the garbage; the unburned coal in the ashes; the saleable paper, rubber, leather, etc. sorted from the rubbish, and the fertilizing material in the street sweepings. All four classes are more or less combustible. If the saleable parts, in the proportions shown by the diagram, were recovered, their value would be about $1.00 for the 1470 lb. of refuse, while the fuel value of the combustible in the mixed wastes is about the same. Generally speaking, it will cost more to recover the valuable portions of the refuse than the material is worth, if all classes of the waste are treated in a sanitary manner.

Between 1895 and 1904, garbage cremation was practised in Richmond Borough, while the ashes, rubbish, and street sweepings with some garbage were used for filling lowlands. The system in use being deemed unsatisfactory, a representative district was selected and a mechanical analysis made of household refuse covering a period of one year. Street sweepings were eliminated from the problem, as their treatment was left for future consideration. About 108,000 lb. of ashes and rubbish and 28,000 pounds of garbage were mechanically separated into the classes shown on Fig. 2. Garbage was low in February and high in September, while "coal and cinders" varied inversely, and the "fine ash" would parallel the "coal and cinders"; rubbish was low in winter and high in summer. The seasonal variations of the various components of refuse shown in Fig. 2 indicate that September will be the critical month of the year in self combustion of the household wastes in the locality considered. Samples were taken of the different components from the mechanical analysis, and calorific tests with proximate analyses numbering 104 determinations were made at the Lederle Laboratories and by Mr. B. F. Welton, at the Laboratory of the Commissioners of Accounts, New York City, so as to determine average heat values and seasonal variations in the calorific powers of the components. The heat units per pound original of the three main divisions of household refuse from this district are given in Fig. 3. The drop in the heat value of "coal and cinders" and the rise in rubbish during the winter were rather surprising, while garbage, contrary to expectations, varied little with the seasons. A chemical analysis of an average sample of the three principal components of refuse with calculated calorific values is shown in the table following:

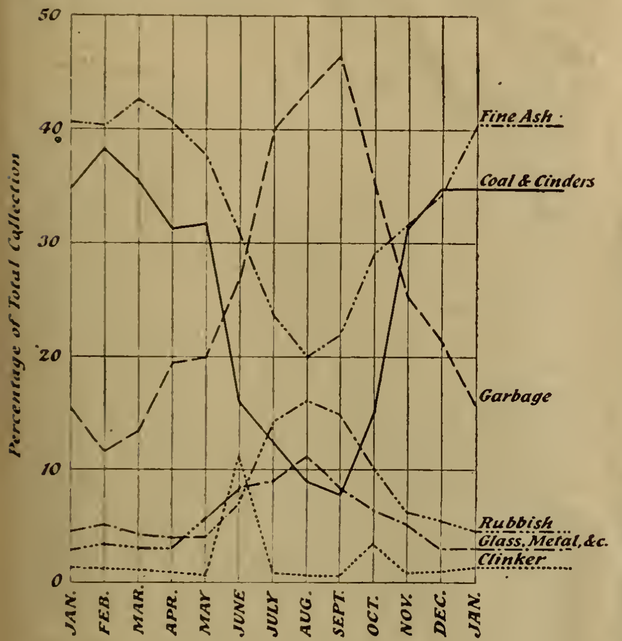

Fig. 2.

Diagram showing monthly variations by weight in components of household refuse, West New Brighton District.

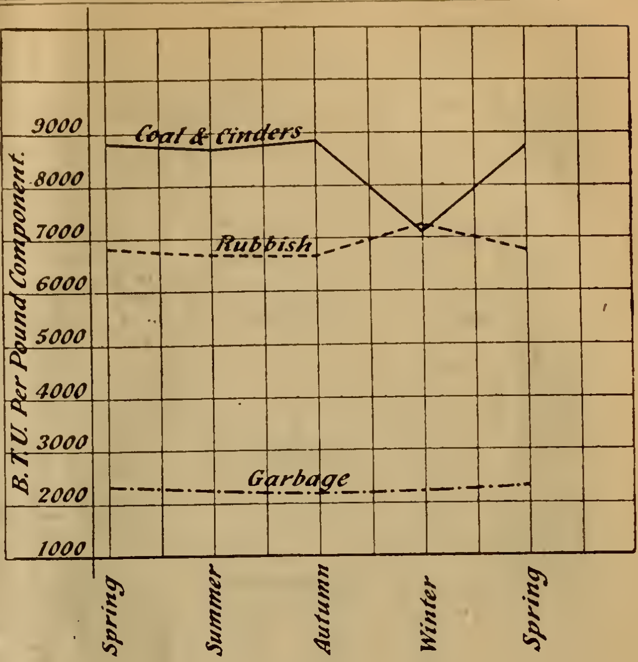

Fig. 3.

Seasonal variations in calorific power of original samples of components of refuse, West New Brighton, New York.

Chemical analyses of dry composite samples of coal and cinders, garbage, and rubbish, 1905–06.

Constituents.	Coal and cinders.	Garbage.	Rubbish.
	per cent.	per cent.	per cent.
Carbon	55·77	43·10	42·39
Hydrogen	0·75	6·24	5·96
Nitrogen	0·64	3·70	3·41
Oxygen	2·37	27·74	33·52
Silica	30·01	7·56	6·49
Iron oxide and alumina	8·98	0·41	2·03
Lime	1·21	4·26	2·26
Magnesia	Trace	0·28	0·57
Phosphoric acid	None	1·47	0·10
Carbonic acid	None	0·59	1·49
Lead	Trace	0·20	0·52
Tin	Trace	Sulphides	Trace
Alkalis and undetermined	0·27	4·45	1·21

Calorific values in British thermal units.

Calculated from above analyses	8,382	7,970	7,250
Average of calorimeter determination	8,510	8,351	7,251

The calculations from the analyses are made as follows $62{,}100\ \left(H - \frac{O}{8}\right) + 14{,}500\ C. =$ British thermal units. The analyses were made by Professor S. F. Peckham. Aided by the calorimeter tests, proximate analyses, and mechanical separations, a basis was provided for the computations shown in the first two divisions of Fig. 4. As might be expected, ash is high in winter and the water content of household refuse increases with the proportion of garbage in summer. The second division of the diagram gives the seasonal variations in the heat units per pound of mixed household refuse. Again the summer

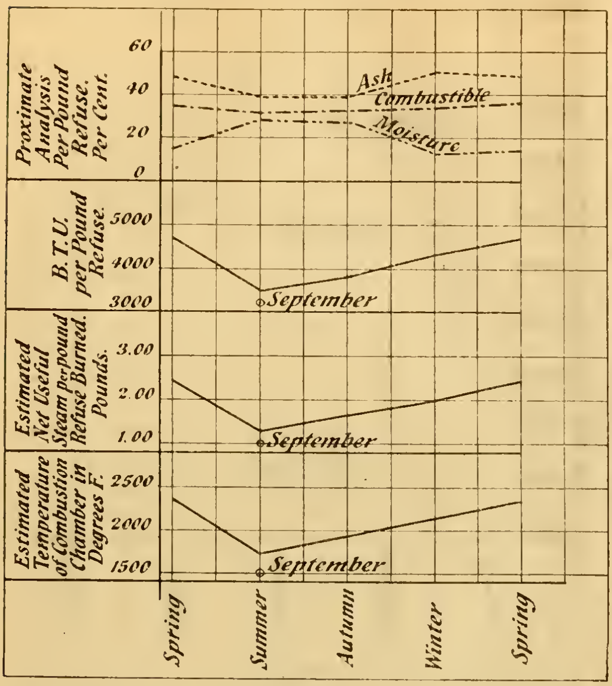

Fig. 4.

Mixed refuse destruction. Seasonal variations, West New Brighton, New York.

refuse is low in calorific power, and September is shown to be the critical time for burning the mixed waste, as a large amount of moisture then tends to lower temperatures and renders the creation of nuisances from unconsumed gases likely. An estimate of the actual power to be expected from the burning of household refuse in Richmond, based upon the foregoing summary, in conjunction with a number of small-size practical experiments in destroying the waste by the aid of forced draught, indicates that each pound of material will evaporate its own weight of water during the worst month of the year (September), while it may be expected that the evaporation will run over 2 lb. of water during the season when refuse is in the most favorable condition for burning. The foregoing estimates were made on the basis of a modern refuse destructor specially designed for conditions in Richmond and efficiently operated. The question of temperatures in the self combustion of refuse containing organic matter determines to a great extent the possibility of destroying the waste without creating a nuisance from the escape of obnoxious gases. Below 1250° F. hydrocarbons are not generally dissociated. Very high degrees of heat on the other hand result in a greatly increased cost of furnace maintenance. It is desirable to keep the temperatures as steady as possible. Temperatures between 1800° to 2000° F. are best suited to present day furnaces. The approximate heat of the gases resulting from the destruction of mixed household refuse in Richmond, as shown in Fig. 4, indicate that even during September temperatures should be sufficiently above the danger point to prevent the escape of odorous gases.

As a result of the various experiments and tests made in the Borough of Richmond, mixed refuse destruction of household wastes was recommended as best suited to the local conditions, and a furnace has been erected at West New Brighton from tests of which actual data of practical value will soon be available.

After it was decided to adopt the British method of burning mixed household refuse, the writer was commissioned by the President of the Borough of Richmond to examine and report on a number of British refuse destructors in actual operation. Forty plants were visited, thirty-nine of which were in Great Britain and one in Canada. Refuse in Great Britain and Ireland is dark in appearance, due to the soft coal ash, and there is, apparently, less rubbish, less garbage, more ashes and more moisture in the material than in mixed refuse found in the vicinity of New York. The summer refuse from New York contains a large proportion of combustible material. The British householder throws away only about one-half the refuse that the average householder in New York does. In Great Britain it costs two to three times more to collect and remove the material than it does to dispose of it. The system of collection is directly dependent upon the method of disposal adopted. A type of wagon used in Great Britain for collecting mixed refuse is constructed of wood, holds about three cubic yards of material, and can be dumped by means of a crank and screw. Another type aims at preventing the escape of dust when the cart is being loaded by means of a wooden cover and side wings. Where garbage is collected separately, it is necessary to provide the cart or wagon with a tight body of the kind common in New York City. Such carts are made of steel and are satisfactory where garbage reduction or garbage cremation systems are in operation. If, however, mixed refuse is to be economically collected, the larger the wagon the less frequent will be the trips to the place of disposal. Such a wagon is of the bottom dump variety and is provided with a canvas cover dividing the open top into four sections, so that when collecting, from one-half to three-quarters of the wagon may always remain covered, and thus, to a great extent, prevent the escape of dust from ashes in windy weather.

As the cost of collection is such an important factor, a plant should be as near as possible to the centre of the district served. British destructors are often placed right in the heart of the city. A plant at Rathmines, near Dublin, Ireland, is quite near the Town Hall. The refuse burned at this place furnishes power for an output of 300 k.w. No odours or nuisances were apparent. Most of the plants inspected in Great Britain were working well in the centre of towns. Shoreditch has a refuse destructor surrounded on practically all sides by higher buildings, which has been working for over ten years, and would have been closed long ago if it were a nuisance. Some of the power produced at this destructor is used for electric lighting. At Batley, near Leeds, the refuse destructor is located near the electric power station, and furnishes steam to run a portion of the power plant. Besides the combination of refuse destructor with electric generating stations, steam power developed by burning the material is used for various other purposes such as pumping sewage, water, and works purposes, or the lighting of the destructor depots, and furnishing power for various municipal uses. It is stated that the power generated at a combination refuse destructor and sewage pumping station at Worthing, near Brighton, saves the municipality about $800 to $1000 per annum in fuel bills. At Swansea power from refuse is used for generating electric current to operate about 4½ miles of street railway.

Besides the steam generated from refuse, about one-third of the original material remains on the grate in the form of clinker. If clinker has been burned hard, it will replace broken stone or gravel and sand as an aggregate for concrete. Crushed, sorted, and mixed with cement it can be made into bricks and pavement slabs. Bricks of good quality are made at Woolwich from cement and clinker by subjecting the mixture to a heavy pressure. Power at this plant is used for electric lighting.

This brief review indicates to some extent the scientific possibilities involved in a consideration of the question. It ought to be borne in mind, however, that utilisation is a secondary consideration, and that the primary object should be to rapidly remove and finally dispose of the materials in a sanitary manner.

THE DESTRUCTION OF WASTE IN PUBLIC INSTITUTIONS AND PRIVATE BUILDINGS.

BY WILLIAM F. MORSE.

The greatest advances in the past ten years in methods for the disposal of city waste have been made not by the municipal authorities of New York, but by public institutions and great business corporations. This movement was inaugurated by the hospitals, which, by their control of isolated buildings, had within their own limits all the elements of a small community, attended by all the conditions of waste production, and the difficulties of its disposal. In old times the waste of a hospital, whatever its nature, was usually burnt under the boiler. In the basement or boiler floor, filled as it was with heavy machinery, there was little space available for any special disposal apparatus, nor was there often a chimney stack available. As the use of a special furnace, however, became better known, in all the later institutions in New York, Boston, Philadelphia, and Washington, the architects provided for the installation of a separate furnace for waste. The first example of this form of furnace was installed in 1890 at the Disinfecting Station attached to the Willard Parker Hospital in East 16th Street, New York. The Commissioner of Health authorised the writer to construct a furnace and chimney in a division of the room set apart for the reception of infected clothing and bedding received from cases of zymotic diseases. The furnace was 12′ by 9′ by 5½′, with top charging hole and large doors for bulky substances, with fire box at the front end from which the flames passed over and under the grate containing the material to be destroyed, the gases and smoke from which were directed through the secondary fire at the rear end, and thus consumed. This was known as the "Engle Cremator," which is still in use, but has been frequently repaired and modified in construction. Similar furnaces were built in the New York Hospital, St. Luke's Hospital, and at the Kingston Avenue Hospital for Contagious Diseases, Brooklyn, all of which are still in use. Since then the writer has designed and constructed some seventy-five separate installations in all parts of the country. The College of Physicians and Surgeons, and afterwards Cornell and Bellevue Medical Schools, put in furnaces to deal with the waste from the dissection rooms, and destructors were built in the more important hospitals, including the Marine Hospital and Department of Public Health at Washington. Some of these installations were fitted with apparatus for gas or oil fuel, and were very compact and powerful.

A furnace for the disposal of the refuse of a department store, built six years ago in Brooklyn, had a 150 horse-power horizontal tubular boiler which utilised the heat from the combustion of a great volume of waste paper and other rubbish. The first installation in the Borough of Manhattan, in 1902, in Macy's department store, was noticeable, in that it formed the outlet for a system of conveyors through which all refuse and sweepings of each floor were carried to the furnace room. This furnace was connected with a Babcock and Wilcox 250 horse power boiler in the hope of utilising the heat to save coal, but was of little practical service, as the heat was so fluctuating, and the feeding of the furnace so irregular that no reliance could be placed upon it as a source of steam power.

From the hotels and larger restaurants in New York City an amount of garbage estimated at 15 to 20,000 tons per annum is taken away by private agency, but the best hotels are now recognising the advantage of a garbage destructor. At the New Hotel Astor, there is about to be installed a destructor, equipped with a boiler for low pressure steam. The first furnace for a railroad station was installed at the Reading R.R. Station, Philadelphia, and followed by another at the Broad Street Station, Pennsylvania R.R. The latest is the new furnace at the buildings of the Hudson Terminal Station, Dey and Cortland Street, N.Y. City. This terminal station is the largest yet constructed in New York. The conditions required a destructor having a capacity of five tons of garbage and five tons of combustible refuse daily. This is equivalent to the total quantity produced by a town of 10,000 inhabitants under usual conditions in the country. Because of the unusual amount of dry refuse, special provision was made for bringing it where it would be used for fuel to consume the wetter garbage. The destructor furnace is 20 ft. long, 10 ft. high, and 9 ft. wide, built of fire brick faced outside with enamel brick and with air spaces between the walls. There are two charging holes, one for garbage and the other for dry refuse, and large doors in front for bulky substances. The chief novelty is that it has inclined garbage grates, beginning at the level of the first fire box and rising nearly to the roof of the furnace. This forms a stoking platform which receives the garbage and upon which it is dried out before being finally drawn down into the fire box. Below the fire box is a second platform, forming a flue for the passage of smoke and gases, and as this becomes incandescent it radiates the heat to the under side of the grates above, greatly aiding the drying out of the moisture and increasing the combustion. Below this second platform is a triangular expanding chamber, extending from the partition or bridge wall of the fuel box to the curtain wall, which encloses the combustion chamber and the secondary fire box. Above the secondary fire box in the combustion chamber is a series of transverse arched partitions, perforated to admit free passage of the gases. Beneath the floor of the expanding chamber are conduits of iron extending from the wall of the combustion chamber to the bridge wall under the fire bars of the fuel box. These conduits are controlled by valves and are arranged to conduct the air for combustion, heated by contact and radiation from the iron plates covering the bottom of the expanding chamber into the ash-pit under the primary fire. The addition of this regenerative system of heating the air brought under the fire bars of the primary fire is a means of increasing combustion not before recognised in American practice. This heated air may be increased to any desired pressure by means of a fan or steam jet, as in the English destructors, and any proportion of mixed waste, garbage, and general refuse may be destroyed without change in the apparatus except by increasing the blast. At the top of this furnace above the combustion chamber, or at the side or back of this, may be placed a steam boiler having its own independent fire box, and so connected with the furnace that it may be worked altogether by the destructor, or partly or entirely by the heat from its own fuel box. By enlarging or diminishing the area of either the primary fire or of the sloping garbage grates the destructor may consume a larger proportion of either dry refuse or garbage as conditions may require. The sloping platform, which gradually diminishes the area of the combustion grates, causes a more intimate contact with the heat, and greatly aids the downward movement of the garbage to the fuel-grate to form additional fuel. The delay of the gases in the expanding chamber permits the deposit of fine dust, which is withdrawn through doors on the bottom. There is no iron surface exposed to the direct attack of the heat except the upper surface of the fire bars of the primary and secondary fires. It is believed that the simplicity of construction, and the few essential elements, make it almost impossible to get out of order or to be destroyed by high temperature unless by gross carelessness. The latest installation made by the Government is a Morse destructor furnace ordered for the new Naval Hospital at New Fort Lyon, Col. All the steel, including the chimney, and the brick required for this destructor are prepared in New York City and sent direct to the ground of installation. The furnace is 10 ft. long, 7 ft. high, and 6 ft. wide. The exterior steel casing is of quarter-inch steel, braced and stayed at the corners by angles, and reinforced by perpendicular buck-stays connected by tie rods. The doors connected with the front fire box are large, while the charging is done from the top through a circular opening 18 inches in diameter

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THE HEENAN REFUSE DESTRUCTOR.

BY E. H. FOSTER.

The Heenan Destructor is designed for burning mixed household refuse. It consists generally of a furnace, divided into three or four separate compartments, one of which is charged at a time, a large combustion chamber which receives the products of combustion from the various parts of the furnace, a water tubular steam boiler by passing through which the gases which leave the combustion chamber will be cooled down, and a heater or regenerator between the boiler and the chimney, in which the temperature of the air to be fed to the furnaces is raised by contact with the waste gases about to enter the chimney. There is a forced draught system, comprising a steam engine directly connected to a high pressure fan, with air valves. The city carts enter the building at an upper elevation, back up against a rail, and dump their contents into hoppers. The under sides of these hoppers are fitted with doors leading to the feeding platform whence the stoker charges the furnace with the refuse. After the refuse has been burned down, which requires a length of time depending upon its character, the clinker is removed from one compartment at a time and wheeled away to be crushed into small particles of assorted sizes for further utilization. The clinker derived from this furnace is suitable for filling in land, or as a basis for brick, mortar or concrete. The steam which is generated from the boiler may be used for running electric lights, pumping water, or, as is often the case in plants of this character, for pumping sewage. It has also been estimated that the steam generated by the refuse collected from a community of a given size will just about produce the amount of ice in an absorption machine that the community would naturally consume.

The first plant of this sort to be introduced into this country has just been put in operation at West New Brighton, Staten Island.

Nottingham Section.

Meeting held at Nottingham on Wednesday, March 25, 1908.

MR. O. QUIBELL IN THE CHAIR.

THE COMPOUNDS OF GELATIN AND TANNIN.

BY J. T. WOOD.

On February 4th, 1803, a paper was read before the Royal Society entitled "An account of some experiments and observations on the constituent parts of certain astringent vegetables, and their operation in tanning," by Humphrey Davy, Professor of Chemistry in the Royal Institution (Phil. Trans., 1803, 233). In this paper, so far as I know, the first account is given of the compound formed when gelatin is added to solutions containing tannin. I had occasion to refer to this paper for information about these compounds in attempting to answer the question "what are the combining proportions of these two bodies?" I sought for this information with the object of throwing some light on the combining proportions of skin and tannin, for, on making some preliminary experiments with gelatin, it was evident that there was no definite combining proportion in a chemical sense, but that the proportions varied according to the concentration of the solutions, the amount of each of the bodies present, and possibly according to the rate at which the precipitate is formed and the temperature. I found Davy's paper most interesting as one of the earliest scientific contributions to the chemistry of tanning. He makes the following remarks:—"The tanning principle in different vegetables, as will be seen hereafter, demands for its saturation different proportions of gelatin, and the quantity of the precipitate obtained by filtration, is not always exactly proportional to the quantities of tannin and gelatin in solution, but is influenced by the degree of their concentration. Thus, I found that 10 grains of dry isinglass, dissolved in two ounces of distilled water, gave with solution of galls in excess, a precipitate weighing, when dry, 17 grains, whilst the same quantity dissolved in six ounces of water produced, all other circumstances being similar, not quite 15 grains. With more diluted solutions, the loss was still greater; and analogous effects took place when equal portions of the same solution of isinglass were acted upon by equal portions of the same infusion of galls diluted in different degrees with water, the least quantity of precipitate being always produced by the least concentrated liquor. In all cases, when the weak solutions were used, it was observed that the residual fluid though passed two or three times through the filter, still remained more or less turbid and opaque, so that it is most likely that the deficiency arose from the continued suspension of some of the minutely divided solid matter in the liquid mass."

The standard solution of gelatin which Davy used for making his experiments, was made by dissolving 120 grains of isinglass in 20 ounces of water (this is equivalent to 13·7 grms. per litre), the temperature at which the precipitation was made being between 60° and 70° F. Great care was taken to prevent the presence of any excess of gelatin, as Davy found that when this excess exists, a portion of the precipitate is re-dissolved. The precipitate was filtered off and dried upon the lower plate of a sand bath at a temperature not exceeding 150° F.; the isinglass used was dried in the same manner in order to eliminate the effect of moisture. He does not say if he washed the precipitate, but from the results given I am inclined to think that he did. As a result of his observations he concluded that 100 grains of the compound of gelatin and tannin, formed by precipitation from saturated solutions, contain about 54 grains of gelatin and 46 of tannin; this is equivalent to a precipitation of 85 parts of tannin by 100 parts of gelatin. According to Lipowitz (Jahresb. Forts. Chemie, 1861, p. 624) 100 parts of isinglass dried over sulphuric acid precipitates exactly 65 parts of tannin. In the determination of gelatin by the Bisler Beumat method (Rideal, Glue & Glue Testing, 1900, p. 111), 42·7 parts of gelatin are said to be equivalent to 57·3 parts of tannin, or 100 parts gelatin precipitate 134 parts of tannin. According to Mulder (Allen, Comm. Org. Anal, IV, p. 463) 100 parts of dry gelatin precipitate 135 parts of gallotannic acid. R. Williams (Allen, p. 484) by precipitating 1 per cent. solutions of glue with pure tannic acid, and estimating the excess of tannin by Lowenthal's process, found 77·5, 77·9 and 78·6 parts of tannin precipitated by 100 parts of glue or gelatin. Procter (Principles. p. 63) quotes Böttinger, who by Kjeldahl's method found the precipitate produced by adding gelatin to excess of gallotannic acid to contain 66 per cent. of gelatin, which is equivalent to 50 parts only of tannin precipitated by 100 parts of gelatin. It is difficult to explain the great divergence between the maximum and minimum amounts of tannin precipitated, though the figures appear to resolve themselves into two groups, in one of which the tannin is from 66 to 85, in the other about 135 per 100 parts of gelatin.

It seemed possible to investigate this matter in a similar way to that employed in the investigation of the combining proportions of skin and tannin, (see note on the absorptive properties of chromed skin for tannin, Collegium, No. 222, Sept. 1, 1906, 301. This J., 1906, 896). I used Coignet's Gold Label gelatin, the same as described in a "Note on Collin," (Wood & Trotman, this J., 1904, p. 1071), and which by Kjeldahl's method, using the factor N × 5·5, contained 74 per cent. of gelatin, and by precipitation with zinc sulphate was found to contain 1·78 per cent. of nitrogenous matter not gelatin. For most of the experiments a 2 per cent. solution of this gelatin was used. The method employed consisted in adding 50 c.c. of gelatin solution containing one grm. of air dry gelatin to the tannin solution, shaking well; allowing to stand for varying lengths of time, filtering through S. & S. 605 filter and evaporating a sufficient quantity of the filtrate to give from 0·3 to 0·6 grm. of residue, from the weight of the residue the quantity of tannin precipitated was calculated. The residues contained only traces of nitrogen, as shown by Kjeldahl's method, due to the small quantity of nitrogenous matter above mentioned which was not precipitated by the tannin, the maximum amount of this nitrogen, if calculated as gelatin, was 0·014 grm. per 100 c.c. The tannin used in some of the experiments was Hasting's tannin containing 95 per cent. by hide powder (*see* Collegium, 1906, 302), and later Kahlbaum's pure tannic acid containing 96·5 per cent. by hide powder and 100 per cent. by Lowenthal on the dry matter.

A few preliminary experiments showed that the quantity of tannin precipitated by this gelatin, when a large excess of tannin was employed, was greater than that found by Davy, and on repeating the experiments with isinglass instead of gelatin similar results were obtained. I found that the greatest amount of tannin which could be precipitated by 1 grm. of air dry gelatin was about 2·4 grms. from a solution containing 6 grms. of tannin, the volume of the solution after the addition of gelatin being 150 c.c.

It was found from these experiments that to obtain the maximum precipitation a large excess of tannin was necessary, about six times the weight of gelatin used. Unless this large excess of tannin be present the gelatin does not carry down so much tannin as it is capable of doing. I believe that all experimentists, including Davy, got erroneous results because they thought that if tannin were present after the addition of the gelatin, they had an excess of tannin over and above what would combine with the gelatin, whereas I have found that unless a definite excess is present the maximum amount of tannin is not precipitated. The results obtained are shown in the following table:—

Amount of tannin precipitated by 1 grm. of air dry gelatin in solutions of equal concentration but different volumes.

Tannin, grms.	Volume of solution, c.c.	Tannin precipitated, grms.
1	100	0·91
2	200	1·50
3	300	1·90
4	400	2·17
5	500	2·28
6	600	2·36
7	700	2·36
8	800	2·36

It has long been known that the precipitate of gelatin with excess of tannin was of different composition to the precipitate with excess of gelatin, and that by washing the former with hot water a considerable amount of tannin could be removed from it, but I have not been able to find any record of experiments made with definite quantities of tannin and gelatin. In order to ascertain how much tannin could be washed out I made use of Kjeldahl's method; the precipitate after filtering off the tannin was transferred to a beaker and washed by decantation with five lots of cold water; the wash water still gave a precipitate with a drop of 1 per cent. gelatin and a blue black coloration with iron alum. It was then washed with boiling water until the wash water gave no precipitate with gelatin and only a very faint coloration with iron alum. The nitrogen found in the dried precipitate before washing was 4·54 per cent., and 5·79 per cent. after washing, an increase of 1·25 per cent. equivalent to 6·9 per cent. of dry gelatin or 9·2 per cent. of original gelatin used.

The composition of the precipitates on the dry matter was therefore:—

	Unwashed.	Washed.
Gelatin	25	32
Tannin	75	68

or for 100 parts of absolutely dry gelatin as estimated by Kjeldahl's method (5·5 factor), the tannin combined was:—Unwashed, 300; washed, 212. The amount fixed when calculated on the original gelatin used is 136 parts of tannin per 100 parts of gelatin, but if this amount of tannin be mixed in solution with the amount of gelatin indicated, the whole of the tannin is not precipitated, but an equilibrium is reached when about 87 per cent. of the tannin is precipitated. Two experiments gave the following results:—1·468 grm. of Kahlbaum's pure tannic acid (=1·36 grm. of absolutely dry acid) was dissolved in 50 c.c. of water; to this was added 1 grm. of Coignet's gelatin dissolved in 50 c.c. of water; the whole was thoroughly stirred and allowed to stand 24 hours. After filtering and evaporating the filtrate as described, the amount of residue obtained in two experiments was 0·084 and 0·087 grm., equivalent to 1·192 and 1·186 grm. of tannin precipitated, a mean of 1·189 grm. or 87 per cent. of the tannin was precipitated. On the gelatin as estimated by Kjeldahl, 1 grm. precipitated 1·6 grm. of tannin. If the quantity of tannin be successively increased, the gelatin and the concentration remaining constant, an increased quantity of tannin will be precipitated until the maximum above named, namely, 2·4 grms. or 3·25 N×5·5 is reached.

In order to ascertain the effect of time on the amount precipitated, experiments were carried out in which the filtrate was examined after the lapse of one hour, twenty-four hours, and forty-eight hours, the results being shown in the table below. They indicate that both for strong and weak solutions an equilibrium is reached in twenty-four hours, after which the precipitate appears to lose a little tannin. The table also shows influence of concentration on the quantity precipitated. One grm. of air-dry gelatin was used in each experiment and 6·04 grms of dry tannin.

Experiment.	Time.	Volume of solution.	Residues.	Tannin precipitated by 1 grm. gelatin N×5·5	Concentration at beginning of experiment.	Concentration at end of experiment %.
	hours.	c.c.	25 c.c.			
1	1	150	0·6215 0·6225	3·10	4	2·45
2	24	150	0·6010 0·6000	3·25	4	2·37
3	48	150	0·6105 0·6100	3·15	4	2·4
			100 c.c.			
4	1	600	0·7545 0·7540	2·04	1	0·69
5	24	600	0·6665 0·6655	2·73	1	0·62
6	48	600	0·6690 0·6650	2·70	1	0·62

The filtrate titrated with permanganate by Lowenthal's method was found to contain the same amount of tannin as that found by weighing.

In order to ascertain the influence of concentration on the amount of tannin precipitated, 1 grm. of air-dry gelatin (=0·74 grm. by Kjeldahl's method) was brought into admixture with 5·51 grms. of absolutely dry tannin under the same conditions as above. The results are shown in the following table. These confirm Davy's results, and show that the least quantity of tannin is precipitated from the least concentrated solution.[*]

Amount of Kahlbaum's gallotannic acid precipitated by 1 grm. of absolutely dry gelatin N × 5·5 *in solutions of different concentration.*

No.	Quantity of dry tannin.	Volume of solution.	Concentration at end of experiment.	Tannin precipitated by 1 grm. of gelatin, N × 5·5
	grms.	c.c.	per 100 c.c.	
1	5·5	150	2·2	3·0
2	5·5	200	1·80	2·95
3	5·5	250	1·32	2·6
4	6·0	500	0·76	2·45
5	5·5	2000	0·19	2·4
6	5·5	6000	0·063	2·4

An experiment to show the influence of temperature was made by adding 1 grm. of air-dry gelatin to 1000 c.c. of the tannin solution at a temperature of 80° C., an exactly similar solution being acted upon at 18° C., the amount precipitated in the former case being 1·74 grms., and in the latter, 1·35 grms. of tannin. In the hot solution the precipitate adheres to the rods and the sides of the beaker, and occupies a very small volume in comparison with the original precipitate.

The compound of gelatin and tannin when dry is a brittle mass of a yellowish-brown colour. When placed in boiling water it melts to a tenacious sticky substance of the consistency of bird lime, and in this state may be drawn out or spun into fibres as fine as those of a spider's web. The fibres have a metallic lustre like silver slightly tinged with gold. When placed in a solution of iron alum they are but slightly coloured blue, becoming the colour of polished steel. The tannin in the compound is insoluble in alcohol, ether, or acetone, and is almost tasteless. I have been unable to observe any evolution or absorption of heat taking place during the precipitation. By boiling the pure preparations continuously with water they are decomposed into constituents of varying composition as shown by the appearance of the water; it contains tannin, and also fine suspended particles which may be filtered off and which appear to be another compound of tannin and a gelatin proteoid containing a much smaller quantity of tannin. By boiling with magnesia it appears to be completely decomposed. Approximately 1 grm. of dry gelatin (N × 5·5) combines with 2 grms. of dry gallotannic acid to form 3 grms. of "leather," but this compound can be partially split up by boiling with water, so that the compounds prepared by drawing the gelatin-tannin precipitate out of boiling water are not of constant composition.

Lumière and Seyewetz (Coll., 1906, 205; this J., 1906, 704) state that tannin and gallic acid only produce the insolubilisation of gelatin in the presence of air and in an alkaline medium; in the case of gallic acid this is true, and the observation is a very interesting one from the point of view of the theory of tanning, since alkaline gallic acid gives no precipitate with gelatin, but in the case of tannin I have not been able to confirm M. Lumière's observation; indeed, the tannin appears to act more vigorously in acid solution, and the same compound is formed as I have described above, which is insoluble in boiling water, although it is gradually decomposed by it. I think that what Lumière and Seyewetz have taken for the solution of the precipitate of tannin and gelatin on boiling, is its condensation or coagulation, for a very large volume of the precipitate is reduced to an extremely small volume by boiling, and if the experiment is carried out on a small scale is apt to be overlooked or neglected; it certainly appears as though almost the whole of the precipitate dissolved, but neither in the cold or hot solutions can I find any nitrogen or only a mere trace which may be accounted for by the presence of a small amount of nitrogenous matter in the original gelatin which is not precipitable by tannin. Unless the experiment is carried out quantitively it is very easy to be deceived. The boiling of the solution causes the precipitate to part with a considerable amount of tannin (about 14 per cent. on the dry matter).

It is possible that the oxygen of the air has some influence on the fixation of tannin in the compounds I have shown, but I have been unable to make further experiments in this direction, though from what has been said above it will be seen that there is some fallacy in Lumière and Seyewetz's results.[*]

In view of the use of chromed hide in the estimate of tannin, I thought it of interest to ascertain the absorption of tannin by chromed gelatin. Lumière and Seyewetz (Bull. Soc. Chim., 1903, 1077; this J., 1903, 1358) state that gelatin fixes a maximum constant quantity of sesquioxide of chromium of between 3·2 and 3·5 grms. per 100 grms. of gelatin, whatever be the chromium salt employed. I have been unable to confirm this, but find that the quantity of chrome fixed by the gelatin depends on the concentration of the chrome solution, and on the basicity of the salt used. By employing the basic chromic chloride as recommended for the chroming of hide powder (Coll., 1907, 252) sheets of gelatin placed for 24 hours in a solution diluted one-tenth gave 5 per cent. of chromic oxide, but when soaked in the concentrated solution 13·6 per cent. was found after washing and neutralizing in the same way as in the chrome tanning of skins, or, as recommended by Lumière and Seyewetz, with weak ammonia. The gelatin is rendered absolutely insoluble even by the weaker solution.

The chroming of the gelatin does not interfere with the absorption of tannin, as a sheet of the heavily chromed gelatin will absorb as much tannin as before chroming. When a sheet of gelatin is soaked in cold distilled water it absorbs from 8 to 9 times its weight of water and loses about 5 per cent. of soluble matter, the greater part of which is precipitable by tannin. This soluble matter is doubtless gelatin partially peptonized during the drying process. Such a sheet of swollen gelatin placed in a solution of tannin will absorb the tannin very much in the same way as a skin does, becoming tanned by the process, but the amount of tannin absorbed is not so great as that precipitated by the gelatin when in solution. A sheet tanned this way was found to have absorbed 1·06 grms. of tannin for every grm. of dry gelatin. An exactly similar sheet was chromed by treating it with a strong solution of basic chromium chloride as above described, and then transferred to a solution of tannin containing 5·5 grms. of tannin for 48 hours. The amount of tannin absorbed (by difference) was 1·06 grms. per grm. of dry gelatin. Thus the chromed gelatin has absorbed as much tannin as the unchromed gelatin. From this it will be seen that the tannin attaches itself to different bonds in the gelatin molecule to those to which the chromic oxide is attached. Procter remarks on this—that recent researches on the proteids lead to the view that gelatin like the rest of them consists of linked chains of amino acids in which the carboxyl of one member is linked to an amino group of another, probably one or more carboxyls and one or more amino groups being free. It is therefore probable that bodies of an acid character attach themselves to the amino groups and those of a basic to the carboxyls, so that one does not interfere with the fixation of the other. There are many illustrations of the fact that this is so, such as the difficulty of attaching basic colours to chrome leather directly, etc., but whether the chemical explanation is the correct one is an open question which cannot be completely answered until we have carried investigations further as to the influence of the colloid state. In this connection I would cite an important paper by Lüppo-Cramer (Collegium, 1908, 24, Ueber einige Kolloiden Oxyde als Gerbungsmittel. *See this J.*, 1908, 37), in which the mode of action of metallic oxides is shewn to be due to their assuming the colloidal state; metals like silver, mercury, and copper, which will not tan in ordinary solution are capable of a tanning action when in the colloidal state. Some time back Dr. Sand suggested this possibility to me in the case of tin, but I have been unable to carry out any experiments for lack of time.

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[*] Alsop (Amer. Leather Chem. J., 1907, 2, 405) shows that the same amount of hide powder in equal volumes of solutions of different density will give the same amount of non-tans. He infers this to be due to physical and chemical reasons and to be dependent on the volumes and not on the tannin content of the solution, but does it not rather point to a chemical combination, since the hide had absorbed the same amount of tannin from the strong as from the weak solution?

[*] Since the reading of the paper Stiasny, Kritische und experimentelle Beiträge zur Aufklärung der Gerbevorgänge, Coll., 1908, 119, has shown that oxidation of hide fibre produces no alteration in its acid or basic characters, and consequently if leather be considered as a salt, that both oxidised and unoxidised hide are equally capable of forming it. Since gelatin is hydrolyzed hide fibre it is probable that the same holds good in this case too.

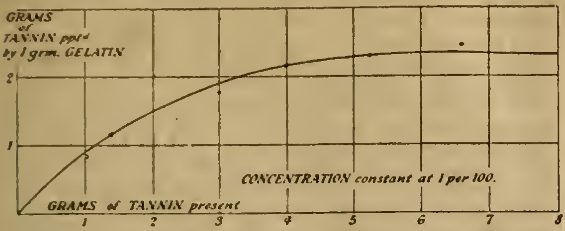
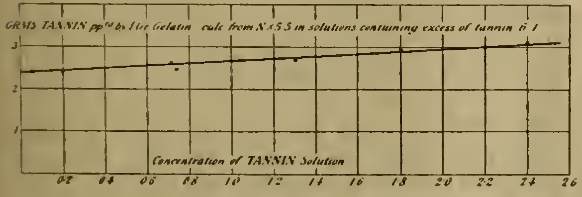


Diagram 1.

An examination of the facts shows that the combination of gelatin and tannin is neither a purely chemical one, since the gelatin and tannin compound is not of constant composition, nor a purely physical one, since it does not obey the solution laws, which require the concentration of the tannin in the solution and the tannin in the gelatin to maintain a constant ratio. The way in which the tannin combines with the gelatin very much resembles the combination of gelatin with hydrochloric acid (see Procter, Principles, p. 86). It is probable that more than one compound of gelatin and tannin exists, and that in the earlier stages only certain of the linkages are saturated with tannin The whole matter is complicated for the reason that we know very little of the constitution of tannin and less of the constitution of gelatin. The investigations which are at present going on in various photographic and other laboratories are all tending to show that the influence of the colloid state is most important, and it is in this direction to which we must look for a fuller explanation of the various gelatin compounds of which the tanno-gelatin is the most important.

As to the explanation of the above facts, if I may be allowed to use the words of Newton "Hypotheses non fingo," I will merely content myself with adding them to what has been done already by others.



In conclusion my thanks are due to Mr. S. R. Trotman and Mr. W. E. Holmes for help in carrying out some of the experiments, and also to Professor H. R. Procter for his friendly advice and criticism.

Discussion.

Mr. O. Quibell remarked that he had found chondrin to be a frequent constituent of the gelatin referred to by Mr. Wood. This was to be expected from the process of the manufacture. He thought the term pure gelatin was somewhat contradictory.

Mr. S. R. Trotman thought that Mr. Wood's experiments were important from a practical point of view, since they indicated the proper excess of tannic acid necessary to obtain the maximum weight of leather from a given weight of skins. Interesting information might be obtained by a process of fractional precipitation of gelatin with tannic acid, and analysis of the resulting compounds. He had recently attempted to fractionally precipitate gelatin with magnesium or zinc sulphate, and the results of these experiments certainly confirmed the view that even the best commercial article was not a simple substance.

Dr. F. S. Kipping also regarded the assumption that gelatin was a single substance as unwarranted, and suggested the use of amino-acids as precipitants, as it was possible that they played an important part in the constitution of gelatin. It would be interesting to know if the residues left by washing the gelatin tannate precipitation had been analysed, and if so, whether they were of identical composition.

Mr. S. J. Pentecost alluded to the capacity for absorbing tannic acid possessed by silk and the increased effect caused by subsequent treatment with metallic salts. This was perhaps similar to the reaction observed between chromed gelatin and tannic acid.

Dr. H. J. S. Sand thought that experiments such as those carried out by Mr. Wood were likely to throw light on processes occurring in some dyeing operations. With regard to Kipping's suggestion he thought that if gelatin were to be replaced by a pure amino-acid this acid ought to be a colloid. It was, however, doubtful whether a chemically pure colloidal amino-acid could be obtained.

Mr. Wood in reply to Mr. Quibell, said that the gelatin he had used was remarkably constant in composition, samples analysed during two years showing almost exactly the same nitrogen content and only a trace of nitrogen not precipitated by tannin. He had reckoned all the substance non-precipitated by tannin as "pure" gelatin, whatever that might be. He thought Mr. Trotman's suggestion a good one, but had not had time to carry it out. In reply to Dr. Kipping, he had already thought of the use of a pure synthetic protein, in fact he had himself suggested the use of such a body (this J., 1904, 1072). Some time ago he wrote to Professor Sorensen of Copenhagen on the subject, who replied that to his knowledge no simple amino-acid, nor even the higher members nor the simple polypeptides are precipitated by tannin. The latter part of Professor Kipping's question he had answered in the paper, though perhaps he had not made it quite clear; it was impossible to wash the residues to a constant composition with water since this decomposed the compound. If the excess of tannin he had indicated were present then he believed that the tannin actually combined with the gelatin was constant. In reply to Mr. Pentecost, Vignon of Lyon had proposed the use of raw silk as an absorbent of tannin in place of hide powder. He did not know whether the increased weight of the silk in the process mentioned by Mr. Pentecost was due to the tannin absorbed or to the metallic salts. In reply to Dr. Sand, he had compared the absorption of tannin to the dyeing process but the formula given by Biltz (this J., 1905, 920) for the absorption of dyes, did not hold good for the absorption of tannin by gelatin. He hoped someone would be able to utilize the facts to which he had called attention.

Scottish Section.

Meeting held at Glasgow on Tuesday, March 24th, 1908.

MR. JOHN S. MACARTHUR IN THE CHAIR.

THE BEHAVIOUR OF METALS WHEN HEATED IN AMMONIA.

BY G. C. HENDERSON AND J. C. GALLETLY.

Some time ago one of the authors, in conjunction with Mr. G. T. Beilby, F.R.S., made a somewhat extended study of the behaviour of a number of metals when exposed to the action of ammonia at high temperatures, with the object of investigating the physical as well as the chemical changes produced (Beilby and Henderson, Chem. Soc. Trans., 1901, 79, 1245; this J., 1901, 1212). Among the metals examined at that time, some, *viz.*, iron, cobalt, nickel, copper, and zinc, were found either to be more or less completely converted into nitrides if the necessary conditions were maintained, or to suffer very marked changes in physical character if the conditions were such that no nitride was permanently formed. On the other hand, it was observed that the action of ammonia on silver, gold, and platinum did not in any case result in the formation of a nitride, but that exposure to the heated gas produced a profound modification of the physical structure of each of these metals. The behaviour of a number of other metals and alloys when heated in ammonia at temperatures below their melting points was also examined, although not so exhaustively, and in every case marked changes in the physical properties of the substance were observed. Moreover, it was found that in every case, whether a nitride of the metal was formed or not, the ammonia suffered some decomposition into its elements, the extent of the decomposition depending upon the character of the metal as well as upon the temperature.

The experiments which we then made led us to the following conclusions. Most, if not all, metals when heated in ammonia are either converted into nitrides or else greatly changed in their physical properties, even when no nitrogen is permanently fixed by the metal. The changes, which include alterations in the colour, lustre, tenacity, elasticity, and electrical conductivity of the metals, are probably caused by the disintegration of the metal through the continuous formation and decomposition of unstable nitrides, since, when examined with the microscope, the altered metals exhibit a characteristic spongy structure due to the escape of minute bubbles of gas from a molten or semi-fluid mass. In the case of those metals which form nitrides, the maximum fixation of nitrogen depends upon the state of aggregation of the metal, the temperature, the excess of ammonia, and the time. Nitrides can hardly be obtained by interaction between metals and ammonia at high temperatures unless excess of the gas is present, since most of them are decomposed into metal and ammonia when heated in hydrogen, the action being in most, if not in all, cases a reversible one.

Subsequent to the publication of the paper quoted above, White and Kirschbraun (J. Amer. Chem. Soc., 1906, 1343; this J., 1906, 1100) again examined the action of ammonia on heated iron and zinc, and also on aluminium. With iron they obtained results similar to those previously published by Fowler (Chem. Soc. Trans., 1901, 285; see this J., 1901, 77) and by Beilby and Henderson. With zinc, heated to a temperature of 600°, they obtained a product containing 10·6 per cent. of nitrogen, as against the 12·5 per cent. required by the formula Zn_3N_2, and with properties similar to those of the nitride of zinc prepared by Frankland by heating zincamide. Aluminium was also found to be attacked by ammonia, yielding a product which contained 1·8 per cent. of nitrogen.

In view of the interest of the results previously obtained, it appeared to us desirable to extend the investigation to a larger number of metals. Our numerous experiments, which are summarised in the following paragraphs, confirmed in every way the conclusions formerly arrived at by Beilby and Henderson, some of the metals examined being converted into nitrides and others affected only as regards their physical state, while in all cases the ammonia was decomposed to a greater or smaller extent by contact with the heated metal. (It may be recalled that in the paper already quoted we showed that dry ammonia suffers little or no decomposition when passed through a glazed porcelain tube at a temperature of 850° C.) It is therefore unnecessary to discuss the results of these experiments at greater length, since they simply confirm the general conclusions stated in the paper on this subject communicated to the Chemical Society.

In carrying out the experiments the metals, either in fine powder or in the form of foil, were placed in glazed porcelain boats which were heated in a porcelain tube glazed inside and outside. As a general rule, a rapid current of dry ammonia was passed through the tube, experience having shown the desirability of a large excess of the gas being present. After each experiment the boats were left to cool in a stream of ammonia before removal from the tube. Many different experiments were made in which the conditions with respect to temperature, time during which the metal was kept in contact with the hot gas, and state of aggregation of the metal were varied, but as it would be tedious to enter into the details, only the principal results are given below.

Manganese.—When manganese in the state of fine powder is heated at a temperature of about 800° C. in a rapid stream of ammonia, it is readily converted into a nitride, and at the same time a large proportion of the ammonia is decomposed into its elements. Two different specimens of the nitride, prepared under these conditions, were found on analysis to contain 13·6 and 14·0 per cent. of nitrogen respectively, while the formula Mn_3N_2 requires 14·5 per cent. of nitrogen; evidently the conversion of the metal into its nitride was practically complete. With coarsely powdered metal and at lower temperatures we obtained products containing from 10·1 to 11·8 per cent. of nitrogen, but these when examined with the microscope were found still to contain particles of the metal, all of which showed rounded edges as if they had been in a partially fused condition. The nitride of manganese, Mn_3N_2, prepared in this way, is a dull black powder. Under the microscope its particles are seen to be black and lustrous, but apparently not crystalline; they rather appear to have been in a semi-fused state. The nitride is decomposed, although not rapidly, by cold water, ammonia being evolved, and it is dissolved by dilute hydrochloric, sulphuric, and nitric acids, somewhat slowly in the cold, but readily on heating. With the two former acids all the nitrogen of the nitride is converted into ammonium salts. When heated in the air the nitride is decomposed, and when heated in hydrogen it yields the metal and ammonia. From these results, which confirm and extend earlier observations on this subject, it is clear that manganese closely resembles iron both in its behaviour towards ammonia and in the character of its nitride.

Chromium, molybdenum, and tungsten.—On heating finely powdered chromium in ammonia at the highest temperature attainable in our furnace, *viz.*, about 850° C., the gas was largely decomposed and the metal was converted into a black powder. The heating in ammonia was continued until no particles of metal could be observed in the product when it was examined with the microscope.

The nitride of chromium was thus obtained as a dull black powder, of which the particles exhibit an appearance under the microscope very similar to that of the nitride of manganese. The chromium compound, however, is characterised by the remarkable resistance which it offers to the action of many reagents. It appears not to react with water, even when heated to redness in a current of steam, and when heated in hydrogen it yields only a small quantity of ammonia. It is not attacked to any notable extent by bromine, or by hydrofluoric acid, or by concentrated hydrochloric or sulphuric acids, or by concentrated aqueous potassium hydroxide, on prolonged heating, and it is but slightly soluble in concentrated nitric acid or in *aqua regia.* It is hardly if at all affected when heated with soda-lime, but when heated in the air it glows and undergoes decomposition, and it is readily oxidised by fusion with sodium peroxide. Since the remarkable stability of the nitride made the direct estimation of the nitrogen contained in it a very difficult matter, we had to content ourselves with estimating the percentage of chromium in the specimen of the metal employed in our experiments and in the nitride prepared from it, using in each case the method of oxidation with sodium peroxide. The metal was found to contain 99·4 per cent. and the nitride 86·3 per cent. of chromium; the nitrogen in the nitride amounted, by difference, to 13·1 per cent. A nitride of chromium of the formula Cr_3N_2 would contain 15·2 per cent. of nitrogen; hence our product was probably composed of a mixture of a nitride of this composition with some unaltered chromium. In most of its properties our product closely resembles the nitride of chromium previously prepared by the direct union of its elements at a red heat and by heating chromic chloride in ammonia, and to which the formula CrN is ascribed. This compound is said to dissolve slowly in concentrated sulphuric acid, and in this respect it differs from the nitride which we obtained, although otherwise it is very like it.

Molybdenum also reacts with ammonia, but with greater difficulty than chromium. When the metal, in fine powder, was exposed to the action of the gas at a temperature of about 850° C., we obtained a black substance intermingled with a large quantity of unaltered molybdenum, and even after repeated treatment with ammonia the conversion of the metal into its nitride was always very incomplete. Different specimens of the product were found to contain quantities of nitrogen varying from 2·4 up to 3·1 per cent., while the formula Mo_3N_2 requires 8·9 per cent. of nitrogen. Under the microscope the product was seen to be composed of black particles mixed with particles of the metal, the latter showing rounded edges. The product is not attacked by dilute hydrochloric or sulphuric acids, but it dissolves very slowly in hot concentrated sulphuric acid and it is readily oxidised by nitric acid. At lower temperatures the quantity of nitrogen fixed by the metal was less than at a red-heat. The ammonia was decomposed to a considerable extent when passed over the heated metal. Practically no nitride was formed when powdered tungsten was heated in ammonia, whether at higher or lower temperatures. The ammonia underwent some decomposition, and the appearance of the metal was altered to the extent that its particles showed rounded edges, as if it had been in a state of incipient fusion, but the product was found on analysis to contain no more than a trace of nitrogen.

Thus, as might have been expected, the behaviour of chromium towards ammonia resembles that of manganese and of iron. When the members of the chromium family are compared with one another it is seen that the resistance of the metal to the action of ammonia, or the instability of the nitride produced, becomes more marked as the atomic weights increase.

Titanium, tin, and lead.—Finely powdered titanium was heated in ammonia at a temperature of about 800° C. Much of the gas was decomposed and there was obtained a dull bronze coloured substance, which became highly lustrous when rubbed in a mortar, and which was seen under the microscope to consist of lustrous particles. A number of different specimens were prepared and analysed, but in no case did the quantity of nitrogen in the product exceed 6·8 per cent., while in some specimens it fell to 5 per cent. A bronze coloured nitride of titanium has been obtained by other methods, but this has the composition represented by the formula TiN, and contains 22·4 per cent. of nitrogen. The product which we obtained reacts very slowly, if at all, with water, and is insoluble in hydrochloric acid, but it slowly dissolves in hot concentrated sulphuric acid. It is decomposed when heated in the air, but it offers considerable resistance to the action of hydrogen at a red heat.

A number of experiments were made with tin, in the form of foil, at temperatures ranging from 160° C. to a red-heat, but no perceptible quantity of nitrogen was fixed under any conditions. Even at 170° C., however, the appearance of the metal began to change, the lustrous surface of the foil acquiring a frosted appearance, and on examination with the microscope showing a number of minute rounded blisters or bubbles. At incipient redness a large proportion of the ammonia passed over the heated metal was decomposed, but the rate of decomposition diminished rapidly as the temperature was lowered.

The behaviour of lead we found to be very similar to that of tin, as regards both the decomposition of the ammonia and the inability of the metal to form a nitride, or the instability of the nitride produced, under the conditions of our experiments.

Zinc and cadmium.—Previous to the publication of White and Kirschbraun's paper (*loc. cit.*) we had examined in detail the interaction between zinc and ammonia at various temperatures, but as our results in the main are in agreement with those already recorded it is not necessary to do more than emphasise the statements that heated zinc readily attacks ammonia, that the most favourable temperature lies in the neighbourhood of 600° C., and that since the temperatures of decomposition and of formation of the nitride of zinc lie close together the product always consists of a mixture of the nitride with the metal. A large proportion of the ammonia is decomposed by contact with the heated metal, and the decomposition of the gas begins at a temperature not much above 200° C.

A few experiments with cadmium showed that its behaviour is similar to that of zinc, but that it is difficult to get more than a rather small proportion of the metal converted into a nitride. When the finely powdered metal was heated in ammonia it was partially converted into a nitride of a greenish colour, but this was mixed with a considerable quantity of the metal. The proportion of the ammonia decomposed was not so great as with zinc. When cadmium foil was heated in the gas little formation of nitride could be observed but the appearance of the foil was greatly changed, in a similar manner to that observed with other metals.

Aluminium.—Our experiments with aluminium were discontinued after the publication of the paper already referred to. We had found, however, that reaction does take place between the metal and ammonia, but that—at least under the conditions of the experiments—only a small proportion of the metal can be permanently converted into the nitride in this way. The rest of the metal is changed in physical properties in a similar manner to the other metals which do not readily form nitrides by interaction with ammonia, and as usual much of the gas was decomposed.

Palladium.—In view of the results formerly obtained with platinum, some comparative experiments with palladium were carried out. The metal was used in the form of a very fine powder. No formation of nitride was observed in any of the experiments, which were made at different temperatures up to bright redness, but on inspection under the microscope the metallic powder was found to contain a number of rounded particles which had the appearance of having been in a semi-fused state. The decomposition of the ammonia was very considerable.

It is known that the alkali and the alkaline earth metals interact with dry ammonia when heated in the gas, yielding amides or nitrides respectively according to the conditions of the experiment. Therefore, taking into consideration the fact that the metals examined by us include representatives of all the groups of these elements, there are grounds for reaffirming our former conclusion that in all probability a reaction of some sort takes place between every metal and ammonia at a suitably high temperature. We incline to the belief that a nitride of the metal is produced, at least transitorily, even though no nitrogen remain permanently in combination with the metal, because it has been proved that frequently the temperature at which a metallic nitride is formed and that at which it is decomposed lie very close together. It is, moreover, difficult to account otherwise for the very marked alterations in the physical character of those metals which do not appear capable of forming comparatively stable nitrides.

THE AMYLOLYTIC AND PROTEOLYTIC FERMENTS OF WHEATEN FLOURS, AND THEIR RELATION TO "BAKING VALUE."

BY JOHN S. FORD AND JOHN M. GUTHRIE.

Part I.

When an attempt is made to determine the activity of the amylolytic ferment, which is well known to be present, to some extent, in wheaten flours, a limited experience shows that the operation is not simply a question of extracting the flour with water and measuring the activity of the extract, by allowing it to act on soluble starch, in the customary manner. Before recording the reasons for this assertion we may state that the actual activity determinations of the various extracts, mentioned hereafter, were made in the manner and with the precautions described by us in previous publications (this J., 1904, 414; J. Inst. Brew., 1905, 206), using soluble starch of R 1·0 as the hydrolyte. The results are in all cases expressed as the grams of maltose produced by the filtered extract of 1 grm. of the substance acting on excess of soluble starch for 1 hour at 40° C.

The first point to be ascertained in connection with the estimation was the influence of the duration of extraction.

Experiments were carried out, with two wheaten flours of different origin, as follows :—

TABLE 1.—*Influence of duration of extraction.*
20 grms. flour, ½ litre water at 18°.

Time of extraction. Minutes.	Grms. maltose per 1 grm. flour.	
	No. 1.	No. 2.
10	8·88	12·88
30	8·03	13·58
60	5·38	13·65
90	3·48	11·41
120	3·00	9·31

These extractions were made by means of a shaking machine described by us (J. Inst. Brew., *loc cit.*).

As it is obvious from these results that destruction* of the enzyme takes place with varying rapidity, dependent on certain characteristics of the flours, we are at once confronted with a difficulty, that of time of extraction. Quite apart from this rapid destruction of amylase, the degree of which varies with the ratio of flour to water, there are other difficulties, for it was found that an aqueous extract added simultaneously to different preparations of soluble starch gave different results, dependent to some extent on the salt concentration of the starches or probably, speaking more accurately, on the resulting hydrion concentration of the solutions. It was also observed that the filtered solutions obtained by limited extractions, when retested after standing several hours gave different values. In some instances an increase and in others a decrease of activity was recorded, the results depending on the time of extraction and the nature of the flour. We need not give the experimental details of these observations as they cannot yet be generalised. Now, as sample No. 1 was acid in reaction and No. 2 very faintly alkaline, to rosolic acid, it seemed probable that we had to deal with destruction of amylase by hydrogen or hydroxyl ions, consequently an evident inference was to extract the flours with a solution of an ampholyte known to have no specific influence on amylolytic action. Various substances suggest themselves for this purpose and were tried, but we need only record a few of our experiments. In the first place an attempt was made to adjust the "neutrality" of the aqueous extraction by the addition of 2 grms. of potassium di-hydrogen phosphate plus 0·2 grm. of di-sodium hydrogen phosphate per ½ litre of water. When No. 1 flour was extracted thus for ½ hour, the value obtained was 14·28 as against 8·03 grms. of maltose formed in the case of simple aqueous extraction. The addition of the same proportion of mixed phosphates to the starch used for the aqueous extract conversion did not appreciably alter the value. Extraction with solutions of other ampholytes, as glycine, gelatine, certain proteoses, etc., gave similar increased values. In the case of extraction with mixed phosphates the increased amylolytic activity is not necessarily a proof simply of adjustment of "neutrality" and consequent preservation of amylase, as it might be due partly to increased solution of the enzyme; the differentiation of these actions is not easy. It seemed of interest to see how far the addition of a neutral salt, such as potassium chloride, would affect the amount of active enzyme in solution. The use of this salt is however tantamount to concurrent addition of amphoteric bodies owing to the increased solution of certain proteins of the flours. The results of such an experiment are tabulated below, as even though they are the measure of a composite effect, they are of considerable interest.

TABLE 2.—*Influence of potassium chloride on solution and activity of the amylolytic ferment of wheaten flours.*

	Grms. maltose per 1 grm. flour.	
	Extraction 1 hour 18°	Digestion 3 hours 30°.
Water alone.............	3·22	2·80
Water plus 10 grms. potassium chloride per ½ litre	13·72	17·36

An extension of these experiments was made thus :—1 grm. of flour was digested for 18 hours at 30° with 50 c.c. water and with potassium chloride solutions as under :—

TABLE 3.

	Pot. chloride per 100 c.c.	Grms. maltose per 1 grm. flour.
Flour with water alone	..	4·06
,, ,, ,, plus	0·02 grm.	6·10
,, ,, ,, ,,	0·20 ,,	11·76
,, ,, ,, ,,	0·40 ,,	13·70
,, ,, ,, ,,	1·00 ,,	17·36
,, ,, ,, ,,	2·00 ,,	18·62
,, ,, ,, ,,	4·00 ,,	18·90
,, ,, ,, ,,	8·00 ,,	18·20
,, ,, ,, ,,	12·00 ,,	15·40
,, ,, ,, ,,	16·00 ,,	13·72
,, ,, ,, ,,	20·00 ,,	12·04

The flour with water alone yielded salts to solution equal to 0·007 grm. per 100 c.c. Toluene was used as an antiseptic in the above digestions.

The solution obtained by aqueous digestion above, when added to starch solutions containing potassium chloride equal in amount to that added by the volumes of the saline extracts used in the starch conversions, gave a maximum value of 4·62. These experiments were carried out at an early stage in this investigation, before we were cognisant of the great destruction of amylase which takes place during aqueous extraction or digestion, and were considered at that time to represent simply increased solution of the enzyme; we now see that this is not the case, the major portion of the increased activity being due to conservation of the enzyme by solution of protecting bodies. Reference to a recently published paper (Contributions to the Bio-chemistry of Barley, Jour. Inst. Brew., 1908, 61; this J., 1908, 239), in which we describe certain methods for the estimation of the amylase of resting barley, will provide reasons for this opinion. In connection with the investigation on barley, just mentioned, some comparative experiments were made with wheaten flours, an extension of which we record here. In making these comparisons it was not our intention to subject wheaten flours to exhaustive examination, but these whilst exhibiting a marked resemblance to barley flours in certain directions, also show such wide differences in the behaviour of their amylase in other respects, that we have felt compelled to carry the inquiry somewhat further, more particularly as our results seem to have some bearing on the problem of the strength or baking value of flours, a subject with which, we hasten to mention, we do not pretend to be familiar. In the paper referred to, it was demonstrated that barley contains a very large and hitherto unsuspected amount of amylase, which may be rendered soluble and extracted under conditions which preserve its activity, by the use of a suitable proteolyst. A full description of the mode of using this "solvent" is given in the paper mentioned and to it, for details, we must refer those interested. It is sufficient to state here that the proteolyst papain was found most suitable for use in this connection with barley, and the same is in the main true in the case of wheaten flours. These however differ in certain respects from entire barley meals and barley flours, and the conditions for the use of papain in estimating the amount of amylolytic ferment are not quite so simple, nor are the results quite so concordant, still much valuable information may be obtained by the application of this method, even though it is far from ideal.

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* A decrease of activity, though to a much less degree, may sometimes be observed in the extraction (under similar conditions) of ground barley, when this is prolonged beyond two or three hours.

When wheaten flours are digested for a few hours with active papain, the filtered extracts so obtained are found to exhibit a very high amylolytic activity. In the case of the Hungarian flour used for the experiments in Table 3 the activity corresponded to the production of 27·4 grms. of maltose per 1 grm. of dry flour. This is by no means a high value as even in our somewhat limited experience high grade Canadian flours have given as great a figure as 48 grams maltose. The mode of operation we adopted provisionally for the determination of this value (which for convenience we shall term "total amylase") is as follows :—2 grams of the flour are digested with 50 c.c. of a 1 per cent. solution of active papain for 18 hours at 30°, the solution is then filtered and ½ c.c. of this is added to 70 c.c. of starch solution (containing 2 grms. of starch) at 40°, after 30 minutes the action is stopped by the addition of 5 c.c. of soda solution (10 grms. per litre). These conditions give concordant results, but it is preferable to dilute 25 c c. of the filtered solution to 100 c.c., to use 1 c.c. of this and to allow the action to proceed for 1 hour. The same values are obtained by either manner of working, but it is obvious that with the more concentrated solution greater precision of measurement of extract and of time is necessary ; with a suitable pipette and a stopwatch this precision is a simple matter. Departure from the conditions of dilution, *i.e.*, ratio of flour to solvent, is not admissible and we are not prepared to say that the values obtained are the maximum. Doubling the amount of active papain does not alter the value, but the addition of a small quantity of a neutral salt (potassium chloride) slightly augments it. The increases, however, practically fall within the limits of experimental error. The amylase of wheat, like highly purified preparations of amylolytic enzymes from other sources (*see* J. Chem. Soc., 1906, 78 ; this J., 1906, 228) does not exhibit its full hydrolytic activity except in presence of a certain salt concentration. As the amount of salts (soluble) in wheaten flours though not great, varies considerably it seems advisable to add a quantity of a neutral salt (*e.g.*, potassium chloride) to the papain solution and also to the soluble starch. A tentative explanation of this influence of neutral salts is given in our paper on barley (*loc. cit.* p. 74). Suitable quantities to employ, are for the papain 0·5 grm., and for the soluble starch 0·25 grm., per 100 c.c. These amounts regulate variations of salt content of the wheats, papain, and starch preparations, and tend to ensure uniformity of results. The function of the active papain is a dual one ; it apparently liberates a certain amount of amylase which is present in an insoluble form as part of a molecular complex, and also prevents its destruction as well as that of the soluble portion of the ferment. A comparison of the amylolytic activities obtained by treatment with active and passive papain shows that the amount of "insoluble" amylase is very variable, ranging from 20 to 60 per cent. of the total. The passive papain figure is however somewhat indeterminate, the addition of small amounts of neutral salts either to the starch or the papain solution increasing the value. For the purpose of a simple comparison between the active and passive proteolyst values, for a given sample, this is not of much moment as the salt concentration can be kept constant, but when we attempt to utilise these values *i.e.* the ratio of soluble to total enzyme, as a means of differentiation between flours of diverse origin, this variation with the salt content introduces a possibility of error which however can only be slight in amount if potassium chloride is added as we have suggested. Before discussing the papain values further, we may refer to another attempt made to find a basis for differentiation, this was an autodigestion of the flours at 30°. . The two samples Nos. 1 and 2, of Table 1, when digested with water at 30° (with addition of nitrobenzene as an antiseptic) behaved as follows :—

Table 4.—"*Autodigestion*" *of wheaten flours.*
20 grms. per ½ litre.

	Grms. maltose per 1 grm. flour.	
	No. 1.	No. 2.
After 1 hour...........	2·87	11·83
,, 3 ,, ...	2·87	11·90
,, 4 ,, ...	2·80	11·69
,, 5 ,, ...	2·66	11·34
,, 26 ,, ...	2·52	12·74

It will be noticed that sample No. 1 falls in value whereas No. 2 shows an increase after 5 hours. From this behaviour we surmised that No. 2 flour contained a proteolytic enzyme, on fuller investigation this was found to be the case, but we shall return to the question of this proteolyst later. Now in such a method of "autodigestion" it would appear at first sight, from the differences exhibited by the above flours, that the equilibrium attained under constant conditions of time and dilution, might prove of service as a differential test. This is true to some extent provided the starch used is also a constant. That is to say concordant results representing a composite something—a balance of solution and destruction—can be obtained, but such extracts containing destroyed, partially destroyed, and active amylase yield results which depend to some degree on the salt concentration of the starch preparation used for the hydrolysis, hence the method is not applicable for general employment.

As it seemed possible that the diastatic powers revealed by proteolysis with papain, represented an approach to absolute values, it was thought desirable to extend the examination to various flours. It is generally admitted that one important factor of the strength of wheat in bread making is the capacity of gas formation (*see* Humphries, Brit. Assoc. Rep., 1907), and as it is apparent that the greater part of the carbon dioxide liberated in panary fermentation must be derived from the starch of the flour by the intervention of diastatic action, it seemed likely that flours with the greatest amount of amylase would, other things being equal, stand highest in baking value. A slight calculation shows that the pre-existent sugars in wheaten flour can only account for a small proportion of the carbonic acid formed. Taking as an example a N. Manitoba flour which when fermented in the usual way with yeast, yielded some 350 c.c. of gas per 20 grms. : this corresponds roughly with the fermentation of 1·3 grm. of sugar or 6½ per cent. on the flour. This flour was found when extracted with water, after destruction of the amylase in the manner described by one of us (Analyst, 1904, 277 ; this J., 1904, 953), to contain 0·82 per cent. of sucrose and 0·1 per cent. of a reducing sugar. Manifestly then, amylolytic action plays a prominent part in providing sugar for the fermentation. Direct experiment by the conventional fermentation test did not yield values in complete accord with the amylase results, this however is only to be expected, for the amylase is not the sole governing factor ; such conditions as the state of the starch, nature of the soluble matters of the flours, their bacterial contamination and that of the yeast as well as its type, have also a large influence on the rapidity and amount of gas production. In order to find how far the amylase values corresponded to baking quality, we communicated with Mr. A. E. Humphries, Ex-President of The National Association of Millers of Great Britain and Ireland, who kindly sent us five samples, of "baking value" known to him. These samples which were marked as under, gave the following results as regards total amylase.

Sample.	Grms. maltose per 1 grm. dry flour.
A	26·8
B	29·2
C	43·2
D	34·3
E	35·8

The flour " D " was found, in the manner indicated, to contain an active proteolytic enzyme. Now as a few experiments showed us that this enzyme had an extremely detrimental influence on the tenacity of the gluten and hence on the property of gas retention, we placed this flour last as regards baking value and the others in the order of their amylase content thus :—C, E, B, A, and D. Mr. Humphries informed us, on receipt of this classification, that it was correct as regards the order of baking value. This result looked rather hopeful, but the number of samples examined was hardly sufficient to warrant overconfidence in a classification by two factors, consequently Mr. Humphries kindly sent other seven flours of different origin which when tested in a similar manner gave total amylase as follows :—

Sample.	Grms. maltose per 1 grm. dry flour.
F	46·8
G	25·4
H	32·3
I	31·7
J	38·8
K	29·6
L	22·1

The sample " L " contained an active proteolyst in even greater amount than " D," it was consequently on this account as well as owing to its low amylase figure, placed last and the others arranged in the order of their " activities " thus F, J, H, I, K, G, and L, or combining both lots the order became F, C, J, E, H, I, K, B, A, G, D, L. On communicating with Mr. Humphries he informed us that actual baking trials yielded the following results :—

TABLE 5.

Sample flour.	Strength Bakers' marks.	Value Total amylase.	Arrangement by	
			Baking.	Amylase.
A	68	26·8	C	F
B	70	29·2	J	C
C	96	43·2	K	J
D	40	34·3	F	E
E	76 to 86[*]	35·8	H	H
F	88	46·8	I	I
G	68	25·4	E	K
H	85	32·3	B	B
I	85	31·7	G	A
J	92	38·8	A	G
K	90	29·6	D	D
L	35	22·1	L	L

[*] A notable increase of strength with age. E might therefore be placed above H in the order of " baking value."

For convenience of reference, the amylase values and classification by these are included in the above table. The results of the examination of this more extended set of samples shows, not greatly to our surprise, that potential gas producing power, as measured by the total amylase of the flours, qualified by the presence or absence of an active proteolyst is not sufficient to assess their baking value. It however indicates that in developing a method of evaluation the total amylase is one important factor, also that the presence of a proteolytic ferment is another and possibly more valuable, consideration. Now though we all along recognised that the capacity of gas retention must of necessity be another of the factors to be considered, we preferred to attempt a classification on the basis of amylase alone on the chance that such might connote proportionately the condition or amount of the " gluten," but apparently it does not do so. The question of the amount of gluten has received attention from many workers and its condition as affected by salts, etc., has recently been raised and investigated by T. B. Wood (Jour. Agric. Sc., 1907, 267 ; this J., 1908, 175), and into this aspect of the question of baking strength we are therefore unable to enter to any extent. We have however made a slightly extended examination of the sample " F " which by its amylase value is so misplaced in the series. This flour Mr. Humphries informs us " gives an extraordinary amount of gas, but the dough does not hold it." From this it is evident that if the " gluten " factor were considered the flour would be differently placed. Now this sample though it does not contain an active proteolyst shows more resemblance to the sample " D " in respects to its soluble nitrogenous constituents[*] than it does to sample " C." The salts and soluble matters are also high and it is therefore probable that in the original grain the metabolism of the endosperm has not attained the stage of maturity characteristic of the wheat from which " C " was milled. This notwithstanding the possibility of similarity of climatic conditions under which these two wheats were grown. It would be interesting to know how far post-maturation (such as is brought about by kiln drying and subsequent storage of barleys) might induce advantageous changes in wheats which do not yield flour of satisfactory quality when milled newly thrashed.

Another point which might repay investigation, is the influence of the salt (sodium chloride) used as a condiment in bread making. It is evident, from our results, that very small amounts of saline substances are capable of greatly augmenting the solution, conservation and activity of the amylase, and the salt so used may thus (leaving out of account other possibilities) indirectly increase gas production. The employment of such adjuncts as yeast foods or malt extracts containing amphoteric substances may also give rise (quite apart from any specific influence due to sugars or amylolytic ferments contained in them) to a like effect.

The protease.—The presence of an active proteolyst in wheaten flours does not seem to have been demonstrated yet by other workers. As we have already stated, it is possible by a combination of amylase determinations to deduce its presence ; the method, however, is much too troublesome to merit employment, especially as the presence of the enzyme may readily be detected by a modification of the usual gelatine test. For this purpose we add 5 grms. of the flour to 50 c.c. of 1·5 per cent. gelatin (pure) solution saturated with nitrobenzene, the mixture is digested at 35° for at least 48 hours. By this test such samples as " D " and " L " show obvious liquefaction. A concentrated aqueous extract of the flour plus gelatine to 1·5 per cent. may also be used, in which case a satisfactory passive control with an equal volume of boiled extract can be carried out. As little is known about the conditions of extraction of this protease, we prefer to test the solid flour,[†] using as a control another flour known to be free from a proteolyst. The gelatin method in this application is unfortunately not quantitative ; we have tried to render it so, by determination of the resulting viscosities, but without success. We have also endeavoured to employ the method proposed by Sörenson (Compt. rend. Carlsberg, 1907, 7, 1), but the amount of enzyme present is too small for the successful application of this elegant device. The use of polypeptides after Abderhalden was also inadequate, and failure attended other processes devised by ourselves, as for example the determination of the amount of change in the nature of the nitrogenous matter in extracts of the wheats, etc.

It seemed advisable to establish by direct experiment on a practical scale, how very detrimental an active proteolyst is to the gas retaining capacity of " gluten," and for this purpose we sent Mr. Humphries a preparation of protease equal in activity to about five times that present in " D." Mr. Humphries kindly carried out baking trials with the active, and an equal amount of passive proteolyst and a control without addition, all with the same high-class flour. He reported that there was no difference between the passive batch and the control, but that within a quarter of an hour the dough of the active showed most conclusively that something very abnormal was taking place. The final loaf was quite useless. "It had practically failed to 'rise' at all and the crumb was devoid of tenacity." Subsequently we sent Mr. Humphries about one-fifth the amount of enzyme, actually 0·5 grm. of a crude preparation, which he added to a baking of 12 lb. of flour. A control with passive enzyme and also one without was carried out. The results were as follows:—

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[*] We would point out that the work of H. A. Guess (J. Amer. Chem. Soc., 1900, 263 ; this J., 1900, 695) shows that though the ratios of the various proteins do not indicate the true " baking value " of a flour they have some intimate connection with it.

[†] The use of solid flour in the manner suggested is convenient as a preliminary test. It is advisable, however, to confirm positive indications by the examination of active and passive aqueous extracts, as it has been shown by Dastre and Floresco (Compt. rend., 1895, 121, 615) that long continued heating of gelatin solution in presence of certain salts gives rise to loss of its property of solidifying.

	Bakers' marks.
Control	90
Active	85
Passive	94

Mr. Humphries remarks that, "the active had a depreciating effect, but not to a very great extent; however, it was a real effect that would quickly be appreciated by a miller or baker." He also adds that by other tests he proved to his satisfaction that, "it was gas retention and not gas making which this proteolytic enzyme had affected."

The above experiments suggest a reason why certain preparations of malt extract prove unsuitable for use as baking adjuncts; they also provide one explanation for the cause of what is known as "rotten gluten," and show conclusively why certain classes of wheats give flours of low baking value, quite apart from other considerations. It is interesting to note that the flour "L" previously mentioned was made from English wheat grown on Plot 10, Rothamstead, a plot which has been manured continuously for about 60 years with ammonium salts.

How far the presence of a proteolyst in wheaten flours is due to racial, climatic, or soil influences is a subject for future investigation.

In concluding we have much pleasure in acknowledging our indebtedness to Mr. Humphries for kindly supplying us with many samples and much information.

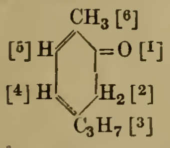
THE IODINE VALUES OF THE PHENOLS.

BY ERNEST WAKE AND HARRY INGLE.

(This J., April 15, 1908, pp. 315—316.)

ERRATA.

The structural formula for carvacrol (p. 316) should be



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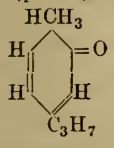

II.

Yorkshire Section.

Meeting held at the University of Sheffield on Wednesday, March 18, 1908.

MR. F. W. BRANSON IN THE CHAIR.

THE RECOVERY OF CYANOGEN COMPOUNDS IN THE DRY DISTILLATION OF COAL, AND THE DISPOSAL OF EFFLUENTS FROM AMMONIA STILLS.

BY DR. J. GROSSMANN.

The process which I published two years ago (this J., 1906, 411) aimed chiefly at the avoidance of noxious effluents in the manufacture of ammonium sulphate, which frequently, when once formed, are difficult to dispose of. It is, however, not every gas or coke works which has difficulties in that direction, and the question of the recovery of cyanogen compounds and that of the disposal of the effluents from the ammonia stills need, therefore, not go hand in hand.

For the last thirty years various processes have been proposed dealing with the problem of extracting cyanogen compounds from the crude coal gases, chiefly in the manufacture of illuminating gas, generally with a view to producing ferrocyanide compounds in an insoluble form. The best known of these processes are those of Foulis, Bueb, etc. They require considerable alteration in plant, and the working up of the cyanogen compounds into commercial ferrocyanide is complicated by the presence of ammonia in the crude products and requires skilled supervision. Within recent years, chiefly in consequence of a new outlet for sulphocyanides, inventors have aimed at obtaining the latter from the crude gas. But as cyanogen in the shape of ferrocyanide has more than double the value of cyanogen in the shape of sulphocyanide, it is evident, apart from other reasons, that it is more advantageous to aim at the production of ferrocyanides.

Although the presumption has been strong that all the cyanogen in crude coal gas is originally present in the state of hydrocyanic acid or ammonium cyanide, the fact that such is indisputably the case has only lately been proved by the work of R. Forbes Carpenter and Linder, and which is recorded in the Annual Reports on Alkali, etc., Works presented to the Local Government Board. Their researches show that the crude gas contains cyanogen only as hydrocyanic acid or ammonium cyanide, and that, in the absence of air during or after condensation, ammonia liquors contain all the cyanogen as ammonium cyanide, so that whatever sulphocyanide or ferrocyanide may be found in these liquors, is due to secondary action. The sulphocyanide is due to the presence of ammonium bisulphide or polysulphide which acts on ammonium cyanide according to the equation: $NH_4.CN+(NH_4)_2S_2=NH_4.CNS+(NH_4)_2S$. But the ammonium bisulphide is a secondary product, which has been formed from the ammonium sulphide by oxidation due to the presence of air: $2(NH_4)_2S+O=(NH_4)_2S_2+2NH_3+H_2O$. In like manner ammonium cyanide has no strong action on metallic iron; but if the iron of the vessels containing the crude ammonia liquors, or of other parts of the apparatus coming into contact with them, has become oxidised, ferrocyanide is freely formed.

It is thus evident that the cyanogen may be recovered from crude ammonia liquors either altogether as ferrocyanide or as sulphocyanide so long as care be taken to perform the necessary operations within a short time after the liquors have been produced, and particularly before their composition has been changed by access of air; and as sulphocyanides, as stated before, are of less commercial value than ferrocyanides the problem before me was how the conversion of ammonium cyanide into ferrocyanide could be best effected. It is well known that the alkali ferrocyanides, including ammonium ferrocyanide as such, are easily soluble; and that they form double compounds which in some cases are insoluble in other cases difficultly soluble. The difficulty which presented itself at the outset of my experiments was that on agitating ammonia liquors with an excess of ferrous oxide or carbonate, I generally obtained part of the ferrocyanide formed in solution and part as an insoluble or difficultly soluble precipitate. As the quantity of cyanide present in crude ammonia liquors varies considerably it is necessary, in order to render any method aiming at the production of ferrocyanide practicable, to use a large excess of the iron compounds; it will also be expedient to obtain the ferrocyanide of ammonia completely as such in solution, free from insoluble ammonium ferrocyanides; for the recovery operations in the case of insoluble double compounds with ammonia become complicated. I have found that these conditions are fulfilled, if the action of an iron compound on ammonium cyanide takes place in the presence of a sufficient excess of ammonium sulphide. Under such conditions only soluble ammonium ferrocyanide is produced.

The most suitable iron compound for the purpose is evidently ferrous sulphide. As previously stated it is necessary to use a considerable excess of ferrous sulphide, and as the quantity of cyanogen compounds in ammonia liquors varies at different times even in the same works, the quantity of iron sulphide must be such as to ensure an excess being present even at times when the liquors contain the maximum amount of cyanogen. A convenient way of arriving at the quantity of iron sulphide required consists in taking an average sample of the liquors, determining the amount of ammonium cyanide in it, dividing it into several portions and adding to the respective portions 3, 5, 7 times the quantity of precipitated iron sulphide which would be theoretically required according to the test. The samples are well shaken up and left to stand. The proportion of the volume of precipitate to the volume of clear liquor is noted after settling. The liquors are tested for ferrocyanide; that sample which shows the least amount of settled precipitate with complete conversion of the cyanogen compounds into ferrocyanide will indicate the most suitable amount of iron sulphide to be used on a large scale. If it were practicable to perform the conversion of cyanide into ferrocyanide by using only such an amount of an iron compound as would be exactly equivalent to that required by theory, it would be possible to use such compounds as will, by the action of the sulphide present in the crude liquors be converted into ferrous sulphide; for the quantity of cyanide in the liquors as compared with the amount of sulphide present is but small. As it is, however, necessary to use a multiple of the theoretical quantity of iron required too much sulphide would be removed from the liquors, by using iron compounds other than sulphide. The process, however, can be simplified in the following manner. Supposing it had been decided to use five times the theoretical quantity of iron sulphide in each operation, it is clear that on an average one-fifth of this quantity would go into solution and four-fifths would remain in the original insoluble form. This four-fifths can be used in the next operation and will require only another fifth of the standard quantity of iron sulphide in order to reproduce the condition which existed in the first operation; but instead of being added as iron sulphide it may in many cases, that is, where the liquors contain a sufficient amount of ammonium sulphide, be added either in the form of ferrous chloride, or in some other more convenient form than iron sulphide. To give a concrete instance of an operation on a large scale we will assume that we have to dispose of ten thousand gallons of crude ammonia liquor per day containing 1200 lb. of ammonia with 5 per cent. of cyanogen equal to 102 lb. of ammonium cyanide. The theoretical quantity of ferrous sulphide necessary for converting this into ferrocyanide is one third, *i.e.* 34 lb. An experiment in the laboratory has shown us that it is advisable to use five times that amount, *i.e.* 170 lb. of ferrous sulphide. We might then prepare a stock of ferrous sulphide sufficient for the treatment of 2,000 gallons of liquor or more and of such strength as to contain a known quantity, say one pound of ferrous sulphide per gallon. In order to facilitate the explanation we will assume that we performed each operation separately with one thousand gallons of crude ammonia liquor. We should place that quantity in a tank provided with an agitator and add 17 gallons of ferrous sulphide emulsion to it. After agitating for an hour or more the liquor would be pumped into the store tank supplying the ammonia still and the bottoms containing the sediment would be pumped back into the agitating tank. The next operation would be performed by adding to them another thousand gallons of crude liquor, and a further quantity of 3.4 gallons of ferrous sulphide which, with the settlings from the first operation, would bring up the total quantity of ferrous sulphide to 17 lb. But instead of using ferrous sulphide we may use ferrous chloride or other suitable compounds of iron equivalent to the 3·4 lb. of ferrous sulphide required, without fear of withdrawing too much ammonium sulphide. The settlings of the second operation may go to the third operation with a further addition of 3·4 lb. of ferrous sulphide or its equivalent in ferrous chloride. In this manner the necessary excess of ammonium sulphide is maintained at the point which is required to ensure complete solution of the ferrocyanide formed. For the sake of clearness we have assumed that we are working intermittently in batches of 1000 gallons. It will, however, be more convenient to work continuously in a properly constructed washer, and to regulate the addition of ferrous sulphide, or of a mixture of ferrous sulphide and ferrous chloride, so as to ensure the proper quantity of these compounds being at all times mixed with the ammonia liquor. In this case, the settlings are collected in a store tank, and the quantity required for the conversion of the ammonium cyanide will be determined by test. It is evident, whether the operation be performed intermittently or continuously, that once a sufficient stock of ferrous sulphide is prepared it will not be necessary to use any more of this compound except in the special circumstances, where the amount of ammonium sulphide present in the liquors is abnormally small. Whatever unavoidable shrinkage of iron sulphide will occur in the course of time through mechanical losses can be balanced by increasing the quantity of ferrous chloride to a corresponding extent. It is necessary that the crude liquor should be used as fresh as possible, but it should be well settled and free from tar before being treated with iron. After treatment and settling the clear liquor is passed through the ammonia still in the same manner as at present. The effluent leaving the still has the same composition qualitatively as at present; it will, however, contain more ferrocyanide and less sulphocyanide. It is settled in the usual way and the ferrocyanide precipitated by ferrous or ferric chloride as insoluble ferrous ferrocyanide or as Prussian Blue, either of which can be easily converted into marketable sodium ferrocyanide. The effluent from which the ferrocyanide has thus been eliminated may still injuriously affect streams and other water courses, for although the quantity of sulphocyanide present will be less than that contained in the present effluents, tar oils and thiosulphates will still render it objectionable. Before explaining my method of dealing with the effluent as obtained at present, or as obtained by the process described above, in such places where its discharge into a water course or sewer is impracticable, I may briefly state how that difficulty is at present overcome. In some places which are particularly favourably situated these liquors are run into disused pits; and where the geological substratum of the pits consists of clay, or is otherwise such as to prevent the effluent from filtering through, that mode of disposal is certainly the simplest. But there should be no doubt in such cases that the effluent is effectually retained in the pit; for if it were to filter through, it might find its way into courses which are used for domestic water supply and cause serious trouble. I need not go into the question of evaporating the liquors to dryness, as even when it is done in Porion or similar special apparatus the operation is costly. In some places the effluent has been tried for coal washing, but for obvious reasons this is not a solution of the question. In others it is said to be used for coke quenching, with what results it is difficult to ascertain. It is stated by manufacturers that coke which has been quenched with effluent deteriorates in colour, is looked upon with suspicion by those who use it for blast furnace and cupola work and other metallurgical operations, and only saleable at reduced prices. From a purely chemical point of view it should not be materially affected, for the total quantity of solids in an effluent arising from the carbonisation of 200 tons of coal per day being about 1000 lb., containing lime, 500 lb., sulphur, 50 lb., chlorine, 500 lb., the percentage of impurities added to the coke would only amount to ·20 per cent. of lime, ·02 per cent. of sulphur, and ·20 per cent. of chlorine. But wherever the effluent is used in this manner special arrangements should be made by which the drainings from the coke quenching bed could be collected, and probably part of the liquor would still have to be dealt with somehow. There appears to me another difficulty likely to arise. If the liquors had been treated for the conversion of cyanide into ferrocyanide, and the latter had been eliminated as explained above, and if the quantity of sulphocyanide present were small, it is possible that no particular nuisance will be created in the atmospheric conditions by using the effluent for coke quenching; but in the case of effluents as produced at present it appears probable that highly poisonous and otherwise objectionable vapours will be evolved, which may seriously interfere with the health of the workers.

Attempts have been made to use the effluents in boilers for steam raising and thus concentrate them to a volume which can ultimately be brought to dryness at little or no expense. These attempts have so far failed; in my opinion chiefly for the reason that there is such an amount of scale-forming calcium sulphate present in the effluent in solution as renders them unfit for boilers. I am aware that this is contrary to the general opinion that the corrosion in boilers which is said to occur by the use of the effluent is due to the presence of sulphocyanide. I have, however, satisfied myself by a series of experiments, which I hope to publish shortly, and by which I have studied the relative corrosiveness of waters and solutions by a simple method which I have designed for the purpose, that under proper conditions the effluent from ammonia stills even when it contains an abnormal quantity of sulphocyanide has no serious corrosive action on wrought iron and steel at a pressure of 40 to 50 lb. per square inch. I have, on the other hand, found that it is possible to remove all the sulphates present in effluents from ammonia stills by means of barium carbonate; in the case of calcium sulphate the reaction is as follows: $CaSO_4+BaCO_3=CaCO_3+BaSO_4$. It is a curious fact that on shaking up a solution of calcium sulphate with barium carbonate even for a considerable time a sample on filtering will apparently show that no decomposition has been taking place, as it will give a strong precipitate with barium chloride. But after settling for 8 or 10 hours or more the clear liquor will be absolutely free from sulphate, and give no precipitate on the addition of barium chloride. For practical reasons it is advisable to work with excess of the quantity of the barium carbonate required by theory, and this I effect in a manner similar to that shown in the conversion of ammonium cyanide into ferrocyanide. I determine in the first place the quantity of total actual sulphate present as such in the liquor. Supposing that quantity to be equal to 50 lb. of calcium sulphate in 10,000 gallons, and supposing the apparatus could treat that quantity at once, in the first place three times the equivalent required might be added, say $3\times86=258$ lb. of barium carbonate. The settlings from this operation could then be used for a second operation, adding only such an amount of fresh barium carbonate as would replace the amount which has been used in the previous operation, that is 86 lb. In this manner, when it becomes necessary to withdraw the precipitate on account of its bulk after twenty operations, there would only be a loss of 10 per cent. of barium carbonate. The precipitate ultimately will mainly consist of barium sulphate and calcium carbonate which can easily be separated by levigation, and as barium sulphate has a commercial value, the quantity recovered in this way will serve to partially cover the expenses of the purification process. The effluent after having been agitated with barium carbonate, an operation which also may be performed in a continuous washer, is passed through settling tanks. After twelve hours, or thereabouts, the settled liquor is sufficiently clear to be used in the boilers. It need hardly be mentioned that when used in steam boilers, after some time a certain quantity will have to be blown off every day, so as not to allow the liquors in the boilers to go beyond a certain concentration. These blow offs, as well as the final blow off at the time of boiler cleaning, may be treated for the recovery of thiosulphate or sulphocyanide, or evaporated to dryness in a special furnace; its bulk will be reduced to a quantity which can be easily and cheaply dealt with, *i.e.*, to $\frac{1}{10}$ or even less of the original volume.

The cost of eliminating the sulphates from the effluents will come to from one farthing to one halfpenny per ton of coal carbonised; where my first process of converting cyanide into ferrocyanide has been used, that amount becomes almost a negligible quantity.

Reverting to the first process which I described in this paper, and which has no intrinsic connection with the second process of utilising the effluent for steam raising, we find that the advantages derived from it are twofold. It has been conclusively shown by R. Forbes Carpenter and Linder's work, to which I have previously referred, that in the distillation of crude ammonia liquors hydrocyanic acid is evolved and that, therefore, the vapours and condensation products obtained in the process of distillation are highly poisonous, and liable to lead to serious accidents. Probably fatal gassing cases which in the past have been ascribed to the action of sulphuretted hydrogen only, have been due to the action of hydrocyanic acid as well. This state of affairs will be completely remedied by the conversion of ammonium cyanide into ferrocyanide, as the evolution of poisonous cyanogen compounds cannot take place after ammonium cyanide has been eliminated from the crude liquors. And whilst the working of the ammonia plant is thus improved from a hygienic point, such an improvement will not only entail no extra charge on the manufacturer, but will actually yield him a further profit. From the many data carefully ascertained by Forbes Carpenter and Linder, it appears that the average quantity of sodium ferrocyanide obtainable per ton of coal carbonised, amounts in coke ovens to about 1·1 lb. and in gas works to about 1·6 lb. The cost for chemicals and working expenses comes to about one penny per lb. of ferrocyanide, leaving a clear margin of about 2¾d. per ton of coal in coke works, and over 4d. per ton of coal in gas works. These estimates are based on averages; in some works the results obtainable will be better, in others worse; the actual results obtainable in each case can be easily ascertained by laboratory tests.

The processes which are used for the extraction of cyanogen from the *gases* are said to yield from three to six pounds of ferrocyanide of sodium per ton of coal carbonised in gas works. Taking the average at four pounds per ton of coal, it will be seen on comparing with it the average of 1·6 lb. per ton of coal obtainable from the crude ammonia *liquors* that there is a discrepancy of 2·4 lb. Part of this difference may be accounted for by the fact that, in the ordinary way of working, cyanogen compounds pass on to the oxide purifiers; but even allowing for the loss in cyanogen which takes place in the revivifying reactions the amount of cyanogen absorbed by the purifiers does not appear to cover the discrepancy. This opens up the important question whether the extra quantity of cyanogen recovered by the processes which deal with the gases before they are passed through the ammonia absorbing plant may not be obtained at a cost of a corresponding quantity of ammonia being lost, which otherwise would have been obtained as such. It is well known that hydrocyanic acid and ammonium cyanide in the presence of alkalis and oxygen become decomposed into carbamates, and ultimately into carbonates, according to the equation: $NH_4CN+2H_2O+O=(NH_4)_2CO_3$. It is quite possible that this reaction may take place in the absorbing apparatus, but not in the washers which are used in Bueb's and similar processes. If it should be found in practice that such is the case, it will considerably alter the commercial aspect of the recovery of cyanogen compounds from the crude *gases*, and add a further factor in favour of the recovery of cyanogen compounds from the *liquors*.

Journal and Patent Literature.

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I.—PLANT, APPARATUS, AND MACHINERY.

Patents.

Drying coal, coke, slag and other materials; Machines for ——. J. Black, A. H., H. and A. B. Lennox, Newcastle-on-Tyne. Eng. Pat. 12,087, May 24, 1907.

The apparatus consists of two concentric vertical cylindrical casings, the inner one being mounted on bearings and rotated from above by suitable gearing and provided with horizontal shelves, spaced apart, which extend to, but do not touch the outer casing, and divide the annular space into superposed compartments. The material is fed on to the top shelf through a hopper placed at the side, and is spread out in an even layer by a plate fixed tangentially to the inner cylinder. It is carried round as the shelf rotates and then discharged by a scraper plate, also fixed tangentially to the inner cylinder, on to a shoot fixed in a vertical box which connects the first with the second shelf. From the box the shoot discharges the material on to the second shelf. In this way the material is caused to pass round each shelf and from and shelf to shelf, till it reaches the lowest, from which it is discharged. Hot air or gas is introduced below the lowest shelf and passes round, in the opposite direction to the material, on to which it is deflected by partitions, and rises from shelf to shelf by external connecting pipes.—W. H. C.

Dryer; Continuous —— for materials liable to be damaged by too high a temperature or by impurities. G. de Vaux and A. Veyrat. Fr. Pat. 384,088, Nov. 16, 1907.

The materials to be dried are fed through a shoot into a horizontal drying tube, which is supported on rollers, and rotated by any suitable means. The material is moved forward in the tube by scrapers, and is finally discharged at the further end into a trough, from which it is removed by a screw conveyor. Products of combustion from a furnace, pass through a series of gilled tubes constituting an air heater, and then through a tube, fixed eccentrically within the drying tube. From the further end of this inner tube, the gases pass into a closed chamber, and then return through an underground flue into a chamber surrounding the central part of the drying tube, from which they are withdrawn by a fan. Air passes through the space between the double walls of the furnace, then over the gilled heating pipes of the air heater, through a chamber surrounding the inlet end of the drying tube, and finally over the material in the drying tube, being withdrawn, along with the vapour given off, by a second fan. Any material which has become attached to the outside of the inner tube, is removed by brushes fixed to the inner wall of the drying tube. As the inner tube is mounted eccentrically to the outer tube, the brushes only touch the surface of the former for a short time and do not wear out quickly.—W. H. C.

Separating the constituent elements of gaseous mixtures; Apparatus for ——. E. Mazza, Turin, Italy. Eng. Pat. 13,598, June 12, 1907.

See Addition of March 27, 1907, to Fr. Pat. 365,534 of 1906; this J., 1907, 999.—T. F. B.

Evaporator. E. Zaremba, Chicago, Ill. U.S. Pat. 882,043, Mar. 17, 1908.

The evaporator comprises a vertical cylindrical shell with two external steam-chests connected by horizontal tubes which pass centrally across the vessel below the level of the liquid. The liquid circulates upwards in the central zone of the vessel between the tubes and downwards at either side of the system of tubes.—A. T. L.

Concentrating liquids; Apparatus for ——. P. Kestner, Lille, France, Assignor to Kestner Evaporator Co., Philadelphia. U.S. Pat. 882,322, March 17, 1908.

See Eng. Pat. 18,576 of 1907; this J., 1908, 13.—T. F. B.

Refrigeration at low temperatures and liquefaction of gases; Process and apparatus for ——. G. Hildebrandt. Fr. Pat. 384,139, Nov. 18, 1907.

A gas which requires a very low temperature for its liquefaction is mixed with a gas which can be liquefied at a higher temperature. The mixture is compressed and then passed through a water cooler. The cooled compressed gas then passes through a coil into an expansion chamber where the condensation of the gas which liquefies at the higher temperature takes place. The non-liquefied portion is passed through a second coil into a second expansion chamber where it is also liquefied. The liquid is partly withdrawn and partly re-vaporised and passed over the second coil, and the gas first liquefied is re-vaporised and passed over the first coil.—W. H. C.

II.—FUEL, GAS, AND LIGHT.

Patents.

Petroleum, alcohol, benzol and other similar materials [*as fuel for explosion motors*]*; Improvement of* ——. R. Wynne. Fr. Pat. 384,177, Nov. 20, 1907.

Petroleum, benzol, etc., especially petroleum of sp. gr. 0·725—0·800 are improved by passing oxides of nitrogen through them, either with or without the addition of acetylene, carbon dioxide, hydrogen and oxygen.
—W. H. C.

Gaseous products of combustion; Filtration of ——. W. F. L. Beth. Fr. Pat. 384,120, Nov. 18, 1907. Under Int. Conv., Nov. 20, 1906.

In order to prevent the clogging of the filtering medium, a coagulating material is introduced into the waste gases before they enter the filter.—W. H. C.

Gas generators. E. Lorin, Doulaincourt, France. Eng. Pat. 7805, April 3, 1907. Under Int. Conv., April 4, 1906.

See Fr. Pat. 364,893 of 1906; this J., 1906, 920.—T. F. B.

[*Oil-*] *gas; Process of making* ——. L. P. Lowe, San Francisco. U.S. Pat. 882,764, Mar. 24, 1908.

A vertical chamber containing loosely piled refractory material, and provided with a gas-outlet at about a third of its height, is highly heated by passing the products of combustion of oil and air through the entire length of the chamber. Gas is then made by introducing oil at the base of the chamber and also at a point midway between the gas-outlet and the top, steam being introduced at the top so as to be superheated in the part of the chamber above the upper oil inlet.—A. T. L.

Gas; Apparatus and methods for manufacturing ——. H. M. Pierson, New York. U.S. Pats. 882,907—882,909, Mar. 24, 1908.

(1). The apparatus comprises a generator. having means for introducing air and steam alternately below the grate, and surmounted by a vertical tapered retort containing a fuel column continuous with that in the generator. The retort is constructed of a number of flanged sections supported by the internal flanges of a surrounding shell or casing which is itself supported independently of the generator. The retort is provided at its upper or smaller end with a feeding hopper for bituminous coal, and with outlets for blast and all other gases, and means are provided for introducing liquid hydrocarbon into the retort.

(2). Air is forced into a body of fuel and the producer gas formed is passed directly through a superincumbent body of bituminous fuel. The hot gases are led away for immediate use. The air blast is periodically stopped and steam forced through the body of incandescent fuel and through the bituminous coal, forming water-gas, which is led away through a different conduit and stored for use.

(3). The hot gas formed during the air-blow in the process described under (2) is burned with air to heat up a fixing chamber; during the steam-blow, liquid hydrocarbon is introduced so as to pass with the water-gas through the heated bituminous coal and the mixed gases are passed through the fixing chamber.—A. T. L.

Gas-producer. H. Gerdes, Berlin, Assignor to Olds Gas Power Co., Lansing, Mich. U.S. Pat. 883,131, Mar. 24, 1908.

The producer comprises a vertical cylindrical casing with an inner depending bell beneath the feeding hopper. The bell is surrounded by the current of hot producer gas passing upwards from the bed of incandescent fuel in the lower part of the producer, and forms a distillation chamber for the raw fuel. The distillation gases are drawn off near the top of the column of fuel and are forced by an ejector into a combustion chamber arranged at the side of, and extending along, the hearth of the producer; the products of combustion pass up through the incandescent fuel. Two such combustion chambers may be provided, one at either side of the hearth.—A. T. L.

Incandescence mantles; Finishing bath for ——. Soc. du Bec Français. Fr. Pat. 383,705, Jan. 15, 1907.

The mantles, after incineration, are dipped in a bath consisting of 35 grms. of caoutchouc dissolved in 965 grms. of carbon tetrachloride, to which has been added 2 grms. of a rare earth such as the oxide of zirconium, beryllium, yttrium or erbium. The dried mantles are ready for transport.—A. T. L.

Filaments for electric incandescence lamps; Manufacture of ——. O. Ephrem. Fr. Pat. 383,822, Nov. 11, 1907.

Elastic filaments, which can be used in the form of a single or double loop, are made from a mixture of collodion with 5—25 per cent. of earths, such as thoria, ceria, or magnesia, and 0·1—1 per cent. of very finely powdered or precipitated metals such as tungsten, iridium, osmium, or boron. The preferred proportions are 10 per cent. of earths and 0·2 per cent. of metals. The filaments have a higher efficiency than carbon filaments and are very durable.—A. T. L.

Candles; Manufacture of ——. G. Agostini. Fr. Pat. 383,851, Jan. 19, 1907.

See Eng. Pat. 965 of 1907; this J., 1907, 817.—T. F. B.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

Petroleum; Bustenari ——. S. Aisinmann. Petroleum, 1908, **3**, 565—571.

"Bustenari crude oil" is a generic term applied to a number of oils from the Prahova district, the sp. gr. of which ranges from 0·820 to 0·926, with a mean of 0·854. The content of light fractions (4·1—29·5 per cent.) varies with the density of the crude oil, but, apart from this the yield of lamp oil and solar oil fractions is fairly uniform, viz., fraction between 125° and 150° C., 10 per cent. (sp. gr. 0·760—0·765); 150°—200° C., 15 per cent. (sp. gr. 0·795—0·800); 200°—250° C., 10 per cent. (sp. gr. 0·835—0·840); 250°—270° C., 4 per cent. (sp. gr. 0·860—0·875); 270°—300° C., 7 per cent. (sp. gr. 0·885—0·890). By the aid of preliminary heaters, the bulk of the light fractions ("benzine") is removed before the crude oil reaches the still proper. The oil is fractionated into three principal grades:—crude spirit, 30 per cent. (average); lamp oil, 15 per cent.; and solar oil, 10 per cent.; leaving 42 per cent. of residuum. On re-fractionation the spirit furnishes 37 per cent. of light spirit (sp. gr. 0·715—0·720), 6 per cent. of heavy spirit (sp. gr. 0·750) and 57 per cent. of light petroleum (sp. gr. 0·795—0·800) flashing at 23° C. The proportion of unsaturated and aromatic compounds in these fractions increases with the density; thus *m*-dinitrotoluene has been obtained by nitrating the fraction boiling between 102 and 110° C. The lamp oil has the sp. gr. 0·830—0·832 and flashes at about 40° C., the solar oil (gas oil) gives the following numbers: sp. gr., 0·885—0·890; flashing point, 100°—120° C.; viscosity (Engler), 2·45 at 20° C. and 1·22 at 50° C.; cold test, 20° C.; calorific value, 10,400 cals., sulphur content, 0·3 per cent. In practice, 100 kilos. of this oil yield 85 cb. m. of gas with an illuminating power of 23—28 candles, and containing about 50 per cent. of methane and 32 per cent. of heavy hydrocarbons. The residuum has the sp. gr. 0·945—0·950, flashing point about 140° C., cold test −15° to −20° C., viscosity (Engler) about 10 at 20° C., calorific value, 12,500 cals., and furnishes excellent lubricating oils. The large proportion (about 21—24 per cent.) of olefinic, benzenoid and partially hydrogenised cyclic hydrocarbons in the lamp oil militates against its value as an illuminant, but these can be eliminated by sulphonation, whereby the mean lighting power is raised from 4·4 to 12·3 candles, the consumption per candle power being reduced from 4·7 to 3·1 grms. and the decrease in light at the end of 9 hours reduced from 35·5 to 19·3 per cent. At present this treatment is too expensive for commercial application, but great improvement can be effected by providing a good supply of air in the burner and by warming the air, the provision of a deflecting button above the flame raising the illuminating power from 5·4 to 13·6 per cent. (in a 14-line Kosmos burner), and lowering the consumption from 4·1 to 2·9 grms. per candle.—C. S.

Crude petroleum from Bibi-Eibat; Optical examination of ——. M. Rakusin. J. Russ. Phys.-Chem. Ges., 1908, **39**, 802—814, 1343—1358. Chem. Zentr., 1908, **1**, 1208—1209.

Eight specimens of crude petroleum from Bibi-Eibat examined by the author, were found to be about twice as rich in "carbonised substances" as Balachany crude petroleum, and to approach in character the natural tars. The specimen obtained from the greatest depth (2161 feet) had the sp. gr. 0·8700, and on fractionation yielded distillates which were dextro-rotatory, and gave the same reaction with trichloracetic acid as specimens examined previously (see this J., 1907, 678). With respect to the best conditions for the distillation of crude petroleum, these may be regarded as the more correctly chosen the greater the optical activity of the distillates and the lower the proportion of "carbonised substances" in the residue. The sp. gr., optical activity, etc., of further 47 specimens of Bibi-Eibat crude petroleum and their distillation products are given in a series of tables.—A. S.

Roumanian asphaltum; Products of destructive distillation of ——. K. V. Charitschkow. Rev. de Pétrole, 1 [3]. Petroleum, 1908, **3**, 633—634.

The author has previously obtained by the destructive distillation of a Russian asphaltum, a liquid product which on distillation, yielded up to 150° C. a fraction similar to Grosny benzine. From a Roumanian asphaltum, which on extraction in a Soxhlet apparatus, yielded 48·98 per cent. of bitumen, there were obtained on destructive distillation: water, 4·76; oil, 4·44; and residue, 79·20 per cent. The residue contained 36·06 per cent. of carbon and 63·94 per cent. of mineral matter. On distillation the oil yielded 13·20 per cent. up to 200° C. and 68·37 per cent. of residue similar to that obtained from petroleum. In the author's opinion both asphaltum and crude petroleum are formed directly from acetylene and hydrogen.—A. S.

Petroleum production of Baku in 1907. Petroleum, 1908, 3, 639—640.

According to a report by the German consul at Baku the total production of petroleum in the first 9 months of 1907 amounted to 356,017,073 puds, of which 338,049,048 puds were obtained from wells and 9,363,442 puds from "fountains." The production on the lands leased from the Government amounted to 153,400,943 puds as compared with 138,547,190 puds in the corresponding period of 1906. The average monthly yield for the first 9 months of 1907 was 39,557,453 puds, the corresponding figures for former years being: 1902, 52,960,738; 1903, 49,717,067; 1904, 51,521,825; 1905 (8 months), 43,707,594; and 1906, 37,364,473 puds. On October 1st, the number of borings amounted to 3894, *viz.*, 1210 in Balachany, 1648 in Sabuntschi, 527 in Ramany and 507 in Bibi-Eibat. During the nine months the number of productive soundings amounted to 2094. The average price for crude petroleum was: 1905, 19·93 kopecks; 1906, 25·27; and 1907, 27·66 kopecks per pud. The value of the petroleum produced amounted to: 1905, 81,772,790; 1906, 113,786,500; and 1907, 131,385,000 roubles. *Note.*—1 pud = 36·112 lb.; 1 rouble = 100 kopecks, = 2s. 1½d.—A. S.

Petroleum refining in Baku in 1907. Petroleum, 1908, 3, 645.

According to a report by the German consul at Baku based on data furnished by the Excise Authorities, the output of the 32 refineries at work in Baku in 1907 was as follows, the corresponding figures for 1906 being given for purposes of comparison.

	1906. Puds.	1907. Puds.
Residuum (masut)	203,749,605	234,786,946
Petroleum and distillates	72,050,819	86,211,416
Crude naphtha	33,331,587	35,317,006
Lubricating oil	13,128,825	12,541,628
Lubricating masut	1,525,971	2,328,814
Oil residues	1,030,678	1,376,936
Viscosin, paraffin wax, etc.	28,967	40,971

1 pud = 36·112 lb.

—A. S.

Roumanian petroleum production in 1907. Moniteur du Pétrole Roumain; through Z. angew. Chem., 1908, **21**, 659.

The production of crude petroleum in Roumania in each of the past 10 years amounted to: 1898, 180,000; 1899, 250,000; 1900, 250,000; 1901, 270,000; 1902, 310,000; 1903, 384,302; 1904, 508,561; 1905, 614,870; 1906, 887,091; and 1907, 1,130,000 metric tons. The price during 1907 amounted to 400—425 f. per tank of 10,000 kilos. The total value of the capital concerned in the Roumanian petroleum industry amounts to 218 million francs.—A. S.

Petroleum and petroleum products in Roumania; Consumption of ——. Petroleum, 1908, 3, 645.

The consumption of petroleum products in Roumania in 1907 was as follows, the corresponding figures for 1906 being given in brackets:—Residuum, 332 metric tons (237); lamp oil, 38,467 (35,200); "oils," 5851 (5350); and benzine, 673 (566); total, 377,990 (278,638) tons. —A. S.

Patents.

Refining crude petroleum and other hydrocarbons; Process for ——. The New Oil Refining Process, Ltd. Fr. Pat. 383,736, Oct. 15, 1907. Under Int. Conv., Sept. 23, 1907.

See Eng. Pat. 21,060 of 1907; this J., 1908, 154.—T. F. B.

Lubricating oils soluble in benzine (petroleum spirit); Manufacture of ——. D. Holde. Ger. Pat. 185,690, Oct. 17, 1903.

Fluid or semi-fluid residues from the distillation of mineral oils are subjected to distillation, with avoidance of decomposition, whereby there are obtained a distillate of lubricating oil and a tarry semi-solid or solid residue of sp. gr. over 0·97, very rich in asphaltic constituents. The latter is treated with benzine or other petroleum distillate having a sp. gr. less than 0.70, the solution is distilled, and the residue is dissolved in the lubricating oil obtained in the first distillation.—A. S.

Asphaltic constituents from mineral oils and mineral oil residues; Process for separating ——. C. Koettnitz. Ger. Pat. 191,839, Oct. 13, 1906.

The claim is for the use of esters of acetic acid, especially ethyl acetate, for the separation of asphaltic constituents from mineral oils and mineral oil residues. A more complete separation is stated to be effected than when benzine or fusel oil is used (see Ger. Pats. 173,616 and 176,468; this J., 1907, 87, 863).—A. S.

Petroleum, etc.; Improvement of ——. Fr. Pat. 384,177. *See* II.

[*Lubricating*] *Oil testing device.* Ger. Pat. 186,601. *See* XXIII.

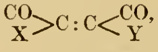
IV.—COLOURING MATTERS AND DYESTUFFS.

Coal-tar colour industry. Presidential address. R. Meldola. J. Soc. Dyers and Col., 1908, **24**, 95—105.

A valuable historic monograph.

Indigoid dyestuffs. P. Friedländer. Ber., 1908, **41**, 772—777.

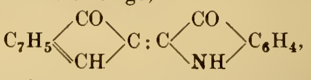
The author proposes the name "indigoid dyestuffs" for those containing the group,



$$\mathrm{{}^{CO}_{X}\!>\!C:C\!<\!{}^{CO}_{Y}},$$

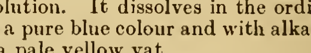
where X and Y denote carbon, nitrogen, sulphur or oxygen.

Naphthalene-indole-indigo,



is obtained by the action of isatin chloride on α-naphthol in benzene solution. It dissolves in the ordinary organic solvents with a pure blue colour and with alkaline reducing agents gives a pale yellow vat.

2-Thionaphthene-2-indole-indigo,

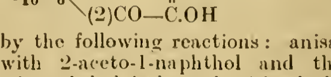


$$\mathrm{C_6H_4\!<\!{}^{CO}_{S}\!>\!C:C\!<\!{}^{CO}_{NH}\!>\!C_6H_4},$$

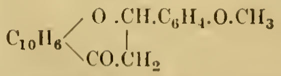
is prepared by warming a glacial acetic acid solution of dibromo-oxythionaphthene and indoxyl. With alkaline reducing agents it furnishes a pale yellow vat from which textile fibres are dyed blue-violet. Both these dyestuffs give sulphonic acids the solutions of which change to yellow with alkalis.—J. C. C.

Monohydroxy-α-naphthoflavonols; Two ——. St. v. Kostanecki. Ber., 1908, **41**, 783—786.

4′-Hydroxy-α-naphthoflavonol,



is obtained by the following reactions: anisaldehyde is condensed with 2-aceto-1-naphthol and the resulting 2-anisalaceto-1-naphthol is heated with alcoholic hydrochloric acid with formation of 4′-methoxy-α-naphthoflavanone,



The isonitroso-derivative of this, when heated with sulphuric acid in glacial acetic acid solution, furnishes the corresponding flavonol which gives yellow shades on an alumina mordant, and on heating with hydriodic acid yields the required 4′-hydroxy-α-naphthoflavonol. This melts at 293° C. and gives yellow shades on an alumina mordant.

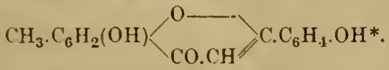
By an exactly analogous series of reactions, 3′-hydroxy-α-naphthoflavonol is prepared. It melts at 248° C. and gives yellow shades on an alumina mordant.—J. C. C.

Flavone group; Syntheses in the ——. J. Tambor. Ber., 1908, **41**, 787—792.

When orcacetophenone dimethyl ether is dissolved in methyl methylsalicylate and the solution warmed with sodium for an hour to 130° C., there is produced 4-methyl-2 : 6 : 2′-trimethoxybenzoylacetophenone,

$$CH_3.C_6H_2(O.CH_3)_2.CO.CH_2.CO.C_6H_4.O.CH_3,$$

which on boiling with hydriodic acid furnishes 1 : 2′-dihydroxy-3-methylflavone,



$$CH_3.C_6H_2(OH)\begin{matrix}\diagup O \text{———} \diagdown \\ \diagdown CO.CH \text{=} \diagup\end{matrix}C.C_6H_4.OH^*.$$

This forms greenish-yellow needles melting at 300—301° C. It dissolves in alcoholic caustic soda or concentrated sulphuric acid with a yellow colour, but does not dye mordanted fibres. On methylation only the hydrogen atom marked with an asterisk is replaced by the methyl group. By an exactly similar series of reactions using, instead of methyl methylsalicylate, the *m-* and *p-* esters and methyl veratrate, there were obtained respectively, 1 : 3′-dihydroxy-3-methylflavone m.pt. 227° C., 1 : 4′-dihydroxy-3-methylflavone, m.pt. 295° C., and 1 : 3′ : 4′-trihydroxy-3-methylflavone, m.pt. 270° C. The first two do not dye mordanted fibres, but the third dyes on an alumina mordant in greenish-yellow shades.—J. C. C.

Patents.

Hydroxyl derivatives of aromatic hydrocarbons; Rendering —— *soluble in water.* H. H. Lake, London. From A. Friedlaender, Berlin. Eng. Pat. 7550, Mar. 28, 1907.

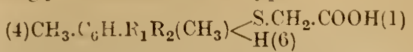
The basis of the process is the mixing of the insoluble hydroxyl derivative with a substance of an analogous nature soluble in water. A mixture of 10 parts of phenol and 3 parts of resorcinol is soluble in every proportion in water, and renders soluble many substances which alone, are insoluble in, or only dissolved with difficulty in solutions of resorcinol. The pure cresols or mixtures of these, are easily soluble in water when mixed with two to three times their weight of resorcinol. A mixture of 1 kilo. of resorcinol with 100 grms. of thymol is readily dissolved by water, and one part of alizarin is dissolved by 60 parts of phenol, liquefied by the addition of a little water, only a part of the alizarin separating out when this solution is poured into an excess of water. 50 kilos. of guaiacol mixed with 120 to 130 grms. of resorcinol are readily dissolved by water.—F. M.

Vat dyestuff; Manufacture of a new red ——. Basler Chem. Fabrik, Basle, Switzerland. Eng. Pat. 344, Jan. 6, 1908. Under Int. Conv., Jan. 16, 1907.

By heating acenaphthene-quinone with salicylthioacetic acid (phenylthioglycollic-*o*-carboxylic acid) or 3-hydroxy-1-thionaphthene or acetyloxythionaphthene, with or without a solvent such as naphthalene, acetic anhydride or sodium acetate, or in solution or suspension in alcohol, with or without a condensing agent such as an alkali or secondary amine, a red vat-dyestuff is produced. Thus 18·2 parts of acenaphthene-quinone and 21·2 parts of salicylthioacetic acid are heated in an oil bath (230°—250° C.) until the separation of water ceases. The red mass is powdered and crystallised from glacial acetic acid or benzene, or is dissolved in sulphuric acid and the dyestuff precipitated by the addition of water. When reduced with alkaline hydrosulphite or with sodium sulphide, it gives a violet-grey vat in which cotton is dyed, the shades being yellow-red on oxidising in the air.—F. M.

Vat [thioindigo] dyestuffs; Making ——. A. Schmidt and E. Bryk, Assignors to Farbwerke vorm. Meister, Lucius und Brüning, Höchst on the Maine, Germany. U.S. Pat. 881,624, March 10, 1908.

Dyestuffs which form vats with alkali hydroxides, from which cotton is dyed blue-violet, are obtained by treating arylthioglycollic acids of the type,



$$(4)CH_3.C_6H.R_1R_2(CH_3)<\begin{matrix}S.CH_2.COOH(1) \\ H(6)\end{matrix}$$

with chlorosulphonic acid: R_1 and R_2 represent hydrogen or methyl groups. The dyestuffs derived from 2.4-dimethyl- and 2.4.5-trimethylphenylthioglycollic acids are specially claimed.—T. F. B.

Methylthiophenol-o-carboxylic acids; Process of making ——. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 383,744, Jan. 16, 1907.

See Eng. Pat. 593 of 1907; this J., 1907, 1003.—T. F. B.

Dyestuffs containing sulphur [Thioindigo dyestuffs]; Process for making ——. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 383,927, Jan. 21, 1907.

See Eng. Pat. 1472 of 1907; this J., 1907, 1235.—T. F. B.

a-Hydroxythionaphthenes; Process for making ——. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 384,343, Jan. 31, 1907.

See Eng. Pat. 1592 of 1907; this J., 1907, 1235.—T. F. B.

Sulphide dyestuff; Process for preparing a yellowish-green ——. L. Cassella und Co. Fr. Pat. 384.344, Jan. 31, 1907.

See Eng. Pat. 3279 of 1907; this J., 1907, 1082.—T. F. B.

Azo dyestuffs containing a fatty acid radical such as is present in fats; Process for the manufacture of ——. N. Sulzberger. Ger. Pat. 193,451, Oct. 14, 1906. Addition to Ger. Pat. 188,909, April 25, 1906 (this J., 1908, 220).

Fatty acid arylides containing amino or hydroxy groups in the aromatic nucleus are combined with diazo compounds. The dyestuffs differ from those described in the main patent, in that the fatty acid radical is contained not in the diazo compound, but in the other component. The present process possesses the advantages that in many cases the raw materials are more easily obtainable, and the formation of the dyestuffs proceeds more rapidly and completely.—A. S.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES YARNS, AND FIBRES.

Turkish silk production in 1906/7 *and* 1907/8. Z. angew. Chem., 1908, **21**, 658—659.

According to the annual report of the "Dette Publique," the production of silk in 1906/7 was considerably less than in the preceding year. In the whole of the provinces in which the silk tithes are mortgaged for the old State debt, these amounted to only 110,000 Ltq. as compared with 117,500 Ltq. in 1905/6. The "Dette Publique" collects the silk tithes throughout the Turkish Empire partly for the old State debt, partly for the so-called "Fishery Loan" taken up by the German bank. The amounts destined for the latter purpose are not included in the above figures. The quality of the silk produced in 1907/8 is stated to be very good, but the yield of silk was only 1 kilo. from 12 cocoons instead of 1 kilo. from 11 cocoons as was expected. This may be due to bringing the cocoons on the market somewhat too soon, when they contained an excessive quantity of moisture. At the time of harvesting the price of the fresh cocoons varied between 3½ and 4 f. per kilo. which is appreciably higher than the corresponding price in 1906/7. The price of the silk was 50 f. per kilo. in July, then fell by 2 or 3 f., and afterwards rose to 59 f. per kilo. in the middle of August. The exports during 1907/8 from Brussa, Anatolia and Adrianople amounted to 6000—7000 bales of 100 kilos. each. No cocoons were exported from Brussa, the whole being consumed by the spinners but from Adrianople a third of the production of cocoon was exported to Europe. *Note.*—1 Ltq. = 1 Turkish pound = 18s. 1d.—A. S.

Silks of the Bombyx Mori class; Properties of ——. G. Gianoli. Rev. Gen. Mat. Col., 1908, 12, 103—105.

A Milan Commission has during a number of years considered and determined the organic differences between the silks obtained from different districts; special consideration was given to those properties which were of importance in the application of the silks to manufacture. Specimens of silk from the different districts of Italy, France, the Levant and Asia Minor, China, Japan, and other parts of Asia, besides samples of wild silks were examined. Determinations were made of: (1), physical constants, and (2), chemical data, such as the quantity of fibroin, sericin and fatty matter, the melting point of the fatty matter, the ash, etc. The results obtained, however, do not explain the different dyeing properties of the silks. The samples resisted in different degrees the action of acids and alkalis, and the amounts of metallic mordants taken up depended on the time and the manner of the cultivation. The principal reagents which affect silk during dyeing are the acids and alkalis used in the dye-baths. To study these actions the degummed samples were treated with: (1), 5 per cent. solution of sulphuric acid, and (2), a solution of potassium hydroxide containing 1·2069 grms. per litre; the weights of the solutions taken were in each case five times the weight of the silk, and the silk was digested with the reagent for 24 hours at a temperature of 27° C. The silks were then washed, weighed and again treated. The loss in weight during each digestion of twenty-seven samples of silk is given in tabular form. Degummed silk always contains a certain amount of fatty acid, so that the first figure obtained with the alkali was too high. The effect of mordanting was tried with the chlorides of iron, aluminium, chromium and tin; the results obtained in the last case are given and show notable differences. The samples of degummed silk were given three baths in stannous chloride solution of 28° B. for one hour, and after each bath the silk was immersed in sodium carbonate solution of 5° B. at 40° C. for one hour. The amounts of tin oxide taken up by the different fibres are given. The silks of Bengal and Canton show the least attraction for the mordant; these silks are of different colours but from similar cocoons. Similar results were obtained when other fixing agents in place of sodium carbonate were used. Some of the Bengal silks do not show the peculiarity mentioned and the differences disappear when raw instead of degummed silks are used. The peculiarity mentioned is not due to the presence of lime on the fibre in the state of a calcium soap, for other experiments were performed in which a treatment with hydrochloric acid was resorted to. To trace the effect of lime, the samples of raw silk were boiled with a 20 per cent. solution of calcium acetate for one hour, washed, and then treated with stannous chloride. The sample treated with the calcium solution took up considerably more of the tin salt than the untreated samples. Figures giving the ash before and after degumming are also tabulated.—S. H. H.

Linen and hemp fibres; Method of distinguishing ——. T. F. Hanausek. Z. Farben-Ind., 1908, 7, 105—108.

Linen fibres are usually distinguished from hemp fibres by the shape of the ends of the fibres; the linen fibre gradually tapers to a point, whereas the hemp fibre exhibits a blunt, rounded or knotty end. The sections of the linen fibre are polygonal whilst those of the hemp fibre are of more irregular outline. The author treats the fibres with a solution obtained by adding an excess of sulphuric acid to a solution of potassium bichromate. In a few seconds the fibres begin to swell and the liquor near to the fibres turns green. Air bubbles appear and assist in causing the active yellow liquor to displace the now inactive green liquor around the fibres; this movement is further assisted by tilting the microscopic slide on which the fibres are resting. The linen fibres are found to swell more quickly than the hemp fibres. The surface of the fibre becomes irregular and dark patches are produced in both cases. These patches are seen to be more pronounced in the case of the hemp. The author, however, attaches most importance to the appearance of the linings of the canals of the treated fibres. The canal of the immersed linen fibre is somewhat similar to that produced on treatment with cuprammonium solution; it is very narrow, wavy, irregular and broken. The canal of the hemp fibre, on the other hand, is a straight, continuous, very plastic tube, which is in no case broken or undulating.—S. H. H.

Mercerised cotton; A qualitative test for ——. E. Knecht. J. Soc. Dyers and Col., 1908, 24, 67.

Ordinary cotton dyed with Benzopurpurin is at once turned blue by hydrochloric acid, but mercerised cotton becomes reddish-violet unless too much acid is used. If the solution containing the cotton is heated and dilute titanous chloride cautiously added, the colour in both cases diminishes in intensity, until just before complete destruction of the colour occurs, the ordinary cotton appears indigo-blue and the mercerised cotton red. This difference only occurs when the mercerised cotton has been treated with caustic soda of more than 30° T. if unstretched or 35° T. if stretched.

The author is unable to account for the reaction; it would almost seem as if the treatment with alkali had enhanced the faintly basic properties of the cellulose. Cotton mercerised with nitric acid of 83° T. also shows the reaction.

A strong solution of stannous chloride may be used in place of the dilute titanous chloride, but the reaction is not so distinct.—R. B. B.

Mercerisation in cotton yarns; Determining the degree of ——. E. Knecht. J. Soc. Dyers and Col., 1908, 24, 68—71.

The author utilises the selective affinity of mercerised and unmercerised cotton for colouring matter in one and the same bath, and estimates the amount of dyestuff on the cotton fibre by indirect titration according to the method described by him in 1904 (J. Soc. Dyers and Colourists, 1905, 21, 3; this J., 1905, 154).

In his first quantitative experiment, skeins of ordinary bleached cotton, cotton mercerised with caustic soda, and cotton mercerised with nitric acid were dyed together for one hour with 3 per cent. of Benzopurpurin 4B, 5 per cent. of sodium carbonate, and 10 per cent. of salt, the amount of liquor being 20 times the weight of the yarn. The result was as follows:—

Material dyed.	Per cent. of colour taken up.
Ordinary cotton	0·69
Mercerised with NaOH 60° T.	2·78
Mercerised with HNO_3 85°T.	5·23

In a second experiment a number of hanks treated under tension with caustic soda of different strengths were all dyed in one bath as before, together with an untreated hank. The averages of two experiments, (the difference being in no case more than 0·04 per cent.), were as follows:—

Yarn.	Per cent. of Benzopurpurin in fibre.
Ordinary	1·77
Mercerised 10° T.	1·88
,, 20° ,, ...	2·39
,, 25° ,, ...	2·57
,, 30° ,, ...	2·95
,, 35° ,, ...	3·02
,, 40° ,, ...	3·15
,, 45° ,, ...	3·27
,, 50° ,, ...	3·38
,, 55° ,, ...	3·50
,, 60° ,, ...	3·56
,, 65° ,, ...	3·60
,, 70° ,, ...	3·66

There is thus a continuous rise in the affinity of cotton for colouring matter from untreated cotton up to that mercerised with caustic soda at 70° Tw. The strength of caustic soda which has been used for mercerising a given sample of yarn may therefore be determined by dyeing known weights of the sample and of ordinary cotton of about the same quality together in the same bath. The colour is then estimated quantitatively in both samples: if the ordinary cotton has taken up less or more than 1·77 per cent., the mercerised yarn will have taken up less or more than indicated in the above table in the same proportion. The amount of Benzopurpurin taken up by different qualities of ordinary yarn dyed in the same bath was found to be very nearly the same.

In a further experiment the influence of time on the mercerising action was studied and the results show that within the limits of actual working, (say 40—180 seconds), there is not much difference in the degree of mercerisation as far as its influence on dyeing capacity is concerned. The accuracy of the method was verified by a series of experiments with yarns mercerised with caustic soda of known strength. Experiments on cotton mercerised in the piece did not yield satisfactory results; the figures came out too low, probably owing to imperfect mercerisation, chiefly due to the great speed at which the process is usually carried out.—R. B. B.

Black sulphide dyestuffs; Comparison of the tinctorial values of ——. R. Buratti. Rev. Gen. Mat. Col., 1908, 12, 105—107.

In comparing the tinctorial values of sulphide blacks it must be remembered that different dyestuffs require different methods of dyeing. The solubility of a sulphide colour is inversely proportional to the facility with which it becomes oxidised; therefore the less oxidisable a colour is, the greater will be the yield of the leuco compound of the dyestuff to the wash water used after dyeing. Hence, if two colours of the same tinctorial power are maintained in solution by the same quantity of alkali, that which is the more readily soluble will give the lighter shade on dyeing. Dye trials must therefore be conducted under conditions favourable to the dyeing of each colour and the amount of leuco compound contained in the wash water must be estimated. Experiments were performed by the author in new and standing baths; the Obermaier machine was employed for the purpose. To determine the leuco compound in the wash water, in each case two litres of wash water were produced and treated with an excess of hydrochloric acid. In this way the sodium sulphide was decomposed and the sulphide dyestuff precipitated. The dyestuff along with a small quantity of sulphur and impurities from the dye-bath was obtained by filtering; on drying and weighing the filter paper, the amount of dyestuff in the wash water was obtained. In an actual example, Thional Black T Extra (Sandoz) and Sulphur Black T Extra (Berlin) were used: 12 per cent. of each colour were taken along with 12 per cent. of sodium sulphide, 5 per cent. of sodium carbonate, and 30 per cent. of sodium sulphate. The weight of water was ten times that of the cotton which was dyed; the dyeing took place during one hour at 92° C. The Thional Black gave a residue of 4·7025 grms. from the wash water whereas the other residue was only 4·080 grms. By dissolving weighed amounts of these residues in sodium sulphide solution and dyeing cotton in the solutions obtained, grey shades of equal intensity were obtained showing that the residues had the same tinctorial power. The amounts of residue show that Thional Black T Extra is a little more soluble than Sulphur Black T Extra. On using the following bath, however: Thional Black T Extra, 12; sodium sulphide, 9; sodium carbonate, 5; and sodium sulphate, 30 per cent., *i.e.*, reducing the amount of sodium sulphide added, it was found on using the same conditions of dyeing that the residue from the wash water was only 4·175 grms. This amount is very near to that of the residue obtained when the Sulphur Black T Extra was used and serves to show that one black may be as concentrated as another, although it may not at first appear to be. Further by altering the additions made to the bath, a strong shade may be obtained and at the same time less sodium sulphide used.—S. H. H.

Azo Blacks; Discharged ——. E. Justin-Müller. Z. Farben-Ind., 1908, 7, 95—98.

White discharge effects produced with sulphoxylate-formaldehyde upon direct or developed Azo Blacks have not acquired the importance they deserve. This method admits of the production of a white design on a black ground upon fabrics too thin or too poor in quality to withstand the dyeing process or after-treatment necessary for Aniline Black. The author has obtained excellent results on goods dyed with Oxydiaminogene Black, diazotised and developed, and discharged with a paste containing 300 grms. of Hyraldite C extra per litre. He also describes an alternative process according to which the dyed cloth is passed through a 2 per cent. solution of potassium ferrocyanide and dried before printing with a discharge paste containing 175 grms. of Hyraldite CW extra per litre. This latter method is also suitable for coloured discharges containing basic dyestuffs and in this case an addition of zinc sulphate to the discharge paste is recommended.—R. B. B.

Cellulose; New constants for ——. W. Viewig. *See* XIX.

Bleach liquor; Electrolytic ——. A. Ahlin. *See* XIA.

Tanning and dyeing. W. Fahrion. *See* XIV.

Patents.

Wool; Method of dyeing ——. R. B. Ransford, London. From L. Cassella und Co., Frankfort-on-Maine, Germany. Eng. Pat. 12,831, June 3, 1907.

In the production of certain shades on wool, a part of the wool is dyed in full shades and then blended with less deeply dyed, or with white, wool. The drawbacks to this method are that where white wool is used, this often shows up in the finished product and when dyed in light shades the fastness is not so good as that of the deeper shades with which it is blended. These objections are overcome by colouring the white wool, or that which is required to be only light in shade, with metallic oxides which give very fast shades and are easily applied. Thus for drab shades, the wool may be stained by treating with 2 per cent. of potassium bichromate, 2 per cent. of copper sulphate and 3 per cent. of formic acid.—F. M.

Dyeing [with sulphide dyestuffs]; Process of ——. G. A. Waldinger and C. F. Iserloth, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 882,543, March 17, 1908.

See Addition of Oct. 19, 1906, to Fr. Pat. 367,921 of 1906; this J., 1907, 253.—T. F. B.

Sulphide dyestuffs; Preparations of ——, and process for dyeing with sulphide dyestuffs. Badische Anilin und Soda Fabrik. Addition dated Oct. 31, 1907, to Fr. Pat. 379,584, June 3, 1907. (See this J., 1907, 964.)

Two additional mixtures are given for use when dyeing with Kryogen Black T.B.O.—T. F. B.

Fabrics; Method and apparatus for impregnating —— with liquids, and drying them. H. Hey, J. Smith, H. L. Mitchell, W. H. Askham, and H. Heymann. Fr. Pat. 384,062, Nov. 16, 1907. Under Int. Conv., Nov. 26, 1906.

See Eng. Pat. 26,843 of 1906; this J., 1908, 19.—T. F. B.

Printing upon woven fabric or paper; Process of ——. W. Beer, Vienna. Eng. Pat. 13,567, June 12, 1907.

See Fr. Pat. 378,729 of 1907; this J., 1907, 1197.—T. F. B.

Colour-spraying apparatus. H. Mikorey, Schöneberg, Germany. U.S. Pat. 883,144, March 24, 1908.

See Eng. Pat. 11,412 of 1907; this J., 1908, 20.—T. F. B.

Finish to cloths; Permanent —— for cloths, and apparatus therefor. J. R. Denison and J. F. Preussner, Bradford. Eng. Pat. 9241, April 20, 1907.

The cloth to be finished is passed, with a damp cloth beneath it, between the bowls of a calender. The upper bowl is heated and at the point of pressure, steam is generated from the water in the damp cloth and strikes through the cloth being treated, imparting to it the improved finish. Different kinds of finish can be arranged for according to the different surfaces of the upper, heating roller in the known manner, or they may be obtained by altering the texture of the cloth used as a damper; thus for a plain finish a smooth-faced sateen is used and for a twill finish, a twill cloth is taken. The damp cloth may be in lengths, being run from one roller on to another through the calender, or it may be endless, passing through troughs in which it is saturated with water or any suitable finishing mixture, before passing between the calender bowls.—F. M.

Drying machines for textile material. J. H. Lorimer, Germantown, U.S.A. Eng. Pat. 17,870, Aug. 6, 1907.

See U.S. Pat. 862,962 of 1907; this J., 1907, 1007.—T. F. B.

VII.—ACIDS, ALKALIS, SALTS, AND NON-METALLIC ELEMENTS.

Iron oxide contact process [*sulphuric acid.*] G. Keppeler. Z. angew. Chem., 1908, **21**, 532—547, 577—589. (See also this J., 1902, 1137.)

A theoretical study of the contact process for the manufacture of sulphuric acid, based on Bodenstein's data (this J., 1905, 729), shows that the method of working in two stages, first at a high temperature, and then, after removing the sulphur trioxide, at a lower one, is well founded. For instance by working with iron oxide in the first stage at 650° or 700° C., and then performing the second stage with a platinum contact mass at 500° C., higher yields are obtained than would be possible by working in one stage at the lower temperature (compare Brode, this J., 1902, 1393). Determinations of the decomposition pressures of ferric sulphate in nitrogen or air, showed that the composition of the gases which are formed, at atmospheric pressure, or which will remain in contact with ferric oxide without alteration, was as follows:—

Temp.	SO_3.	SO_2 in presence of:	
		Air.	Nitrogen.
	Per cent. by vol.	Per cent. by vol.	Per cent. by vol.
600°	0·64	0·24	0·90
625°	1·34	0·57	1·88
650°	2·59	1·42	3·83
675°	4·92	3·20	7·50
700°	9·05	10·00	14·13

Thus if burner-gases of any composition be passed over ferric oxide at a given temperature, the percentage of sulphur trioxide in the effluent gases will be that given in the table provided that equilibrium is attained. The percentage of sulphur dioxide will, however, vary according to the proportion of oxygen in the burner-gases, and under technical conditions will vary between the figures given in the table as obtaining in presence of nitrogen and of air respectively. A comparison of the final gases obtained with ferric oxide and platinum contact masses, respectively, from burner-gases of different composition, shows that with burner-gases of a given composition, there exists a definite temperature at which the concentration of sulphur trioxide obtained over platinum is equal to the sulphur trioxide partial pressure of ferric sulphate at that temperature. The highest possible yield of sulphur trioxide by the iron oxide contact process is obtained at this so-called "optimum" temperature, which is dependent upon the composition of the burner-gases used, as is shown in the following table:—

SO_2 in burner gases.	"Optimum" temperature.	SO_2 oxidised.
Per cent. by vol.	° C.	Per cent. by vol.
7	655	53·2
4	650	65·0
2	628	72·5

At temperatures above the "optimum" there will be loss of sulphur trioxide by dissociation, whilst at lower temperatures loss will ensue through formation of ferric sulphate. A comparison of the author's results with those obtained in practice indicated that losses probably do occur, and this was confirmed by analysis of a specimen of burnt pyrites before and after use in the contact process: the percentage of sulphur trioxide in the pyrites had increased from 4·5 to 9·4. The author expresses the opinion that it would be possible to use ferric oxide in the contact apparatus for longer periods than are at present in vogue, without any danger of the arsenic in the burner-gases escaping absorption. In this way losses due to formation of ferric sulphate would be diminished. It was found that almost the whole of the arsenic in the used oxide contact masses was in the form of arsenate, and the retention of the arsenic is favoured by increasing the concentration of oxygen in the burner-gases, *i.e.*, by diluting them with air. A comprehensive study of the nature of the iron oxide contact process, in the second part of the paper, leads the author to conclude that most probability attaches to the view that the catalysis is due to condensation (adsorption) of the sulphur dioxide at the surface of the contact material.—A. S.

Nitrogen oxides; Analysis of —— by means of their absorption spectra in the ultra-red. E. Warburg and G. Leithäuser. Sitzungsber. Kgl. Pr. Akad. Wiss. Berlin, 1908, 148—153. Chem. Zentr., 1908, **1**, 922—923.

Ozone and the different oxides of nitrogen exhibit in the ultra-red, between 2·7 and 7 μ, intense and characteristic absorption bands. The authors observe the absorption spectra by means of a mirror spectrometer with a fluorspar prism, a vacuum bolometer, and a Panzer galvanometer. The bodies in the gaseous state are examined at different partial pressures, and with layers of different thicknesses. The absorption-maxima are so disposed (N_2O_5,5·81μ; N_2O,4·45μ; NO_2,6·12μ; O_3,4·74μ) that it is possible to detect ozone, nitrous oxide, and nitrogen pentoxide when present together as gases, and also in like manner, nitrous oxide and nitrogen peroxide. The sensitiveness of the test is greatest with nitrogen pentoxide, less with nitrogen peroxide and nitrous oxide, and least with ozone and nitric oxide. By the application of this method it was found that on ozonising air in a Siemens' tube, nitrogen pentoxide and nitrous oxide are formed in addition to ozone. In the oxidation of air by a current from an electrical machine, between platinum electrodes, without production of ozone, nitrogen peroxide and nitrous oxide are formed. From nitrogen peroxide dissolved in pure nitrogen, nitrous oxide is formed by the action of the silent discharge in a Siemens' tube. By the action of an electric arc between platinum electrodes (alternating current of about 2000 volts) on dry air, only nitric oxide or peroxide is formed.—A. S.

Arsenic acid; Hydrates of ——. V. Auger. Compt. rend., 1908, **146**, 585—588.

The hydrate, $(AsO_4H_3)_2,H_2O$, possesses even at −10° C. a measurable dissociation-pressure, which increases without a break up to 12° C., when the hydrate, $As_3O_{10}H_5$, or $As_2O_7H_4,AsO_3H$, is formed: thus pyroarsenic acid $As_2O_7H_4$ has no existence. From 12° to 148° C. the hydrate, $As_3O_{10}H_5$, persists, and it is really to this hydrate that Joly attributed the formula, $As_4O_{13}H_6$.—J. T. D.

Calcium carbonate; Solubility of —— in aqueous solutions of potassium chloride and potassium sulphate. F. K. Cameron and W. O. Robinson. J. of Physic. Chem., **11**, 577—80.

Calcium carbonate is proved to be much more soluble in aqueous solutions of potassium sulphate than of potassium chloride, at 25° C. In the same solutions saturated with carbon dioxide at atmospheric pressure, the solubility is greater, and passes through a maximum value in each case. This maximum occurs in potassium chloride solutions at a concentration of 15·5 per cent., and in potassium sulphate solution at a concentration of 2·98 per cent. In the latter case, syngenite, $CaK_2(SO_4),H_2O$, is formed as solid phase, above that concentration.

Gypsum; Solubility of —— in copper sulphate solutions. J. M. Bell and W. C. Taber. J. of Physic. Chem., **11**, 637—8.

The concentration of calcium sulphate decreases with increasing copper sulphate concentration until a minimum is reached at about 30 grms. of copper sulphate per litre, at which concentration there is nearly 1·7 grms. of calcium sulphate in solution. The solubility then increases, at first rather rapidly, and then slowly, until the point of saturation is reached with respect to copper sulphate, when there are 2·08 grms. calcium sulphate per litre in solution. The solid phases present at this point are gypsum and copper sulphate; therefore the solution has a "constant" composition. The influence of gypsum in solution on the solubility of copper sulphate was found to be very small.

Ferric sulphates. F. K. Cameron and W. O. Robinson. J. of Physic. Chem., **11**, 641.

At 25° C., no definite basic ferric sulphates are said to be formed. This was confirmed for solutions containing less than 25 per. cent. of sulphur trioxide, when ferric sulphate solutions were saturated at 25° C. with freshly precipitated ferric hydroxide. In contact with a solution containing less than about 25 per cent. of sulphur trioxide, the stable solid is stated to be one of a series of solid solutions containing ferric oxide, sulphur trioxide, and probably water. It was shown that in contact with solutions containing from about 25 to 28 per cent. of sulphur trioxide, the stable solid is a hydrated normal ferric sulphate, $Fe_2O_3,3SO_3,10H_2O$, whilst in contact with solutions of a concentration greater than about 28 per cent. of sulphur trioxide, the stable solid is a hydrated acid sulphate, $Fe_2O_3,4SO_3,10H_2O$.

Ferric chlorides. F. K. Cameron and W. O. Robinson. J. of Physic. Chem., **11**, 690—4.

Roozeboom and Schreinemakers (Zeits. physik. Chem., 1894, **15**, 588) give data for the solubility of ferric oxide in aqueous solutions of hydrochloric acid when the solution contains more than an equivalent amount of hydrogen chloride. The present investigation is an extension of this work at 25° C. to cover cases where there is present relatively more ferric oxide than acid. It was found that solutions of ferric chloride dissolve ferric oxide, although to a much less extent than solutions of ferric sulphate do; and that the ratio, $Fe_2O_3 : HCl$, in these solutions is approximately constant. The solid phase in contact with these solutions has no definite composition, but is one of a series of solid solutions containing Fe_2O_3, HCl and H_2O.

Salt production in Elsass-Lothringen. Z. angew. Chem., 1908, **21**, 659.

The eight works in Elsass-Lothringen engaged in the manufacture of salt, produced in the last business year 636,504 double zentners (1 dz. = 100 kilos.), or 5563 less than in the preceding year. The sales of salt, however, increased from 668,066 to 674,198 double zentners. The salt produced in Elsass-Lothringen comes almost exclusively from the Lothringen salt works, and is sent chiefly to Rheinish Prussia, Luxembourg, Bavaria, Thüringia, Wurtemberg, Hesse, Darmstadt, Hesse-Nassau, and Belgium. The cessation of competition by Spanish salt favoured the exports to Belgium. No salt is exported from Elsass-Lothringen to France.—A. S.

Magnesium oxide; Reducibility of —— by carbon. R. E. Slade. Chem. Soc. Trans., 1908, **93**, 327—333.

The experiments consisted generally in heating mixtures of magnesia and carbon, under varied conditions, in carbon-tube electric furnaces of different designs. The results show that magnesia is reduced by carbon not only at the high temperature of the electric arc, but also at as low a temperature as 1700° C. Under ordinary conditions the magnesium vapour produced is re-oxidised by the carbon monoxide, but if the latter be removed, for example, by working in a vacuum, by means of a rapid stream of hydrogen, or by adding aluminium which reacts with it to form alumina and aluminium carbide, the reduced magnesium can be obtained in the metallic state. The condensed magnesium is always contaminated with small quantities of a carbide, probably identical with that prepared by Berthelot by heating magnesium redness in a current of acetylene.—A. S.

Cuprous compounds of carbon monoxide. W. Manchot and J. N. Friend. Annalen, 1908, **359**, 100—128.

The authors investigated the absorption of carbon monoxide by cuprous chloride, bromide, and iodide, dissolved in different solvents. It was found that invariably compounds of one and the same type were formed, containing 1 mol. of carbon monoxide to 1 atom of copper. With cuprous chloride the same product, $CuCl,CO,2H_2O$, was formed whether the absorption of carbon monoxide took place in presence of water, hydrochloric acid, dilute ammonia, or dilute caustic soda solution. The compounds produced are dissociable, the degree depending on the temperature, carbon monoxide pressure, the concentration of the copper, and nature of the solvent. The absorption of the carbon monoxide in hydrochloric acid solution increases with the concentration of copper and the pressure of the gas, but decreases with increasing concentration of the acid, owing to the reversible reaction, $CuCl,CO,2H_2O + HCl \rightleftarrows CuCl,HCl + 2H_2O + CO$. In presence of water it would have been expected that in all cases the absorption of carbon monoxide would be greater than in presence of hydrochloric acid, and that the concentration of the copper would be without influence. This is not the case, however, owing to hydrolysis of the cuprous chloride, the cuprous hydroxide formed not being capable of absorbing carbon monoxide. In presence of weak alkali or ammonia, hydrolysis proceeds further and the absorption of carbon monoxide decreases. In presence of strong ammonia, the absorption of carbon monoxide decreases strongly as the concentration of copper increases, and it is concluded that the absorption is effected by the ammonia compound of cuprous chloride, not by the chloride itself. From the fact that anhydrous cuprous chloride does not absorb carbon monoxide and from other considerations, the view is taken that cuprous chloride combines with carbon monoxide only in presence of water or such substances as aniline, ammonia, or the like, capable of acting in a similar manner. the first stage of the process being the addition of the water molecule or its equivalent to the cuprous chloride.—A. S.

Lead sulphide, cuprous sulphide, argentous, and ferrous sulphides; Notes on ——. K. Friedrich. Metallurgie, 1908, 5, 23—30, 50—58.

The author determined the melting-points of the above sulphides of lead, copper, silver, and iron, by heating them to a temperature a little above their melting-points, and plotting cooling-curves. In some cases sulphur was added to the molten sulphide before allowing it to cool. The heating was carried out by means of a kryptol electric tube furnace, and an atmosphere of hydrogen was used in some of the experiments. On account of the readiness with which the sulphides are oxidised, however, even under these conditions, the cooling had to be somewhat rapid (10° C. in 5 or 10 seconds). In all cases, the sulphide obtained was carefully analysed, and the melting-points for the theoretical compounds are obtained by interpolation from the melting-points found for the sulphides actually obtained, some of these compounds containing an excess of sulphur, whilst others are deficient in sulphur. The melting-points are: For PbS, 1120°; Cu_2S, 1135°; Ag_2S, 812°; and FeS, 1171° C., with a probable error of ±10°. In all cases, mixtures containing an excess of metal have lower melting-points than the above; for silver sulphide and iron sulphide, and probably for lead sulphide, mixtures with an excess of sulphur show higher melting-points; whilst in the case of copper, the compound, Cu_2S, possesses the maximum melting-point. Most of the curves show a second break at a point below the melting-point.—A. G. L.

Barium peroxide; Valuation of ——. A. Chwala. Z. angew. Chem., 1908, **21**, 589—592.

The author has examined the various methods used for the determination of barium peroxide. For technical use. satisfactory though somewhat low results are obtained by dissolving the peroxide in just the necessary quantity of very dilute hydrochloric acid, adding sulphuric acid (1 : 6) to the clear solution, and titrating with $N/10$ permanganate solution. For more accurate work two methods are recommended. The first, devised by Quincke (Z. anal. Chem., 1892, **31**, 28) consists in measuring the oxygen evolved on adding an alkaline solution of potassium ferricyanide to the barium peroxide dissolved in just sufficient dilute hydrochloric acid. $BaO_2 + 2K_3Fe(CN)_6 = K_6BaFe_2(CN)_{12} + O_2$. The apparatus used must be such that any oxygen evolved on dissolving the peroxide in hydrochloric acid is not lost. The second method devised by the author is an iodometric one. 0·1 grm. of the peroxide is well shaken in a stoppered flask with 200 c.c. of water, and 100—150 c.c. of a standardised solution of potassium ferricyanide solution (65·9 grms. $K_3Fe(CN)_6$ per litre) are added. After the first violent reaction has ceased, the mixture is heated slowly to boiling, with agitation, till oxygen is no longer evolved, then cooled somewhat, rendered acid with about 5 c.c. of hydrochloric acid of sp. gr. 1·15, and 1·3—1·5 grms. of crystallised zinc sulphate (free from iron) and 2—3 grms. of potassium iodide added. After shaking well and allowing to stand in a closed vessel for 90 minutes at 40°—45° C., the solution is either nearly neutralised and excess of $N/10$ thiosulphate solution added, or rendered alkaline with sodium bicarbonate, and excess of $N/10$ arsenite solution added. Finally the excess of thiosulphate or arsenite is titrated with $N/10$ iodine solution. The results are calculated on the basis of $1\,BaO_2 = 2K_3Fe(CN)_6$; $K_3Fe(CN)_6 = I$.—A. S.

Phosphorus and phosphorus compounds ; Phosphorescence of ——. E. Scharff. Z. physik. Chem., 1908, **62**, 179—193

The phosphorescence of phosphorus and also that of phosphorus trisulphide is really due to phosphorus trioxide. The phenomenon is an intermittent and reversible one ; at the highest oxygen-pressure at which it occurs, a particular mixture of trioxide vapour and oxygen, which is spontaneously inflammable, is formed by diffusion, and after its combustion some time elapses before another portion of the same mixture is generated. As the pressure is reduced, these successive actions occur more rapidly, and finally the intervals between them are so short that the light is apparently continuous. When this stage is reached, the temperature rises rapidly to the point of ignition, but if before ignition the oxygen-pressure be again increased, the action is retarded and ultimately there is extinction of the phosphorescence.—J. T. D.

Sulphur trioxide ; Preparation of —— without use of contact substance. R. Frank. Ger Pat. Application, F. 21,933, Chem. Zeit., 1908, **32**, 219.

Applicant states that a mixture of sulphur dioxide with excess of oxygen at a pressure of over 100 atmospheres, is quantitatively converted into trioxide, and that on allowing the mixture of gases to escape from the compressor, it becomes liquefied and subsequently solid, owing to the reduction of temperature which ensues.

Hydrochloric acid ; Electrolysis of ——. T. Guilloz. *See* XIA.

Patents.

Sulphuric acid ; Manufacture of ——. F. G. Cottrell, Berkeley, U.S.A. Eng. Pat. 21,147, Sept. 24, 1907.

See U.S. Pat. 866,843 of 1907 ; this J., 1907, 1138.—T.F.B.

Lime (calcium oxide, magnesium oxide, and the like) ; Method of and machinery for hydrating, drying, and sifting ——. G. A. Wallis, Horsforth, Yorks. Eng. Pat. 5783, Mar. 11, 1907.

The apparatus consists of a dust-proof triple hydrator and sifting machine combined, which is said to furnish perfectly slaked lime as a fine dry powder. The main hydration takes place in a circular metal pan, into which the lime passes from one of two measuring boxes, fixed on the cover-plate and provided with slide valves ; but a preliminary hydration is effected in the measuring box itself by steam produced in the slaking of a previous charge in the pan, in which the steam is retained for a sufficient time, before passing by a special connecting pipe into the measuring box. The water required for the hydration enters the pan as a spray from a tank fixed to the cover, and a delivery slide in the bottom of the pan controls the discharge of the lime, after 10—20 minutes, into a second similar pan, where the hydration is completed, and from which the lime passes direct to the sifting machine. The second pan is jacketed, so that it may be heated by steam coming from the first, in order to dry the lime during the last stages of hydration, and the surplus steam from this pan also is sent to the measuring boxes. The lime is thoroughly agitated in both pans by stirrers attached to a vertical shaft passing through them, and connected by bevel-gearing with the shaft of the sifting machine. This sifter consists of a revolving drum, covered with wire gauze and having angular blades fitted to the interior, and the lime is conveyed into it by a worm feed, the finished product being delivered from the dust-proof case, by another worm conveyor, as a dry powder suitable for use in the production of artificial stone. The process has the advantage of being continuous and absorbing very little water.—F. Sodn.

Ores containing lithia ; Process of treating ——. W. E. Wadman, Bayonne, U.S.A. Eng. Pat. 6626, March 19, 1907.

See U.S. Pat. 847,856 of 1907 ; this J., 1907, 469.—T. F. B.

Evaporating apparatus [for brine]. A. H. McDonald and F. H. Nickle, Trenton, Mich., U.S.A. Eng. Pat. 26,314, Nov. 28, 1907.

See U.S. Pat. 872,533 of 1907 ; this J., 1908, 22.—T. F. B.

Stannic chloride ; Method of making ——. E. A. Sperry, Brooklyn, N.Y., Assignor to Chem. Reduction Co., New York. U.S. Pat. 882,354, Mar. 17, 1908.

For the production of stannic chloride a tin-bearing material is treated with chlorine, which may be diluted with moisture and air, in the presence of anhydrous stannic chloride, kept saturated with the gas. The reacting mass is cooled, so as to maintain the temperature below the vaporising point of stannic chloride during the reaction. The use of chlorine in the presence of liquid hydrated stannic chloride is also claimed.—F. Sodn.

Ammonium chloride ; Manufacture of ——. A. G. French, Grey Lynn, N. Zealand. U.S. Pat. 882,460, Mar. 17, 1908.

Ammonium chloride is manufactured by a process which consists in drenching carbonised coal, containing sulphur and nitrogen, with strong brine, and then burning it in a current of air containing at least 10 per cent. of steam. —F. Sodn.

Copper pyrites ; Method of treating —— [to obtain copper, sulphur, iron (as steel), gold, and silver]. A. M. G. Sébillot and G. P. J. Dubois. Fr. Pat. 384,072, Jan. 24, 1907.

The pyrites is first heated in a series of retorts, which brings about the reaction : $6FeS_2 = Fe_6S_7 + 5S$, and the sulphide, Fe_6S_7, is then converted into the monosulphide, FeS, by melting the residue with iron oxide and charcoal. After crushing, this is treated with dilute sulphuric acid and gives : (*a*), sulphuretted hydrogen ; (*b*), ferrous sulphate ; and (*c*), a comparatively small residue containing all the copper, silver, and gold, which may be treated by any known method for their extraction. The sulphuretted hydrogen is made to react with sulphur dioxide in a tower, in which water is caused to circulate as a shower by means of a pump, the whole of the sulphur being thus liberated. The ferrous sulphate is allowed to crystallise and is then converted into the monohydrate at 100°—150° C., which on stronger heating gives sulphuric acid again and iron oxide. This oxide is treated in an electric furnace of special design, so as directly to produce steel. The furnace is like a vertical kiln and is so arranged that the charge, as it sinks towards the carbons situated at the lower end, which is narrow, may be subjected to the reducing action of a highly heated blast of carbon monoxide, introduced near the base from a closed coke furnace. Reduction of the oxide is thus effected and the electric energy has merely to melt the spongy metal already produced and at a very high temperature. Any ingredient required in the steel may be mixed with the charge or introduced into the crucible.—F. Sodn.

Alkaline-earth phosphates, aluminium-sodium chloride, and ferric chloride; Process for producing —— from alumino-ferric and calcio-alumino-ferric phosphates. H. Schröder. Fr. Pat. 384,006, Nov. 4, 1907.

See Ger. Pat. 192,591 of 1906; this J., 1908, 282.—T. F. B.

Barium sulphate, carbonate, etc.; Manufacture of —— [from barytes]. C. E. Maistre. Fr. Pat. 383,758, Nov. 8, 1907.

The barytes, preferably in lumps as mined, is mixed with fuel, such as wood charcoal, and fed in at the top of a closed kiln, which is first of all started with a charge of fuel only, and is specially designed to secure a reducing atmosphere. The kiln is furnished with two superposed grates, the fire-bars of which are so spaced as not to allow coarse unburnt material to pass into the receiving waggon in the ash-pit below, and the upper one being capable of a to and fro lateral motion, when required. Another grate, the fire-bars of which are more widely spaced, divides the main body of the kiln from the lower portion. The amount of carbon used should be slightly in excess of that required by the equation: $3BaSO_4+8C+4O_2=3BaS+8CO_2$, the volume of air being rather less than that indicated. Reduction to the sulphide is accomplished partly by the carbon itself and partly by carbon monoxide, which latter may be also specially introduced from a gas producer, an arrangement which diminishes the proportion of ash in the product. For the production of barium sulphate, carbonate, or other insoluble salt, the sulphide is first separated from insoluble impurities by dissolving it in water with the aid of waste heat, and the solution of mixed hydroxide and sulphhydrate thus obtained is then precipitated, *e.g.*, with sodium sulphate or with carbon dioxide from the kiln: useful by-products, such as sodium hydroxide, carbonate, and sulphhydrate result in these reactions. The chloride and other soluble barium salts are obtained by the direct action of acids on the crude sulphide or by treatment of the precipitated carbonate.—F. Sodn.

Sodium sulphate; Manufacture of ——. J. Hargreaves. Fr. Pat. 384,144, Nov. 18, 1907.

The decomposition of sodium chloride by a mixture of sulphur dioxide, steam, and air, resulting in the formation of sodium sulphate and hydrochloric acid, is accelerated by the addition of certain salts or oxides, such as those of copper and iron, which act as catalysts, facilitating the conversion of sulphurous into sulphuric acid. The catalyst (oxide, hydroxide, or salt, of iron or copper) may be mixed with the salt, and the mixture made into briquettes, which are preferably grooved or perforated, or the catalyst, in the form of iron or copper chloride, may be volatilised, and the vapour mixed with the gases employed. The briquettes are stacked in the decomposition chamber in columns, the upper portions of which are supported so as to prevent crushing near the base. The catalyst should be very intimately mixed with the salt and is, therefore, preferably added in the form of a solution, and its amount may vary from about 0·1 to 1 per cent. according to the desired purity of the product. The residual liquids, obtained in the precipitation of copper by iron in the wet method for the treatment of copper ores, which contain principally sodium and iron salts, may be utilised in this process, after a preliminary crystallisation to extract most of the sodium sulphate already present.—F. Sodn.

[Zinc blende] Ore treating process. U.S. Pat. 882,217. *See* X.

VIII.—GLASS, POTTERY, AND ENAMELS.

Pottery; Russian lead-glazed ——. N. P. Marasueff. Z. Unters. Nahr. Genussm., 1908, **15**, 338—342.

The action of dilute organic acids on the glaze of various articles of pottery (basins, jugs, etc.) bought in St. Petersburg is recorded. In 30 minutes, boiling 4 per cent. acetic acid dissolved from 0·9 to 28·8 mgrms. of lead per litre from the articles. Considerable quantities of lead were dissolved on treating the articles a second, third, and fourth time with the acid. Further experiments showed that the lead in the glaze was more soluble in 0·5 per cent. solutions of citric and lactic acids than in similar solutions of acetic acid. At ordinary temperatures, the solvent action of the acids was also very considerable.—W. P. S.

Patents.

Glass sheets or plates; Apparatus for the manufacture of ——. W. W. Pilkington, Prescot, Lancs. Eng. Pat. 5879, Mar. 11, 1907.

The invention constitutes an improvement on Eng. Pat. 22,520 of 1905 (this J., 1907, 256). The glass is drawn upwards by means of a bait and a pair of rollers, and then passes over a bending roller, which changes its direction to the horizontal. It then passes between one or more pairs of rollers, which in order to prevent wrinkling of the glass owing to the bending, are driven at a higher speed than the bending roller, which, in turn, rotates more rapidly than the pair of rollers between it and the tank. Further, a series of gas-jets may be provided to heat the glass at the point at which it is bent, and a smoothing device may be inserted between the bending roller and the next pair of rollers. This device consists of a fixed lower block, and a heavy upper block, which moves with the glass for a certain distance, pressing it against the lower block, rises, and then moves back to its first position. In order that the bait may be lowered into the tank vertically, the framework carrying the later rollers is pivoted on the axis of the bending roller, and in its first position these rollers are immediately above the slot through which the glass is drawn. As soon as the bait has drawn the glass to a point above the bending roller, a weight is released, which, acting on a cord passing over a drum, gradually pulls the framework over into the horizontal position. —A. G. L.

Glass; Machines for drawing sheet ——. E. C. R. Marks, London. From I. W. Colburn, Franklin, Pa., U.S.A. Eng. Pat. 20,222, Sept. 10, 1907.

See Fr. Pat. 382,805 of 1907; this J., 1908, 283.—T. F. B.

Glass; Method of producing ——. E. Morenus, Cleveland, N.Y., Assignor to G. W. Morenus, Kane, Pa. U.S. Pat. 883,039, March 24, 1908.

Successive glass sheets are drawn vertically from a mass of molten glass by means of a bait, the sheets being severed as soon as they reach the hottest part of an annealing chamber situated immediately above the molten glass. The lower severed end of each sheet is then subjected to a welding temperature to remove cracks, after which the sheet is passed through the cooler portions of the annealing chamber.—A. G. L.

Glass; Apparatus for drawing ——. Window Glass Machine Co. Fr. Pat. 383,921, Nov. 14, 1907.

See Eng. Pat. 24,979 of 1907; this J., 1908, 282.—T. F. B.

Ceramic products; Process for the manufacture of ——, using as raw materials artificial crystalline compounds produced by fusion. E. von Seemen. Fr. Pat. 383,871, Nov. 12, 1907.

Crystalline compounds of silica and alumina, silica and magnesia, or alumina and magnesia, are first prepared by fusing these materials together. Pieces of one of these compounds are then mixed with at least 20 per cent. of the same material powdered and moistened with sufficient liquid to make it pasty. The mass is moulded under pressure, dried and burnt as usual. Lime may be added to the materials before fusion, with the object of altering the melting-point.—A. G. L.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Patent.

Artificial stone; Process for manufacturing ——. J. Staudt, Bonn, Germany. U.S. Pat. 882,975, March 24, 1908.

Kieselguhr (100 parts by weight) is mixed with 15 to 20 parts of flowers of sulphur and 75 parts of linseed oil. The mixture is heated until vulcanisation takes place, exposed to the action of air "as long as its plasticity is preserved," and then moulded into stone. Or else, the filling material may be mixed with a partly vulcanised and oxidisable oil, and this mixture heated.—A. G. L.

X.—METALS AND METALLURGY.

Graphite; Solubility of —— *in iron.* C. Benedicks. Metallurgie, 1908, **5**, 41—45.

The author shows that graphite is soluble in iron in the following way: A Swedish grey pig-iron, containing 3·9 per cent. of carbon, 0·75 of silicon, 0·37 of manganese, and small quantities of sulphur and phosphorus, was first converted into a mixture of ferrite and graphite, by rapidly heating the metal to above 800° C., allowing it to cool slowly during several hours, rapidly re-heating to a point below the original temperature, allowing to cool slowly, and repeating this procedure a number of times. Microscopic examination of the metal finally obtained showed that all pearlite and cementite had disappeared, and that it consisted only of ferrite and graphite. The metal was then heated to 940±10° C. for one or two hours, and quenched in rape oil. Microscopic examination now showed the presence of considerable quantities of martensite, troostite, sorbite and pearlite, so that at 940° C. graphite appears to be appreciably soluble in iron.—A. G. L.

Iron-carbon alloys; Specific heat of ——. P. Oberhoffer and A. Meuthen. Metallurgie, 1908, **5**, 173—177. (See also this J., 1907, 1094.)

A redetermination of the specific heat of Krupp mild steel at temperatures from 0° to above 650° C. gave slightly lower results than the authors had formerly obtained, and shewed very clearly in the curve an angle at 650° C. and a steepening above that temperature. Carbon increases the specific heat of iron, between 0° and 650° C., proportionally to its amount, each per cent. of carbon raising the mean specific heat by 0·0022. The specific heats of pure iron and of iron carbide were obtained graphically by extrapolation, as 0·1432 and 0·1581 respectively.—J. T. D.

Iron-carbon alloys; Influence of phosphorus on ——. F. Wüst. Metallurgie, 1908, **5**, 73—87.

The temperature of commencement of solidification of iron-carbon alloys is lowered by phosphorus, to the extent of about 27° C. for one per cent. of phosphorus, till the phosphorus-content reaches 6·7 per cent. Further increase of phosphorus raises the temperature at which solidification begins. A pause in the cooling-curve of iron is produced by phosphorus; the temperature at which this occurs, 950° C., is not affected by the amount of phosphorus present, but its duration increases with increase of phosphorus up to 6·7 per cent., and diminishes with further increase of phosphorus, till at 15 per cent., corresponding to the compound, Fe_3P, it disappears altogether. The break in the cooling curve due to pearlite is not altered in temperature by phosphorus, but is lessened in duration, and vanishes somewhere about 15 per cent. of phosphorus. The solubility of carbon in iron is lowered by phosphorus; the curve shewing this solubility forms an angle representing nearly 6 per cent. of phosphorus. Phosphorus produces, with the saturated iron-carbon alloy, a ternary eutectic, melting about 950° C., and containing approximately 6·7 per cent. of phosphorus, 2·0 of carbon, and 91·3 of iron. Micrographic examination of phosphorus-carbon-iron alloys shews an increasing amount of this eutectic up to 6·7 per cent. of phosphorus, and beyond that an increasing amount of the compound, Fe_3P.—J. T. D.

Corrosion of iron; Notes on the cause and prevention of the ——. F. N. Speller. Applied Science, Toronto, 1908, **1**, 123—129. (*See also* Walker, this J., 1907, 1051.)

The general opinion is that iron will not corrode in dry air or water free from air, the presence of both carbon dioxide and moisture being necessary. The author however, illustrates the theory that corrosion is due to electro-chemical action by the following experiment:—A solution is prepared by adding a few drops of phenolphthalein to distilled water, neutralized with caustic soda and making faintly yellow with potassium ferricyanide. When a piece of bright iron is placed in it, areas of blue and pink coloration form, indicating that ions of iron are entering the solution at one point and hydroxyl is being formed through liberation of hydrogen at another. Experiments were made in air-free water and it was found that after a certain very small proportion of iron had entered solution as ferrous hydroxide (about 1 in 5 or 10 million parts), action practically ceased owing to polarisation at the cathodic portion of the iron. If a little air was admitted, the cathode became depolarised and action re-commenced, the ferrous hydroxide being oxidised and precipitated as ferric hydroxide. The difference of potential is explained by the lack of complete homogeneity in the piece of iron or steel, but this difference is extremely slight compared with the difference set up by the presence of iron oxide. The author found that the local polarity indicated on the surface of a piece of bright metal by the blue and pink areas, was not consistent, gradual reversion taking place, this conversion of anode into cathode causing corrosion to proceed uniformly, but where difference of potential was caused by oxide of iron or other matter adhering to the surface, the polarity remained constant and resulted in uneven corrosion and "pitting." This would explain why "scale" or other impurities adhering to the surface, are much more active in causing corrosion than segregation within the metal itself, and why clean iron tends to corrode evenly. In a hot water system, where the water is not drawn off, the air present is limited, and after a time, corrosion practically ceases, but if the water be constantly changed, corrosion becomes continuous. The author refers to the various methods of rendering iron "passive," and explains the phenomenon as a condition of polarisation.—F. R.

Quenched steel; Structural constituents of ——. P. Breuil. Bull. Soc. Ind. Min. 1907, [4], **6**, No. 3; through Metallurgie, 1908, **5**, 59—60, 96—99, 105—114.

A monograph accompanied by a large number of excellent micro-photographs.—A. S.

Gold ores; Cyanogen bromide treatment of ——. E. W. Nardin. Proc. Austral. Inst. Min. Eng., June, 1907.

As the result of experiment and investigation at Kalgoorlie, the author suggests the following improvements: (1) The daily samples should be taken each morning from the boxes, and assayed as early as possible. (2) The slimes should be treated as long as possible with cyanide, and this treatment should go on till the determination of the residual gold is finished. (3) The alkalinity should then be determined, and reduced by sulphuric acid to 0·01 per cent. before adding cyanogen bromide. (4) The necessary quantity of cyanogen bromide should be calculated from the gold-content of the residues and the amount contained in the boxes. (5) The lime added during the grinding should be calculated according to the alkalinity of the cyanide residues, so that the solutions returning to the process have an alkalinity of about

0·02 per cent. (6) Lime-water, not lime, should be added to the boxes and to the solutions coming from the filter-presses. (7) All metallic iron should be removed from the slimes, since it destroys cyanide and cyanogen bromide. In the production of cyanogen bromide from bromides, bromates, cyanides and sulphuric acid, the cyanide should be cooled with ice before adding first the sulphuric acid and then the bromide-bromate mixture. Since cyanogen bromide is volatile, the mixture should be made in closed vessels. The cyanide used should be as pure as possible; especially should it be free from carbonates and chlorides.—J. T. D.

" Battery chips " and " screens "; Assay of ——. L. J. Wilmoth. J. Chem. Met. and Min. Soc., S. Africa, 1908, **8**, 230—232.

Battery chips are usually sold at a fixed price per ton, irrespective of assay value, but as the gold adhering to the iron may amount to upwards of 6 oz. per ton of 2,000 lb., the assay is of great assistance in determining the selling price. The chips are generally received for assay in the form of lumps of iron, from the size of a pin's head up to pieces of half an inch in diameter, and so cannot be sampled and assayed in the usual way. The author considers the method of dissolving the iron in acid and assaying the residue, slow and expensive. He prefers a direct fire assay in which the iron is converted into a matte (*i.e.*, a regulus or subsulphide of iron, etc.), whilst the gold is collected as usual in a button of lead. He finds that the matte, whilst removing the iron, carries down practically none of the gold, but that if the silver is also to be determined, the matte must be treated by the usual methods. The following charge was found to work well:—Battery chips, 1 A.T. [A.T. or assay ton = 29·1667 grms.]; sodium carbonate, 1·5 A.T.; borax glass, 1·5 A.T.; and sulphur, 0·5 A.T. [No mention is made of litharge but, judging from the context, 1 A.T. should probably be included.] The addition of an iron nail to the charge is recommended. A higher temperature than that for gold assaying should be used and after quick fusion, a small quantity of a mixture of litharge and charcoal is added to clean the slag. Twenty minutes is allowed after quiescence, before pouring, the lead button being then cupelled and parted, etc. *Battery screens*:—The samples are received as small clippings, which may be assayed in the same manner as the chips, but the author prefers to first roast them for about an hour in a muffle, as the resulting oxide can be readily pulverised. The oxidised sample may then be assayed similarly to an iron ore or may be converted into a regulus by the addition of sulphur. The following charge is recommended for the latter method: Iron oxides, sodium carbonate, and litharge, 1 A.T. each; silica, borax glass, and sulphur, 0·5 A.T. each; charcoal, 1 grm., and an iron nail.—F. R.

Mercury; Purification of ——. W. Bettel. Chem. News, 1908, **97**, 158.

Cyanide has for many years been in use in amalgamation for keeping " plates " in good condition, but its use has been deprecated because it seemed likely that loss of gold would occur through the solvent action of the cyanide on the (" float ") gold. To the author it was unknown that gold in solution in mercury (amalgam), could be so readily removed. More recently, having to purify some impure mercury (7 kilos.) containing zinc, tin, lead, copper, iron, and gold (150 mgrms. per kilo.), before resorting to distillation, the author decided to subject the mercury to cyanide treatment, using sodium peroxide to shorten the process, by facilitating oxidation of the " base " metals. The mercury was placed in a shallow enamelled iron pan with a flat bottom and treated with 1500 c.c. of a 2 per cent. solution of 98 per cent. cyanide, to which were added 20 grms. of sodium peroxide. After 14 days of treatment, the gold content of the mercury was too minute to be estimated, and the mercury was found to be purer than that usually obtained by distillation *in vacuo*. The mercury dissolved by the cyanide solution is so small that it may be disregarded.—W. S.

Iron determination by permanganate according to Reinhardt's method; Influence of accompanying metals on ——. *See* XXIII.

Metallic sulphides. K. Friedrich. *See* VII.

Magnesium oxide; Reducibility of —— *by carbon.* R. E. Slade. *See* VII.

Aluminium industry; Position of the ——. Times, Finan. Suppl., April 3, 1908. [T.R.]

The following table gives the figures for production and price for the period 1897–1907. The companies controlling the production of aluminium have not published any official figures since 1902, and the tonnage of metal produced is, therefore, based upon estimates. The prices are the average of those quoted by the British Aluminium Company for 98–99 per cent. ingot metal in one-ton lots.

Year.	Estimated production in tons.	Price per ton.	Year.	Estimated production in tons.	Price per ton.
1897 ..	3,327	£155	1902..	7,750	£120 (average)
1898 ..	3,953	£148 (average)	1903..	8,102	
1899 ..	5,459		1904..	8,550	
1900 ..	7,192		1905..	9,000	£150
1901 ..	7,420		1906..	12,000	£200
			1907..	19,000	£167

As regards demand, the high prices quoted for aluminium and its alloys during the first half of 1907 undoubtedly curtailed its use, while the depressed condition of the motor-car industry further reduced the consumption of the metal. The price reductions which have been announced since July, 1907, have, however, opened up new outlets for aluminium and some of its alloys, and the year closed with a satisfactory and increased demand, especially for electrical purposes. Two of the new works in the United Kingdom—at Kinlochleven and at Wallsend-on-Tyne, have now commenced manufacturing operations. Aluminium can be manufactured by the electrolytic method at a cost of 10½d. per lb., and, therefore, a small margin of profit exists even at the present low selling prices of the metal and its alloys. No marked reduction in the cost of manufacture is likely to occur, however, until some cheaper material than refined alumina is used in the electrolytic baths. What is required in order that the cost of producing aluminium may be largely reduced, is a process which would allow bauxite to be used directly in the electrolytic baths, and by which the impure aluminium obtained at the cathode could be subjected to a further electrolytic refining operation. The British Aluminium Company has works operating at Foyers, Kinlochleven, and Stangfiord, Norway, while others are in course of erection at Loch Leven and Orsières, Switzerland. The share capital of the company was increased to £1,300,000 in February, 1907, and when all of the new schemes are fully developed, the company's share and debenture capital will stand at £2,000,000, and it will have control of over 70,000 h.p. The gross profit for the year 1906 was £155,023, as compared with £93,296 in the previous year. The estimated output of aluminium by this company in 1907 was 1,500 tons. This total will be largely increased in 1908, owing to the operation of the new works. The Aluminium Corporation has two works in progress at Wallsend-on-Tyne and Dolgarrog, North Wales. The company was floated with a capital of £500,000 in May, 1907. The development of the water power of 5,400 h.p. at Lake Eagure in North Wales is now proceeding. It is expected that the reduction works here will be completed by the middle of the present year, and the whole of the hydraulic engineering work by the middle of 1909. In order that manufacturing operations may commence at the earliest possible date, the company has arranged to take a supply of 1,200 k.w. from the North Wales Electric Power Company and also 4,000 k.w. from the Newcastle Electric Supply Company. A plot of land has been secured adjoining the works of the latter company, at Wallsend-on-Tyne, and a reduction works has been erected. It is hoped to inaugurate the manufacture at Dolgarrog towards the middle or end of the year. Another flotation of last year is the Anglo-Norwegian Aluminium Company, with works in progress at Vigeland Falls, Norway. The company was promoted in this country for the purpose of acquiring and utilising the water-power of the Vigeland Falls on the Otterdal River, near Christiansand, Norway. It has a capital of £110,000. The Aluminium Ind. Akt.-Ges. has three works in operation, at Neuhausen, Rheinfelden, and Lend Gastein. It has also works in course of construction at Navigense, Switzerland. It is the oldest of the European companies manufacturing aluminium, the works at Neuhausen having been started in 1889. The capital has been increased from time to time, and in 1906 the ordinary share capital stood at £758,000. The gross profits in 1906 amounted to £318,886, as compared with £185,599 in 1905, and a dividend of 26 per cent. was declared upon the ordinary shares. The estimated output of aluminium by this company in 1907 was 4500 tons. The Pittsburg Reduction Company has works in operation at Niagara Falls and Shawinigan Falls, and also at Massena. This company is the oldest of the aluminium manufacturing companies, the original works at New Kensington having been started in 1888. The name was changed to the Aluminium Company of America on Jan. 1, 1907. The capital of this company is now $3,800,000. The gross profits for the last two years have been:—1904-5, $1,771,342; 1905-6, $3,399,322. The estimated output of aluminium by this company in 1907 was 8,000 tons. Official figures for the consumption (*i.e.*, sales) of aluminium in the United States during the years 1904, 1905, 1906 are as follows:—1904, 8,600,000 lb.; 1905, 11,343,000 lb.; 1906, 14,910,000 lb. Other companies are the Société Electrométallurgique Française, with a capital of 8,000,000 f., and works at Froges (Gardannes), La Praz, and St. Michel, and the Compagnie des Produits Chimiques d'Alais et de la Carmargue. The capital of the latter company is 4,500,000 f., and the works are at Calypso, near St. Michel. The estimated output of aluminium by these four works in 1907 was 5,000 tons. In addition to the works already named, a company, with headquarters in Rome, is promoting the manufacture of aluminium in Italy, and works situated near Bussi, in the valley of Pescara, are believed to be now in operation.

Zinc; World's production of ——. Ch. of Comm. J., April, 1908. [T.R.]

P. SPEIER, of Breslau, reports that the world's production of zinc in 1906 and 1907 was as follows:—

	1906.	1907.
	Tons.	Tons.
United States	199,385	226,837
Germany	205,024	208,707
Belgium	152,461	154,493
France and Spain	53,787	55,733
England	52,588	55,596
Holland	14,651	14,991
Austria and Italy	10,779	11,359
Russian Poland	9,611	9,347
Australia	1,026	996
Totals	699,312	738,059

PATENTS.

Metals or metallic alloys; Treatment of —— by agglomeration. H. H. Lake, London. From Soc. Anon. le Carbone, Levallois-Perret, France. Eng. Pat. 5973, March 12, 1907.

SEE Fr. Pat. 375,180 of 1907; this J., 1907, 875.—T. F. B.

Steel alloys; Production of ——. J. Churchward, New York. Eng. Pat. 6554, March 19, 1907.

SEE U.S. Pat. 867,642 of 1907; this J., 1907, 1202.—T. F. B.

Welding of metals [*steel*]. A. Astruc, Courbevoie, France. Eng. Pat. 9924, April 29, 1907. Under Int. Conv., May 22, 1906.

IN plating a metal, *e.g.*, steel, with another metal or alloy, *e.g.*, copper, silver, brass, bronze, etc., a thick sheet of the supporting metal and a sheet of the casing metal are cleaned, dried, and placed in contact with each other. The composite sheet is then heated in a non-oxidising atmosphere to a temperature approaching the melting point of the casing metal, when it is rapidly passed through a rolling machine.—A. G. L.

Steel. R. H. Illingworth, Newark, N.J., Assignor to Crucible Steel Co. of America. U.S. Pat. 882,112, March 17, 1908.

THE claims are for nickel-chromium-tungsten steels containing approximately the following proportions: (1). Nickel, 0·50 to 5; chromium, 0·10 to 5; tungsten, 0·25 to 3 per cent. (2). Nickel, 2 to 3; chromium, 1 to 2; tungsten, 0·25 to 1 per cent. (3). Nickel, 2·50; chromium, 1·25; tungsten, 1; and carbon less than 1 per cent.; this last having a high elastic limit, tensile strength and elongation.—C. A. W.

Steel; Method of hardening ——. W. A. Painter Allegheny, Pa. U.S. Pat. 882,162, March 17, 1908.

THE portion of the steel, which is not to be hardened, is partially protected by a layer of material whose thickness, however, is such as to allow a graduated heating and cooling in the piece it covers. The portion to be hardened being left exposed, the whole is heated to the required temperature and suddenly cooled.—C. A. W.

Ferrochromium; Process of producing slag-free ——. J. B. Huffard, Ferris, W. Va., Assignor to Electro Metallurgical Co., Chicago, Ill. U.S. Pat. 882,637, March 24, 1908.

MOLTEN ferrochromium and slag are discharged into a vessel in which they are allowed to separate, the slag solidifying. The molten metal is then run away from the solidified slag.—A. G. L.

[*Precious metals.*] *Minerals; Apparatus for washing or extracting* ——. R. Freygang, Hamburg, Germany. Eng. Pat. 13,901, June 15, 1907.

THE apparatus is designed to treat Chilian and other South American gold and silver ores, containing quartz and clay, as well as iron and copper. A stream of water or cyanide solution washes the powdered ore from a hopper through a vertical tube into the lower end of an inclined tube, in which a screw conveyor moves. Near its upper end the inclined tube is provided with a small dome-shaped projection, to which is attached a discharge pipe. The water and light minerals, especially the clay, pass up into this projection, and are sucked down through the discharge pipe, whilst the heavy minerals, especially the quartz carrying the precious metals, are conveyed further up the tube by the worm and are discharged, together with very little water, through an opening in the bottom of the upper end of the inclined tube.—A. G. L.

Copper and titanium; Process of producing alloys or compounds of ——. A. J. Rossi, New York, Assignor to The Titanium Alloy Manufacturing Co., Maine. Re-issue 12,764, March 17, 1908, of U.S. Pat. 700,244, May 20, 1902.

TITANIC oxide is introduced into a bath of molten aluminium and copper. The temperature is then raised to a point at which aluminium reduces titanic oxide, the resulting titanium alloying with the other metals to form an alloy containing not less than 10 per cent. of copper and not less than 5 per cent. of titanium.—A. G. L.

[*Metallurgical*] *Fume-condensing apparatus.* J. R. Moffitt, Denver, Colo. U.S. Pat. 882,073, March 17, 1908.

IN furnaces where ores are treated for the volatilisation of certain elements, a hood is connected to the escape flue, and immersed in liquid contained in a tank. The downwardly inclined walls of this hood are perforated so as to present a jagged surface within.—C. A. W.

Lead ores; Method of reducing ——. A. Francis, St. Louis, Mo. U.S. Pat. 882,193, March 17, 1908.

SULPHIDE ores of lead, or concentrates of such ores, are melted with the necessary fluxes and fuel so as to produce the approximately pure lead matte. The matte is then run on to a bath of molten lead while, at the same time, air is blown through the fluid metal, oxidising the latter and so, ultimately, reducing the matte to metallic lead. —C. A. W.

[Zinc blende] Ore-treating process. W. G. Swart, Denver, Colo. U.S. Pat. 882,217, March 17, 1908.

Sulphide ore (zinc blende), which can only be roasted with difficulty, is continuously passed through a roaster, in which it meets hot sulphurous gases evolved in the roasting of a non-carbonaceous material, *e.g.*, pyrites, which gives out heat on oxidation. The mixed gases from the pyrites and the zinc blende are used for the manufacture of sulphuric acid.—A. G. L.

Smelting sulphide ores. J. T. Carrick and S. Pattison, Johannesburg. U.S. Pat. 882,234, March 17, 1908.

See Eng. Pat. 22,166 of 1906; this J., 1907, 827. —T. F. B.

Ores; Process of roasting and sintering ——. A. S. Dwight and R. L. Lloyd, Cananea, Mexico. U.S. Pat. 882,518, March 17, 1908.

The ore is supported on a perforated screen and is moved forward from the inlet end to the discharge end. At an intermediate point it is ignited, roasted and sintered by a blast of air passing downwards through the mass of ore.—A. G. L.

Roasting furnace; Mechanical ——. R. von Zelewski, Engis, Belgium. U.S. Pat. 882,730, March 24, 1908.

See Eng. Pat. 21,961 of 1907; this J., 1908, 165.—T. F. B.

Furnace for roasting ores, etc.; Rotary ——. W. Hommel. Fr. Pat. 384,350, Nov. 25, 1907.

See Eng. Pat. 27,639 of 1906; this J., 1908, 25.—T. F. B.

Aluminium; Autogenous soldering of ——. M. U. Schoop. Addition dated Nov. 11, 1907, to Fr. Pat. 374,089, Jan. 30, 1907 (this J., 1907, 828).

The flux now claimed consists of a mixture of alkali bromides or iodides with finely-divided aluminium and an oil free from fixed residue. The flux is conveniently contained in metal tubes similar to those used for paints. Soldering is effected by means of the oxy-hydrogen blowpipe. (See also this J., 1907, 927.)—A. G. L.

Silicates of aluminium; Process for treating —— to obtain useful products [aluminium]. A. Sinding-Larsen. Fr. Pat. 384,069, Nov. 16, 1907. Under Int. Conv., Nov. 17, 1906.

When natural silicates of aluminium, such as felspar, clay, or kaolin, are very strongly heated with a metal, such as iron, having an affinity for silicon, in the presence of a reducing agent and flux, the silica becomes reduced to silicon, which combines with the metal, leaving the aluminium as oxide, from which the element itself may be obtained by electrolysis. For example, when a charge consisting of clay 4 parts, scrap iron 1 part, coke 1 part, and cryolite 1 part, is heated in an electric furnace at a temperature sufficient for the reduction of the silica, ferrosilicon forms as a lower molten layer, above which floats a solution of aluminium oxide in the flux. Or the process may be carried out as follows:—Into one end of a long shallow electric furnace, fitted with several electrodes, is fed the silicate, and into the other end a mixture of iron and coke (or iron rich in carbon) and flux. During the process, a continuous current of ferrosilicon passes along the bottom of the furnace in one direction, and above this a stream of aluminium oxide slag moves in the opposite direction. Tap-holes are placed at appropriate levels, one at each end.—F. Sodn.

Aluminium; Alloys of ——. Centralstelle für Wiss. Techn. Untersuchungen G.m.b.H. Fr. Pat. 384,187, Nov. 20, 1907. Under Int. Conv., Jan. 10, 1907.

Alloys of aluminium are claimed, containing about 5 per cent. of copper and about 2 of magnesium; in particular, an alloy containing 4 per cent. of copper and 0·25 to 0·5 of magnesium.—A. G. L.

Detinning process. E. A. Sperry. Fr. Pat. 384,168, Nov. 19, 1907.

See U.S. Pats. 872,090, 874,040, and 879,596; this J., 1908, 26, 128, and 287.—T. F. B.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(A.)—ELECTRO-CHEMISTRY.

Hydrochloric acid; Electrolysis of ——. T. Guilloz. Compt. rend., 1908, **146**, 581—582.

In reply to a note of Doumer (this J., 1908, 288), stating that in the electrolysis of dilute aqueous hydrochloric acid a considerable proportion of the total current was occupied in electrolysing the water present, and that this affected the rates of migration of the hydrogen and chlorine ions, the author quotes work by Noyes and Sammet (Z. physik. Chem. 1903, **43**, 49) and by Haber and Grindberg (this J., 1899, 690 and 1028) which proves that the transport numbers are not affected by dilution. —J. T. D.

Bleach liquor; Electrolytic ——. A. Ahlin. Papier-Zeit., 1908, **33**, 834—835.

Rock salt which is used for the electrolytic preparation of bleach liquors is liable to considerable variations in composition and the impurities exert an important influence on the results. During the electrolysis certain harmful secondary reactions may go on, which may be classed under two heads: formation of chlorate and reduction. The formation of chlorate may be either indirect, owing to the oxidation of the hypochlorite, or direct, according to the equation $Cl + 5OH = HClO_3 + 2H_2O$. The indirect formation of chlorate may occur in small plants where the circulation is deficient, *e.g.* in laboratory electrolysers. The direct production of chlorate has been studied by the author in the case of Schuckert's apparatus. Reduction takes place by a re-conversion of hypochlorite into chloride, and occurs when the hypochlorite already produced comes in contact with the hydrogen from the cathode. It is prevented by the formation of a protective "diaphragm," consisting of sparingly soluble basic deposits on the cathode, produced by impurities in the salt solution. The work of each electrolyser should be checked by drawing a curve with chlorine strengths as ordinates and the times of electrolysis as abscissæ. Such curves will show when any of the electrolysers is not giving normal results. Constant attention must be devoted to the temperature and the alkalinity of the liquor. The former should be low, and the latter should be such that 1 litre of the salt solution, when reddened with phenolphthalein, is decolorised by 2 drops of $N/_1$-acid. This alkalinity is to be neutralised before the liquor is used for bleaching. The presence of magnesium chloride is objectionable, since it forms heavy deposits on the cathodes which impede circulation and create electrical resistance; it is removed by the addition of alkali as specified above. The only difference between the electrolytic bleach liquor and ordinary bleach liquor is the slightly more rapid action of the former; the consumption of chlorine for a given amount of bleaching work done is very slightly lower on this account. In the author's opinion no electrolyser gives really satisfactory results unless the anodes, at least, are of platinum. The consumption of platinum depends on the construction of the apparatus; it may be either mechanical, through the friction of solid particles suspended in an imperfectly filtered liquor, or electrical, increasing with the current density. The Schuckert apparatus is very economical in this respect; so long as the platinum has a smooth, clean surface no waste takes place, this only beginning when the surface gets rough.—J. F. B.

Tin; Separation of —— from manganese, chromium, and iron by electrolysis. N. Puschin. *See* XXIII.

Patents.

Electrode. M. Ruthenburg, Philadelphia, Pa. U.S. Pat. 882,169, March 17, 1908.

The electrode consists of a solid mass of uniform non-ferruginous composition, comprising silicon and another ingredient, such as carbon, capable of resisting the action of free chlorine, "chlorous" acid and nitric acid, the electrode being characterised by its capacity to conduct electricity through its mass.—B. N.

Electric furnace. H. L. Hartenstein, Constantine, Mich., Assignor to Continental Investment Co., Duluth, Minn. U.S. Pat. 883,110, March 24, 1908.

See Eng. Pat. 20,650 of 1907; this J., 1908, 166.—T. F. B.

Insulating and refractory products with base of kieselguhr. Denniel et Cie. Fr. Pat. 383,803, Nov. 9, 1907.

The plasticity of the clay used for agglomerating kieselguhr, is augmented by the addition of tannin materials, the improved clay being afterwards added to the kieselguhr in the minimum quantity required to form a paste which is easily moulded, and which gives on roasting very light and insulating products.

—B. N.

Fertiliser containing phosphorus. Fr. Pat. 383,779. *See* XV.

Filaments for electric incandescence lamps. Fr. Pat. 383,822. *See* II.

(*B.*)—ELECTRO-METALLURGY

Magnetic separation; An electro-magnet for testing the suitability of an ore for ——. L. H. L. Huddart. Trans. Inst. Min. and Met. [Advance proof.] April 9, 1908.

The apparatus, which is intended for the laboratory separation of materials of variable magnetic permeability, consists essentially of a 6-in. soft iron electro-magnet with 1 in. core. Two special chisel-shaped pole pieces are provided, bent downwards so that they approach each other at an angle of about 45°, thus causing the magnetic field to be concentrated along their thin edges. Means are provided for altering the intensity of the field, by adjusting the distance between the pole pieces. The magnet is suspended by a bracket over a small horizontal endless travelling belt, actuated by hand. The material to be treated is fed on to the belt through a hopper and thus conveyed beneath the pole pieces, the edges of which are set at right angles to the movement of the material. A hand-driven dynamo is mentioned as a convenient source of current. A higher grade product than can be produced by a full-sized plant is said to be obtained, but, as the difference is fairly constant, the probable behaviour of an ore when treated magnetically may be predicted. Two working drawings showing the methods of adjustment, etc., accompany the paper. (See also A. Treloar and G. Johnson, this J., 1907, 1094.)

F. R.

Tin ores; Electric smelting of ——. F. Mattonet. Metallurgie, 1908, **5**, 186—191.

The results of experiments show that tin ores can be reduced by means of carbon in an electrically heated furnace, by a continuous process. Sulphur-containing ores must first be roasted, and the ore is then mixed with sufficient of a mixture of three parts of sodium carbonate and four of lime to make a slightly basic slag with the silica present. Working in this way, the following results were obtained. From an ore containing 50·3 per cent. of tin, 1·9 of lead, 0·5 of copper, 7·6 of iron, 3·3 of zinc, 11·4 of silica, and 6·7 per cent. of sulphur, there was obtained a metal containing 97·0 per cent. of tin, 1·8 of lead, 0·2 of copper, 1·2 of iron, and a trace of zinc, with a yield of 86 per cent. of the total tin; the loss of tin was about 1 per cent. in the slag, and 13 per cent. through volatilisation and dust. The latter losses would be largely reduced in continuous working on an industrial scale. It was not found possible to produce a metal free from lead by direct smelting; but by melting and carefully cooling the metal produced, and treating it as in the Pattinson process for desilverising lead, pure tin was obtained in crystals, and the lead could be concentrated to form a 90 : 10 tin-lead alloy, which is a merchantable product.—J. T. D.

Copper-aluminium alloys; Electrolytic corrosion of ——. W. S. Rowland. J. of Phys. Chem., 1908, **12**, 180—206.

The alloys were prepared from electrolytic copper and 99·99 per cent. aluminium in crucibles of Acheson graphite. In the case of alloys containing up to about 50 per cent. of aluminium, this metal was first melted under powdered carbon and the copper then added. In other cases the copper was melted first. The melts were kept covered with powdered graphite. The castings were made in graphite moulds. The alloys were annealed at 500° C. and some also at 610° C. The corrosion was studied in 7 per cent. solutions of caustic soda, sodium sulphate, sodium chloride, sodium nitrate, sodium carbonate and sodium acetate, and in solutions containing 3 per cent. of sodium oxalate with 3 per cent. of oxalic acid, and 7 per cent. of sodium tartrate with 3 per cent. of caustic soda. The test-pieces were used as anodes, being mounted so that they could be rapidly rotated, and a current of 35 "milamperes" passed through for 7—9 hours, platinum cathodes being employed. The pieces of metal were weighed before and after the tests, and the percentage of copper dissolved was also determined. The results show that the organic acid salts, with the exception of the tartrate, dissolve the α-phase (see this J., 1907, 1241) most easily. In the tartrate solution the γ-phase is considerably more soluble. The compound, $CuAl_2$, and the η-phase are practically insoluble in the organic acid salt solutions. In the nitrate and sulphate solutions the α-phase is the most soluble, followed by ϵ- and γ-phases, whilst in the chloride solution the γ-phase is slightly more soluble than the ϵ-phase. The α-, γ-, and ϵ-phases are practically insoluble in caustic soda solution, but the compound, $CuAl_2$, and the η-phase dissolve readily. All of the bronzes remain practically unaffected in sodium carbonate solution. Except in the chloride and nitrate solutions, but especially in the organic acid solutions, there is a tendency for the bronzes high in aluminium to become "aluic," *i.e.*, to cease to dissolve and to prevent the passage of the current. This is accompanied by the formation on the metal of a thin film of alumina. It should be noted that the phases which have the greater resistance to corrosion are those which have the poorer physical properties. Probably, however, alloys containing 10—20 per cent. of copper would prove very serviceable for metal parts exposed to the weather.—A. S.

Patents.

Furnace; Electrical induction ——. A. Hiorth, Christiania, Norway. Eng. Pat. 28,542, Dec. 28, 1907. Under Int. Conv., Jan. 4, 1907.

With the object of avoiding the formation of eddies in the charges of large electrical induction furnaces, the hearth is built in a spiral form. The extreme ends of this spiral channel are connected electrically by a suitable solid or liquid material.—J. W. H.

Furnaces; Electric fusion ——. E. A. A. Grönwall, A. R. Lindblad, and O. Stalhane. Fr. Pat. 383,857, Oct. 21, 1907. Under Int. Conv., Oct. 25, 1906, Feb. 20, March 8, July 16, July 26, and Sept. 25, 1907.

The electrodes consist of the melted product obtained in the process, this being contained in channels extending into the interior of the furnace, and connected to the conductors by contact blocks of carbon or metal provided with a cooling arrangement. The base of the fusion chamber is at the level of the upper surfaces of the electrodes, or lower, or one electrode may be at a higher level than the other, with an inclined furnace base between the two channels, or the base may consist of two inclined planes descending towards a central channel. The gas escaping at the furnace mouth may be brought back by means of a fan to the lower part of the furnace. The channels containing the metal forming the electrodes and extending into the furnace from opposite sides, may be in the form of a T or may be arranged concentrically, but are of such a form that a greater intensity of current will pass through one of the channels and thus produce a higher temperature.—B. N.

Furnace ; Electric arc ——. F. Bergmann. Fr. Pat. 384,096, Nov. 16, 1907.

The arc is produced between two electrodes placed above the bath of the furnace, the latter being made in two parts, one portion forming the crucible, and the other carrying the electrodes. One part is made movable, so that the distance between the surface of the bath and the arc may be increased or diminished without displacing the electrodes.—B. N.

Aluminium-magnesium alloys ; Producing —— [*electrolytically*]. F. Von Kügelgen and G. O. Seward, Holcombs Rock, Va., Assignors to Virginia Laboratory Co., New York. U.S. Pat. 881,934, March 17, 1908.

The process consists in electrolysing a combined fused bath of a magnesium compound and an aluminium compound, such as magnesium oxide dissolved in a fused salt, *e.g.*, a fluoride, of low specific gravity. Or, a bath of magnesium oxide dissolved in magnesium fluoride and a fluoride of a more electro-positive metal may be used, in the presence of a cathode of molten aluminium-magnesium alloy with which the separated magnesium alloys.—B. N.

Copper-nickel matte ; Separating the metals contained in ——. J. M. Neil, Toronto, Canada, Assignor to F. C. Norris, Detroit, Mich. U.S. Pat. 882,075, March 17, 1908.

The matte is treated with sulphuric acid, and the resulting solution of sulphates electrolysed, a copper-nickel anode and a copper cathode being employed. Any copper which has not been precipitated in this way, together with other metals present as impurities, are subsequently precipitated as sulphides, and the remaining solution of nickel sulphate is mixed with a solution of an alkaline-earth chloride. After removal of the insoluble sulphate, the nickel is precipitated by electrolysis, with an insoluble anode and nickel cathode, chlorine being obtained as one of the products. For the regeneration of the alkaline-earth chloride, this chlorine is passed over the sulphide obtained from the insoluble sulphate, produced as above, by roasting the latter with carbon. —C. A. W.

Ferrosilicon and silicospiegel ; Process of producing ——. E. F. Price, Niagara Falls, N.Y., Assignor to Central Trust Co. of New York. U.S. Pats. 882,417 and 882,418, March 17, 1908.

A charge consisting of a silicon compound, carbon, and a material containing iron, or, of compounds of manganese and silicon, carbon and a material containing iron, is smelted in an electrical resistance furnace. The charge itself may constitute the resistance material through which the current is passed.—A. G. L.

Copper pyrites ; Treating —— . Fr. Pat. 384,072. *See* VII.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

Fats, lipoids and waxes ; Proportion of iron in ——. W. Glikin. Ber., 1908, **41**, 910—915.

The results of a large number of determinations given in tabular form) of the iron in organic combination in the marrow from the bones of different animals and of man show that the amount decreases with the growth of the animal. Thus, in the case of a new-born pig the amount of iron in the marrow was 1·15 per cent., whilst in a pig six weeks old it was 0·3 per cent., in one 8 weeks old 0·15 per cent., and in old pigs the average amount was only 0·03 per cent. The proportion of iron in the marrow decreases almost in the same ratio as the lecithin decreases as the animal grows, and an analogous decrease of iron takes place in the liver. For instance, the proportion of iron in the liver of a newly-born rabbit is about 10 per cent. but falls to about 0·4 per cent. during the first three months. The author has found iron in the fat from various parts of animals, and in various vegetable fats, *e.g.*, in muscular tissue, whale oil (trace), cacao butter, and Japan wax. Two samples of Merck's lecithin contained 0·173 and 0·181 per cent. of iron respectively and a specimen prepared by the author from brain substance contained 0·526 per cent. The proportion of iron in two samples of commercial cholesterol purified by recrystallisation was 0·06 and 0·03 per cent. respectively. The ratio of iron to phosphoric acid in a compound containing one atom of iron to 3 mols. of lecithin is as 80 : 213, and this ratio was obversed in the case of the calf, horse, sucking-pig, dog and man, whilst in the case of the ox, pig, sheep and child there is probably another ratio between the iron and phosphorus.—C. A. M.

Paraffin hydrocarbons ; Presence of two —— *in the unsaponifiable matter of the fat of silk-worm* (*Bombyx mori*) *pupæ.* [*Chrysalis oil.*] A. Menozzi and A. Moreschi. Atti R. Accad. dei Lincei, Roma, 1908, [5], **17**, I., 100—101. Chem. Zentr., 1908, **1**, 1378.

The unsaponifiable matter from chrysalis oil (this J., 1907 24 and 622), was treated with aqueous alcohol on the water-bath. Oily drops separated and gradually settled to the bottom. After decanting off the alcoholic liquid, the residual oil was washed with aqueous alcohol, when a wax-like mass was left, constituting about one-half of the total insoluble matter. This was separated into two portions : the less fusible part crystallised from ether in leaflets having the composition, $C_{28}H_{58}$, m. pt., 62·5° C. ; and b. pt. 270° C. The other portion melted at 41°—42° C., and also appeared to consist of a saturated hydrocarbon. —A. S.

Patents.

Oils ; Treatment of ——. C. Dreymann, Turin, Italy. Eng. Pat. 9766, April 26, 1907. Under Int. Conv., May 1, 1906.

See Fr. Pat. 377,262 of 1907 ; this J., 1907, 1057.—T. F. B.

Soaps ; Polishing ——. J. C. S. McLay, Hadleigh, Essex. Eng. Pat. 15,213, July 2, 1907.

"Soap ash," the waste calcium carbonate produced in the making of "leys," is mixed with soap, saltpetre and ammonia. When the polishing soap is required for rough surfaces, powdered silicious material is added. The proportions given are :—"Soap ash," 60 ; yellow soap, 30 ; saltpetre, 5 ; and ammonia, 5 per cent.—J. W. H.

Soap powder ; Process for making ——. Soc. Franç. d'Exploitation des Appareils Koerting. Fr. Pat. 383,889, Nov. 12, 1907.

See Eng. Pat. 25,276 of 1907 ; this J., 1908, 345.—T. F. B.

Butter, oils, etc. ; Renovating ——. U.S. Pat. 881,929. *See* XVIIIA.

[*Lubricating*] *Oil testing device.* Ger. Pat. 186,601. *See* XXIII.

XIII.—PIGMENTS, PAINTS ; RESINS, VARNISHES ; INDIA-RUBBER, &c.

(*A.*)—PIGMENTS, PAINTS.

Patents.

White lead ; Manufacture of ——. E. H Strange and C. A. Pim, London. Eng. Pat. 6629, March 19, 1907.

In the manufacture of white lead, cast strips of the metal are more readily attacked than cut strips. Such strips are expeditiously produced by pouring the molten metal on to a travelling cool surface.—J. W. H.

Cerussite; Process of making ——. F. W. Morris, J. B. Raine, J. Kerr, and C. McLachlan. Fr. Pat. 383,931, Nov. 14, 1907.

See U.S. Pat. 871,947 of 1907; this J., 1907, 1287.—T.F.B.

Paints free from lead; Process for the manufacture of ——. E. Hildt. Fr. Pat. 383,952, Nov. 15, 1907.

Stearine pitch is melted with chalk and then further heated with calcium permanganate until all volatile constituents are eliminated. The product is incorporated at a suitable temperature with a drying oil and oxide, borate, acetate or other salt of manganese, together with, if desired, inert substances such as graphite, talc, etc., pigments such as iron oxide and the like, and petroleum spirit. The resulting paste may be prepared for use as a paint by mixing it with oil of turpentine and a drier. —A. S.

(*B.*)—RESINS, VARNISHES.

Gum-lac insect of Madagascar, and other coccids. R. Newstead. Quart. J. Inst. Comm. Research in Tropics, Liverpool Univ., 1908, **3**, 3—5.

The author reproduces a translation of a paper by M. A. Gascard, from a work by Targioni-Tozzetti (1893, I c, p. 38), in the course of which some details of a chemical study of Madagascar gum-lac are recorded. The lac contains 57 per cent. of a yellowish resin soluble in cold alcohol, and 24 per cent. of a white wax, insoluble in that solvent. The resin contains amino-acids and a small quantity of formic acid. On oxidation with permanganate it yields ammonia and several acids, including butyric and oxalic acids. The proportion of wax is higher than in Indian lac, and its composition is very different. It contains a very small quantity of ceryl esters of formic, and, perhaps, oleic acids, and also of amino-acids, which latter are present in the free state.—E. W. L.

Shellac; Further notes on ——. H. Endemann. J. Franklin. Inst., 1908, **165**, 217—221. (Compare this J., 1907, 1207).

The trihydroxypalmitic acid previously described has been further investigated. From the pure acid neither butyric nor azelaic acid are obtained on oxidation with permanganate (compare Farner, this J., 1899, 379) but the oxidation products are sebacic acid and δ-hydroxy-caproic acid, proving the trihydroxypalmitic acid to have the following constitution:—

$$CO_2H.[CH_2]_8.CH(OH).CH(OH).[CH_2]_3.CH(OH).CH_3.$$

Abietic acid takes up about "18 atoms of bromine," forming a body containing 57·7 per cent. of bromine and devoid of acid properties. In analysing shellac the author now advises the use of less sand (3—4 gms.) than formerly (this J., 1907, 1207). Refuse lac (seed-lac) should be analysed by determining the alcohol-soluble portion and treating this with sand and hydrochloric acid to determine the non-condensable resins. The figure of 8 per cent. of resins as the maximum for a good pure shellac is upheld and a number of analyses are quoted of shellacs containing 3—6 per cent. of colophony.—E.F.A.

Resins; Properties of —— *from different varieties of pine trees.* W. Schkateloff. Monit. Scient., 1908, **22**, 217—227.

The author has investigated the nature of the resinous discharge from a considerable number of different varieties of pine trees. They were all found to contain some of the following substances dissolved in oil of turpentine: α-sylvic acid, m. pt. 143°—144° C., rotatory power $\alpha_D = -73{\cdot}67^\circ$; β-sylvic acid, m. pt. 160° C., $\alpha_D = -92{\cdot}5^\circ$; γ-sylvic acid, m. pt. 180° C., optically inactive; pinic acid, a coloured product probably formed by oxidation of the others. Of these only α- and β-sylvic acid are contained in important quantities and only these were investigated. They are white crystalline substances and both have the composition, $HC_{20}H_{29}O_3$; the α-form is transformed into the β-acid by treatment with hydrochloric acid. To obtain these substances from the crude exudation, this is first distilled with steam to remove the oil of turpentine. The resin in the retort is melted and filtered through a sieve. It is allowed to solidify and then compressed by a powerful press: a brown liquid is squeezed out and leaves behind white crystals of sylvic acid.—C. E. F.

Patents.

Resins and gums; Manufacture of substitutes for —— *from aldehydes and phenols.* L. Helm, Le Vésinet, France. Eng. Pat. 25,216, Nov. 13, 1907.

Aldehydes and phenols are condensed by means of amines or ammonium salts with the production of resinous bodies. Examples: (1). 290 parts of naphthol are dissolved in 150 parts of a 40 per cent. solution of formaldehyde, and 95 parts of aniline are added. After the reaction, which may be modified by heat, is over, the resinous product is washed and may be used as a substitute for gum-lac. (2). 190 parts of phenol are dissolved in 150 parts of a 40 per cent. solution of formaldehyde, and 95 parts of aniline added. The resinous product is heated under water or exposed to the atmosphere if further condensation is desired. A similar substitute for resins or gums is obtained.—J. W. H.

Waxing or polishing of wood; Process for preparing resins for the ——. Chem. Fabr. Elkeles und Co. Fr. Pat. 383,950, Nov. 15, 1907.

The process consists essentially in mixing suitable resins with small quantities of wax or wax-like substances. For example, 100 grms. of a copal resin are dissolved in a solution of 20 grms. of caustic soda in 1 litre of water, and well mixed with an alkaline emulsion of about ½ grm. of Chinese wax. The solution is then acidified, the acid mixture heated to 70°—80° C., and the precipitated resin and wax filtered off, washed, and dried. The wax may be added directly to the alkaline solution of resin, without being previously emulsified, but in this case, after precipitating with acid, the mixture must be heated to the melting point of the wax in order to ensure thorough admixture.—A. S.

(*C.*)—INDIA-RUBBER, &c.

Latex from Ficus Vogelii; Analysis of ——. D. Spence. Quart. J. Inst. of Comm. Research in Tropics, Liverpool Univ., 1908, **3**, 64—75.

The samples examined were obtained from the Botanical Gardens, Aburi, and were preserved during their transit to England by the addition of formalin (1 oz. per litre of latex). The samples as received were quite fresh, were only faintly acid to phenolphthalein, and had partly agglutinated, though no coagulation had occurred. The method of dialysis (this J., 1907, 1021) failing on account of the agglutination, the samples were coagulated by heating on the water-bath, and the clot of rubber separated, washed and dried, and this and the mother-liquors were examined separately. The yield of "technically pure" rubber from two samples (A and B) of latex, was respectively 33·8 and 32·4 per cent., and the two samples of rubber gave on analysis the following figures: caoutchouc, (A) 64·36. (B) 59·08; resins, 32·90, 37·84; nitrogen, 0·305, 0·287; protein (calcd. from nitrogen), 1·9, 1·8; mineral matter (ash), 0·21, 0·33; insoluble matter 2·54, 3·26; and nitrogen in insoluble matter, 5·6, and 4·3 per cent. The rubbers were of very inferior quality physically, and were valued at 1/- to 1/3 per lb., fine hard Para then being 4/3 per lb. The resins have been dealt with in a previous paper (this J., 1907, 422). The ash consisted largely of magnesia with traces of iron, calcium, potassium, and a small quantity of phosphoric acid. Chlorides were absent, and potassium present only in mere traces. Reference is made to previous analyses of latex of F. Vogelii (*cf.* Terry, this J., 1892, 970; Spence, this J., 1906, 435; also Report on Botanical and Agric. Dept. of Gold Coast for 1906), a comparison indicating that the resinous and caoutchouc contents are subject to great variation. The mother-liquors gave on analysis the following results: Total solids, (A) 3·1, (B) 3·95; ash, 1·05, 1·24; ash in total solids, 32·67, 31·42; nitrogen, 0·0095, 0·0196; and nitrogen calculated on total solids, 0·307, 0·49 per cent. The ash had the following composition: MgO, (A) 16·82, (B) 28·97; CaO, 3·2, 3·2; Fe_2O_3, Al_2O_3, 1·1, 1·6; K_2O, 30·4, 29·3; and Cl, 50·4, 35·9 per cent.: carbonates, though present, were not determined. The high percentage of magnesium and of chlorides, and the absence of phosphates may be taken as characteristic of this latex (see also this J., 1907, 1020—1021). Magnesium is probably present as malate, and potassium largely as chloride. It is improbable that tannic acid is present in the latex, as affirmed by Terry (*loc. cit.*), but there is some evidence of the presence of a substance of glucosidal nature. No evidence of the presence of pentoses has been obtained.—E. W. L.

Karité Gutta; The so-called —— from Sierra Leone. D. Spence. Quart. J. Inst. Comm. Research in Tropics, Liverpool Univ., 1908, **3**, 61—63.

The sample examined formed a hard, almost brittle mass, of a dark brownish colour outside, lighter inside, and containing bark and vegetable impurities; it appeared to be identical with the product Karite gutta obtained from the latex of *Butyrospermum Parkii.* The mass became sticky and soft when held in the hand for some time, and on comparison with a sample of true gutta-percha containing 78 per cent. of gutta, by gradually heating the two samples in water, the following principal differences were noted: The true gutta showed the first signs of becoming plastic at 55° C. and did not become sticky even at 75° C., whereas the product under examination became plastic even at 35° C., and at 55° C. became somewhat sticky, being very soft and sticky at 75° C. Approximate analysis of the raw, dry product gave the following figures: Gutta, 18·4; resins (acetone extract), 75·7; ash (Ca, Mg and K largely, traces of Fe, Al, SO_3; no Cl or PO_4), 1·0; and insoluble, 5·6 per cent. The insoluble portion contained 11·13 per cent. of nitrogen, and is regarded by the author as vegetable protein largely, analogous to the insoluble constituent of india-rubber. The resins are hard, dry and amorphous, and gave cinnamic acid on saponification. The gutta has a greater resemblance to caoutchouc than to true gutta, being more or less elastic at ordinary temperatures. The product appears to be of little value commercially in its present state.—E. W. L.

Patent.

Gums [caoutchouc, gutta-percha, etc.]; Process and apparatus for extracting ——. A. Nodon. Fr. Pat. 384,108, Jan. 25, 1907.

The plants, or parts of plants, are finely divided and macerated in a 6 per cent. solution of sodium hydroxide for 3 or 4 days. Fermentation takes place and the woody tissue, resins, etc., are either dissolved or broken up so that they can be removed by treating the mass with water, while the gums remain insoluble. This washing is carried out on sieves and the agglomerated gums are then pressed. The apparatus consists of a pulveriser, a macerating tank, centrifugal pump, sieves, and press.—W. P. S.

XIV.—TANNING, LEATHER, GLUE, SIZE.

Tannery; Relation of the —— to colloid chemistry. E. Stiasny. Z. Chem. Ind. der Kolloide, 1908, **2**, 257—263.

In the preparation of the pelt it is pointed out that the process is similar for all leathers, involving the removal of the hair and epidermis and the conversion of the corium into a very powerfully adsorptive gel. These changes are brought about by soaking, unhairing and deliming or bating. In soaking, the skin is softened by treatment with water and is also cleansed from blood and dirt. Unhairing may be brought about by sweating, liming, or painting. Sweating is a putrefactive process in which the hair roots and softer parts of the epidermis are attacked, thus making possible the mechanical removal of all epithelial structures. Liming accomplishes the same with the assistance of the chemical action of milk of lime. The chemical action may be strengthened by raising the concentration of the hydroxyl ions by the addition of sodium or potassium carbonate, or by using also sulphydrate ions, obtained by the addition of sodium sulphide to the lime liquor or of red arsenic to the lime in slaking. The specific influence of the metallic ion is also discussed. Painting is used when the hair (*e.g.*, sheep wool) is required in good condition. Lime paste, with or without sulphides, is applied to the flesh side of the skin and the wool pulled out when sufficiently loose. After the removal of the hair and epidermis, further treatment with lime liquor is given to swell and plump the fibres and to cause them to split up into still finer fibrils. The deliming is brought about by treatment with acids, hydrochloric, sulphuric, formic, acetic, lactic, boric, carbolic, and aromatic sulphonic acids being all employed. The skin then "falls," the swelling being reduced, but excess of acid will cause another swelling. Deliming is also brought about by treating the goods with fermenting infusions of dung; the weak organic acids neutralise the lime and the enzymes cause a solution of hide substance, thereby making possible the preparation of a soft leather. The actual tanning process is divided into vegetable, mineral, fat, and formaldehyde tannages, in all of which (except the last) the tannin substance is adsorbed by the pelt out of its colloidal solution, and afterwards changed to an insoluble form (irreversible colloid). The laws of adsorption are reviewed, and it is pointed out that they are applicable in the case of the tannage of pelt. In vegetable tannages the solutions are colloidal, as shown by molecular weight measurements, rates of diffusion, and other physical measurements. Although the different vegetable tannins can be distinguished both physically and chemically, the choice of a special tannage for any desired variety of leather is so far only empirically determined. For the early tanning liquors, however, the more quickly diffusing and less quickly precipitating tannins are employed, whilst those which are easily adsorbed are reserved for the later stages. As moreover an approximation to the crystalloidal condition is obtained in dilute solution, such solutions are used in the early stages of tanning and stronger infusions for later stages. The tanning is divided into two parts, the conversion of the hydrosol into the hydrogel by the skin, due probably to both its colloidal and fibrous nature, and also further changes in the chemical nature of the adsorbed tannin, involving possibly oxidation, dehydration (phlobaphene formation) and polymerisation. In mineral tannages those salts may be employed which in aqueous solutions are hydrolysed into colloidal basic salts and free acid. This is especially the case with the salts of chromium, aluminium and iron. The chrome tannages, which are commercially the most important, include one-bath and two-bath processes. In the one-bath process a solution of chrome alum is made basic by the addition of alkali (or potassium bichromate is appropriately reduced) and the pelt placed in this infusion. The weakly basic chromium salt is then decomposed by the skin into free acid, which is quickly adsorbed (reversibly), and into a still more basic salt which is also adsorbed and converted into a gel, hence making the tannage irreversible. By washing in water after tannage and also in solutions of weak alkalis (borax, sodium phosphate, etc.), the adsorbed acid is neutralised and eliminated. The two-bath process is more complicated in that the basic chromium salt is formed inside the skin by first using a bath of potassium bichromate and acid, and afterwards a bath of sodium thiosulphate and acid. The difference between the two processes is found in the formation and adsorption of free sulphur in the two-bath process. In alum tannages less thoroughly hydrolysed and therefore less colloidal solutions are used, so that the adsorption is reversible to a large extent. This gives rise to the necessity for "ageing" alumed leathers by keeping them in the dry state in order to permit the change from sol into gel. Iron salts on the other hand are so completely hydrolysed that their power of diffusion is seriously impaired and the colloidal hydroxide is too easily precipitated, so that they have as yet no practical value. A fat tannage often follows a vegetable or mineral tannage (stuffing, fat-liquoring), but purely fat-tanned leathers are obtained in chamoising. In this process the limed pelt is stocked with oil, suspended, and allowed to heat in pile, etc., until the colloid fats are sufficiently adsorbed by the hide fibre, on which they become changed into insoluble oxidation products and thereby make the tannage irreversible. Formaldehyde tannages do not seem to find an explanation in colloidal precipitation and change. The quantity required to make satisfactory leather is so small, the amount of formaldehyde adsorbed by other colloids is also so small and the action on gelatin and agar-agar so different from that of the other tannins, that it is necessary to conceive some different mode of action, possibly a direct chemical action, but the experimental evidence for a clearer knowledge is not yet to hand.—H. G. B.

Tanning and dyeing. W. Fahrion. Chem.-Zeit., 1908, **32**, 357—358.

The author discusses the various theories of the tanning and dyeing processes. He concludes that in both cases, the process comprises two stages, *viz.*, first, adsorption of the tannin or dyestuff by the hide substance or fibre respectively; and secondly, chemical reaction between the hide substance and the tannin, and between the fibre and the dyestuff.—A. S.

Leather; Micrographic study of ——. H. Boulanger. Bull. Soc. d'Encour., 1908, **110**, 236—254.

The author has applied the methods of microscopic anatomy to the study of hides, skins, and leather. He gives a description, illustrated by microphotographs, of the microscopic structure of sections of cow-hide, ox-hide, and buffalo-hide, and of vegetable-tanned leathers prepared from them and from calf-skin and sheep-skin.—A. S.

Leather; Book-binding —— from Nigeria. M. Nierenstein. Quart. J. Inst. Comm. Research in Tropics, Liverpool Univ., 1908, **3**, 44—46.

The skin examined was a medium-sized goat-skin, evidently not sufficiently tanned, a fact demonstrated by boiling a piece of the skin with acetic acid, when a transparent strip of pelt could be seen. The following figures were obtained on analysis: water, 5·72; fat, 10·06; extractives, 6·54; ash (Al, Na, Mn, Ca, PO_4''', and SO_4'', 42·83 per cent. being alumina), 5·91; and insoluble, 71·77 per cent. Only 14·26 per cent. of nitrogen was present, as against 17·47 per cent. in goat pelt. The tannin present appeared to be a pyrogallol tannin, but some catechol tannin was also detected. The author makes a number of suggestions as to possible improvements in the production of Nigerian leather; catechol tannins should be avoided in the manufacture of bookbinding leather, as they cause "red decay" or so-called "rot." Attention should also be paid to the camwood industry for dyeing purposes.—E. W. L.

Patents.

Leather-dressing from sapped or exhausted tanning liquors; Process for making ——. G. W. Childs, New York. U.S. Pats. 882,489 and 882,490, March 17, 1908.

(1). The sapped liquors are neutralised with alkali and concentrated to a sp. gr. of 1·05 to 1·3. Excess of alkali may be used and the precipitate filtered off, and barium salts may be added to remove sulphates.

(2). Waste tanning liquors are mixed with active tanning material or liquor, and concentrated to a sp. gr. of 1·05 to 1·3.—H. G. B.

Tanning extracts; Process for decolorising ——. C. Feuerlein. Fr. Pat. 383,890, Nov. 12, 1907. Under Int. Conv., Aug. 8, 1907.

The extracts are treated with salts of chromium.—H. G. B.

Tanning; Process of and extracts for ——. J. P. Rasmussen. Fr. Pat. 384,080, Nov. 16, 1907. Under Int. Conv., Nov. 26, 1906.

Four parts by weight of cashew, 10 parts of aloes, and 25 parts of sodium hydroxide are dissolved in 100 parts of boiling water. Seventy-five parts of alum are added, and the solution is then diluted with hot water and added to the water in the tank in which the hides have already been placed. Sufficient of the solution must be added to raise the density of the whole to about 15° B. The hides are next placed in a dilute sulphuric acid bath, and then treated in the ordinary way in baths containing tannin. The preliminary treatment is stated to shorten the actual tanning process to about 70 days.—W. P. S.

Glue from mineral-dressed or chrome-tanned leather; Process for the extraction of ——. A. R. Weiss, Hilchenbach, Germany. U.S. Pat. 882,481, March 17, 1908.

See Eng. Pat. 19,019 of 1907; this J., 1908, 82.—T. F. B.

XV.—MANURES, &c.

Poisonous insecticides [in agriculture]. The Petroleum insecticide. Spray apparatus, etc. Jos. Barsacq. Bull. Soc. d'Encouragement, 1908, **110**, 368—392.

Illustrated monograph, subdivided as follows:—General considerations. Arsenical compounds. Paris Green, Schweinfurt Green (Copper arseniate). Lead arsenite ("Gypsine"). Barium chloride. Spraying poisonous liquids. Spraying Apparatus. Practical utilisation of petroleum as insecticide.

Patent.

Fertiliser containing phosphorus; Manufacture of ——. C. N. Riiber, Fr. Pat. 383,779, Nov. 9, 1907.

This process consists in electrolysing alkali chlorides for the production of alkali metals, caustic alkalis or alkali carbonates or bicarbonates, the chlorine obtained at the same time being converted into hydrochloric acid by combining it with the hydrogen formed during the electrolysis. The hydrochloric acid is then used to dissolve phosphates, more especially those of mineral origin which cannot be employed as fertilisers owing to the other substances present. On adding lime or calcium carbonate to the solution, calcium phosphate is precipitated as a fine powder readily assimilable by plants, whilst calcium chloride remains in solution.—T. H. P.

XVI.—SUGAR, STARCH, GUM, &c.

Sugar precipitated with the aid of gypsum. G. Kassner. Ber. pharm. Ges., 17, 243—50.

The author describes a double saccharate of the composition, $C_{12}H_{22}O_{11},2CaO,CaSO_4$, which forms microscopical needle-shaped crystals with difficulty soluble in water. He suggests its use in the technical separation of sugar from the accompanying salts in impure sugar solutions and gives data for the conditions under which the salt can be made to separate from pure and highly contaminated sugar solutions. From 0·5 grm.-mol. of cane sugar (171 grms.) and the corresponding molecular amounts of calcium hydroxide and sulphate to form the double saccharate, in 2.5 l. of water, the precipitate formed after 2 days, contained 60·3 per cent. of the total sugar present. From beet sugar juice, (obtained by pressing), containing about 10 per cent. of sugar, the precipitated saccharate removed about 50 per cent. of the dissolved sugar.

Electrolysis in the sugar series. C. Neuberg. Biochem. Zeits., 1908, **7**, 527—528.

The author succeeded in obtaining *d*-arabinose from *d*-gluconic acid by applying to the latter, the method used by Kolbe for the electro-synthesis of ethane. In a similar manner *l*-erythrose can be obtained from *l*-arabonic acid, *i*-glyceric aldehyde from *i*-erythronic acid, glycollic aldehyde from *i*-glyceric acid, and formaldehyde from glycollic acid. The effect of electrolysis can be expressed by the formula: $CH_2OH(CH.OH)_xCH.O \vdots H.COOH \rightarrow CH_2OH(CH.OH)_x.CHO$. Ketone-acids of the general formula, $CH_2OH(CH.OH)_xCO.COOH$, are apparently formed as by-products during the electrolysis. The electrolytic method of decomposition was also applied to the carboxylic acids of disaccharides. Melibionic acid in this way yielded a reducing sugar containing 11 atoms of carbon. Of dicarboxylic acids, saccharic acid yielded tartaric acid dialdehyde, whilst tartaric acid gave glyoxal. From serin and isoserin substances were obtained which on treatment with *p*-nitrophenylhydrazine gave the corresponding osazone of glycollic aldehyde.—A. S.

Starch granule; Composition of the ——. Z. Gatin-Gruzewska and L. Maquenne. Compt. rend., 1908, **146**, 540—545.

A METHOD by which the amylose of starch may be separated from amylopectin is given as follows by Gatin-Gruzewska. (See also Compt. rend. Soc. Biol., 1908, **64**, 178.) It consists in adding to a 3 per cent. paste of potato starch, a quarter of its volume of a hot 40 per cent. solution of potassium or sodium carbonate, and treating the mixture with one-third of its volume of 95 per cent. alcohol. The filamentous precipitate of amylopectin produced, is washed, caused to swell in water, neutralised, and purified by dialysis or decantation. From the mother-liquors from the first precipitate, a certain quantity of amylose can be separated. The following method which enables the two substances to be separated almost in the natural state, is also recommended. It depends on the fact that when starch is treated with dilute solutions of alkalis, the envelopes consisting of amylopectin swell up and the contained substance attracts water and dissolves rapidly. The envelope bursts under the osmotic pressure set up, and the contained substance diffuses out. The operation is completed by neutralising, which makes the envelopes contract. Thus to 10 grms. of potato starch, 500 c.c. of a 1 per cent. solution of sodium carbonate are added, the mixture made up to 1 litre, neutralised with acetic acid, an equal volume of water added, and the liquid allowed to stand for 24 hours. Amylopectin is found in the form of empty sacs at the bottom of the vessel; the amylose is in solution. The two substances are separated and purified. The amylose is stained a clear blue with iodine, and the amylopectin is stained violet-blue. Amylopectin is a mucilaginous body having all the characters of starch except that of breaking down on heating. It appears to be allied to glycogen. It forms from 40—45 per cent. of the total weight of the starch. Amylose or pure soluble starch is a collection of substances in different states of condensation and perhaps of hydration. The less dense portions are soluble in cold water. Solutions prepared by means of alkalis are stable, whilst those obtained by the action of heat are less so and break down rapidly.

In a note on the work of Gatin-Gruzewska, Maquenne points out that the similarity in the colouring observed when amylose and amylopectin are treated with iodine suggests a structural relation between the two bodies, and that amylopectin is composed of a series of related bodies as is amylose. It would seem that no sharp line of demarcation exists between the slightly soluble members of the amylose group and the less resistant members of the amylopectin series. Starch paste unless superheated does not form a true colloid, as amylose dissolves while amylopectin forms fragments of material which are remarkably stable. In boiling water or not too strong alkaline solutions, these fragments seem to disappear, as their refractive index is that of the liquid, but they preserve their shape and may be recognised, after the addition of iodine, under low powers. If a substance really exists as a colloid in starch paste this should be a third substance, neither amylose nor amylopectin. Such considerations do not apply to starch paste prepared under pressure. Here the amylopectin has lost its organised form by partial hydrolysis, and the colloid then appearing is formed of dextrins representing the ultimate products of disaggregation. Finally if starch be boiled with a concentrated solution of sodium citrate or sulphate, and the liquid be filtered, the clear part is rich in amylose and the insoluble part in amylopectin. If this treatment be repeated three or four times, the clear liquid is found to contain amylose equal in weight to 60 per cent. of the original starch. The insoluble residue consists of the open sacs noted by Gatin-Gruzewska. These consist of amylopectin containing an unknown amount of amylose insoluble in boiling water. The same results are obtained with lime water.—J. W. G.

PATENTS.

Sugar; Manufacture of refinable —— *from materials containing starch or cellulose.* B. Hafner and F. Krist. Fr. Pat. 383,776, Nov. 9, 1907.

THE starchy or cellulosic material is mixed with water and the mixture submitted, at a pressure of not less than two atmospheres and a temperature above 100° C., to the action of an electric current.—T. H. P.

Sugar; Capillary refining process for ——. J. Ost. Fr. Pat. 384,024, Nov. 11, 1907. Under Int. Conv., Nov. 15, 1906.

SEE Eng. Pat. 25,860 of 1906; this J., 1908, 32.—T. F. B.

Starch; Soluble ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 383,902, Nov. 13, 1907. Under Int. Conv., March 5, 1907.

STARCH is treated with a small amount of a mineral acid in presence of acetic acid, by which means it is rendered soluble in hot water, probably owing to its conversion into an acetyl-derivative.—T. H. P.

XVII.—BREWING, WINES, SPIRITS, &c.

Yeasts: Influence of meal and other nitrogenous materials, salts and acids on the life and fermenting power of —— *in distilled water with sucrose and in worts.* W. Henneberg. Woch. f. Brau., 1908, **25**, 77—81, 99—104, 118—123, 138—141, 161—164.

THE author has carried out an extensive series of experiments which show that rye- or wheat-meal, egg albumin peptone, lecithin and inorganic ammonium salts exhibit striking similarities in their action on yeasts. These substances are: (1) non-poisonous to yeasts in pure, distilled water; (2) more or less poisonous in distilled water in presence of sucrose; (3) non-poisonous in supply water; (4) non-poisonous in sucrose solutions, if calcium salts, carbonates or bases are present in small amounts or other salts (such as acid potassium phosphate, magnesium sulphate, sodium sulphide, sodium formate or potassium sulphate) in higher concentrations; (5) of great nutritive value in presence of the substances mentioned under (4). Further, rye- or wheat-meal, egg albumin, peptone, ammonium citrate and ammonium oxalate have a much more powerful poisonous action on bottom-fermenting beer yeasts than on top-fermenting distillery yeasts; this is also the case with lecithin, though in a less marked degree. The inorganic ammonium salts have an approximately equal poisonous action on both kinds of yeast. Under ordinary conditions, these nitrogenous substances form excellent nutrient materials for yeasts, their injurious action only appearing in the absence of certain salts, which are more especially compounds capable of neutralising acids. The other salts able to annul this injurious action of the nitrogenous substances comprise all the calcium salts with the exception of the oxalate and, in much greater concentrations, magnesium sulphate, ammonium sulphate, potassium phosphate, etc.; the experiments show that calcium and certain other salts are capable of acting to some extent, on acids in such a way as to render them less harmful to the yeast. It must, therefore, be assumed that the nitrogenous compounds give rise, in the interior of the cells, to free acids, which, under normal conditions, are immediately rendered innocuous by the above-mentioned salts; if such salts are lacking, the acids exert a poisonous action on the cells. In the case of ammonium salts, these must undergo decomposition in order to take part in the formation of proteins, the acid of the ammonium salt being liberated; if, therefore, this acid has a poisonous action on yeast, the corresponding ammonium salt will have a similar action. Similarly, lecithin owes its poisonous action to the phosphoric acid set free. Experiments on the length of time required by the different nitrogenous substances to act on yeast, show that the soluble proteins are the most rapidly assimilate and decomposed by the yeast, the action being slower for ammonium salts; the rapidity with which yeast dies under the action of rye- or wheat-meal is possibly due to the large quantities of nuclein substances present. Distillery yeasts are considerably more resistant to the action of acids than are bottom-fermenting beer yeasts. The remarkable fact that small quantities of ammonium salts exert a greater injurious effect than larger quantities is possibly due to the more rapid assimilation of the smaller amounts by the yeast cells; perhaps also the harmful action of distilled water is reduced when larger quantities of salts are present.—T. H. P.

Yeast; Sugar formation and other fermentations in ——. E. Salkowski. Z. physiol. Chem., 1908, **54**, 398—405. Chem. Zentr., 1908, **1**, 1309—1310.

The lævo-rotation of the filtrate from autolysed yeast (see Z. physiol. Chem., **13**, 56) is due to the presence of leucine, and not as the author originally believed, to a lævo-rotatory sugar. The liquid does not contain lævulose, but dextrose, yeast gum, a dextrin, pentoses, purine bases, tyrosine, lysine, leucine, peptone, and succinic acid are present. The dextrose was identified by means of its diphenylhydrazone.—A. S.

Invertase of yeast; Adsorption affinities of ——. L. Michaelis. Biochem. Zeits., 1908, **7**, 488—492.

A solution of invertase prepared by grinding yeast with sand and shaking for some hours with chloroform water, was treated with various colloids. By electro-positive colloids, such as colloidal iron oxide solution and alumina hydrogel, the invertase was completely adsorbed from solution, the liquid after filtering being without action on sucrose. On the other hand, after treatment with electro-negative colloids, such as kaolin, mastic, and arsenic sulphide, the ferment solution has practically the same inverting power on sucrose as before. Invertase must therefore be regarded as an electro-negative colloid. The adsorption-compounds of invertase with iron oxide and aluminium hydroxide are capable of inverting sucrose. The colloidal properties of invertase (*e.g.*, the formation of adsorption compounds) can be utilised for its separation from albuminous substances. For example a solution containing invertase and albumin, after shaking with kaolin, yields a filtrate free from albumin, but containing practically the whole of the invertase.—A. S.

Acetic fermentation; Formation of aldehydic or ketonic substances during ——. K. Farnsteiner. Z. Unters. Nahr. Genussm., 1908, **15**, 321—326.

It is shown that all solutions which have undergone more or less complete acetic fermentation contain a volatile, neutral substance which reduces Fehling's solution. In its physical properties, and in its behaviour towards Fehling's solution and sulphurous acid, the substance resembles acetol; it differs from acetol in that its osazone melts at 243° C., whilst acetol osazone melts at 145° C. Besides the osazone, an oily body is obtained on treating a solution of the substance with phenylhydrazine, showing that other compounds are present in addition to the one resembling acetol. (See also this J., 1901, 944.)—W. P. S.

Alcohol and water; Refractive power of mixtures of ——. A. Doroszewski and S. Dworzanczyk. J. Russ. Phys.-Chem. Ges., 1908, **40**, 101—125. Chem. Zentr., 1908, **1**, 1375—1377.

A table is given showing the refractive indices of mixtures of alcohol and water as determined by means of the Zeiss immersion refractometer at temperatures of 17·5°, 20°, 22° and 24° C. respectively, together with the corresponding temperature-coefficients.—A. S.

Patent.

Peat; Treatment of —— for the production of alcoholic and other products. H. H. Lake, London. From G. J. L. Pradel, Aubervilliers, France. Eng. Pat. 5128, Mar. 2, 1907.

Four hundred kilos. of dry peat, about 22 hectolitres of water, and 24 kilos. of sulphuric acid (53° B.) are heated by means of steam, in a digester, for 40 minutes under "a pressure of 3 kilos." The contents of the digester are then run off, neutralised with calcium carbonate, and cooled to 35° C. The acidity of the product is "regulated so as to comprise about 3 grms. of free acid per litre," and the whole is then allowed to ferment, yeast obtained from the berries growing on peat bogs being used. The liquid is next distilled. Instead of the water used in the first digestion, a corresponding quantity of the fermented liquid may be employed; in this case, less sulphuric acid, namely 17·4 kilos., is added, and the vapours which contain alcohol are allowed to escape through a condenser, as the pressure in the digester increases. After the fermentation of the material when it leaves the digester, 22 hectolitres of fermented liquid collected by decantation, and used for treating a fresh charge of peat, are deducted. The remainder left in the tank is distilled, and the residue, consisting of cellulose, yeast, etc., is subjected to dry distillation, the products being collected. "Bog mud," consisting of calcium carbonate, sand, clay, phosphates, nitrogenous matter, etc., may be used for neutralising the digested peat.—W. P. S.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

(*A*.)—FOODS.

Sulphuretted hydrogen; Formation of —— on heating milk. E. Fynn. Z. Fleisch- u. Milchhyg., 1908, **18**, 180—182. Chem. Zentr., 1908, **1**, 1312.

The author's experiments show that the formation of hydrogen sulphide occurs with some milks but not with others. The phenomenon does not appear to be due to the casein, since amphoteric solutions of casein yielded no hydrogen sulphide on heating at 100° or 120° C. If the precipitate obtained by adding acetic acid to milk, be extracted with cold 95 per cent. alcohol, only the portion soluble in alcohol evolves hydrogen sulphide on heating. The occurrence of free sulphur in sterilised milk is probably to be traced to the formation of hydrogen sulphide during sterilisation.—A. S.

Caseins; Composition of different ——. F. Tangl. Pflüger's Arch. d. Physiol., 1908, **121**, 534—549. Chem. Zentr., 1908, **1**, 1288.

From the mean results of a number of analyses, the percentage composition of caseins from different sources is given in the following table:—

Casein from:	C.	H.	S	P.	N.	O.
Cow's milk ..	52·69	6·81	0·832	0·877	15·65	23·141
Buffalo's milk	52·88	7·81	0·833	0·773	15·78	21·925
Sheep's milk	52·92	7·05	0·717	0·809	15·71	22·794
Goat's milk .	52·90	6·86	0·700	0·760	15·48	23·300
Mare's milk .	52·36	7·09	0·528	0·877	16·44	22·705
Asses' milk .	52·57	7·01	0·588	1·057	16·28	22·495

—A. S.

Patents.

Baking powder. J. H. Hooker, Buckingham, and W. H. Thew, London. Eng. Pat. 53, Jan. 1, 1907.

Milk powder is used, wholly or partly, in place of starchy ingredients in the baking powder. For instance, the latter may consist of tartaric acid, 20 parts; sodium bicarbonate, 25 parts; milk powder, 54 parts; moisture, 1 part. The milk powder employed is preferably prepared from separated milk, and the best results are obtained by evaporating the milk at a temperature of 50° to 60° C. under reduced pressure and adding the sodium bicarbonate, or a portion thereof, before the milk is completely dry. The drying is then continued, the product is finely ground, and added to the other ingredients of the baking powder. If any starch is used, it is also added to the semi-dry milk.—W. P. S.

Liquids [mineral waters]; Method and apparatus for aerating and carbonating ——. R. B. Clark, Rhyl, Flintshire. Eng. Pat. 9460. Apr. 23, 1907.

Water and a "mineralising agent" are admitted through separate pipes into a wide vertical tube, filled with granulated material, such as augite, and connected at its lower end with a gas cylinder charged with carbon dioxide under high pressure. When the tap of the gas cylinder is turned on, the water is forced upwards by the gas through a non-return valve at the top of the tube into a storage cylinder until the pressure rises to the height under which the bottling operation is to be carried on. As the liquid is withdrawn from this storage cylinder, more water and gas are forced automatically into it. The pressure of the gas carries the water, etc., past the non-return valve in a manner resembling that of an injector.—W. P. S.

Butter fat; Process of obtaining ——. P. M. Justice, London. From H. D. Cooke, Monmouth Beach, N.J., U.S.A. Eng. Pat. 28,024, Dec. 19, 1907.

The process relates to the production of butter fat directly from milk. The milk is first passed in the form of a thin layer between two discs rotating in opposite directions, in order to rupture the coatings of the fat globules. The milk is then heated, and the fat rising to the surface is removed. If desired, the fat may be washed with hot water to remove any salts or other soluble substances.—W. P. S.

Butter, oils, etc.; Renovating ——. W. F. Jensen, Lincoln, Nebr. U.S. Pat. 881,929, March 17, 1908.

The butter is first melted, and impurities removed by skimming and sedimentation. It is then washed with pure water, or warm water, without chemicals or salt, and afterwards withdrawn. The melted butter is aerated, without forming an emulsion, in the absence of chemicals or salt, and without the addition of skim milk, buttermilk, whey, or their equivalents. Ripened skim milk, or its equivalent, is then added "during mild agitation to mix the same but without aeration to form an emulsion," and finally the product is allowed to crystallise, ripened and churned.—B. N.

Butter; Method for detecting adulteration of ——. L. Pink. Ger Pat. 192,919, Aug. 28, 1906.

The butter is shaken with distilled water at about 60° C., and after allowing to settle, the degree of transparency of the lower aqueous layer is observed by means of test sheets of manuscript or print. It is stated that the addition of even small quantities of margarine or cocoanut oil to butter considerably increases the degree of transparency of the aqueous layer.—A. S.

Flour and other grain products; Apparatus and process for bleaching and ageing ——, *and [nitric oxide] gas generator.* F. Mears, Minneapolis, and J. Craig, Princeton, Minn., Assignors to Hygienic Refiner Co., Princeton, Minn. U.S. Pats. 882,526, 882,527, and 882,528, Mar. 17, 1908.

(1). The apparatus consists of a nitric oxide generator and a closed vessel in which the flour is treated with the gas. The flour falls by gravity into the closed vessel, and a device is provided for scattering the flour through the vessel. (2). The flour or other grain product is subjected to the action of nitric oxide. (3). A vessel containing acid is surmounted by a small collecting chamber for the nitric oxide gas. A tube, adjustably suspended from this chamber, supports rods of a suitable metal and allows them to be fed gradually into the acid. —W. P. S.

Rice flour or other amylaceous product; Preparation of —— *in a highly hygroscopic form.* T. Schlüter, jun., and H. Paucksch. Fr. Pat. 383,943, Nov. 15, 1907.

The rice or other starchy material is made into a paste and disaggregated by treatment with boiling water, either with or without the action of steam pressure. The paste is then subjected to rapid drying by spreading it out in thin layers and heating to a temperature slightly above 100° C.; the drying may or may not be carried out under reduced pressure.—T. H. P.

Milk and dairy products; Process for the determination of fat in ——. N. Gerbers Co. m. b. H. Ger. Pat. 192,767, May 27, 1906.

The claim is for the use of ketones, either alone or mixed with aliphatic alcohols, as solvents for the fat.—A. S.

Albumoses and peptones; Process for the preparation of digestible ——. Chem. Werke vorm. H. Byk. Ger. Pat. 192,840, July 22, 1906.

Horn, hoofs, nails, feathers, hair, and similar substances containing keratin, or products containing keratin obtained therefrom, are heated for about half an hour at 60° C. with 50-60 per cent. sulphuric acid.—A. S.

(*B.*)—SANITATION; WATER PURIFICATION.

Patents.

Sand filters. J. M. K. Pennink, Amsterdam. Eng. Pat. 21,647, Sept. 30, 1907. Under Int. Conv., Oct. 8, 1906.

See Fr. Pat. 382,232 of 1907; this J., 1908, 177.—T. F. B.

Sewage; Apparatus for separating liquid and solid matter in ——. M. Nadein, St. Petersburg. Eng. Pat. 26,653, Dec. 2, 1907.

The sewage is delivered on to the convex surface of a vertical curved plate, the lower edge of which passes over the edge of a tank, a narrow space being left between the two. The liquid portion of the sewage flows over the surface of the plate and through this space into a tank, whilst the solid portions are stopped at the edge of the tank and fall into a separate tank. The liquid portion is conducted from the tank through a channel on to a water-wheel and thence is allowed to flow away. The motion of the water-wheel actuates a device for distributing peat over the solid matters collected in the second tank, and also operates a revolving shaft in contact with the edge of the first tank. This shaft removes pieces of solid matter, such as paper, etc., which are apt to clog the narrow slit between the curved plate and the edge of the tank. The upper part of the plate is inclined from the middle to the sides to cause the sewage to be distributed uniformly over its surface.—W. P. S.

Sewage; Process for the biological purification of ——. A. Vogelsang. Fr. Pat. 383,947, Nov. 15, 1907.

The sewage is distributed over oxidising beds which are aerated by means of a current of air introduced below the beds. This air is enriched with a quantity of ozone sufficient to aid the oxidising action of the beds but insufficient to have an injurious action on the organisms present.—W. P. S.

(*C.*)—DISINFECTANTS.

Poisonous insecticides. The petroleum insecticide. Spray apparatus, etc. Jos. Barsacq. *See* XV.

XIX.—PAPER, PASTEBOARD, &c.

Blotting papers; Testing the absorbent qualities of ——. C. Beadle and H. P. Stevens. Papier-Zeit., 1908, 33, 910—911, 946—947, 987.

The authors have improved the apparatus usually employed for measuring the rise of water in vertically suspended strips of blotting paper. Their apparatus which they call a "bibliometer," possesses a pointer, corresponding with the zero of the scale, which can be rapidly and accurately adjusted so as to touch the surface of the water in the trough. The authors have observed that the rapidity with which the water rises in the strip of paper is greatly influenced by the temperature of the water, being faster at higher temperatures, and they propose a constant temperature of 15° C. for the test. The rise of water is slightly more rapid in strips cut parallel to the machine direction of the paper than in strips cut at right angles; the mean of the two directions should therefore be recorded. Numbers are quoted which prove that, in ordinary cases, the rapidity of the rise of water by capillary action is proportional to the volume-percentage of air spaces in the paper, as calculated from its apparent density. Other tests with blotting papers may be made with Stephens' blue-black ink, which should be taken from a freshly opened bottle. The time required for the absorption of 1 c.c. of this ink, when allowed to fall drop by drop from a height of 8 inches on one spot of the paper, may be determined. The result of this test will depend on the thickness as well as on the porosity of the paper, and the result should be corrected by calculation to a standard thickness of 0·03 mm. The authors are of opinion that papers which require more than 1 second for the absorption of 1 drop of ink will not give satisfactory results in actual use. The percentage by weight of ink absorbed by strips of paper immersed in an excess of the liquid, drained off and weighed, may also be determined, and these strips, after drying, may again be submitted to the drop test in order to ascertain the decrease in the rate of absorption of the drops. Good blotting papers will absorb about twice their weight of ink. Lastly, the ratio of the areas of the non-absorbent zones of the dried blots to their total areas (see this J., 1908, 35), will also give an important indication of the quality of the paper.—J. F. B.

Celluloses ; New constants for ——. W. Vieweg. Chem.-Zeit., 1908, **32**, 329—330.

It is found that cellulose combines with different quantities of sodium hydroxide on treatment with solutions of different concentrations. The maximum quantity entering into combination with the cellulose is reached with a 16 per cent. solution of sodium hydroxide, the combining proportions being represented in this case by the formula, $C_{12}H_{19}O_{10},NaOH$. The author proposes that the amount of sodium hydroxide which 100 grms. of cellulose will combine with on treatment with a 2 per cent. solution, should be known as the "degree of mercerisation" of the cellulose and that this constant be used as a test for different celluloses. To carry out the test, 3 grms. of dry cotton are well shaken for half an hour with 200 c.c. of a 2 per cent. solution of sodium hydroxide, and 50 c.c. of the solution are then withdrawn and titrated with *N*/2 acid. From the difference in strength of the solution before and after the action on the cellulose, the "degree of mercerisation" can be calculated.—W. S.

Patent.

Cellulose ; Method and apparatus for producing ——. A. Müntzing, Stockholm. U.S. Pat. 882,790, March 24, 1908.

See Fr. Pat. 376,894 of 1907 ; this J., 1907, 1027.—T. F. B.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

Alkaloids ; Iron double salts of the ——. M. Scholtz. Ber. d. pharm. Ges., 1908, **18**, 44. Chem.-Zeit., 1908, **32**, Rep., 165.

When a solution of an alkaloid hydrochloride is treated with ferric chloride and concentrated hydrochloric acid, the iron double salt of the alkaloid is obtained, generally as a precipitate. The salt, composed of 1 molecule of the alkaloid hydrochloride with 1 molecule of ferric chloride, is easily purified and generally crystallises well, the colour varying from light yellow to dark brownish red. Strychnine hydrochloride iron chloride, $C_{21}H_{22}N_2O_2.HCl,FeCl_3$, crystallises in brilliant reddish-brown hexagonal needles which decompose at 260° C. Atropine hydrochloride iron chloride, $C_{17}H_{23}NO_3,HCl,FeCl_3+H_2O$, crystallises as thin light yellow plates, melting at 167—168° C. The cocaine salt is obtained as light yellow anhydrous crystals. The codeine salt crystallises with 2 molecules of water and the thebaine salt with 3 molecules.—W. S.

Belladonna ; Alkaloidal value of the alcoholic extract of the leaves of ——, *prepared according to the International formula.* J. Warin. J. Pharm. Chim., 1908, **27**, 321—331.

The standard suggested at the International Pharmaceutical Congress, at Brussels, for alcoholic extract of belladonna leaves, 1·5 per cent. of total alkaloids, was not adopted, since the published results of investigators show the markedly higher figure of 2·4 to 4 per cent. Extracts were prepared by the author from French, German, Italian, Belgian, and Austrian leaves. All these gave percentages of alkaloids in excess of 1·5 per cent., except that from Italian leaves, with 0·319 and 0·932 per cent., and that from Austrian leaves, with 1·127 per cent. It was found that these two varieties were not pure *Atropa belladonna* leaves; the Austrian drug was mainly composed of the leaves of *Scopola carniolica;* the Italian samples were adulterated with the leaves of *Phytolacca decandra.* A large quantity of the spurious Austrian drug is at present on the market. The following percentages of alkaloid were obtained from the extract of genuine leaves derived from the sources indicated:—French, 3·162, 4·356; cultivated at Nielly, 4·058; Ardennes, wild, 2·455; Somme, wild, 2·861; German, 3·034; Belgian, 1·666. Cultivated plants are generally richer in alkaloids than those growing wild. Leaves collected in June gave an extract containing 2·805 per cent. of alkaloids; those from the same plant, in September, gave 3·641 per cent. In order to determine if the nature of the soil has any marked influence on the alkaloidal content of the leaves, plants were cultivated in argillaceous, sandy, and chalky ground. The extract prepared from the leaves under similar conditions gave, from the first, 2·47 per cent., from the second, 2·687 per cent., and from the third, 2·833 per cent. of alkaloids. Soil appears, therefore, to be without marked influence in this direction. The expressed juice of fresh belladonna from the Ardennes, converted into extract, gave 2·08 per cent. of alkaloids. In no case were the bases present, in any of the extracts examined, in a free state. —J. O. B.

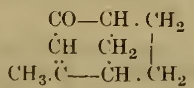
Digitalis and its preparations ; Standardisation of ——. *by chemical means.* C. E. Vanderkleed. Amer, J. Pharm., 1908, **80**, 114—120.

The following modification of Keller's method for the determination of digitoxin affords results in close accordance with the physiological determination of the lethal dose, as shown by simultaneous control experiments. Twenty grms. of the powdered leaves are extracted by percolation with 70 per cent. alcohol, and the percolate is evaporated on the water-bath until all the alcohol has been driven off. In the case of a tincture, 200 c.c., or of a fluid extract, 20 c.c., are similarly treated. The residue is mixed with sufficient water to bring the volume to 150 c.c. Fifteen c.c. of a 25 per cent. solution of lead acetate are then added, and the mixture is diluted to 200 c.c. The precipitate is filtered off, thoroughly drained and washed. The filtrate is made up to 200 c.c. and excess of lead removed by means of sodium sulphate or phosphate. After standing for 24 hours, the precipitate is filtered off, drained and washed. (The taking of aliquot parts, in order to avoid filtrations and washings, cannot be advocated in digitalis assays, on account of the volume of the precipitates.) The filtrate is transferred to a separator, 2 c.c. of 10 per cent. solution of ammonia are added, and the alkaline liquid is shaken with 5 successive 30 c.c. of chloroform. The chloroform extract is distilled to dryness in a tared flask on the water-bath; the crude residual digitoxin is redissolved in 3 c.c. of chloroform; 10 c.c. of ether and 70 c.c. of light petroleum spirit are added, and the mixture is allowed to stand in a cold place for 24 hours. The digitoxin, in a micro-crystalline form, adheres to the flask, allowing the greater part of the liquid to be decanted. The last few drops are evaporated, and the precipitate is dried, in the flask, at 60° C., and then weighed as digitoxin. The average amount of digitoxin found, in 4 years, in digitalis leaves is 0·313 per cent.; the highest yield is 0·455 per cent.; the lowest, 0·171 per cent.

Four samples of U.S.P. tincture gave from 0·023 to 0·037 per cent.; one tincture free from fat yielded 0·027 per cent. Three fluid extracts gave from 0·234 to 0·264 per cent., and the powdered solid extract, 1·061 per cent. of digitoxin.—J. O. B.

Essential oils; Constituents of ——. Derivatives of santene. F. W. Semmler and K. Bartelt. Ber., 1908, **41**, 866—871.

Santene was dissolved in acetone and a little water added. This was followed by the addition of powdered permanganate. The liquid was distilled with steam and extracted with ether, when santene-glycol, $C_9H_{14}(OH)_2$, was obtained, boiling at 135° C. at 10 mm., and melting at 193° C. If its solution in water be treated with sulphuric acid and distilled with steam, a ketone, $C_9H_{14}O$, is produced, boiling at 76°—80° C. at 10 mm., with the sp. gr. 0·988 at 20° C., and $n_D = 1{\cdot}47980$. When the dioxime of the diketone, $C_9H_{14}O_2$ (this J., 1907, 1292), is reduced with sodium in alcohol, a base, $C_9H_{17}N$, is produced, boiling at 78°—80° C. at 10 mm., with the sp. gr. 0·953 at 20° C., and $n_D = 1{\cdot}49856$, and forming a picrate, m. pt., 192° C. When the diketone is heated with alcoholic ammonia to 170° C., a good yield of the unsaturated ketone, $C_9H_{12}O$ (this J., 1908, 89), is obtained, the semicarbazone of which melts at 205° C. This is described as methyl-bicyclo-1.2.3-octenone. When it is oxidised with powdered permanganate in acetone, a methylketo-acid, $C_8H_{12}O_3$, is produced. This boils at 173°—175° C. at 10 mm., has the sp. gr. 1·150 at 20° C., and $n_D = 1{\cdot}47936$. The semicarbazone of this acid melts at 182° C. Oxidation with an alkaline solution of bromine converts the keto-acid into *cis*-cyclopentane-1.3-dicarboxylic acid, melting at 121° C., and forming an anhydride, m. pt. 160°—161° C. When reduced with sodium and alcohol, the unsaturated ketone, $C_9H_{12}O$, is converted into the fully saturated alcohol, $C_9H_{16}O$ (this J., 1908, 89). The formula of the unsaturated ketone is:



$$\begin{array}{l} \quad\ CO—CH.CH_2 \\ \quad\ \dot{C}H \quad \dot{C}H_2 \ | \\ CH_3.\ddot{C}—\dot{C}H.CH_2 \end{array}$$

—F. Shdn.

Pine oils of commerce. C. T. Bennett. Pharm. J., 1908, **80**, 483—484.

A brief account of the pine oils met with in commerce is given. The term pine oil may be said to include two classes of oils, *viz.*, turpentine oils and pine oils from leaves and cones, both classes consisting largely of pinene and allied hydrocarbons. The principal pine oils in English commerce are those of *Pinus pumilio* (*Pinus montana*) and *Pinus sibirica*. The chief constituents of *Pinus pumilio*, which is obtained in Hungary and the Austrian Tyrol from the leaves and twigs, are *l*-phellandrene and sylvestrene, with a small proportion of esters. The oil of *Pinus sibirica* is distilled from the leaves and twigs in Northern Russia and the Ural Mountains. It contains pinene, camphene, dipentene and phellandrene, with a high percentage of esters, principally bornyl acetate. *Abies pectinata* oil is a fragrant and more costly oil, distilled chiefly in Switzerland. Among the rarer pine oils are those of *Pinus excelsa*, *P. larix*, *P. maritima* and *P. strobus*. *Pinus canadensis*, *P. mariana* and *P. rubens* are of American origin. Artificial bornyl acetate is now a commercial product. Its aroma resembles that of *Pinus sibirica* oil and somewhat that of pinene hydrochloride. It is very slightly optically active. The following tables show a comparison of the physical characteristics of the oils, and represent a large number of samples investigated by the author:

Turpentine oils.

——	Sp. gr.	Opt. Rot.	Ref. index (average).	Portion distilling between 155° to 165° C.
				per cent.
American	0·865 to 0·868	+ 1° to + 6°	1·4765	80 to 85
French	0·870 to 0·874	−31° to −35°	1·4805	75 to 90
Russian	0·855 to 0·874	+ 5° to +16°	1·4790	30 to 70

Pine-needle oils.

——	Sp. gr.	Opt. Rot.	Ref. index.	Esters.	Portion distilling between 155° to 165°.
				per cent.	per cent.
P. Pumilio	0·863 to 0·875	− 6° to 14°	1·4805	5 to 7	0 to 12
P. Sibirica	0·901 to 0·920	−32° to 42°	1·4735	30 to 40	5 to 10
P. Sylvestris	0·868 to 0·925	+ 5° to + 7°	1·4735	3 to 11	40 to 65

—W. S.

Methyl alcohol; Conversion of —— into formaldehyde, and the preparation of formalin. E. Orlow. J. Russ. Phys.-Chem. Ges., 1908, **39**, 1023—1044, 1414—1439. Chem. Zentr., 1908, **1**, 1155—1156.

The experiments described in the previous paper (this J., 1908, 139) were carried out with copper turnings, fireclay permeated with finely-divided copper, and asbestos impregnated with oxides of vanadium as contact substances. Other catalytic agents have now been tried, *viz.*, coke permeated with finely-divided copper, asbestos impregnated with freshly-reduced copper, ceric sulphate, thorium oxide, or "molecular" platinum respectively, and metallic platinum. Of these the coke impregnated with finely-divided copper, at a temperature of 380°—420° C., and metallic platinum at 330°—400° C. gave the best yields of formaldehyde. With the former, 39·78, and with the latter 41 per cent. of the methyl alcohol could be converted into formaldehyde under suitable conditions. The oxidation of methyl alcohol is exothermic, and under suitable conditions will proceed without the aid of external heat when once started. A current of air at a velocity of 2·5 litres per second is passed through methyl alcohol warmed to 53·5—55° C. The temperature of the effluent gas is 42°—43° C., and the vapour carried over by the air contains 95·5—100 per cent. of methyl alcohol. The air and vapour are led over a layer of reduced copper gauze (10—15 cm. long) in a tube of refractory glass contained in a jacket of iron and asbestos, which at the beginning, is heated to about 300° C. When the reaction is once started, no further heating is required. Under these conditions, 48·45—49·25 per cent. of the methyl alcohol is converted into formaldehyde. After condensing the formaldehyde, the gas contains carbon dioxide, oxygen, carbon monoxide, and up to 20 per cent. of hydrogen. It burns with a non-luminous flame, and may be collected and utilised as heating agent for starting the reaction. The vapour carried by the current of air must contain at least 98 per cent. of methyl alcohol, otherwise the reaction will not proceed without external heat. By increasing the length of the layer of contact material to 20 cm., the proportion of methyl alcohol converted into formaldehyde is reduced to 39·7 per cent. The author finds that it is possible to concentrate dilute methyl alcoholic solutions of formaldehyde, but they cannot be entirely freed from methyl alcohol in this way. —A. S.

Bismuth subnitrate ; [Contamination of commercial ——] with ammonia. J. Rutherford Hill. Pharm. J., 1908, **80**, 221.

A SPECIMEN of commercial bismuth subnitrate having been found to evolve a distinct odour of ammonia when rubbed in a mortar with sodium bicarbonate, a series of samples was examined and all were found to contain more or less of the impurity. It is suggested that a test for ammonia should be inserted in the British Pharmacopœia ; this is done in the United States Pharmacopœia, which requires that 0·10 grm. of the subnitrate, when boiled with 5 c.c. of potassium hydroxide solution, shall afford no odour of ammonia.—J. O. B.

Essential oils ; Prizes for extraction of ——. Times, Eng. Suppl., April 1, 1908. [T.R.]

An international competition is announced by an Italian Royal decree for the most commercially economical process of extracting essential oils of lemon and of bergamot. The prizes offered amount to 10.000 f. (£400) and will be awarded by the selected jury. Entries must reach the Ministry of Agriculture not later than Jan. 1, 1909. If the method of extraction be purely mechanical, or if it comprise mechanical apparatus, it will be necessary to specify the weights, power required, and the method of working. The different processes will be studied by a special commission to be elected by the Ministry, at whose expense trials of the apparatus entered will be carried out. The depositors of the competing processes will in all cases be considered as the representatives of the makers, and to them the rewards will be assigned.

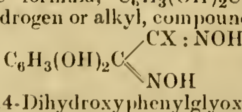
Patents.

p-Aminophenylarsenic acid ; Manufacture of acidyl derivatives of ——. H. H. Lake, London. From Curatorium der G. und F. Speyerschen Studienstiftung, Frankfort on Maine, Germany. Eng. Pat. 3934, Feb. 16, 1907.

p-AMINOPHENYLARSENIC acid ("atoxyl") is converted into acidyl derivatives by the known methods of acidylation, either with aliphatic or aromatic acid derivatives. The acidyl derivatives do not exhibit the characteristic colour reactions of the free amino-compound, and their toxic properties differ ; thus, the phenoxyacetyl derivative is more poisonous, and the phthalyl derivative less poisonous than the original compound. The preparation of the derivatives by means of formic acid, acetic anhydride or chloride, chloroacetyl chloride, butyryl chloride, benzoyl chloride, phthalyl chloride, and carbonyl chloride is described in full.—T. F. B.

3.4-*Dioxyphenylglyoxime and* 3.4-*dioxyphenylalkylglyoximes ; Manufacture of ——.* A. Zimmermann, London. From Chem. Fabr. auf Actien, vorm. E. Schering, Berlin. Eng. Pat. 13,599, June 12, 1907.

HYDROXYLAMINE so acts on 3.4-dihydroxyphenylhalogen ketones of the formula, $C_6H_3(OH)_2CO.CHX$ halogen, that X being hydrogen or alkyl, compounds of the formula,



$$C_6H_3(OH)_2C\begin{cases}CX:NOH\\NOH\end{cases}$$

are formed. 3.4-Dihydroxyphenylglyoxime can also be prepared by the action of hydroxylamine on amino- or mono- or dialkylamino-acetocatechol.—T. F. B.

Formates ; Manufacture of ——. J. Raschen, C. L. Higgins, and The United Alkali Co., Ltd., Liverpool. Eng. Pat. 13,953, June 17, 1907.

THE absorption of carbon monoxide by bases is found to be much more rapid and complete in the presence of titanium compounds. The base, such as caustic soda or potash, or lime, is mixed with a titanium compound (*e.g.*, titanic acid) and exposed to the action of carbon monoxide, as pure as practicable, at a temperature of about 150° C. One part of titanic acid to 9 parts of the base is found to answer the purpose, and it is convenient to exhaust the vessel containing the mixture, and then admit the carbon monoxide under a pressure equal to a few inches of mercury, whilst stirring the mixture. When absorption ceases, the product is practically pure formate, mixed with the titanium compound, which can be recovered in any convenient way for re-use.—F. SODN.

Fatty substances extracted from bacteria ; Application to medicinal purposes of ——. Kalle und Co., Akt.-Ges., Biebrich on Rhine, Germany. Eng. Pat. 27,383, Dec. 11, 1907. Under Int. Conv., April 16, 1907.

FOR use in cases of leprosy or tuberculosis, the "bacterial fats," described in Eng. Pat. 26,077 of 1906 (this J., 1907, 934), are mixed with a substance containing the benzoyl radical or which will produce it in the subject, to increase the quantity of leucocytes. Thus, benzoyl chloride, benzyl alcohol, cinnamic acid, or benzaldehyde may be employed.—T. F. B.

1-*Phenyl*-2.3-*dimethyl*-4-*dimethylamino*-5-*pyrazolone ; Manufacture of ——.* Farbwerke vorm. Meister, Lucius, und Brüning, Hoechst a/Main, Germany. Eng. Pat. 27,485, Dec. 12, 1907. Under Int. Conv., Jan. 10, 1907.

ACIDYL or alkyl derivatives of 1-phenyl-3-methyl-4-amino-5-pyrazolone, in which the acidyl or alkyl groups are attached to the pyrazolone oxygen or to the nitrogen of the amino group, are treated with methylating agents ; the acidyl group or groups are removed in the process, and 1-phenyl-2.3-dimethyl-4-dimethylamino-5-pyrazolone is produced. A number of the intermediate compounds is described in the specification. (See also Eng. Pat. 13,383 of 1907 ; this J., 1908, 91.)—T. F. B.

Salicylic acid glycerin esters ; Manufacture of ——. C. Sorger, Frankfort on Maine, Germany. U.S. Pat. 882,590, March 24, 1908.

SEE Fr. Pat. 373,854 of 1907 ; this J., 1907, 778.—T. F. B.

Hydroxyl derivatives ; Rendering —— soluble. Eng. Pat. 7550. *See* IV.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Patents.

Photographic plates or films ; Iso- or orthochromatic ——. T. Macwalter, High Barnet. Eng. Pat. 17,452, July 30, 1907.

AN emulsion for iso- or orthochromatic plates for working without a screen, is prepared by adding to each litre of the ordinary emulsion, 25 c.c. of a 2½ per cent. solution of Yellow Filter K. (See Eng. Pat. 2622 of 1906 ; this J., 1906, 922.)—T. F. B.

Films with gelatin base for cinematography and photography ; Manufacture of non-inflammable ——. L. Labbe and V. Pauthonier. Addition dated Nov. 5, 1907, to Fr. Pat. 381,637, Sept. 7, 1907 (this J., 1908, 184).

PAPER is coated with collodion containing 5 per cent. of acetic acid, a film of formolised gelatin containing glycerin and shellac is applied, and the whole is dried. A second layer of collodion containing acetic acid is now added, and the film is passed through an aqueous solution of glycerin and albumin. The film is then detached from its paper support, when it is ready to receive the sensitive emulsion. —T. F. B.

XXII.—EXPLOSIVES, MATCHES, &c.

Nitro-cotton ; Falsification of —— with mercuric chloride and its detection. [*Heat test*]. J. Moir. J. Chem., Met. and Min. Soc., S. Africa, 1907, 8, No. 7.

Mercuric chloride is frequently added to wet collodion cotton, ostensibly to prevent its becoming mouldy, but sometimes also to make it pass the official heat test, even when it is really defective. Ordinary tests for mercury fail because mercuric chloride cannot be extracted (except by volatilisation) owing to its affinity for organic matter. The author has devised the two following simple processes :—(a) *Combination of Hargreaves and Rowe's method with E. A. Mann's method.*—The moist guncotton, along with a piece of (ignited) silver foil is placed in a flask immersed in boiling water, and air is aspirated through it, and then through bulbs containing 2 per cent. sulphuric acid. After two hours any mercuric chloride which has escaped the silver becomes deposited thereon by using the foil as anode in electrolysing the dilute sulphuric acid from the bulbs (two hours with about 4 volts required.) The foil is dried and the deposit sublimed on to a microscopic slide, as in the other methods. (b). *Conversion into non-volatile compound.*—The cotton is extracted with hot very weak potassium iodide solution, and the extract (containing K_2HgI_4) concentrated to a small bulk and electrolysed. Iodine separates on the platinum basin used as cathode, and the whole of the mercury collects on the gold or silver foil anode after two or three hours, and is worked up as above. The latter method is the quickest and most sensitive the author has as yet tried, and has the advantage of absence of all danger of explosion.

Patents.

Nitro-compounds from solvent naphtha ; Production of aromatic ——. G. Schultz, Munich, Germany. Eng. Pat. 19,565, Aug. 31, 1907.

Coal-tar naphtha is washed alternately with sulphuric acid and sodium carbonate solution, and fractionated, and the portion which boils between 120° and 180° C. (sp. gr. 0·860 to 0·875) is nitrated as follows :—30 litres of the naphtha are run slowly into 60 litres of a mixture of nitric acid (130 parts by volume, sp. gr. 1·49 to 1·52) and sulphuric acid (27 parts by vol., 66° B.), the mixture being agitated and kept at 25° C. 60 litres of the mixed acids are now added, and the mixture is heated to 80° C. and then cooled to 25° C., with constant stirring. The acid is removed, and the oil again treated with 60 litres of the mixed acids and 45 litres of sulphuric acid, the temperature being raised to 80° C., and then reduced to 25° C. The acid is removed, and the nitrated product washed and separated into its solid and liquid portions. The products are suitable for use in preparing safety explosives, the solid or liquid portions being used according to the disruptive power required. If desired, the naphtha may be resolved into two or more fractions by distillation, and the fractions nitrated separately. If the naphtha is resolved into three fractions (b. pts. 120°—140°, 140°—160°, and 160° to 180° C. respectively), the nitro-compounds produced are solid from the lowest fraction, chiefly oily from the middle fraction, and chiefly solid from the fraction of highest boiling point.—T. F. B.

Safety explosives ; Manufacture of —— from the nitro-compounds of solvent naphtha. G. Schultz, Munich. Eng. Pat. 19,565a, Aug. 31, 1907.

A safety explosive may be prepared from liquid or solid nitro-compounds derived from solvent naphtha (see preceding abstract) by : (1), mixing them with oxygen-containing materials as nitrates, perchlorates, chromates, or metallic oxides ; (2), adding to such mixtures of nitro-compounds and oxidising matter, peroxides or easily oxidisable metals as copper, iron, or aluminium ; (3), mixing such nitro-compounds with picric acid, nitro-cotton, or aurantia (hexanitrodiphenylamine) ; (4), melting the solid nitro-compounds with picric acid ; and (5), dissolving nitro-cellulose in the oily nitro-compounds, mixing the resulting product with oxidising matter as in claim 1, and with an organic material such as flour.—J. W. G.

Gunpowder ; Apparatus for dividing gelatinous —— into particles or grains. G. H. Wadsworth, Lyndhurst, Hants. Eng. Pat. 23,112, Oct. 19, 1907.

The explosive is placed in a receptacle and forced in streams by means of a plunger through 6 or 8 holes arranged in a straight line in a circular die-plate. A shaft below the die-plate, in line with the perforations therein, revolves at a high velocity (6000—8000 revolutions per minute) and carries a doubly-flanged wheel bearing about sixty peripheral, tempered steel knives arranged at right angles to the plane of the wheel, and extending across the annular channel formed by the flanges to which they are fixed by screws. The knives are not in frictional contact with the die-plate, hence the explosive is cut in space by reason of its own inertia and the high velocity of the knives. The plunger on nearly reaching the die-plate at the end of the operation rises automatically, thus allowing the receptacle to be either removed or refilled. The plunger is started, and controlled through each cycle of operations, by a lever which actuates suitable exhaust and pressure valves connected with a pressure cylinder carried on an extension of the frame-work which holds the receptacle.—J. W. G.

Explosives ; Machine for mixing ——. G. P. Jones, Emporium, Pa. U.S. Pat. 882,114, March 17, 1908.

The receptacle is provided with a mixer which, by means of a flexible connection passing over a wheel, is connected to a heavy piston so that, under ordinary conditions, it is raised above the mixing vessel. It can be lowered when necessary by applying fluid pressure to the piston, but it automatically returns to its former position when the pressure is released.—C. A. W.

Explosive ; Safety ——. B. G. Reschke, Hamburg, Germany. U.S. Pat. 882,910, March 24, 1908.

See Eng. Pat. 12,716 of 1906 ; this J., 1906, 953.—T. F. B.

Explosives ; Manufacture of ——. P. Winand. Fr. Pat. 384,079, Nov. 16, 1907. Under Int. Conv., Dec. 6, 1906.

See Eng. Pat. 26,261 of 1907 ; this J., 1908, 297.—T. F. B.

"*Explosive gelatin*" *; Machines for forming a cartridge rope from ——.* H. Auchu, Emporium, Pa. U.S. Pats. 881,365—881,368, March 10, 1908.

(1). The apparatus comprises a casing, 22 (Fig. 1), into which the "explosive gelatin" is fed. From this casing the material is forced by means of the rotary feeder, 30, 31, into the delivery mouth, 8, from which it is discharged by means of the packing-screw, 4. The feeder is rotated by means of the friction-wheel, 34, carried by it and driven by a second friction-wheel, 39. Should

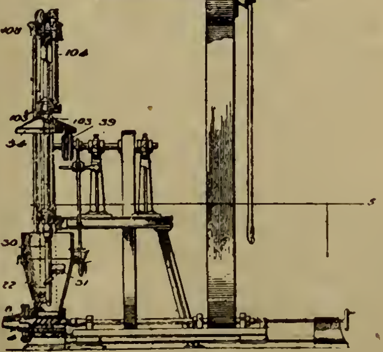


Fig. 1.

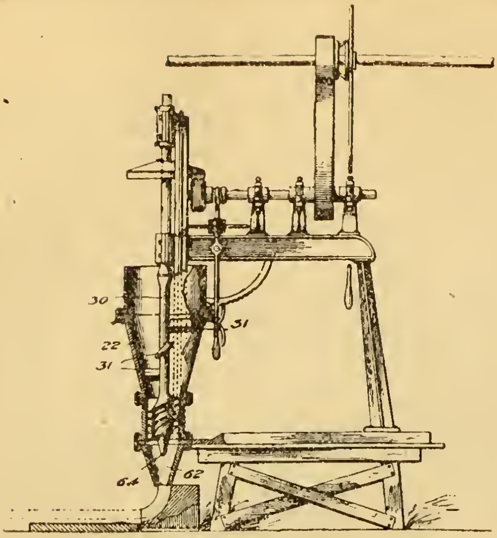


Fig. 2.

the pressure of the feeder on the "explosive gelatin," become too great, the back pressure causes it to lift slightly, whereby the two friction wheels, 34 and 39, are thrown out of gear. (2). The "explosive gelatin" is forced out of a tapered hopper, 22 (Fig. 2), through a delivery mouth, 62, by means of a feeder, 30, and a packing-screw, 64, the former having blades, 31, with inclined faces. If the back pressure on the packing-screw become excessive, the screw and feeder are lifted slightly, and the friction-wheels, 34 and 39, by which they are driven, are thrown out of gear. (3). In the apparatus described under (1) (see Fig. 1), the feeder, 30, 31, may be supported by a carriage, 103, movable up and down by means of the screw, 104, and other arrangements not shown, in order that the feeder may be moved bodily into or out of the casing, 22. (4). In apparatus of the type described, means not shown in detail, may be provided for holding together the two friction-wheels or analogous driving arrangements, under any desired pressure. In this case when the back pressure on the feeder becomes excessive, the two wheels are not thrown out of gear, but the driving wheel rotates without causing any corresponding rotation of the wheel on the feeder shaft.—A. S.

XXIII.—ANALYTICAL CHEMISTRY.

APPARATUS.

Patent.

[*Lubricating*] *Oil testing device.* F. Schmalz. Ger. Pat. 186,601, March 29, 1906.

The apparatus comprises two friction discs driven by spindles geared together, and working against two other friction discs, the motion of which is transmitted by suitable means to two pointers, mounted in a common bearing. From the indications of the pointers on a common scale, a comparison of the two lubricants under examination is obtained.—A. S.

INORGANIC—QUANTITATIVE.

Iron determination by permanganate according to Reinhardt's method; Influence of accompanying metals on ——. Report of the "Chemiker-Kommission des Vereins deutcher Eisenhüttenleute." Stahl u. Eisen, 1908, **28**, 508—513.

Experiments were made to determine the influence of copper, arsenic, chromium, nickel, cobalt, titanium, lead and antimony on the determination of iron by Reinhardt's permanganate process. The results show that of the metals mentioned, antimony alone has an appreciable influence on the results. In most cases, however, the influence of antimony is of no importance, since this metal occurs in iron ores only to a very limited extent. The Commission conclude that Reinhardt's method on account of its simplicity and its almost general applicability, is to be preferred to all others.—A. S.

Tin; Separation of —— *from manganese, chromium and iron by electrolysis.* N. Puschin. Monit. Scient., 1908, **22**, 262—264.

When a solution of the oxalates of manganese or chromium in oxalic acid is electrolysed, these metals are not precipitated on the cathode when the current used is 0·8—5 ampères at 2—4 volts; under these conditions it is possible to completely deposit any tin in the solution. The best results were obtained in the separation of tin and manganese by using a current of 1·5—3 ampères at 2·2—2·9 volts, and in the separation of chromium and tin by using a current of 5 ampères at 4 volts. Although iron is not itself deposited by electrolysis from oxalic acid solutions, it has not been found possible to obtain a good method for separating tin and iron, as there is a formation of insoluble ferrous oxalate at the cathode which prevents the proper separation of the tin.—C. E. F.

Barium peroxide; Valuation of ——. A. Chwala. *See* VII.

"*Battery chips*" *and* "*screens*"; *Assay of* ——. L. J. Wilmoth. *See* X.

ORGANIC—QUALITATIVE.

Mercerised cotton; Qualitative test for ——. E. Knecht. *See* V.

Patent.

Butter; Detecting adulteration of ——. Ger. Pat. 192,919. *See* XVIII A.

ORGANIC—QUANTITATIVE.

Lead, copper, and silver in complex organic salts; Determination of ——. M. Rindl and H. Simonis. Ber., 1908, **41**, 838—840.

The simplest method of determining lead and copper in their organic salts, consists in heating with concentrated sulphuric acid. In cases where the substance contains more than 1 atom of sulphur per atom of lead, the determination of lead as sulphate may be combined with that of sulphur by Carius' method. In the filtrate from the lead sulphate, the remaining sulphur is precipitated as barium sulphate. Copper salts containing besides carbon, hydrogen, and oxygen, only sulphur and nitrogen, are converted quantitatively into copper oxide on ignition. The silver in complex salts containing halogens can be more rapidly determined by Dupont and Freundler's method of evaporating with *aqua regia* (or with a mixture of nitric and hydrobromic acids in the case of substances containing bromine) than by the usual process of heating in a sealed tube with fuming nitric acid and potassium halogenide. The method of reduction with formaldehyde and caustic potash given by Vanino (this J., 1898, 873; 1899, 176) for salts containing halogens can also be applied to salts containing sulphur, but the reduction must be repeated several times. Silver salts containing only sulphur and nitrogen in addition to the usual elements, yield metallic silver on ignition. The silver determination may be combined with that of the halogens by Carius' method, a weighed excess of silver nitrate being added, if necessary, and the excess afterwards determined.—A. S.

Mercerisation in cotton yarns; Determining the degree of ——. E. Knecht. *See* V.

Digitalis and its preparations; Standardisation of —— *by chemical means.* C. E. Vanderkleed. *See* XX.

Patent.

Milk and dairy products; Determination of fat in ——. Ger. Pat. 192,767. *See* XVIII A.

XXIV.—SCIENTIFIC & TECHNICAL NOTES.

l-Serine into active natural cystine; Conversion of ——. E. Fischer and K. Raske. Ber., 1908, 41, 893—897.

When an ester of serine is treated with phosphorus pentachloride, α-amino-β-chloropropionic acid is produced. The hydrochloride of aminochloropropionic acid obtained in this way from racemic serine was heated with freshly prepared barium hydrosulphide and water in a sealed tube to 100° C. for $1\frac{1}{2}$ hours. The excess of hydrogen sulphide and barium were removed, the liquid concentrated under reduced pressure, a slight excess of ammonia added, and a current of air passed through for an hour. The filtered liquid was evaporated to complete dryness in a vacuum, when a mixture of ammonium salts and *dl*-cystine, $(C_3H_6O_2NS)_2$, was obtained. After dissolving in ammonia, and precipitating with acetic acid, the cystine was obtained in needles or minute prisms. By using *l*-α-amino-β-chloropropionic acid, *l*-cystine was produced, which had $[\alpha]_D = -209{\cdot}6°$ $(\pm 1°)$ at 20° C. in $N/_1$ hydrochloric acid solution. When the hydrochloride of *l*-cystine is dissolved in water, free cystine separates in hexagonal tablets. Acetic acid added to the ammoniacal solution precipitates rectangular prisms.
—F. Shdn.

Ketenes. Part 7. Classification of ketenes. H. Staudinger and H. W. Klever. Ber., 1908, 41, 906—909.

By treating an ethereal solution of α-bromopropionyl and α-bromobutyryl bromides with zinc, the authors have obtained dilute ethereal solutions of methylketene and ethylketene respectively. With aniline the corresponding anilides are formed, but with quinoline the ketenes are polymerised. By acting with zinc on an ethereal solution of dibromomalonyl bromide, Diels' carbon suboxide, C_3O_2, was produced. The authors divide the ketenes into two groups, namely. (1), Colourless, non-oxidisable compounds such as ketene, methylketene, ethylketene and carbon suboxide ("aldoketenes"); and (2), coloured, readily oxidisable compounds such as dimethyl-, diphenyl- and diphenylene-ketene ("ketoketenes.")—J. C. C.

Trade Report.

The figures given below are in continuation of the curve published in 1894 (this J., 1894, 762A) shewing the average prices of general commodities in England from 1820 to 1894.

Prices of commodities. A. Sauerbeck, April 10, 1908.

The following are the index numbers of the prices of 45 commodities, the average of the 11 years 1867–77 being 100:—

	Average.		Monthly Numbers.
1878—1887	79	February, 1895 ..	60·0
1888—1897	67	July, 1896.......	59·2
1890—1899	66	July, 1900.......	76·2
1898—1907	71	December, 1901 ..	68·4
	—	December, 1906 ..	79·7
1888	82	March, 1907	80·0
1896	61	May, 1907	82·4
1900	75	August, 1907	79·4
1901	70	September, 1907..	79·1
1902	69	October, 1907 ...	78·8
1903	69	November, 1907 .	76·7
1904	70	December, 1907 ..	76·2
1905	72	January, 1908 ...	76·0
1906	77	February, 1908 ..	74·5
1907	80	March, 1908	74·1

The index numbers show a further moderate reduction. Corn remained practically unchanged in the aggregate, butter was somewhat lower, but sugar distinctly higher. Among minerals, iron was firmly maintained, copper and lead were a little dearer, but tin had a considerable advance, from E.129$\frac{3}{8}$ per ton to E.144$\frac{1}{4}$. In the case of textiles, cotton, flax, hemp, and silk were all lower, but jute experienced some recovery. Wool suffered a heavy decline, particularly the coarser Colonial sorts, while the quotations for English wool have not been reduced in the same proportion and are quite nominal. Most kinds of "sundry materials" were rather easier.

Taking articles of food and materials separately, the index numbers compare thus (1867–77 = 100 in both cases):—

	1878–87. Average.	1888–97. Average.	1898–1907. Average	1895. Feb.	1900. Feb.
Food	84	70	68	63·8	65·8
Materials.	76	65	74	57·0	81·9
	1900. July.	**1907. May.**	**1907. Dec.**	**1908. Feb.**	**1908. March.**
Food	71·2	73·5	73·6	73·0	72·5
Materials.	79·8	88·9	78·1	75·6	75·2

The position of trade remains unsatisfactory in most branches.

Silver.—The prices and index numbers compare thus (60·84d. per ounce being the parity of 1 gold to $15\frac{1}{2}$ silver = 100):—

	Price.	Index No.
Average 1888–97	37d.	= 60·8
,, 1898–1907	$27\frac{3}{8}$d.	= 45·0
,, 1893	$35\frac{5}{8}$d.	= 58·6
,, 1902..................	$24\frac{1}{16}$d.	= 39·6
Lowest Nov., 1902	$21\frac{11}{16}$d.	= 35·6
End March, 1905..................	$25\frac{13}{16}$d.	= 42·4
,, Dec., 1906	$32\frac{5}{16}$d.	= 53·1
,, Dec., 1907	$24\frac{7}{8}$d.	= 40·9
,, Feb., 1908	$25\frac{9}{16}$d.	= 42·0
,, March, 1908..................	$25\frac{9}{16}$d.	= 42·0

The silver market is weak and stocks of the metal have accumulated in the Indian Treasury.

South Africa; Preferential treatment of British goods in ——. Board of Trade Circular, April 7, 1908.

The mere packing or bottling of imported foreign goods in the United Kingdom does not, for the purposes of the South African Preferential Tariff, constitute United Kingdom manufacture. Such goods must, in addition, be subjected to some manufacturing process in this country. Thus oil, which is imported in the crude state and refined, bottled, &c., in the United Kingdom is considered as of United Kingdom manufacture, whilst goods imported in bulk and merely bottled in the United Kingdom are not so considered, and are not, therefore, entitled to preferential treatment.

British trade marks in Japan. Board of Trade Circular, April 1, 1908.

British owners of trade marks used in the Far East are reminded of the risks they run by failing to register their marks in Japan, and of the necessity of taking steps to protect their interests after registration. Attention of firms whose products, bearing marks duly registered, are on sale in Japan, is called to the precaution—as one means of securing their marks against infringement, of adding on their labels, in Japanese characters, the words "Registered Trade Mark" (Toroku Shohyo).

According to the Japanese Trade Marks Law, marks cannot be registered if they are identical with, or similar to, marks used by another person or firm prior to July 1, 1899 (the date on which the Law came into force), provided that such marks have been continuously in use in Japan since that date. The Japanese Patent Bureau are prepared to receive particulars of all marks fulfilling these conditions, with a view to minimise the possibility of infringement, and particulars of such marks should be supplied with as little delay as possible. In the event, however, of marks identical with, or similar to, marks in use in Japan prior to July 1, 1899, having by inadvertence been placed upon the register, they cannot be removed therefrom if more than three years have elapsed from the date of registration.

Patent List.

Where a complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

Applications.

6977. Anderson and Meikle. Evaporating water. March 30.

7054. Rayne. Apparatus for raising liquids. March 31.

7094. Richards. Apparatus for condensing fumes, vapours, &c.* March 31.

7177. Robson. Apparatus for drying granular and powdered substances. April 1.

7605. Matter. Delixiviating materials and recovering the lye. April 6.

7613. Brougham (Von Preyss). Raising the temperature of substances containing bodies sensitive to changes. April 6.

7728. James (Separator Aktiebolaget Mundus). Centrifugal separators. April 7.

7841. Churchill. Separators for materials of different specific gravities.* April 8.

7910. Siemens Bros. and Co. (Siemens und Halske A.-G.). Pyrometers or thermometers of the thermoelectric or electric resistance type.* April 9.

7920. Peat. *See under* X.

Complete Specifications Accepted.

8317 (1907). City of Bradford, Wyld, and Shepherd. Towers for absorbing, eliminating, or condensing chemical vapours. April 15.

15,748 (1907). Jeffcock and Yardley. Dryer or separator for treating steam. April 15.

17,793 (1907). Baron, and Fuel Saving and Water Treating Co. Separating solid matter from fluids. April 8.

19,431 (1907). Hencke. Vacuum drum filters. April 8.

21,010 (1907). Boult (Blair). Reverberatory furnaces. April 8.

25,644 (1907). Beth. *See under* II.

II.—FUEL, GAS. AND LIGHT.

Applications.

6966. Moore and Crombie. Plant for treating fuel and recovering and separating the by-products.* March 30.

6971. Fennell and Perry. Photometer. March 30.

6998. Shirt. Fuel. March 30.

7102. Andrews. Gas generators. March 31.

7105. Junquera. Gas generators. [Fr. Appl., June 26, 1907.]* March 31.

7229. Wolters. Coking ovens or furnaces. [Addition to No. 9087 of 1903.]* April 1.

7501. Mumford and Israel. Rendering coal or other carbonaceous fuel smokeless when ignited. April 4.

7594. Rutgerswerke A.-G. Utilising naphthalene and similar substances as the motor medium for internal combustion engines. [Ger. Appl., May 15, 1907.]* April 6.

7597. Skelhorne. Treatment of liquid fuel. April 6.

7699. Heaton. Gas generators.* April 7.

7703. Medberg and Medberger. Manufacture of fuel suitable for internal combustion engines.* April 7.

8014. Lymn. *See under* VII.

8087. Krause. Suction gas installations.* April 11.

8103. Marcon. Furnaces for distilling coal. April 11.

8104. Michaud and Delasson. Manufacture of filaments for illuminating and heating purposes. [Addition to No. 4461 of 1908.]* April 11.

Complete Specifications Accepted.

7642 (1907). Lake (Parker-Clark Electric Co.). Filaments for incandescent electric lamps. April 8.

8315 (1907). Lynde. Apparatus for producing gas from oil. April 15.

8563 (1907). Deuts. Gasglühlicht A.-G. Manufacture of metallic illuminating bodies for electric incandescence lamps. April 15.

16,489 (1907). Siemens und Halske A.-G. *See under* VII.

21,105 (1907). Jaubert. Facilitating ignition of combustible mixtures. April 15.

25,644 (1907). Beth. Filtering smoke, gases, or products of combustion. April 15.

27,567 (1907). Feld. *See under* VII.

28,181 (1907). Rusby. Water gas apparatus. April 15.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

Applications.

6966. Moore and Crombie. *See under* II.

7920. Peat. *See under* X.

IV.—COLOURING MATTERS AND DYESTUFFS.

Applications.

7418. Johnson (Badische Anilin und Soda Fabrik). Manufacture of colouring matters of the anthracene series. [Addition to No. 4235 of 1907.] April 3.

7552. Read Holliday and Sons, Turner, and Dean. Preparation of direct cotton dyestuffs for dyeing. April 6.

7575. Newton (Bayer und Co.). Manufacture of condensation products from 1.8-naphthylenediamine. April 6.

7583. Imray (Soc. Chem. Ind. in Basle). Manufacture of vat dyestuffs containing sulphur.* April 6.

Complete Specifications Accepted.

10,527 (1907). Imray (Meister, Lucius, und Brüning). Manufacture of sulphurised dyestuffs for printing. April 15.

14,167 (1907). Bloxam (Act.-Ges. f. Anilinfabr.). Manufacture of *p*-nitro- and *p*-aminodiphenylamine and derivatives. April 15.

19,029 (1907). Chaumat. Electrolytic preparation of indigo dyes. April 8.

19,810 (1907). Chem. Fabr. Griesheim-Elektron. Manufacture of *o*-oxymonoazo dyestuffs. April 8.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

Applications.

6970. Calico Printers' Assoc., and Schofield. Printing textile fabrics. March 30.

7126. Crumière. Manufacture of artificial horsehair and ribbons of cellulose. [Addition to No. 6766 of 1908.]* March 31.

7175. Maguire. Drying textile fabrics, warps, etc. April 1.

7201. Caberti, and Manifatturae Stamperia Lombarda. Obtaining double-face printing effects on fabrics. [Ital Appl., April 2, 1907.]* April 1.

7345. Calico Printers' Assoc., and Fourneaux. Production of black on textile fibres. April 3.

7552. Holliday and Sons, and others. *See under* IV.

7671. Halliwell, and Mather and Platt, Ltd. Apparatus for dyeing, bleaching, and treating fibrous materials. [Addition to No. 14,780 of 1907.] April 7.

7690. Waddell. *See under* XIX.

7915. Van de Vathorst. Producing imitations of silk. April 9.

7972. Hübner, and Riley and Co. Waterproof, lustrous fabric. April 10.

7988. Rumpf. Producing a permanent lustre on cotton goods. April 10.

8002. Turner and Turner. Hawking machines employed in indigo dye vats.* April 10.

Complete Specifications Accepted.

8111 (1907). Levinstein, and Levinstein, Ltd. Production of two-coloured effects in union goods by dyeing. April 8.

9120 (1907). Jardin. Bleaching flax, hemp, and like textile materials. April 15.

13,831 (1907). Giesler. Apparatus for treating wool, etc. April 8.

16,757 (1907). Dillberg and Gadd. Protecting vegetable fibres from decomposition and putrefaction. April 15.

28,510 (1907). Rothemann. Apparatus for dyeing and bleaching bobbins of yarn with paper sleeves. April 15.

VII.—ACIDS, ALKALIS, AND SALTS.

Applications.

7259. Peyton and MacDuff. Apparatus for the manufacture of calcium carbide. April 2.

7758. Hird. Production of ammonia from ammonia liquor. April 8.

7849. Vincent. Preparation and application of ozone. April 9.

7850. Vincent. Manufacture of oxygen. April 9.

7909. Ostwald. Catalytic apparatus for transforming ammonia into oxides of nitrogen.* April 9.

8012. Meister, Lucius, und Brüning. Manufacture of alkali formate. [Ger. Appl., April 10, 1907.]* April 10.

8014. Lymn. Plant for recovering ammonia from producer gas.* April 10.

8102. Matignon, Trannoy, Urbain, Feige, and Verley. Manufacture of sulphuric acid and sulphuric anhydride by the contact process. [Fr. Appl., April 12, 1907.]* April 11.

Complete Specifications Accepted.

12,575 (1907). Kynaston, and United Alkali Co. Recovery of zinc and iron from liquors. April 8.

16,489 (1907). Siemens und Halske A.-G. Manufacture of a plastic mass from tungsten compounds. April 15.

20,679 (1907). Meyzonnier. Manufacture of chrome alum. April 15.

20,827 (1907). Wyssling. Lime crushing, slaking, drying, and sifting machine. April 15.

27,567 (1907). Feld. Washing out ammonia from coal gases, etc. April 15.

6265 (1908). Aktieselskabet det Norske Kvaelstof-Kompagni. Manufacture of nitric acid and nitrites. April 15.

VIII.—GLASS, POTTERY, AND ENAMELS.

Applications.

7044. Pilkington (Opperman). Manufacture of sheet glass. March 30.

7139. Stein. Producing hardware similar to alfenid.* March 31.

7230. Sulman and Picard. Application of metallic coatings to china, porcelain, glass, etc. April 1.

8049. Ford, Ford, and Hill. Decoration of pottery, earthenware, china, etc. April 11.

Complete Specification Accepted.

19,429 (1907). Schmidt. Method of enamelling. April 15.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Applications.

7091. Lake (Sackett Plaster Board Co.). Manufacture of plaster cement and the like. March 31.

7826. Thomä. Cement. April 8.

Complete Specifications Accepted.

2994 (1907). De Karyscheff. Materials capable of withstanding heat, acids, and alkalis. April 15.

15,434 (1907). Barnhurst and Fuller. Producing cement clinker in the manufacture of cement. April 8.

28,745 (1907). Schruf. Production of artificial stone and mortar impermeable to water. April 8.

X.—METALLURGY.

Applications.

7211. Strange, Pim, and Matthews. Recovery of gold by the cyanide process. April 1.

7227. Rosenberg. Depositing metals on metallic and other surfaces. April 1.

7429. Herrenschmidt. Treatment of antimony ores. [Fr. Appl., April 5, 1907.]* April 3.

7442. Kirkham. Regenerative gas-heated cementation furnace. April 4.

7477. Zohrab and Evans. Treatment of refractory ores, iron sands, etc., for smelting. April 4.

7584. Nodon. Recovery of tin from waste tinned metal, mixtures and alloys of tin, etc. [Fr. Appl., April 11, 1907.]* April 6.

7705 and 7706. Nodon. Recovery of tin from waste mixtures and alloys of tin with lead. [Fr. Appls., Sept. 7, 1907, and Feb. 10, 1908.] [Additions to No. 7584 of 1908.]* April 7.

7726. Norton. Preparation of iron or steel sheets.* April 7.

7917. Pratt. Manufacture of steel. April 9.

7920. Peat. Retorts for subjecting ores, shale, etc., to heat.* April 9.

7951. Charlton. Smelting iron ores. April 9.

Complete Specifications Accepted.

7946 (1907). Muirhead. Desiliconising or purifying cast iron for use in making basic open-hearth steel. April 8.

8567 (1907). Boult (Chapman). Separation of certain non-metallic from other mineral substances. April 15.

10,750 (1907). Reid. Treating ore or like material by the aid of heat. April 8.

17,519 (1907). Schneider. Manufacture of steel for armour plates, etc. April 8.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

Applications.

7188. Nathusius, and Westdeutsche Thomasphosphatwerke. Electric furnaces.* April 1.

7923. Nathusius, and Westdeutsche Thomasphosphatwerke. Electric furnaces. [Addition to No. 7188 of 1908.]* April 9.

8017. Branco and Gumpert. Manufacture of an insulating material.* April 10.

Complete Specifications Accepted.

8036 (1907). Craig. Electrodes for the evolution of ozone from oxygen or air. April 8.

19,027 (1907). Chaumat. *See under* IV.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

Applications.

7103. Lake (Blakeman). Oils.* March 31.

7110. Lake (Blakeman). Oils.* March 31.

7224. Austerlitz. Pressing oil-seeds. [Addition to No. 10,860 of 1907.]* April 1.

7531. Küchle. Production of soap containing albumen. April 4.

Complete Specifications Accepted.

12,746 (1907). Glenister and Glenister. Manufacture of wax matches, candles, tapers, etc. April 15.

16,886 (1907). Schou and Schou. Preparation of fatty substances. April 8.

23,746 (1907). Boehringer und Soehne. Application of compounds of ammonia and higher fatty acids for candle making, etc. April 8.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(*A.*)—Pigments, Paints.

Applications.

7090. Lake (Blakeman). Manufacture of paint compounds.* March 31.

7100. Lake (Blakeman). Manufacture of paint compounds.* March 31.

Complete Specification Accepted.

25,181 (1907). Anderson. Dry water-colour or distemper. April 15.

(*B.*)—Resins, Varnishes.

Complete Specification Accepted.

18,481 (1907). Linoleum Manufacturing Co., and Vincent. Manufacture of linoleum. April 15.

(*C.*)—India-Rubber.

Application.

7561. Milne and Hutchison. Preparatory treatment of rubber. April 6.

Complete Specification Accepted.

7714 (1907). Rouxeville. Agglomerating and regenerating rubber, guttapercha, and their artificial substitutes. April 8.

XIV.—TANNING, LEATHER, GLUE, SIZE, &c.

Application.

7580. Pianko and Knaster. Manufacture of leather. [Addition to No. 28,743 of 1907.]* April 6.

Complete Specification Accepted.

8381 (1907). Gevaert-Naert. Manufacture of artificial leather and similar products. April 15.

XVI.—SUGAR, STARCH, GUM, &c.

Application.

7813. Boult (Sparre). *See under* XVII.

Complete Specification Accepted.

18,341 (1907). Ekström. Making grape sugar and ethyl alcohol from materials containing cellulose. April 15.

XVII.—BREWING, WINES, SPIRITS, &c.

Applications.

7479. Royston (Victoria Distillery Co.). Apparatus for distilling alcohol, low wines, and raw or other spirits.* April 4.

7813. Boult (Sparre). Production of products in addition to alcohol by fermentation of saccharine solutions, preferably maltose.* April 8.

Complete Specification Accepted.

18,341 (1907). Ekström. *See under* XVI.

XVIII.—FOODS; SANITATION, WATER PURIFICATION; AND DISINFECTANTS.

(*A.*)—Foods.

Applications.

7525. Macadam. Manufacture of extracts from malted grain or cereal. April 4.

7577. Longfield. Baking powder. April 6.

7732. Jung and Jung. Non-alcoholic beverages.* April 7.

Complete Specifications Accepted.

8422 (1907). Bredenkamp and Christiansen. Deacidification and purification of old butter. April 15.

27,660 (1907). Mörig. Destroying the power of germination of wheat and other seeds. April 15.

(*B.*)—Sanitation; Water Purification.

Applications.

7365. Parsons. Purification and utilisation of sewage.* April 3.

7505. Grimm. Water purifying apparatus.* April 4.

XIX.—PAPER, PASTEBOARD, &c.

Applications.

7430. Marino. Preparation of soluble cellulose. [Addition to No. 3374 of 1908.] April 3.

7690. Waddell. Filtering and spinning heads for machines for forming filaments of metamorphosed cellulose, &c., in the manufacture of artificial silk. [Dated March 11, 1907. Comprised in No. 5881 of 1907.]* April 7.

8023. Lyncke. Production of powdered soluble alkali-cellulose xanthate. [Ger. Appl., Sept. 21, 1907.]* April 10.

Complete Specification Accepted.

13,744 (1907). Caldwell. Apparatus for treating pulp. April 15.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

Applications.

7319. Bentley, Weizmann, and Clayton Aniline Co. Treatment of liquid or oily pinene hydrochloride, and obtaining solid pinene hydrochloride and camphene. April 2.

7601 and 7602. Wellcome, Pyman, and Reynolds. Manufacture of therapeutic compounds. April 6.

8068. Wellcome, Bates, and Remfry. Manufacture of a therapeutic compound. April 11.

Complete Specifications Accepted.

27,113 (1907). Lewy. Manufacture of preparations of hæmoglobin. April 8.

139 (1908). Raschig. Manufacture of hydrazine. April 8.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Application.

7087. Donisthorpe. Photographic films. March 31.

XXII.—EXPLOSIVES, MATCHES, &c.

Application.

7921. Boult (La Motte). Explosives.* April 9.

Complete Specification Accepted.

19,993 (1907). Ansay and Namèche. Explosive. April 8.

Journal of the Society of Chemical Industry.

No. 9, Vol. XXVII. MAY 15, 1908. No. 9, Vol. XXVII.

Official Notice.

ANNUAL GENERAL MEETING.

The Annual General Meeting will be held in the Armstrong College, Newcastle-on-Tyne, on Wednesday, July 22nd, at 10.30 a.m. Full particulars will appear later.

In accordance with the provisions of By-law 18 of the Society of 1881, notice is hereby given that those members whose names are printed in *italics* in the list of Council (see p. 363, April 30th number) will retire from their respective offices at the forthcoming Annual Meeting.

Prof. R. Meldola, F.R.S., has been nominated to the office of President under By-law 8; Dr. J. T. Dunn, Mr. A. R. Ling, Mr. George C. Stone, and Mr. R. C. Woodcock, have been nominated Vice-Presidents under By-law 8; Sir Boverton Redwood has been nominated a Vice-President under By-law 11; and Dr. T. B. Wagner has been nominated a Vice-President under By-law 26. Prof. P. Phillips Bedson and Mr. H. Van der Linde have been nominated Ordinary Members of Council under By-law 26; and Mr. Thomas Tyrer and Dr. Ludwig Mond, F.R.S., have been nominated Hon. Treasurer and Hon. Foreign Secretary respectively under By-law 9.

Members are hereby invited to nominate fit and proper persons to fill four vacancies among the Ordinary Members of Council. Forms for this purpose can be obtained from the General Secretary.

Extract from By-law 18.—"No such nomination shall be valid unless it be signed by at least ten members of the Society, who are not in arrear with their subscriptions, and by the nominee, nor unless it be received by the General Secretary, at the Society's office, not later than the last day of May prior to the commencement of the Annual General Meeting, at which the election to which the nomination refers is to take place. Nor shall any such nomination be valid if the person nominated be ineligible for election under By-laws 12 or 15. No member shall sign more than one nomination form."

By order of the Council,

Charles G. Cresswell, Secretary.

Liverpool Section.

Meeting held at the University, Liverpool, on Wednesday, April 8th, 1908.

DR. JAMES T. CONROY IN THE CHAIR.

THE DETERMINATION OF PHOSPHORUS IN PHOSPHOR TIN.

BY W. GEMMELL AND S. L. ARCHBUTT.

(From The National Physical Laboratory).

Some time ago we had occasion to analyse two samples of phosphor tin containing approximately three and five per cent. of phosphorus. On attempting to dissolve the five per cent. alloy in *aqua regia*, the action was so violent that phosphoretted hydrogen was evolved in considerable quantity and ignited spontaneously in the air. The samples were therefore attacked with nitric acid of 1·2 sp. gr., when a much less violent action ensued, and no phosphoretted hydrogen was lost. The acid was evaporated off, and the residue thoroughly dried on the water bath. It was then taken up with warm dilute nitric acid and filtered. By this treatment all the phosphorus is contained in the residue as tin phosphate together with tin oxide. The residue was treated in two ways for the purpose of removing the tin and obtaining the phosphorus in the form of a soluble phosphate. The one consisted of fusion of the residue with a mixture of equal parts of anhydrous sodium carbonate and sulphur, which we will call the Hepar method; the other, fusion with potassium cyanide.

The Hepar fusion was carried out in a covered porcelain crucible and heating continued until the excess of sulphur was driven off. The phosphorus now exists as sodium phosphate and the tin as sodium sulpho-stannate. The melt was cooled and dissolved in water, in which the above compounds are easily soluble. Hydrochloric acid was now added to the solution until present in small excess, whereby the tin was thrown out as a bulky precipitate of tin sulphide; the precipitate was then filtered off and well washed with sulphuretted hydrogen water. The filtrate was boiled to remove sulphuretted hydrogen, evaporated to a suitable bulk, and the phosphorus precipitated with magnesia mixture in the usual manner. Fresenius states that the tin sulphide is liable to carry down phosphorus with it. We therefore examined this precipitate for phosphorus by evaporating it to dryness with nitric acid. The insoluble residue was then fused with the Hepar mixture, the further treatment being exactly as described above. In two estimations on the five per cent. alloy, the phosphorus found in the precipitate amounted to 0·212 and 0·216 per cent. In the case of the three per cent. alloy, the amount was less.

The cyanide fusion method.—By fusion of the residue, from the nitric acid evaporation, with potassium cyanide, the tin is separated in the metallic condition. This fusion was also carried out in a covered porcelain crucible, the melt cooled, extracted with water, and the tin removed by filtration. An excess of hydrochloric acid was added to the filtrate, which was boiled until all hydrocyanic acid was expelled, and the phosphorus precipitated with magnesia mixture in the usual way. Some high results were obtained by this process, which were subsequently traced to the presence of tin in the filtrate. The difficulty was overcome by nearly neutralising the acid filtrate with ammonia and passing sulphuretted hydrogen, when we invariably obtained a small precipitate of tin sulphide, which was filtered off previous to the precipitation of the phosphorus. This tin had caused the high results by being precipitated with the phosphorus. Two other alloys of lower phosphorus content were prepared from the three per cent. alloy by melting and dilution with pure tin These alloys contained approximately 1·4 and 0·7 per cent. of phosphorus.

The following is a comparison of the results given by the two methods:—

Determination.	5 per cent. alloy.		3 per cent. alloy.		1·4 per cent. alloy.		0·7 per cent. alloy.	
	Hepar fusion.	Cyanide fusion.	Hepar fusion.	Cyanide fusion.	Hepar fusion.	Cyanide fusion.	Hepar fusion.	Cyanide fusion.
1...............	4·983	4·863	2·812	2·902	1·293	1·293	0·698	0·662
2...............	5·124	—	2·817	—	—	1·245	—	—

Several objections may be raised against the above methods :—

1. The porcelain crucibles are attacked by the fused alkalis, and, unless precautions be taken, the magnesium pyrophosphate precipitate is liable to contamination with silica and alumina from the material of which the crucible is made.

2. The carrying down of phosphorus by the tin sulphide precipitated necessitates further treatment of this precipitate.

3. We have already seen that, in the case of the potassium cyanide method, it is necessary to remove the last traces of tin with sulphuretted hydrogen before precipitation of the phosphorus.

4. The Hepar method is practically restricted to amounts of alloy not exceeding one gramme, on account of the bulkiness of the tin sulphide precipitate.

5. The above processes are very lengthy and tedious when compared with the method now about to be described.

The new method.—We found that the above samples of phosphor tin were easily decomposed by hydrochloric acid, and it seemed probable that all the phosphorus was evolved as hydrides, and might be absorbed and converted into phosphoric acid by suitable means. Bromine and water proved very effective for the attainment of this end. We therefore proceeded as follows :— Two to five grms. of the sample were placed in a 500 c.c. Jena flask fitted with a tap funnel and delivery tube. The tap of the funnel was a "two way," allowing gas or liquid to be introduced as desired. The absorption apparatus consisted of three Drechsel bottles, the first two containing about ½ inch of liquid bromine covered with bromine water of about one inch in depth, and the third bromine water only. The air was first completely removed by passing a current of carbon dioxide through the apparatus for about 5 minutes. 50 to 100 c.c. of concentrated hydrochloric acid were then introduced, and the contents of the flask gently heated. The sample dissolved readily, and it was obivous from the appearance of the first Drechsel bottle that vigorous action was taking place between the evolved gases and the bromine. When the action had practically ceased, the contents of the flask were gently boiled to effect complete solution of the tin, and to expel any phosphorus hydrides in the liquid. A current of carbon dioxide was then passed through the flask for five minutes to drive forward any remaining traces of evolved gases into the Drechsel bottles. These were then disconnected, the contents rinsed into a large beaker, the bromine boiled off, and the solution concentrated. From this solution the phosphorus was precipitated in the usual manner with magnesia mixture.

The alloys used in these tests contained no arsenic, which would have been estimated along with the phosphorus, had it been present. Any appreciable quantity present in the sample should subsequently be estimated in the magnesium pyrophosphate by solution in hydrochloric acid, reduction, and precipitation with sulphuretted hydrogen. Before the precipitation of the phosphorus by magnesia mixture no precipitate was ever obtained with ammonia or sulphuretted hydrogen, showing that no tin had been carried over. The contents of the evolution flask were always tested for phosphorus, and nothing more than the merest trace was ever found.

The results given by this method on the four alloys are as follows :—

No.	5 per cent. alloy.	3 per cent. alloy.	1·4 per cent. alloy.	0·7 per cent. alloy.
1	5·068	2·885	1·371	0·718
2	5·052	2·881	1·359	0·708
3	5·064	2·887	1·345	0·713
4	—	—	—	0·712

It will be seen that these results are satisfactory and concordant, and either agree with those of the older methods or are very slightly higher. We therefore regard the method as accurate, while it presents the following decided advantages :—

1. There are no bulky precipitates to be dealt with.

2. There is no liability of introducing silica or alumina derived from fusion in porcelain crucibles.

3. The method is much shorter, as the actual evolution and absorption occupies less than twenty minutes.

London Section.

Meeting held at Burlington House on April 6, 1908.

DR. J. LEWKOWITSCH IN THE CHAIR.

THE OCCURRENCE OF CYANOGENETIC GLUCOSIDES IN FEEDING-STUFFS.

BY THOS. A. HENRY, D.SC. (LOND.), AND S. J. M. AULD, PH.D. (WÜRZBURG).

During the last eight years, a considerable number of plants containing cyanogenetic glucosides have been examined at the Imperial Institute, and as several of these are used both in their countries of origin and also in Europe as feeding stuffs, it seems desirable that the information which has been obtained regarding the amounts of hydrocyanic acid furnished by these products under different conditions, should be placed on record, and as there appears to be some difference of opinion among analysts as to the methods which should be adopted in estimating the hydrocyanic acid in such cases, an account of the methods used in the investigations referred to, may be of general interest.

It is unnecessary for the present purpose to describe in detail the results of purely scientific interest, which this work has afforded, since these have been published already by Prof. W. R. Dunstan, in association with one or both of the present authors, in a series of papers on "Cyanogenesis in Plants," presented to the Royal Society, which include the following cases :—

Lotus arabicus. Phil. Trans., 1901, B., **194**, 515.

Sorghum vulgare, commonly known as "the great millet" or "common sorghum," *ibid*, 1902, A., **199**, 399.

Beans of *Phaseolus lunatus.* Proc. Roy. Soc., 1903, **72**, 285.

Linseed (or flax) and cassava, *ibid.*, 1905, **78**, 145.

It is sufficient to say, in this connection, that each of these plants has been found to contain a cyanogenetic glucoside and a glucosidolytic enzyme, and that when these two products are brought into contact by placing the ground plant in water, decomposition of the glucoside ensues with the production of hydrocyanic acid. The diverse nature of these glucosides is sufficiently indicated by the following table :—

Table I.

Name of plant.	Cyanogenetic glucoside.	Nature of decomposition products of glucoside.
Lotus arabicus .	Lotusin	Lotoflavin (a colouring matter of the quercetin group), *d*-glucose, and hydrocyanic acid.
Sorghum vulgare .	Dhurrin	*p*-Hydroxybenzaldehyde, *d*-glucose, and hydrocyanic acid.
Phaseolus lunatus (Lima, Rangoon or Java beans)	Phaseolunatin	Acetone, *d*-glucose, and hydrocyanic acid.
Linum usitatissimum (Flax or linseed)		
Manihot utillissima (Cassava or manioc)		

Detection and estimation of hydrocyanic acid.—From the statement made above that these plants when ground and placed in contact with water liberate hydrocyanic acid, it would, at first sight, appear that the estimation of the amount of hydrocyanic acid could be readily conducted by allowing a weighed quantity of the ground plant to remain in contact with water in a closed vessel for a period long enough to ensure complete decomposition.

of the glucoside, and then to distil off and estimate by any of the usual methods, the hydrocyanic acid formed. The aqueous liquid so prepared is, however, usually difficult to distil, owing to the formation of froth, and there is, moreover, good reason to believe that under these conditions the decomposition of the glucoside is practically never complete, so that an estimation conducted in this manner gives low results. One of the most important factors in this connection is the inhibiting action exerted by the *d*-glucose, produced in the initial stages of the hydrolysis, on the decomposition of the glucoside in the later stages of the reaction. This inhibition has been repeatedly observed by investigators who have worked on the decomposition of glucosides by enzymes. In the present connection, this point is of special importance, since not only is *d*-glucose produced by the hydrolysis of the glucoside, but there is also some originally present in the beans. In order to obtain some information as to the sort of effect produced in this way, a number of experiments on the inhibiting action of various sugars on the decomposition of phaseolunatin by the enzyme, which accompanies it in the beans of *Phaseolus lunatus*, were made. The pure glucoside was employed in these experiments, and the enzyme used was prepared from a cultivated variety of the beans, which contained the enzyme, but no cyanogenetic glucoside. The results obtained are given in the following table. A comparative experiment with ammonium sulphate in place of sugar was also made, in order to ascertain how soluble inorganic salts, which are frequently present in these products in considerable quantity, affect the decomposition. The quantity of glucoside decomposed in each case was ascertained by a determination of the amount of hydrocyanic acid produced.

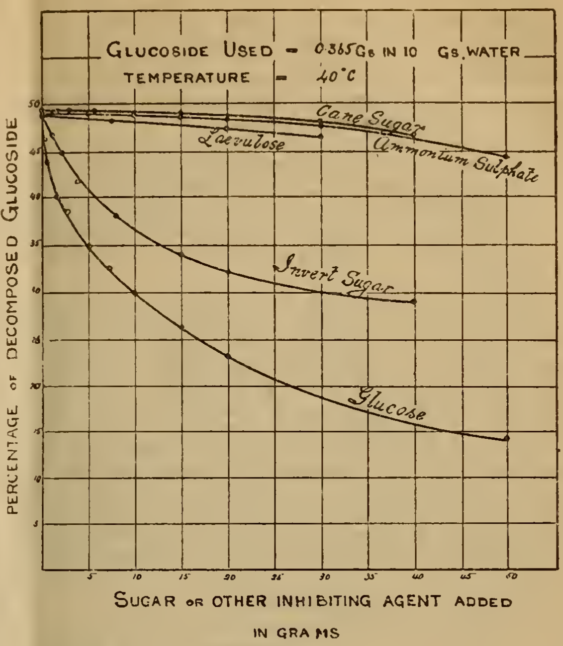


Diagram 1.

Table II.—*Temperature*=40·0° C. *Time*=1 *hour*. *Concentration*=0·365 *grm. in* 10 *grms. water.*

d-Glucose added.	Glucoside decomposed by enzyme.	Invert sugar added.	Glucoside decomposed by enzyme.	Lævulose added.	Glucoside decomposed.	Sucrose added.	Glucoside decomposed.	Ammonium sulphate added.	Glucoside decomposed.
grms.	per cent.	grms.	per cent.	grms.	per cent.	grms.*	per cent.*	grms.†	per cent.†
—	49·3	—	46·3	—	48·0	—	71·5	—	54·7
0·5	44·2	0·4	45·8	0·5	48·0	0·6	71·0	0·5	54·7
1·5	39·9	1·2	44·3	1·5	48·0	1·8	71·5	1·5	55·2
2·5	38·4	2·0	41·9	2·5	48·3	3·0	71·5	2·5	54·7
5·0	34·8	4·0	38·4	5·0	48·0	6·0	71·5	5·0	54·3
7·5	32·3	8·0	34·5	7·5	47·2	12·0	70·5	10·0	54·3
10·0	29·5	15·0	30·3	10·0	47·6	15·0	70·3	15·0	53·7
15·0	25·8	20·0	28·6	20·0	46·0	30·0	69·4	20·0	53·3
20·0	22·7	40·0	25·5	30·0	45·6	40·0	68·0	30·0	53·0
50·0	14·3	—	—	—	—	50·0	66·6	50·0	49·3

* The experiments with sucrose were continued for 90 in place of 60 minutes.

† The enzyme used in these experiments with ammonium sulphate was part of a new preparation, and different from that used in the first four sets.

It will be seen from the tabular statement, that whereas the percentage of glucoside decomposed in presence of sucrose, lævulose, and ammonium sulphate only falls off to a slight extent as the concentration of these substances is increased, the falling off in the case of glucose is very large, even for relatively small additions of the sugar, and though smaller in the case of invert sugar is still considerable. These points are perhaps more clearly indicated by means of Diagram 1, which represents graphically the results recorded in Table II.

In view of these facts it is important that the method adopted for the estimation of the hydrocyanic acid, yielded by feeding stuffs containing cyanogenetic glucosides, should avoid this difficulty of incomplete decomposition of the glucoside. As the estimation of the amount of hydrocyanic acid formed is usually undertaken with a view to ascertaining whether the product in question is likely to be poisonous, it is desirable that the results obtained should represent as nearly as possible the maximum amount of hydrocyanic acid obtainable. The authors have therefore used in all cases a process, which depends on the partial isolation of the glucoside and its decomposition by boiling with mineral acids. This process is carried out as follows:—A convenient quantity of the product is ground as rapidly as possible, weighed, placed in a Soxhlet extractor of the ordinary type, and re-percolated with hot alcohol (in which all the glucosides of this type, so far described, are soluble) until exhausted. The solvent is then distilled off on the water-bath and the residue mixed with about 50 c.c. of water to which 10 c.c. of 10 per cent. hydrochloric acid or sulphuric acid has been added. This mixture is then distilled, more water being added from time to time, if necessary, until hydrocyanic acid is no longer found in the distillate. The distillation can be greatly expedited by using a current of steam. The amount of hydrocyanic acid in the distillate may then be estimated volumetrically by Liebig's method, but the authors have found it more convenient to use a slightly modified form of the Fordos and Gelis process (J. Pharm. Chim., 23, 48), which depends on the conversion of the hydrocyanic acid into cyanogen iodide according to the equation, $HCN + I_2 = HI + CNI$. In the original Fordos and Gelis process the solution containing the hydrocyanic acid is made faintly alkaline by adding caustic soda, and then the excess of alkali is converted into sodium bicarbonate by adding "soda water," but it is much more convenient to add at once a slight excess of sodium bicarbonate, and then to titrate with standard iodine solution, taking the production of a faintly yellow colour, due to excess of iodine, as indicating the end of the reaction. In this way minute quantities of hydrocyanic acid, such as are obtainable from some kinds of white Rangoon beans, can be estimated readily. It will be shown later that it is also important to ascertain whether the product under examination contains both glucoside and enzyme, and this can be done by placing a quantity of the freshly-ground product in water and ascertaining whether hydrocyanic acid is formed. It is advantageous to render the water antiseptic by the addition of a little chloroform or toluene.

Of the five plants mentioned above, only two are of importance at present as yielding feeding stuffs, which are in use in Europe, viz., *Linum usitatissimum*, the seed of which is largely used for feeding purposes in the form of linseed cake, and *Phaseolus lunatus*, which furnishes the three different products known as Java, Rangoon and Lima beans.

Linseed.—The fact that linseed is capable of yielding hydrocyanic acid was first established by Jorissen in 1893 (Bull. Acad. Roy. Belg., 1883, **3**, 5, 750), and the same author, in association with Hairs, isolated from this material, in 1891 (*ibid.*, **3**, 21, 529), a cyanogenetic glucoside which was named linamarin. The present authors, in association with Professor Dunstan, have re-examined linamarin (Proc. Roy. Soc., 1906, B, **78**, 145), and shown that it is identical with phaseolunatin (α-dextrose ether of acetone cyanohydrin), which they had previously isolated from the beans of *Phaseolus lunatus*. The amount of hydrocyanic acid obtainable from linseed and young linseed plants is given in the following table.

TABLE III.

Height, inches	Hydrocyanic acid obtained. per cent.
PLANTS.	
1— 1·5	0·15*
2— 3	0·17*
3— 4	0·15*
4— 5	0·13*
5— 6	0·10*
6— 7	0·10*
8—10	0·08*
12—15	0·07*
15—18	0·03*
18	0·009*
18	none*
SEED.	
—	0·008*
—	0·01†
GERMINATED SEED.	
—	0·07†

* Dunstan, Henry, and Auld, *loc. cit.*
† Jorissen, *loc. cit.*

It was obvious from these facts that linseed cake, consisting merely of linseed freed from oil, must be capable of yielding considerable quantities of hydrocyanic acid. Samples of linseed cake were therefore obtained from two of the principal manufacturers of oil cake in this country for examination. Both samples were guaranteed to have been made from 98 per cent. linseed. On analysis by the method described above, they were found to yield 0·032 and 0·045 per cent. of hydrocyanic acid respectively. Although it was established so long ago as 1891 that linseed is capable of yielding hydrocyanic acid, the fact does not appear to be well known, and the authors have been unable to find any record of poisoning cases having occurred owing to the use of linseed cake as a feeding stuff. The only case bearing remotely on this point is that mentioned by Leather (Agric. Journ. India, 1906, **1**, 225), who states that several cows were poisoned in India in 1905, as the result of eating young flax plants. The explanation of the non-toxicity of linseed cake appears to be that all the cake now on the market is prepared by hot expression of the oil, and the temperature to which the seed is heated in a moist state in this process is high enough to destroy the enzyme, so that when the cake is eaten no decomposition of the glucoside occurs in the stomach. Confirmation of this view is obtained from the fact that neither of the two samples of cake, referred to above, liberated any hydrocyanic acid when ground and placed in water. Comparatively little evidence is available as to whether cyanogenetic glucosides are toxic in the absence of an enzyme capable of decomposing them, and although it has been stated that amygdalin, the cyanogenetic glucoside of bitter almonds, is hydrolysed in the small intestine liberating hydrocyanic acid, the statement is commonly made that amygdalin is not toxic in the absence of emulsin.

Beans of Phaseolus lunatus.—Several varieties of these appear in commerce.

1. *Java beans* consist of beans varying in colour from pale brown to almost black. The sample of beans of this plant from which phaseolunation was first isolated at the Imperial Institute, was of this type, and was received from M. Boname, of the Station Agronomique, Mauritius, who had already obtained hydrocyanic acid from them.

2. *Rangoon, Burma or Paigya beans* differ from the former in being smaller and plumper, and lighter in colour. Two classes come on the market; "red Rangoon beans," which are pink with small purple splotches, and "white Rangoon beans," which are pale cream in colour.

3. *Lima beans* are much larger than the Rangoon beans, and are pale cream in colour. A very similar product is the Haricots de Sieva of French commerce, also derived from *Phaseolus lunatus*.

It has been suggested by Cordemoy (*Flore de l'isle Reunion*) that these three types of beans, in the order given above, represent progressively improved agricultural types, the first being an almost wild product and markedly poisonous, the second a cultivated material not possessing the markedly toxic properties of the first type, and the third a well cultivated product free from toxicity.

The fact that the beans of *Phaseolus lunatus* are liable to be poisonous, has long been known, and is mentioned by various authors, notably by Church in his "Food grains of India" (p. 155), and by Watt in his "Dictionary of the Economic Products of India." In recent years, through the importation of large quantities of the most virulent type of these beans from Java, numerous cases of the poisoning of cattle by them have been recorded in Europe (Bull. Imp. Inst., 1903, **1**, 12, 112; 1905, **3**, 373; 1906, **4**, 329), Guignard (Compt. rend., 1906, **147**, 545), Kohn-Abrest (*ibid*, p. 586), Robertson and Wynne (Zeits. Anal. Chem., 1905, **44**, 735), Tatlock and Thomson (Analyst, August, 1906).

A considerable number of determinations of the amounts of hydrocyanic acid obtainable from beans of *Phaseolus lunatus* from various sources have been made during the last few years, and the most important of these are summarised in Table IV., to which a number of new of new determinations by the authors have been added.

These results, it will be seen, agree in showing that the dark coloured Java or Mauritius beans yield much larger quantities of hydrocyanic acid than the lighter coloured kinds from Burma, and these again more than the carefully cultivated large white beans produced in Madagascar, France, or the United States, which usually furnish only traces of the acid or none at all. These facts, on the whole, confirm Cordemoy's view that cultivation with a view to the production of large white seeds tends to diminish the poisonous character of these beans, but the colour of the beans cannot be definitely correlated with the quantity of hydrocyanic acid produced. Thus, the white beans found to a small extent in all consignments of Java beans, and one of the samples of Ceylon white beans, which are described as "cultivated," yield fairly large quantities of hydrocyanic acid. Further, the first samples of white Rangoon beans received in this country and examined at the Imperial Institute yielded no hydrocyanic acid, but more recently Guignard and Tatlock and Thomson have recorded the production of small quantities of the acid by beans of this type. Last year a sample of white Rangoon beans was received at the Imperial Institute from Mr. Hendrick, which yielded as much as 0·026 per cent. of hydrocyanic acid, and

TABLE IV.

Description of beans.	Results obtained.			
	At the Imperial Institute.	By Guignard.	By Kohn-Abrest.	By Tatlock and Thomson.
	Hydrocyanic acid, per cent.			
Java—				
Mixed beans, various colours	0·038 to 0·123	0·052 to 0·112	—	0·027 to 0·137
Black	0·116	—	—	0·042
Purplish black	0·116	—	0·052	0·031
Wine red	—	—	0·058	—
Reddish brown	—	—	0·037	0·038
Bright maroon	—	—	0·050	—
Light brown with dark spots	0·103	—	0·041	0·038
Pale brown with dark spots	0·104	—	0·126	—
Cream white	0·105 to 0·110	0·052	0·037	0·027
Black with white spots	0·062	—	0·058	—
Burma—				
Pale pink with purple spots	0·004 to 0·024	0·011	—	—
Cream white	nil to 0·027	0·006	—	—
France—				
Haricots de Lima (large cream)	nil.	traces.	—	—
Haricots de Sieva (large cream)	traces	0·004 to 0·008	—	—
Haricots du Cap marbré (pale brown)	traces.	—	—	—
Madagascar—				
Large white	—	0·008	—	—
Ceylon—				
Black and white stripes	0·060	—	—	—
Small white	0·026	—	—	—
Cream white	0·068	—	—	—
Mauritius—				
Purplish black	0·088	—	—	—
Brown	0·087	—	—	—
Light brown	0·041	—	—	—
United States—				
Cooked Lima beans	nil.	—	—	—
Miscellaneous—				
" Butter beans " *	0·002	—	—	—

* Mr. E. M. Holmes, F.L.S., states that these are probably the product of *Phaseolus lunatus*. The geographical origin of this sample is unknown.

recently in a series of samples supplied by the Board of Agriculture some were found to yield none, others mere traces, and still others up to 0·024 per cent. It is evident, therefore, that although Rangoon beans yield less hydrocyanic acid than Java beans, they are not free from this property, and may even yield the acid in comparatively large quantity. It is worth noting that, in our experience, white Rangoon beans yielding notable quantities of hydrocyanic acid only began to come on the market last year (1907).

Beans of other Phaseolus sp.—When phaseolunatin was first isolated from the beans of *Phaseolus lunatus* at the Imperial Institute, a systematic investigation of the beans of such other species of this genus as were readily available was made, but none of these yielded hydrocyanic acid. Among those examined were, haricots, grown in France and Hungary (derived from *Phaseolus vulgaris*), scarlet runner beans (from *Phaseolus multiflorus*), and numerous Indian species (*e.g.*, *Phaseolus calcaratus*, *Phaseolus mungo*, *etc.*). Last year, however, four samples of edible beans described as " Hungarian " and " Carniolan " were obtained by Professor Dunstan in Trieste, and these, on examination, yielded 0·003, 0·003, *nil*, and 0·001 per cent. respectively of hydrocyanic acid. These four samples were examined by Dr. S. E. Chandler, of the Imperial Institute, who states that the first three are undoubtedly races of *Phaseolus vulgaris*. These results are of some interest, since Evesque, Verdier, and Bretin (J. Pharm. Chim., 1907, **8**, 348) have stated recently that they obtained from beans of *Phaseolus vulgaris* grown in Hungary as much as 0·034 per cent. of hydrocyanic acid, while Guignard, on the contrary, has stated that he was unable to obtain any hydrocyanic acid (Compt. rend., 1906, **142**, 545, and 1907, **145**, 1112) from samples of Hungarian haricots examined by him. These observations seem to leave no doubt that the beans of some varieties at least of *Phaseolus vulgaris* may yield hydrocyanic acid. In this connection it may be mentioned that the roots of the scarlet runner are well known to be poisonous, but the examination of a single small sample of these roots at the Imperial Institute, in 1900, showed that it did not yield any hydrocyanic acid, but in view of the variability in this respect shown by the seeds of this plant as produced in Hungary, the single result cannot be regarded as conclusive.

Other plants.—In a list of plants known to yield hydrocyanic acid, published by Dr. Greshoff in 1906, over 140 species are enumerated, and since that time considerable additions have been made to the list. In the present connection, however, further reference need only be made to a few presenting features of special interest which have been investigated recently, or are still under investigation at the Imperial Institute.

Cassava.—It has long been known that the two varieties of cassava, " bitter " and " sweet," yield hydrocyanic acid, and it has been assumed generally that only the roots or tubers of the first named furnished hydrocyanic acid in considerable amount, and that in both plants the acid occurs free. The authors, in association with Professor Dunstan, first proved that the tubers of the bitter plants contain the same glucoside (phaseolunatin) as is present in the beans of *Phaseolus lunatus* and in flax. (Proc. Roy. Soc., 1906, B, **78**, 145, and 1907, B, **79**, 315), whence it became probable that hydrocyanic acid does not occur free in the plant, but is liberated by the interaction of the glucoside and enzyme, when the fresh fleshy tubers are ground up. Francis had already, by a series of comparative analyses (Analyst, 1870, 2, 4), shown that the roots of the bitter and sweet varieties of cassava yielded about the same amounts of acid and this was confirmed by Carmody (Lancet, 1900), who also found that, in the case of sweet cassava, the acid was derived mainly from the rind, whereas in the roots of the bitter sort it is evenly distributed through the mass of the root. The same author showed that a portion of the acid, at any rate, probably existed in the roots in a combined form. It was of some importance, especially from a botanical point of view, to ascertain whether hydrocyanic acid actually occurs free in cassava, and the authors have been enabled to investigate this point, through the kindness of Mr. J. H. Hart, Superintendent of the Department of Agriculture, Trinidad, who forwarded last year to the Imperial Institute two living cassava plants, one of the " bitter " variety, and the other " sweet," which had been grown in tubs so that they could be transported without danger.

The plants were apparently quite normal when received, but they were not healthy, since although they arrived in the middle of the summer and were kept in a warm place, exposed to the sun and well lighted, a few leaves which they put forth did not mature and eventually withered and dropped off. The various parts of the plants—stems, green shoots and tubers—were carefully examined and the results obtained are given below.

Variety.	Portion of plant.	Free hydrocyanic acid.	Amount of hydrocyanic acid present in the form of cyanogenetic glucoside.	
			Calc. on moist material.	Calc. on dry material.
			per cent.	per cent.
Bitter Cassava	Green branches	nil.	—	—
	Stem	,,	0·007	0·021
	Whole tubers	,,	0·013	0·032
Sweet Cassava	Stem	,,	0·005	0·015
	Tubers—			
	(*a*) whole	,,	0·014	0·034
	(*b*) rind	,,	0·040	0·100
	(*c*) inner portion	,,	0·007	0·018

Special precautions were taken in searching for free hydrocyanic acid to prevent the liberation of acid by the decomposition of the glucoside and the results clearly prove that *free* hydrocyanic acid does not occur in these cassava plants and that all the acid obtainable from them was present in the form of the cyanogenetic glucoside.

The general truth of these results with regard to cassava cannot, however, be asserted, as the special conditions under which these two plants were grown, and the fact that they had been transported from Trinidad to this country, may possibly have rendered them somewhat abnormal. Incidentally the results confirm Professor Carmody's statements that the "sweet" and "bitter" tubers yield about the same amount of acid, and that in the first named this is mainly obtained from the rind.

Para rubber seed.—It was shown by van Romburgh (Ann. Jard. Bot. Buit., 1899, 2. 2) that the Para rubber tree (*Hevea brasiliensis*) is capable of yielding hydrocyanic acid, and this observation has been extended by Professor Harrison to other species of Hevea. (Reports Dept. Agric., Brit. Guiana), and in a note published recently (Proc. Chem. Soc., 1907, **23**, 168), Prof. Dunstan has shown that Para rubber reeds probably contain a cyanogenetic glucoside resembling phaseolunatin. This is of some importance from a practical point of view, since considerable quantities of these seeds may in the near future be placed on the market as an oil-seed from certain of the Colonies, where Para rubber is being extensively cultivated. Several samples of these seeds have been received at the Imperial Institute recently for examination, and have been found to furnish about 0·048 per cent. of hydrocyanic acid. Since the kernels contain about 49 per cent. of oil, press cake made from the kernels would probably yield from about 0·09 per cent. of hydrocyanic acid, *i.e.*, would furnish rather more than ordinary linseed cake.

Utilisation of Cyanogenetic materials as feeding stuffs.—It will be seen from the foregoing that this matter of the production of hydrocyanic acid by plants affects the utilisation of a considerable number of materials otherwise unexceptionable as feeding stuffs. In all the well-authenticated cases of poisoning by these products, except those mentioned by Robertson and Wynne (*loc. cit.*), where several persons were poisoned by eating cooked Java beans, it appears that they have been consumed in a condition in which the enzyme was capable of acting on the glucoside and liberating hydrocyanic acid. If, however, the facts now recorded regarding the occurrence of considerable quantites of cyanogenetic glucoside in linseed cake prove to be generally true of this material, and if further investigation proves that the generally innocuous character of linseed cake is due to the fact that the glucosidolytic enzyme originally present in the seeds is rendered inactive in the "hot" process of expressing the oil, this would seem to offer a simple method of rendering some, at least, of these materials suitable for use as feeding stuffs. The enzyme which accompanies phaseolunatin in the beans of *Phaseolus lunatus*, cassava, and linseed is rendered inactive when heated at 60° C., so that simple boiling of these materials should serve to render the enzyme they contain inactive, and if the case of linseed cake may be regarded as strictly analogous, they should then be innocuous as feeding stuffs. In this connection it may be mentioned that Tatlock and Thomson have stated (Analyst, August, 1906) that boiled Java beans yield less hydrocyanic acid than the raw beans. The authors have repeated this experiment and are unable to confirm this observation. The boiled beans no longer liberate hydrocyanic acid when ground and placed in water, since the enzyme is rendered inactive by the boiling process, but they still yield practically the same quantity of hydrocyanic acid as the raw beans when this is estimated by the process described in the present paper.

The possibility of using, as feeding stuffs, cyanogenetic materials in which the enzyme has been rendered inactive by heating depends on the assumptions, (1) that these materials will not be used along with any other product which may contain the enzyme appropriate to the decomposition of the glucoside they contain, *e.g.*, it would be inadmissible to feed any product containing the enzyme emulsin along with sorghum, in which the enzymes had been rendered inactive, but in which the glucoside had not been destroyed, and (2) that the glucosides are not likely to be decomposed, at any rate in any large quantity, by enzymes secreted in any part of the intestine. From the evidence at present available, it would not be safe to assume that these assumptions may be generally made.

DISCUSSION.

The CHAIRMAN said this paper was important as showing the necessity of studying manufacturing processes. Linseed cake was a most wholesome and nutritious cattle food, and it was curious that it should have hitherto escaped notice that there was present in the seed a cyanogenetic enzyme, which was rendered innocuous by the usual process of hot pressing. This was somewhat parallel to the case of so-called "Neutral Lard No. 1" and "Neutral Lard No. 2." These two products did not keep well, and had to be used up immediately. No doubt this was due to the fact that at the low temperature at which these two lards were rendered, the enzymes were not completely destroyed, and so produced hydrolysis and subsequently rancidity of the fat; while leaf lard, which was steamed out at a higher temperature, kept well. The authors showed the linseed cake manufacturer how he must proceed. Hitherto cases of poisoning from linseed cake had not been recorded, because the maker by using a high temperature produced unwittingly a non-poisonous cake. In cases where illness had occurred consequent upon feeding linseed cake, the agricultural chemist had been able to find some castor seed shells, and had promptly declared that castor seed cake was mixed with the linseed cake. Now, in many works where linseed cake was produced, castor seed was also pressed, and when the sweepings at the week-end were gathered and put into the meal it was not unnatural that microscopical examination of the cake revealed traces of castor seed shells. In a linseed oil mill it may happen that when work was started hurriedly on a Monday morning that the temperature of the meal might not reach the high point at which the activity of the enzyme is destroyed. Cake produced under these circumstances might cause illness and even poisoning. Such cases did occur, especially in Germany.

Dr. VOELCKER asked if the Chairman would advocate any better method of preparing the cake.

The CHAIRMAN said linseed cake was, no doubt, wholesome, and if it was heated properly there would be no production of prussic acid.

Dr. **Divers** said the oil cake left in the preparation of Chinese wood oil, which was made in large quantities in Japan, one of the most remarkable drying oils, had the reputation in Japan of being poisonous, and was therefore used only as manure and not as cattle food. Some years ago, a Japanese pharmacologist took up the subject with a view of finding what was the poison in it, but gave it up on finding that the cake was not poisonous to animals. Probably, in the days when this reputation was acquired, the poisonous quality was due to prussic acid, and in recent times the Japanese having used higher temperatures the cake had become no longer poisonous. At any rate, he thought it would be well if the authors would investigate these seeds and see if they contained these cyanogenetic substances.

Dr. B. **Dyer** asked whether the poisonous action of the Java beans was really due to the prussic acid produced by the glucoside. The cyanogenetic action in linseed was discovered some time ago, but the fact was wholly forgotten, and only comparatively recently disinterred, and most of them had no suspicion that there was anything of the kind in linseed. They knew that linseed cake was one of the safest and most wholesome foods a farmer could use; but the question now assumed a certain amount of interest, and he was recently led to ascertain for himself whether the presence of this glucoside was usual in linseed cake. He made an average sample from 20 consecutive samples of pure cake received in the usual course from various farmers, and he found that when it was mixed to a thin paste with water and kept at 98° F. for two days and steam distilled with a little sulphuric acid 0·06 per cent., or 4 grains per lb., of prussic acid was formed. Since the appearance of a note based on Dr. Henry's work in the Board of Agriculture Journal recently, where the destruction of the hydrolysing enzyme was referred to, he repeated the experiment, keeping the ground cake in cold water for 36 hours, and then steam distilling without using any acid. Prussic acid was given off then, but only about one-third of that given off by the more complete hydrolysis in which acid was used. Apparently if one took any sample of linseed cake, mixed it with water and kept it stoppered up for a few hours and then tested the air in the bottle with copper and guaiucum paper in the usual way, the paper would turn distinctly blue, so that in the ordinary way, no doubt, linseed cake did yield some prussic acid. It would be interesting to know what effect a small quantity of prussic acid in that diluted form would have on herbivorous animals. He did not think the Chairman's suggestion could be taken altogether seriously, that the prussic acid poisoning could be attributed to castor seed, as the symptoms of prussic acid poisoning would surely be different from the symptoms produced by castor seed poisoning.

The **Chairman** said after hearing this paper he should certainly not recommend for pressing linseed oil the Anderson press, which pressed linseed in the cold, because he should be afraid that it might lead to prussic acid poisoning. Notwithstanding Dr. Dyer's remarks, he might say that there had been, especially on the Lower Rhine, a number of cases where cattle had died after taking linseed cake food, and it was always attributed to castor seed cake. What the symptoms were he did not know. Cases of illness had also been noticed after feeding arachis cake, but had remained hitherto unexplained. He would therefore ask the authors whether arachis nuts contained substances similar to those they found in linseed.

Dr. **Henry** in reply said that he had not examined the residue from the Japanese wood oil seeds, but would do so. He thought probably one reason for its not being used for feeding was the very unpleasant smell which attached to it.

Dr. **Divers** said it was not at all unpleasant when fresh.

Dr. **Henry** in reply to Dr. Dyer said he did not think there could be any doubt the poisoning was due to prussic acid.

Dr. **Dyer** asked if any experiments had been made with the isolated glucoside to see what would happen to it under conditions similar to those it would have to undergo in the animal, or whether there would be any action by the various digestive juices upon the dry glucoside.

Dr. **Henry** said that very few data were available on this point. The best known of the cyanogenetic glucosides was amygdalin and there were cases on record in which this had been taken by human beings without any ill effect, but many text books stated that amygdalin was invariably decomposed in the lower intestine. He would not like to suggest that, because linseed cake when pressed hot did not cause poisoning or liberate prussic acid when placed in water, boiled Java beans would not be poisonous. There was a case on record in which four persons out of seven were poisoned in 1905 from eating cooked Java beans, and in that case there could hardly be any doubt that the enzyme had been rendered inactive by the cooking. If the beans proved on further trial to be still poisonous after being cooked it would indicate that an enzyme like that which occurs naturally in the Java bean also occurs in the intestine.

Manchester Section.

Meeting held at Manchester on Friday, February 7, 1908.

MR. R. H. CLAYTON IN THE CHAIR.

AN EXPERIMENTAL FORM OF GAS-HEATED STEAM BOILER.

BY J. H. LESTER, M.SC., F.I.C.

The object of these experiments was to produce steam or hot water with the greatest possible economy as regards both space and fuel consumption, keeping also in view the possibility of carrying out the same principles subsequently on a larger scale.

In studying the combustion of gases in confined spaces or tubes, the apparatus shown in Fig. I. was used, with interesting results.

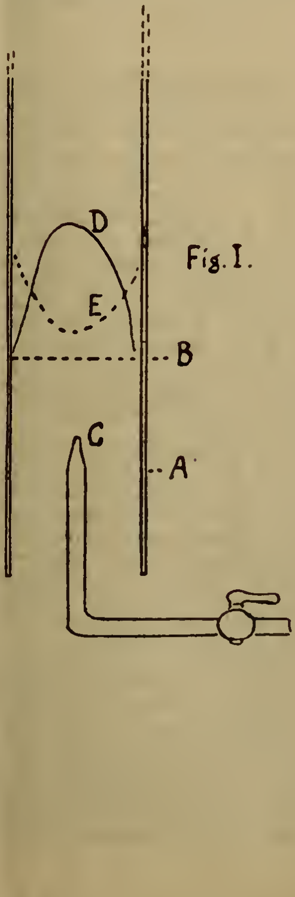


Fig. I.

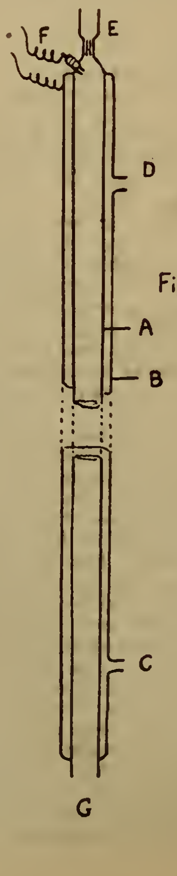


Fig. II

The glass tube, A, of about $1\frac{1}{2}$ inch diameter, was fitted with a wire gauze disc, B, and supplied with coal gas through the small jet, C. If the gas supply was sufficiently reduced, a flame could be produced above the gauze, showing the convex outline, D, the combustion under these conditions being substantially complete and a considerable excess of air being possible. On increasing the gas supply to a certain point, the shape of the flame became indefinite, or at any rate without well-defined margin, and a buzzing or musical sound was produced, whilst further increase of gas supply resulted in the flame assuming the concave form outlined at E. In this, and in other later experiments, the production of a rapid series of explosions or musical notes appeared to be coincident with rapid alternations between convexity and concavity of the flame, and also coincident with the conditions of "perfect gas mixture," that is to say, with the substantial absence of both oxygen and carbon monoxide from the burnt gases. The highest musical note gave the most satisfactory results of analysis. The bearing of these results upon the structure and nature of flame cannot be now dealt with, but the musical note as an indicator of completeness of combustion may be pointed to as having a direct bearing upon the practical working of flames used for heating purposes in confined spaces. Attempts were made to increase the rate of fuel consumption in the glass tube, and also in iron tubes, by directing the gas through small apertures at high pressure, but the mixture of gas and air was so difficult to control, and the cooling effect of the tube itself upon the flame was so great, that this procedure had to be abandoned. A very graphic form of the difficulty to be faced was exhibited in the impossibility of inflaming a jet of gas issuing from a cylinder of compressed coal gas, after the pressure had been raised above a certain and not very high point. Eventually the only practicable means of obtaining complete combustion in confined tubes was found in the pre-mixing of the coal- or producer-gas with air in correct proportions, the mixture being introduced to the combustion chamber under any required pressure through a suitable non-return seal and jet, ignition being produced electrically. The experimental boiler is shown in Fig. II.

The copper tube, A, was of 3/16 inch internal diameter about 20 inches in length, and constituted the combustion chamber of the boiler; it was surrounded by a jacket, B, with water supply at C, and steam or hot water outlet at D, the construction being such that the intervening space between the combustion tube and the jacket was only about 1/16 inch. This restricted space was intended to prevent, as far as possible, any downward current of water in any part of this boiler space, and as far as possible to restrict any "circulation" in that space to the upward flow of the water due to removal of water or steam from the outlet, D. The jet, E, and the igniter plug, D, are shown in position, the burnt gases passing into the air at G. There was found to be no difficulty in maintaining a flame of about 7 inches length from the jet downward, and analysis of the products at G showed that it would be easy to prevent oxygen or carbon monoxide exceeding 0·5 per cent.

It will be noted that the "counter-current" principle of transferring heat from the gas to the water has been incorporated, and this was so far efficient in cooling the burnt gases that the latent heat of condensation of water produced by burning of the gas, was given up to the boiler. The total loss of heat from the "chimney" or base of the combustion chamber never exceeded 5 per cent. when based upon the calorific value of the gas employed, and it is quite clear that lengthening of the tube would permit of its use as a calorimeter.

As an example of the high "duty" in steam production possible with this type of apparatus, it will be of interest to state that if it were possible to build up a series of such tubes into a block occupying one cubic yard, the amount of water evaporated would be equivalent to the average product of a 30 ft. by 8 ft. Lancashire boiler working with an economiser. The above comparison is calculated upon the rate of gas consumption obtained with the experimental tube, but with somewhat longer tubes it was evident that the gas consumption and consequent evaporation could be greatly increased.

The use of producer gas for the generation of steam for industrial purposes has not yet, so far as the writer is aware, been carried out with reasonable evaporative efficiency; but the experiments outlined above would appear to indicate that the difficulties are by no means insuperable.

The writer wishes to acknowledge the co-operation of Mr. G. A. Ashcroft in carrying out the above experiments.

Meeting held at Manchester on Friday, March 6, 1908.

MR. R. H. CLAYTON IN THE CHAIR.

ESTIMATION OF HIGH TEMPERATURES IN WORKS OPERATIONS.

BY DR. F. W. SKIRROW.

In carrying out high temperature operations on a manufacturing scale, it is often necessary that the temperature should be kept within certain limits, and it is desirable that the workman should have some ready and simple means for ascertaining when the temperature is approaching either of these limits. Mercury thermometers may be used for temperatures up to 300° C., but for higher temperatures they are not very satisfactory, as the cost becomes considerably greater, and breakages much more numerous. Electrical apparatus, on the other hand, is much more costly, and can scarcely be entrusted to an ordinary workman.

The author has for some years employed the following simple means with entire satisfaction. The temperature in question is compared with the melting point of a known substance of definite melting point, which is contained in a narrow iron tube* welded up at one end. A stiff wire passes down the tube and into the solid substance at the bottom in order to indicate when the substance melts. This wire remains fixed as long as the substance is below its melting point, but when the substance melts the wire becomes loose and can be freely moved up and down.

A number of these tubes are prepared, containing a series of substances having melting points covering the range within which it is desired to work. The ends of these tubes are placed in the apparatus under observation, and by noting which of the wires are fixed and which loose, one can readily ascertain the approximate temperature. It is generally found to be sufficient to use two tubes, one containing a substance melting somewhat below the upper temperature limit, and the other containing a substance melting somewhat above the lower temperature limit. The workman is then instructed to regulate his fire so that one of the wires is loose and the other fixed. For materials which would act on iron, other metals might be used, and there seems to be no reason why porcelain tubes should not be employed if account be taken of the greater temperature lag. The tubes may be of any convenient length to suit the apparatus in question.

VOLUMETRIC PROCESS FOR THE ESTIMATION OF CHLORATES.

BY PROF. EDMUND KNECHT, PH.D., M.SC.TECH., F.I.C.

Of the various volumetric processes which have been worked out for the determination of chlorates, probably the best known are the iodimetric one and the one based on the quantitative oxidation of ferrous sulphate. Of these, the former can scarcely be regarded as a technical process, on account of the large amount of time required to carry out the operations. The ferrous sulphate process, which was devised by Lunge, and is the one adopted by the International Commission on Technical Methods, is the most rapid that has hitherto been brought forward. In principle, it consists in adding a known volume of the chlorate solution to a solution of a known weight of ferrous sulphate in dilute sulphuric acid contained in a flask provided with a Contat-Göckel valve (trap), boiling for ten minutes, cooling, and then titrating the excess of ferrous sulphate with permanganate. Lunge* states that it gives results which are exact to within 0·2 to 0·4 per cent.

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* A somewhat similar, but more complicated, arrangement has recently been described by Brearley and Moorwood (Iron and Steel Inst., May, 1907).

Having recently been interested in determining experimentally the amount of oxygen required for the conversion of aniline into emeraldine, using sodium chlorate as the oxidising agent, I have worked out the process outlined below for its rapid estimation during the course of the experiments.

In character, my process is similar to that of Lunge, the main difference being that I employ as reducing agent a solution of titanous chloride in place of ferrous sulphate. This being a much more powerful reducing agent than the latter, the reduction of the chlorate takes place more rapidly, and no heating (and subsequent cooling) is required. It further has the advantage that it is not necessary to weigh off the reducing agent, a known volume of the standard solution of titanous chloride being measured off for the purpose. With potassium chlorate, for instance, the reduction takes place quantitatively according to the following equation :

$$6\,TiCl_3 + KClO_3 + 6HCl = 6TiCl_4 + KCl + 3H_2O.$$

The method of standardising and storing the titanous chloride solution is fully described in the Journal of the Society of Dyers and Colourists, 19, p. 169, also in the Ber. d. deutschen chem. Ges., 1907, p. 3819, and on p. 223 of the last edition (9th) of Sutton's Volumetric Analysis (see this J., 1907, 1165.)

The procedure is as follows :—50 c.c. of standard titanous chloride solution (of which 1 c.c. = 0·0015 grm. of iron or thereabouts) are run into 5 c.c. of concentrated hydrochloric acid contained in a conical flask through which a current of carbon dioxide is maintained. Then 10 c.c. of the chlorate solution (1 grm. in 500 c.c.) are added. After a lapse of not less than three minutes, potassium sulphocyanide is added, and the excess of titanous chloride estimated by titration with standard iron alum solution, until a permanent red colour is obtained. All the values being based upon an iron standard, the calculation is simple, for six atoms of iron are equivalent to one mol. of chlorate.

The method was carefully tested on recrystallised potassium chlorate, the purity of which was ascertained by other methods. I find it more rapid than the ferrous sulphate process, and at least equally exact, others who have used it being of the same opinion.

For the estimation of chlorate in bleaching powder, the available chlorine due to hypochlorite is first determined in the usual way by adding potassium iodide and starch, and titrating with hydrosulphite in presence of acetic acid. A second portion of the solution is then titrated with titanous chloride, the result giving total chlorine from hypochlorite and chlorate. By subtracting the hypochlorite chlorine from the total chlorine, the amount of chlorate is ascertained from the difference. This process was tested on an ordinary bleaching powder to which successive known amounts of pure sodium chlorate were added.

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* Chem. techn. Untersuchungsmethoden, 5th Ed., I. p. 505.

ERRATA.

DETERMINATION OF ARSENIC BY THE GUTZEIT METHOD.

BY CHARLES ROBERT SANGER.

(*This Journal, Feb. 29th,* 1908, *p.* 150.)

Reference to this Note was omitted in the Table of Contents of that number by inadvertence.

Nottingham Section.—"The Compounds of Tannin and Gelatin," by J. T. Wood (this J., April 30th, 1908, pp. 384—387). On p. 387, col. 2, line 29, read "precipitated" for "non-precipitated."

Journal and Patent Literature.

Patent Specifications may be obtained by post by remitting as follows :—

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I.—PLANT, APPARATUS, AND MACHINERY.

Continuous alcohol distillation apparatus ; Steam consumption and number of horizontal plates (Bodenzahl) required for ——. E. Hausbrand. Z. für Chem. Apparatenkunde, 1907, 2, 585—591 ; 617—622 ; and 641—648.

Monograph, illustrated with seven engravings and numerous tables.

Patents.

Cooling liquids ; Apparatus for —— W. Reeves and B. Bramwell, Belfast. Eng. Pat. 10,448, May 4, 1907.

Liquids are cooled by being allowed to pass over cooling surfaces arranged in separate compartments. Each compartment is separately connected to a source of draught. The compartments are superposed in order of size, the largest being at the bottom of the apparatus and the smallest at the top, so that approximately equal cooling effects are obtained in successive compartments. —J. W. H.

Condensing, evaporating, concentrating, distilling, heating, and the like ; Apparatus for ——. J. and F. M. Dunn, Santiago, Cuba. Eng. Pat. 20,003, Sept. 7, 1907.

See Fr. Pat. 384,264 of 1907 ; following.—T. F. B.

Evaporators. T. Suzuki, Sunamura, Japan. Eng. Pat. 14,024, June 18, 1907.

See Fr. Pat. 378,978 of 1907 ; this J., 1907, 1190.—T. F. B.

Evaporating apparatus suitable for the manufacture of salt. F. H. Nickle. Fr. Pat. 384,212, Nov. 21, 1907.

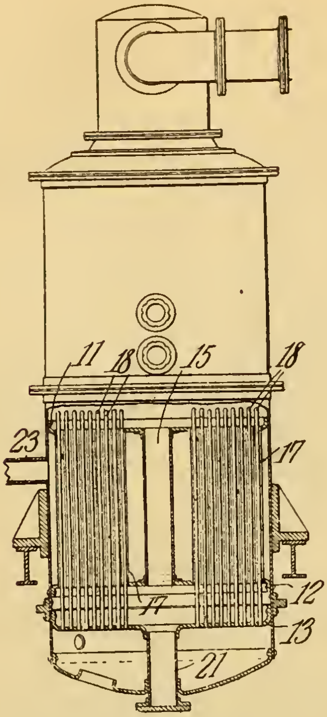
See U.S. Pat. 872,533 of 1907 ; this J., 1908, 22.—W. H. C.

Multiple evaporator and still ; Combined and continuous ——. F. Pampe. Fr. Pat. 384,476, Nov. 29, 1907.

A continuous still having heating and fractionating columns is connected with a series of tubular evaporators. The still is heated by the vapours from the evaporators and the latter are heated by steam and by vapour from the previous effect. The rising tubes of the evaporators are made of less diameter and longer than the descending tubes in order that the liquid may rise with a high velocity and so prevent incrustation. By means of a central overflow tube the level of the liquid above the tops of the descending tubes is kept constant.—W. H. C.

Evaporating in vacuo ; Apparatus for ——. J. and F. Dunn. Fr Pat. 384,264, Nov. 19, 1907.

The apparatus has three tube-plates, 11, 12, and 13, the open ends of the liquor tubes, 17, being expanded



into the plates, 11 and 12, respectively. The steam tubes, 18, which are closed at the top, or have only a very small aperture for the escape of gas or air, pass centrally through the tubes, 17, and have their lower, open ends expanded into the tube-plate, 13. Steam is supplied to the casing around the tubes, 17, through the pipe, 23, and also to the steam-chest, 21. The liquid to be evaporated rises in the annular spaces between the tubes, 17, and 18, in a very thin film which is rapidly heated to a high temperature by the steam in the casing and in the tubes, 18. The liquor returns by a wide central tube, 15, to the liquid-circulating chamber between the plates, 12, and 13.—W. H. C.

Evaporating pan with partitions which lengthen the path of the liquid as it travels through the pan. P. Sturmfels. Ger. Pat. 194,444, Sept. 5, 1906.

The evaporating pan is provided with partitions with openings alternately above and below, these openings being provided with doors or the like so that they can be closed at will. The whole or any number of the compartments of a pan can thus be used as desired.—A. S.

Atomising liquids ; Centrifugally operating apparatus for ——. P. Kestner, Lille, France. Eng. Pat. 17 784, Aug. 3, 1907. Under Int. Conv., Aug. 4, 1906.

In order to secure even distribution of the liquid over the atomising drum described in Eng. Pat. 20,697 of 1905 (this J., 1906, 915), or over the blades of an ordinary fan-wheel, the liquid is delivered axially on to a distributing disc fixed on the rotating spindle of the apparatus. The disc has radial corrugations which may be angular, smooth, or sinuous ; or the disc may have a serrated edge, alternate teeth being bent towards opposite sides. A conical projection on the centre of the disc prevents splashing. In one form of the apparatus, the atomising drum is arranged within a fan-wheel and rotates with it, serving as a secondary distributor ; in another form, a fan-wheel is arranged within an atomising drum. In the latter arrangement, the fan-wheel draws in air or gas and serves as a secondary distributor, and the atomising drum may consist of a number of flat rings or annular plates supported on the blades of the fan-wheel.—A. T. L.

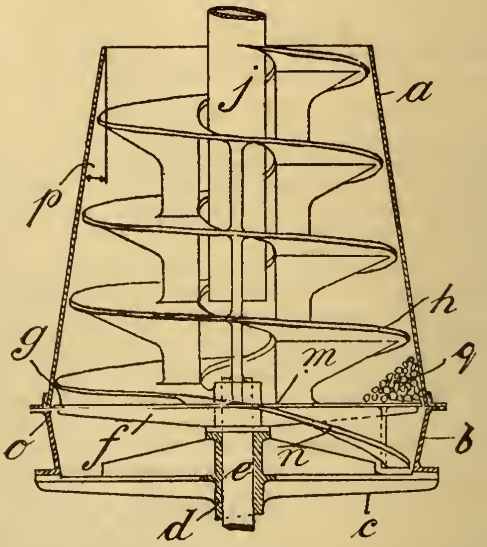
Emulsions ; Process for the manufacture of ——. J. P. van der Ploeg, Amsterdam. U.S. Pat. 884,878, April 14, 1908.

See Eng. Pat. 7699 of 1905 ; this J., 1906, 423.—T. F. B.

Separating solid matter from fluids and apparatus therefor. W. B. Baron and The Fuel Saving and Water Co., Manchester. Eng. Pat. 17,793, Aug. 3, 1907.

Liquids containing solid matter are passed downwards or upwards, according as their temperature is higher or lower than that of the atmosphere, over steep inclined planes upon which the solid matter deposits and slides to the base of the apparatus. The apparatus consists of two concentric cylindrical vessels, the inclined planes being arranged spirally in the annulus formed. The inner vessel communicates with the annulus by openings near its base and forms the inlet or outlet according to the temperature of the liquor.—J. W. H.

Separators ; Centrifugal ——. W. Holzer, Darmstadt, Germany. Eng. Pat. 25,399, Nov. 15, 1907.



The apparatus consists of two truncated conical casings, *a* and *b*, attached by the bars, *c*, to the hollow shaft, or sleeve, *d*, by which they are rotated. Within the casing, *a*, is an elevator screw, *h*, and a horizontal plate, *g*, attached to the shaft, *e*, by the arms, *f*, and rotated at a different speed to that at which *a* is rotated. The material to be separated is fed through the pipe, *j*, on to the plate, *g*, and the solid matter is elevated by the screw, *h*, and discharged at the top. The liquid passes down between the edge of the screw, *h*, and the interior surface of the casing, *a*, and escapes through the opening, *o*, between the plate, *g*, and the wall of the casing. Any solid matter carried away by the liquid is returned to the separating plate, *g*, through the opening, *m*, by the lower screw-blade, *n*. In order to facilitate the separation, the semi-vertical angle, *p*, of the casing, *a*, is made less than the angle of friction between the solid material to be separated and the material of the casing or mantle, *a*. —W. H. C.

Filters ; Vacuum drum —— for separating solid substances from liquids. H. Hencke, Charlottenburg, Germany. Eng. Pat. 19,431, Aug. 29, 1907. Under Int. Conv., Aug. 31, 1906.

The filter (drier) consists of a rotating drum covered with filtering material and having cells upon its surface which, by means of a special trunnion, can be separately put into communication with the vacuum pump. In this way, the cells can be put into action as soon as they are covered with the material to be dried, and put out of action where the material is removed. Suction of air is prevented by a spray of water when the cells near the cleaning device are put in action.—J. W. H.

Filtering, and apparatus therefor. B. M. Jäger, Birkenhead. Eng. Pat. 20,677, Sept. 17, 1907.

The invention relates to apparatus of the sand-filter type, but is also applicable to filtering with gravel, peat, spongy iron, and other fibrous or granular material. The filtering medium is supported on a false bottom of corrugated gauze, and in order that the filter may be rapidly cleaned without emptying, perforated steam-pipes protected by gauze are arranged in the hollows of the corrugations. The steam-pipes are connected in pairs to a main steam-pipe, and a cock is provided between each pair of pipes and the main. In filtering, an open trough running the length of the filter and arranged within an outer trough of wire gauze serves to distribute the liquor and retain heavy sediment, which may be discharged through an opening to the drain. To clean the filter, water is admitted beneath the false bottom, and steam or hot air is passed through each pair of perforated pipes in turn to boil the water immediately above the pair of pipes and agitate the filtering medium. The scum is carried away by the upward current of water and passes through the gauze trough, which keeps back the sand, etc., into the distributing channel and thence to the drain.—A. T. L.

Filters. F. Tiemann, Berlin. Eng. Pat. 3290, Feb. 13, 1908. Under Int. Conv., Mar. 23, 1907.

The filtering medium is contained within a vertical cylinder with perforated ends. The cylinder is placed within an outer casing provided at its upper end with an inlet for the liquid to be treated, and at its lower end with an outlet for the filtered liquid. Packing is provided between the filtering cylinder and the casing, dividing the apparatus into an upper and a lower chamber. To clean the filter, the inner cylinder is reciprocated mechanically; on the upstroke, water under slight pressure enters the lower chamber through a non-return valve, and the liquid in the upper chamber is discharged through a non-return delivery valve, whilst on the downstroke the water in the lower chamber is forced through the filtering medium to clean it.—A T. L.

Mixing, blending, or washing apparatus. J. W. Jaggard and H. W. King, Bury St. Edmunds. Eng. Pat. 28,214, Dec. 21, 1907.

A cylindrical vessel having a conical bottom, carries centrally a tube having openings into the vessel at its lower end, and external cones to guide the materials to be mixed. A worm longer than the tube rotates inside it, and also carries stirrers near the bottom of the vessel. The discharge opening at the bottom of the vessel is controlled by means of a rotating disc valve.—J. W. H.

Furnace. A. Smallwood, London. U.S. Pat. 883,916, April 7, 1908.

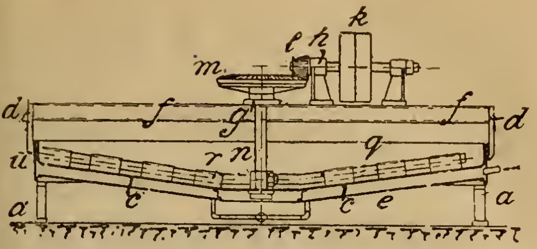
See Eng. Pat. 18,877 of 1905; this J., 1906, 1049.—T. F. B.

Materials of all kinds; Process for the extraction of —— with volatile solvents. W. Stadler. Ger. Pat. 191,911, Nov. 4, 1906.

The vessel containing the material to be extracted is arranged as a float in the solvent, or is provided with means whereby it can be moved up and down. Preferably the weight of the vessel is so chosen that when loaded with fresh material it sinks in the solvent, but gradually rises as the soluble matter is extracted.—A. S.

Crystallising vessels; Stirring device for ——. J. Knappe. Ger. Pat. 195,654, Feb. 14, 1907.

The uprights, *a*, support the pan, *c*, having the double bottom, *e*, enclosing a cooling space, and provided with a bearing for the stirring mechanism. On opposite sides of the pan, two uprights, *d*, are fixed; these carry the cross-bar, *f*, on which are fixed the bearings, *g*, *h*. By means of the pulleys, *k*, and the gearing, *l*, *m*, the vertical spindle, *n*, is rotated, this latter carrying radial arms, *q*, on which scoops, *r*, are mounted so that they can turn freely. The crystals are moved by the stirring device from the centre of the pan to the edge, *u*, where they are removed by scrapers.—A. S.



II.—FUEL, GAS, AND LIGHT.

"*Cell-pitch*" *from sulphite wood pulp waste liquors.* W. Sembritzki. *See* XIX.

Patents.

Alcohol composition for replacing mineral spirit for all kinds of internal combustion engines. A. M. A. Mabille. First Addition, dated Nov. 8, 1907, to Fr. Pat. 378,518, June 6, 1907 (this J., 1907, 1131).

The mixture of alcohol, benzene and phosphorus is saturated with nitrous oxide gas in order to increase its combustibility.—W. H. C.

Gas and coke; Process of making ——. L. P. Lowe, San Francisco, Cal. U.S. Pat. 883,466, Mar. 31, 1908.

Two chambers containing refractory material, and a third chamber which serves as a retort, are highly heated and used intermittingly for the gas- and coke-making process, which consists in passing oil directly into the retort, where the non-volatile components are retained as coke, and passing the volatile products from the retort into one of the heated chambers with steam previously superheated in the other chamber.—A. T. L.

Oil-gas; Apparatus for making ——. H. Gerdes, Berlin. U.S. Pat. 883,681, Mar. 31, 1908.

The apparatus comprises an oil-gas generator and a superheater, connected at their lower ends, the generator having a projecting combustion chamber near its upper end. Oil and air are supplied to the combustion chamber and to the upper end of the generator, and air is admitted to the lower end of the superheater.—A. T. L.

Gas producer plant. C. Whitfield, Kettering. U.S. Pat. 883,845, April 7, 1908.

See Eng. Pat. 4917 of 1905; this J., 1906, 306.—T. F. B.

Suction gas-producer working with either up- or down-draught. A Maguin. Fr. Pat. 384,432, Nov. 27, 1907.

The producer has an inclined grate at the lower end, and a fuel-containing bell at the upper end, surmounted by a charging hopper. Gas-outlet passages are provided near the top of the producer chamber and also near the bottom of the fuel column. The two gas-outlet pipes are connected to adjacent sides of a rectangular junction-box so that one or other of the passages is closed by a hinged valve in the box. The gas is led from the junction-box to a recuperator for heating the air on its way to the producer. The hot air passes through a similar junction-box either to the space below the grate or to the upper part of the producer. The grate is inclined downwards towards the front of the producer; a grate inclined in the opposite direction is hinged to it along the lower edge, and is rocked to and fro to cause ash and clinker to fall into a water-trough beneath the producer. Other improvements comprise a water-supply device for the producer, controlled by the engine suction; a depending bell with a contracted neck arranged beneath the column of coke in the scrubber, and a series of baffle-plates above the column of coke; and a gas reservoir having an inlet-pipe connected to a junction-box in the gas main near the engine and an outlet pipe connected to the gas main between the junction-box and the engine, a valve being arranged in the junction-box so that the gas may pass through the reservoir or direct to the engine or by both passages.—A. T. L.

Gas; Production of —— in gas producers. W. J. Crossley and T. Rigby. Fr. Pat. 384,706, Dec. 5, 1907. Under Int. Conv., Dec. 11, 1906.

SEE Eng. Pat. 28,181 of 1906; this J., 1908, 67.—T. F. B.

Gas and coke from peat briquettes; Production of ——, and recovery of by-products. B. Kittler. Ger. Pat. 196,603, Dec. 14, 1905.

THE process is carried out in retorts fed from a common fore-chamber, which latter is connected to a charging chamber provided with tightly-fitting discs or plates which alternately open and close. The invention consists in removing, by means of an air-pump or other suction device, any air or gas which enters the charging chamber when the discs are open.—A. S.

Illuminating and heating gas from solid carbonaceous materials; Production of ——. O. Pieron. Ger. Pat. 196,208, June 3, 1906.

A PERFORATED tube of iron plate is placed centrally in the retort whilst the latter is being charged. The whole is then heated until the carbonaceous material is sintered, then the retort is opened, the tube withdrawn, the retort again closed, and the heating continued. The central hollow space formed by the tube allows of an unimpeded outflow of the gases.—A. S.

Acetylene gas; Production of —— in the dry way from carbide and sodium carbonate. A. Bastian. Ger. Pat. 196,209, Aug. 3, 1906.

PREVIOUS attempts to prepare acetylene in the dry way from calcium carbide and crystallised sodium carbonate, have failed on account of the slow evolution of the gas. It is claimed that the evolution of gas proceeds rapidly if the sodium carbonate be mixed with a certain quantity of powdered rock salt before use.—A. S.

Incandescent mantles; Manufacture of ——. G. Buhlmann, Gross-Lichterfelde, Germany. Eng. Pat. 6828, March 21, 1907. Under Int. Conv., June 28, 1906.

SEE Fr. Pat. 374,796 of 1907; this J., 1907, 863.—T. F. B.

Filaments for incandescent electric lamps. H. H. Lake, London. From Parker Clark Electric Co., New York. Eng. Pat. 7642, March 30, 1907.

SEE Fr. Pat. 376,413 of 1907; this J., 1907, 1002.—T. F. B.

Metal filaments; Manufacturing —— from colloidal metals. V. Scholz, Berlin. Eng. Pat. 20,372, Sept. 12, 1907.

IT has been found that U- or V-shaped filaments are deformed or bent during the process of passing a current for the purpose of heating them to convert the metal of which they are formed from the colloidal into the crystalline condition. This defect is avoided by subjecting the filaments to a strain during the heating. The desired tension is produced by a weight or by means of a magnet.—W. H. C.

Incandescence filaments; Process for making —— with difficultly fusible metals or metallic oxides. W. Eggers. Fr. Pats. 384,413, 384,414 and 384,421, Nov. 27, 1907.

(1). FILAMENTS containing very little carbon are formed by using as binding material for the powdered metal a metallic trichloride, tetrachloride, pentachloride or hexachloride, which yields the free metal on heating, mixed with 1 to 20 per cent. of gum tragacanth. The filaments are finished by heating in hydrogen or in an inert gas. The process is suitable for making filaments of chromium, molybdenum, tungsten, uranium, titanium and thorium. Bromides or fluorides may be used instead of chlorides, and dichlorides may be used in conjunction with higher chlorides. In the latter case the filament may contain the oxide, which may be extracted with acid. (2). Gum tragacanth is dissolved in water, in solutions of halogen salts or bases, or in dilute acids, to form a viscous mass which is intimately mixed with a finely-powdered metal or oxide. Filaments formed from the mass are finished by heating in a vacuum, in air, or in a gas, according to their nature. The finished filaments contain very little carbon. (3). In forming very fine filaments from a pasty mass by squirting, the binding material must not give up moisture under the influence of the pressure. A suitable binding material consists of a mixture of gum arabic with aluminium chloride or with a solution of iron chloride. Other salts may be used, such as the chlorides, bromides and fluorides of other polyvalent or of divalent metals, phosphates, and the hydroxides of the alkaline-earth metals and of aluminium, magnesium, chromium and their analogues.
—A. T. L.

Photometer; Direct reading ——. Fr. Pat. 384,392.
See XXIII.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

Molasses waste liquors; Destructive distillation of —— with special reference to molasses tar. P. Rinckleben. Chem.-Zeit., 1908, **32**, 343—345, 358—361.

IN a process patented by Reichardt and Bueb for manufacturing cyanides from lyes and molasses (see this J., 1896, 114), a large quantity of tar is produced, which, at present, is a by-product of little value. The author has submitted this tar to direct, acid, and alkaline distillation, and to acid and alkaline extraction, and has obtained a number of substances of which creosote and a mixture of pyridine bases were the only valuable ones from a commercial point of view.—L. E.

Roumanian petroleum; Chemical study of ——. L. Edeleanu. Rev. du Pétrole, **1**, [2]. Petroleum, 1908, **3**, 689.

THE constituents of Roumanian petroleum may be divided into two groups, *viz.*, (1), those compounds which react with fuming sulphuric acid, yielding sulphonic acids or polymerisation- or oxidation-products; and (2), compounds which under ordinary conditions do not react with this reagent, but under more severe conditions suffer decomposition with separation of carbon. The author treated different specimens of petroleum with fuming sulphuric acid containing 20 per cent. of sulphur trioxide for several hours at a low temperature, care being taken to prevent loss of volatile substances. The results were as follows:—

Source of oil.	Percentage of oil.		Sp. gr.	
	absorbed	non-absorbed.	before treatment.	after treatment.
Berca..........	21·0	79·0	0·801	0·775
Campeni Bacau..	23·0	77·0	0·815	0·787
Policiori	25·5	74·5	0·816	0·786
Matita	31·5	68·5	0·807	0·775
Comanesti.......	40·0	60·0	0·843	0·799
Bustenari	48·0	52·0	0·861	0·818
Moinesti	50·0	70·0	0·858	0·809
Sarata-Mont	56·0	44·0	0·892	0·850

The non-absorbed portion consists of paraffins and polymethylenes, together with traces of low-boiling aromatic hydrocarbons. Of the paraffins, butane, pentane, hexane, and heptane were detected, the predominant forms, being the iso-compounds, *i.e.*, those with branched chains. Of the polymethylenes, penta-, methylpenta-, dimethylpenta-, and ethylhexamethylene were detected. These predominate in the higher-boiling fractions of the oils, whilst the paraffins are the chief constituents of the lower-boiling fractions. The portion of the petroleum absorbed by the fuming acid consists of benzenoid hydrocarbons, partially saturated polymethylene derivatives, hydrogenised derivatives of naphthalene, and hydrocarbons of a terpene character. The fuming acid also absorbs a portion of the constituents containing oxygen and sulphur. Of aromatic hydrocarbons, benzene, toluene, xylene, mesitylene, and pseudocumene were detected. The oxygenated constituents of petroleum have weak acidic properties, forming unstable salts. The copper salt is soluble in ether. Sulphur-containing constituents are present only in small quantities in Roumanian petroleum. They can be isolated as white amorphous mercury compounds by addition of mercury salts. On decomposing the mercury compounds with hydrogen sulphide, oils of very unpleasant odour are obtained. The oils obtained in this way from the low-boiling fractions of Bustenari petroleum, give with nitrites a reaction similar to that yielded by the thiophens.—A. S.

Waste lyes from petroleum refining; Utilisation of —— at Baku. E. Pyhala. Petroleum, 1908, **3**, 571—574.

The author gives an account of the progress which has been made in the utilisation of the waste lyes from petroleum refining. Up to the present the best results have been obtained in the preparation of a soap substitute consisting of the sodium salts of the naphthenic acids present in the waste lyes from the refining of lamp oils. Further, but to a more limited extent, the lyes from the refining of lubricating oils are worked up for the preparation of low-grade lubricating oils and "soap oils," the latter being used as a filling material in the manufacture of cheap soaps. For the recovery of low-grade lubricating oils, the waste lyes (so-called "white water" or "milk water") are neutralised with sulphuric acid, and the oil which separates is washed with sea water, and clarified by settling, with the aid of heat. The "soap oil" ("bakusin") prepared from the "white water" can be incorporated with soaps to the extent of up to 25 per cent. It resembles in appearance the lubricating oil from which it has been derived; some of the products obtained from waste lyes from the refining of cylinder oils yield with caustic soda solid, black substances soluble in water. These "soap oils," in general, when carefully saponified yield neutral, inodorous soft soaps.

In the manufacture of soap substitutes from the clear waste lyes from the refining of lamp oils, the lyes are concentrated, and treated with common salt, when the sodium salts of the naphthenic acids separate. These are heated until the excess of water is expelled and they become nearly transparent, when the product is filled into wooden casks. The soap-substitutes obtained in this way are yellowish-white soft soaps, and have found extensive use in textile works, but their unpleasant odour is a great drawback. Jefimoff states that by incorporating with them a certain proportion of the soap paste obtained from the lubricating oil waste lyes by salting out, inodorous soft soaps of tolerably good lathering power can be obtained. Besides this application of the sodium salts as soap substitutes, Charitschkoff has proposed the use of the lead and manganese salts of the naphthenic acids for the preparation of driers for varnishes and lacquers, whilst the naphthenic acids themselves may serve as raw materials for the preparation of numerous organic compounds. The average amount of waste lyes from 1 million pouds (1 poud = 36·112 lb.) of refined lamp oil is 30,000 pouds, which will yield 7000 pouds of soap substitutes, selling at 1 rouble 30 kopecks (1 rouble = 100 kopecks = 3s. 2·06d.) per poud. The salting out process consumes 7—13 per cent. of common salt. For each million pouds of refined lubricating oil, there are obtained, on the average, 80,000 pouds of waste lyes ("white water"), which yield about 13,000 pouds of low-grade lubricating oil and 57,000 pouds of soap oils ("bakusin"). If the whole of the waste lyes were worked up, it would be possible to produce 500,000 pouds of soap substitutes and 800,000 pounds of soap oils per annum, of a value at least 1,300,000 roubles.—A. S.

Petroleum benzine; Germicidal power of ——. F. J. Farrell and F. Howles. *See* XVIIIC.

Petroleum discoveries in Orange River Colony. Board of Trade J., April 23, 1908. [T.R.]

Investigations relating to oil have been proceeding in the Orange River Colony ever since the war, but more particularly within the past six months. A large amount of ground has been covered, and careful investigation has resulted in the definition of a broad oil belt, which stretches across the colony, roughly from the north-east to the south-west districts of Harrismith, Bethlehem, Senekal, Ficksburg, Ladybrand, Thaba 'Nchu, Bloemfontein, Wepener, Smithfield, Edenburg, and Fauresmith. In Ladybrand district alone, five distinct basins have been located. The discoveries there embrace oil springs, oil shales, ozokerite, blue clay, coarse sandstone impregnated with oil, bituminous tufa, &c. The basins in each case are clearly defined.

Patents.

Distilling wood; Apparatus for ——. W. Danner, New Orleans, La., Assignor to J. D. Lacey, Chicago, Ill. U.S. Pat. 883,091, March 24, 1908.

The apparatus consists of a horizontal oven closed at one end and having a door at the other end and provided with a vapour-escape pipe and with rails on which the wheels of the wood container may travel. The latter is a similarly shaped and constructed vessel of smaller dimensions, adapted to be run into and withdrawn from the oven and provided with a vapour exit in the top and with wheels. Horizontal perforated steam pipes are arranged in the lower portion of both oven and wood container, those in the latter having easily detached connections. By an arrangement of valves the pipes may be connected to a supply of either ordinary or superheated steam.—W. H. C.

Pitch; Manufacture of ——. G. Craig, Glasgow. Eng. Pat. 7615, Mar. 30, 1907.

Blast-furnace tar is distilled with an inert gas, such as blast-furnace gas, producer gas, or flue gas, instead of air, in order to prevent oxidation and to improve the quality of the pitch and oil produced.—A. T. L.

Gas liquor; Removal of hydrogen sulphide and hydrocyanic acid in the distillation of ——. J. Becker. Ger. Pat. 196,015, Feb. 11, 1906.

The gases coming from the saturator, after passing through the pre-heater, are washed with water, and the resulting solution of hydrogen sulphide and hydrocyanic acid is led into the waste liquor from the still, which contains excess of lime; if necessary a further quantity of lime may be added. In this way the noxious gases are converted into odourless compounds (calcium sulphide and cyanide) soluble in water.—A. S.

Asphalt; Substitute for natural rock ——. H. S. Flynt, Bolton. Eng. Pat. 9375, Apr. 23, 1907.

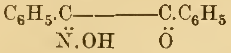
Limestone, sand or other mineral matter (80—90 parts by weight) is heated to 350—550° F., and mixed at this temperature with 10—5 parts of petroleum residue. Whilst still hot, 5—10 parts of resin are added, and the whole well mixed. Colouring matter, sawdust, ground cork, etc., may also be added.—A. G. L.

Ammonia stills; Treatment of effluents from ——. Eng. Pat. 7932. *See* VII.

IV.—COLOURING MATTERS AND DYESTUFFS.

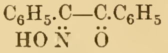
Mordant dyestuffs; Theory of ——. A. Werner. Ber., 1908, **41**, 1062—1071.

The author puts forward the theory that the property of chemical compounds of combining with mordants depends on their property of forming "inner" complex metallic salts. Mordant dyestuffs are therefore those which contain a salt-forming group together with a group capable of forming a co-ordination linking with the metallic atom, these two groups being in such a position that an "inner" metallic complex can result. Amongst the numerous examples cited by the author may be mentioned the case of the stereoisomeric benzil monoximes.



$\underset{\ddot{N}.OH}{C_6H_5.C}-\!\!-\!\!-\!\!-\underset{\ddot{O}}{C.C_6H_5}$

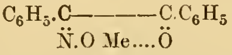
α-oxime.



$\underset{HO\,\ddot{N}}{C_6H_5.C}-\underset{\ddot{O}}{C.C_6H_5}$

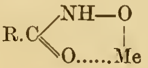
γ-oxime.

The α-oxime has a strong affinity for mordants, giving an orange yellow on a cobalt and a green on a copper mordant, whilst the γ-oxime has no affinity for any mordant. This was to be expected from the theory, for the α-oxime should form an "inner" complex salt of the constitution,

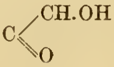


$\underset{\ddot{N}.O\ Me....}{C_6H_5.C}-\!\!-\!\!-\!\!-\underset{\ddot{O}}{C.C_6H_5}$

(the dotted line indicating the co-ordination linking according to the author's theory of valency), whilst the isomeric oxime cannot form such an "inner" complex. Further, benzhydroxamic acid and its homologues give coloured compounds with mordants and the "inner" complex of these compounds is evidently that represented by formula I:

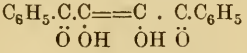


I.



II.

When the nitrogen atom in (I) is replaced by carbon, the characteristic grouping of the mordant-dyeing flavonols is obtained (II), which is obviously favourable to the formation of an "inner" complex. In order to ascertain if such formation would take place in a compound containing an open chain, the author examined the behaviour of the (pale yellow) benzoin of phenylglyoxal,

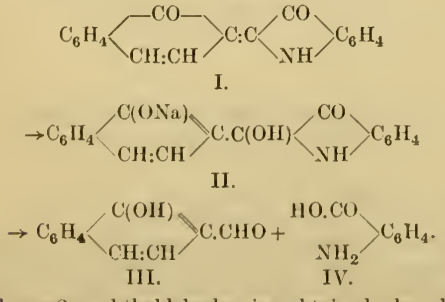


$\underset{\ddot{O}}{C_6H_5.C}.\underset{OH}{C}{=}\!{=}\!{=}\underset{OH}{C}\ .\ \underset{\ddot{O}}{C}.C_6H_5$

and found it to be an excellent mordant dyestuff, giving for example, a black brown with iron, a brick red with uranium and a bright orange with yttrium.—J. C. C.

Indigoid dyestuffs and Indigo; Behaviour of —— towards alkalis. P. Friedländer. Ber., 1908, **41**, 1035—1039.

MOST of the indigoid dyestuffs (see this J., 1908, 398) resemble Indigo in their behaviour towards concentrated caustic soda in that they first form sodium salts and then by further action the molecule is decomposed. Thioindigo and 2-thionaphthene-2-indolindigo are more resistant to the action of caustic soda than is Indigo, whilst 1-naphthalene-2-indolindigo and 2-naphthalene-2-indolindigo are readily dissolved by the dilute alkali and are easily decomposed by boiling. The presence of the sulphonic acid group (as in Indigo Carmine) renders the molecule more sensitive to the action of the alkali, whilst dyestuffs containing a methoxyl group are more stable than those without. The author considers that in this action (for example, in the case of 2-naphthalene-2-indolindigo, (I), a sodium salt of constitution (II) is first formed and this then undergoes further decomposition into 1-hydroxy-2-naphthaldehyde (III) and anthranilic acid (IV).



I. II. III. IV.

1-Hydroxy-2-naphthaldehyde is obtained by boiling 2-naphthalene-2-indolindigo with 10 parts of 10 per cent. aqueous caustic soda until the solution becomes brownish-yellow and no unchanged dyestuff is precipitated on acidifying. Yellow plates separate which on acidifying, yield the hydroxyaldehyde in greenish-yellow needles melting at 59° C. Similarly from 1-naphthalene-2-indolindigo, the known 2-hydroxy-1-naphthaldehyde is obtained, and the corresponding aldehydes from other dyestuffs of this class have been prepared.—J. C. C.

Diazo-compounds and azo-dyestuffs; Reaction between——. A. Lwoff. Ber., 1908, **41**, 1096–1097.

WHEN *p*-sulphobenzeneazo-β-naphthol is treated with diazotised *p*-nitraniline or *o*-chloro-*p*-nitraniline, *p*-nitrobenzeneazo- or *o*-chloro-*p*-nitrobenzeneazo-β-naphthol respectively is produced.—J. C. C.

Benzeneazo-α-naphthol and tetramethyldiaminodiphenylcarbinol; Constitution of the acetylated product of condensation of ——. R. Möhlau. Ber., 1908, **41**, 989—990.

BY condensing benzeneazo-α-naphthol with Michler's ketone the author and Kegel (Ber., 1900, **33**, 2858) obtained a substance which they regarded as a hydrazone because its acetyl derivative on reduction furnished acetanilide and an aminonaphthol derivative. This view was confirmed by the fact that phenylhydrazine condensed with α-naphthoquinonetetramethyldiaminodiphenylmethane to give the same compound. Auwers and Eisenlohr, however, have recently shown (Ber., 1908, **41**, 415) that no trace of acetanilide is formed by reducing the acetyl derivative with zinc and acetic acid, but aniline is produced. The author has now repeated the operation and confirms the latter observation. The products of reduction are aniline and *O*-acetyl-*p*-aminonaphtholtetramethyldiaminodiphenylmethane,

$$CH_3.CO.O.C_{10}H_5(NH_2).CH[C_6H_4.N(CH_3)_2]_2$$

and consequently the original condensation product is probably an azo-compound and not a hydrazone. In the earlier experiments carried out under slightly different conditions in which acetanilide was found, this may have been formed by acetylation of the aniline and some of the latter may have been carried away with the acetic acid during heating.—J. C. C.

Fukugiflavin; Nitro-dyestuffs derived from ——. E. Itō. J. Coll. Engineering, Imp. University, Tokyo, 1908, **4**, 53—55.

DIRECT nitration of fukugiflavin did not give good results, but by first converting it into its sulphonic acid and treating the latter with nitric acid, soluble substantive dyestuffs were obtained. Among them were two for which the names, *Nitrofukugiflavin* and *Nitrofukugiflavin* G are suggested. The former is an orange-yellow powder which dissolves in water to form a yellow solution which acts as a direct dyestuff upon animal fibres, whilst the latter dyes them yellow with a greenish tinge. Both dyestuffs possess great tinctorial power and "equalising property." It is suggested that other insoluble natural mordant dyestuffs may be rendered more applicable by similar treatment.—C. A. M.

"Doss"; The Japanese dyewood termed ——. E. Ito. J. Coll. Engineering, Imp. University, Tokyo, 1908, **4**, 57—62.

THE ever-green tree "doss," *Ilex Mertensii, Maxim.*, occurs in the Ogasawara and Okinawa islands of Japan, and has hitherto given unsatisfactory results as a substitute for myrica bark. The author has isolated from the aqueous extract a new dyestuff, *dossetin*, $C_{15}H_9O_5$, melting at 271°—272° C., and crystallising in yellow needles. Doss extract gives a dull yellow with alumina mordant, a bright yellow with a tin mordant, orange yellow with chrome mordant, and olive with iron mordant. In the author's opinion, however, its tinctorial power and the brightness of the colours do not justify its addition to the available yellow dyestuffs.—C. A. M.

Morinda citrifolia, L.; Constituents of the root-bark of ——. O. A. Oesterle and E. Tisza. Arch. Pharm., 1908, **246**, 150—164.

In the study of the root-bark of *Morinda citrifolia*, L., which is used in India as a dyestuff, the authors followed in general the methods employed by Perkin and Hummel (Chem. Soc. Trans., 1894, **65**, 851; see also this J., 1894, 348). The following substances were isolated:—(1). Morindin, $C_{27}H_{30}O_{15}$, light yellow needles melting at 245° C.; yields morindone and an unfermentable sugar on hydrolysis. (See also this J., 1907, 1273). (2). The monomethyl ether of a trihydroxymethylanthraquinone, $C_{16}H_{12}O_5$, lemon-yellow needles melting at 172° C.; dissolves in alkalis and sulphuric acid with an orange-red coloration. (3). A dihydroxymethylanthraquinone, *morindadiol*, $C_{15}H_{10}O_4$, yellow needles melting at 244° C.; dissolves in alkalis with an orange-red, and in sulphuric acid with a cherry-red coloration. (4). A second dihydroxymethylanthraquinone, *soranjidiol*, reddish-brown needles melting at 276° C.; gives in alkalis a bluish-violet, and in sulphuric acid a cherry-red solution, the latter gradually changing to violet. (5). A substance, $C_{18}H_{10}O_5$, yellow needles melting at 210° C.; dissolves in alkalis and sulphuric acid with an orange-red coloration. (6). A wax, $C_{18}H_{28}O$, white needles melting at 124·5° C. Morindin, the trihydroxymethylanthraquinone monomethyl ether, the substance, $C_{18}H_{10}O_5$, and the wax are also present in the root-bark of *M. umbellata* (see Perkin and Hummel, *loc. cit.*).—A. S.

Colloids [dyestuffs, etc.]; Mutual coagulation of ——. O. Teague and B. H. Buxton. Z. physik. Chem., 1908, **62**, 287—307.

In a former paper (this J., 1907, 1081) it was shown that the mutual precipitation of dyestuffs is more or less complete according to the more or less pronounced colloidal nature of the dyestuffs used. The authors embody their conclusion in a "Law of Colloidal Coagulation" and in the present paper endeavour to show that this "law" is of general application to colloidal solutions. The following colloids were used:—*Inorganic, positive;* Ferric hydroxide, aluminium hydroxide. *Inorganic, negative;* Colloidal platinum, arsenic sulphide, soot. *Organic* (*all negative colloids*):—*Non-nitrogenous:* Mastic, tannin, starch. *Nitrogenous:*—Serum, hæmoglobin, lecithin, gelatin. *Microscopic suspensions:*—Bacteria, agglutin-bacteria. The colloids were coagulated with a number of acid and basic dyestuffs, the degrees of colloidisation of which were compared by dialysis through parchment paper. The results, on the whole, confirm the authors' law, and the following conclusions are drawn:—(1.) The coagulation of acid dyestuffs by basic dyestuffs is most complete when the two are present in equimolecular quantities. (2.) During coagulation, sodium chloride is liberated, but is not the cause of the phenomenon, though its presence extends the limits within which coagulation takes place. (3.) Dyeing experiments with mixtures of dyestuffs show that highly colloidal dyestuffs are more firmly united than those of a less colloidal character. (4.) The conclusions of the former paper referred to above were confirmed with another series of dyestuffs, these conclusions being that highly colloidal dyestuffs completely coagulate one another within narrow limits (of concentration, etc.), whilst less colloidal dyestuffs coagulate one another only incompletely but within wide limits. ("Law of Colloidal Coagulation.") (5.) The above law is shown to hold for various inorganic and organic colloids other than dyestuffs.—E. F.

Patents.

Indigo; Manufacture of monochloromonobromo derivatives, of ——. O. Imray, London. From Soc. Chem. Ind. in Basle, Basle. Eng. Pat. 13,148, June 6, 1907.

See U.S. Pat. 872,280 of 1907; this J., 1907, 1274.—T.F.B.

Dibromindigo; Process of making ——. G. Engi, Assignor to Soc. Chem. Ind. in Basle, Basle. U.S. Pat. 883,703, April 7, 1908.

See Addition of March 18, 1907, to Fr. Pat. 375,514 of 1907; this J., 1907, 961.—T. F. B.

Sulphurised [sulphide] dyestuffs; Manufacture of brown ——. A. G. Bloxam, London. From Act.-Ges. f. Anilinfabr., Berlin. Eng. Pat. 14,746, June 26, 1907.

See Fr. Pat. 379,416 of 1907; this J., 1907, 1236.—T. F. B.

Leuco compounds of the indophenol series; Process for preparing ——. Act.-Ges. f. Anilinfabr. Ger. Pats. 184,601 and 184,651, Aug. 13, 1905.

Quinonemonoimines and aromatic amino compounds with free *p*-position are caused to interact in molecular proportions, in dilute hydrochloric acid solution. The compounds can also be prepared by the interaction of quinonedi-imines on phenols with free *p*-position, in molecular proportions and in presence of hydrochloric acid solution.—T. F. B.

Azoxy- and azo compounds of the benzene series; Preparation of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 15,420, July 4, 1907.

See Fr. Pat. 380,175 of 1907; this J., 1907, 1274.—T. F. B.

Vat dyestuffs; Production of ——. Farbenfabr. vorm. F. Bayer und Co. First Addition, dated Nov. 18, 1907, to Fr. Pat. 380,176, July 23, 1907 (this J., 1907, 1274; see also this J., 1908, 116).

The main patent describes the manufacture of vat dyestuffs from anthranol or its derivatives, by treatment with sulphuric acid. In the present addition, the process for making the same dyestuffs from corresponding anthraquinone derivatives by treating with metals in the presence of sulphuric acid, is claimed. The reaction takes place in two stages, the anthraquinone being first reduced, by the action of the metal and acid, to anthranol derivatives, and these are then condensed under the influence of the sulphuric acid and yield the dyestuffs. The reactions of the dyestuffs obtained from various derivatives of anthraquinone are tabulated.—F. M.

Indigo dyes; Electrolytic process for the preparation of ——. H. Chaumat, Paris. Eng. Pat. 19,027, Aug. 23, 1907. Under Int. Conv., Aug. 28, 1906.

See Fr. Pat. 379,041 of 1906; this J., 1907, 1196.—T. F. B.

o-Oxymonoazo dyestuffs; Manufacture of ——. Chem. Fabr. Griesheim-Elektron, Frankfort on Maine, Germany. Eng. Pat. 19,810, Sept. 4, 1907. Under Int. Conv., Jan. 5, 1907.

See U.S. Pat. 863,290 of 1907; this J., 1907, 1004.—T.F.B.

o-Hydroxymonoazo dyestuffs; Manufacture of ——. Chem. Fabr. Griesheim-Elektron. Fr. Pat. 384,824, Dec. 7, 1907. Under Int. Conv., Jan. 6, 1907.

See U.S. Pat. 863,290 of 1907; this J., 1907, 1004.—T.F.B.

Vat [thioindigo] dyestuffs; Process of making ——. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 384,418, Feb. 2, 1907.

See Eng. Pat. 1472 of 1907; this J., 1907, 1235.—T. F. B.

Vat dyestuffs; Process of making red ——. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 384,532, Feb. 6, 1907.

See Eng. Pat. 2592 of 1907; this J., 1908, 71.—T. F. B.

Vat dyestuffs; Manufacture of ——. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 384,606, Feb. 7, 1907.

See U.S. Pat. 877,743 of 1908; this J., 1908, 328.—T. F. B.

Leuco-derivatives [of thioindigo] containing sulphur; Process of making ——. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 384,381, Feb. 18, 1907.

See Eng. Pat. 1594 of 1907; this J., 1907, 1044.—T. F. B.

Triphenylmethane dyestuffs; Production of green ——. Badische Anilin und Soda Fabrik. First Addition, dated Mar. 5, 1907 (under Int. Conv, Dec 27, 1906), to Fr. Pat. 371,742, Nov. 22, 1906 (this J., 1907, 404).

In the original patent a process is described whereby the leuco-derivatives of green dyestuffs of the triphenylmethane class, are prepared by condensing 2.6-dinitrodiphenylamine-4.3-disulphonic acid or 2.4-dinitrodiphenylamine-6.3-disulphonic acid, or derivatives in which the second para position to the imino nitrogen is free, with alkylated diaminodiphenylcarbinols. Upon reduction of the nitro groups and combination with suitable diazo derivatives of the benzene or naphthylamine series, dyestuffs are obtained which dye unmordanted wool in yellow to brown shades which are changed to green, or bluish-green by after-chroming.—F. M.

Anthracene dyestuffs ; Halogenated anthraquinonesulphonic acids and ——. Badische Anilin und Soda Fabrik. Fr. Pat. 384,471, Nov. 28, 1907. Under Int. Conv., Sept. 20 and Oct. 21, 1907.

IT is found, that by dissolving anthraquinonesulphonic acids in concentrated or fuming sulphuric acid and treating with halogens or halogenating compounds, in the presence or absence of halogen-carriers, halogen derivatives are easily produced. Further, that these halogen derivatives readily yield valuable dyestuffs, soluble in water, when treated with ammonia or primary aliphatic or aromatic amines.—F. M.

Azo dyestuffs for wool and cotton ; Manufacture of blue ——. C. Jäger. Fr. Pat. 383,747, Oct. 28, 1907. Under Int. Conv., Jan. 10 and Feb. 21, 1907.

BLUE azo dyestuffs with a strong affinity for wool, and dyeing cotton directly, are obtained by combining the intermediate products derived from tetrazo-compounds of the benzidine series and one molecule of 2-naphthol-8-sulphonic acid (croceinic acid) with one molecule of 1-amino-8-naphthol-4-sulphonic acid. The products dye unmordanted cotton and also wool in shades varying from bluish-violet to pure blue from a boiling sodium sulphate bath. The dyeings on wool are distinguished by their intensity and fastness to fulling ; after subsequent treatment with copper sulphate, they are also very fast to light. This affinity for wool is not shared to a similar degree by known dyestuffs of similar constitution in which 2-naphthol-8-sulphonic acid is replaced by other naphtholsulphonic acids or 1-amino-8-naphthol-4-sulphonic acid by its isomerides. *Example.*—12·2 kilos. of dianisidine are tetrazotised in the usual manner and combined in sodium carbonate solution with 12·3 kilos. of the sodium salt of 2-naphthol-8-sulphonic acid. The intermediate product separates as a brightly-coloured precipitate ; it is added to an alkaline solution of 11·9 kilos. of 1-amino-8-naphthol-4-sulphonic acid, the liquid boiled for some hours and the dyestuff salted out with common salt. When dry it forms a bright blue powder with intense metallic reflex. The aqueous solution of the dyestuff does not appreciably change in shade on adding sodium hydroxide. The dyestuff dyes unmordanted cotton and wool in pure bright blue shades. On treating the dyeings on wool with copper sulphate and a little acetic acid, they change to bright indigo shades of great fastness to fulling and to light. The analogous dyestuffs derived from diaminoethoxydiphenyl, tolidine and benzidine give blue dyeings of increasingly redder shade up to violet.—E. F.

3-*Chloroalizarin and monochloroflavopurpurin ; Process for preparing* ——. R. Wedekind und Co. Ger. Pat. 189,937, Nov. 15, 1903.

BY the action of nascent chlorine on a hot, slightly acidified, aqueous suspension of alizarin or flavopurpurin, the respective monochloro derivatives are obtained.
—T. F. B.

o-*Nitromandelic acid ; Preparation of a compound from* —— *which is converted into isatin by heating.* Kalle und Co. Ger. Pat. 184,693, March 21, 1906.

o-NITROMANDELIC acid is reduced by zinc dust in presence of ammonium chloride, and in alkaline solution, and the product is treated with acids.—T. F. B.

Isatin ; Process for preparing ——. Kalle und Co. Ger. Pats. 184,694, March 21, 1906, and 189,841, July 17, 1906.

1). THE compound described in the preceding abstract is converted into isatin by warming with acetic anhydride or with an aqueous alkali solution. (2). o-Nitromandelic acid is reduced with two molecular proportions of zinc dust in neutral aqueous suspension, the solution is then treated with acid (without filtration), and allowed to stand for some time.—T. F. B.

Anthroxanic acid ; Process for preparing ——. Kalle und Co. Ger. Pat. 191,855, July 11, 1906.

A SALT of o-nitromandelic acid is treated, in presence of ammonium chloride, with the quantity of zinc dust or other finely-divided metal, necessary to produce the nitroso derivative. When the reduction is complete, the solution is filtered, treated with acid, and then heated with excess of alkali until the deep violet colour has disappeared.—T. F. B.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

Mixed fabrics ; Method of distinguishing and counting the threads of different materials in ——. O. Lecomte. Rev. intend. mil., 20, 55—9.

IN connection with the tariff laws of some countries, notably Persia, the number of threads of each material in mixed goods must be counted. One sq. decim. of the bleached fabric is treated with 30 c.c. of dilute nitric acid (1 : 10). When well impregnated, 30 c.c of a solution of sodium nitrite (1 : 20), are added, little by little, with constant stirring. Action is complete at the end of 10 min. The fabric is drained, plunged into a 5 litre glass dish filled with water, rinsed for 2 min. and cut into halves. To one of these is added 40 c.c. of a solution of lead subacetate, caustic soda and β-naphthol (25 : 50 : 5 : 1000) and to the other a solution of lead subacetate, caustic soda, and resorcinol (25 : 50 : 2 : 1000). Each part is then kept at a temperature not exceeding 20° C., stirred constantly for an hour, washed in running water for 15 min. and then treated with 100 c.c. of dilute hydrochloric acid. After 5 min., the pieces are again washed in running water for at least an hour. In the piece treated with resorcinol, the silk threads appear rose colour, whilst in the other sample they are orange. In each case the wool is black, and the vegetable fibres white.

Mercerised cotton and oxycellulose ; Qualitative tests for ——. A. B. Knaggs. J. Soc. Dyers and Colour., 1908, **24**, 112—113.

IN testing whether cotton has been mercerised or not, Knecht (this J., 1908, 400) has proposed to dye the sample in a weak solution of Benzopurpurin. On carefully reducing with titanous chloride, the shade on mercerised material appears bluish-red, just before the dyestuff is all destroyed, whereas upon unmercerised cotton the colour is bluish-violet. The author now finds that reduction is not necessary, and that when strong hydrochloric acid is added drop by drop to the dilute dye-bath in which samples of mercerised and unmercerised cotton are lying, until the shade of the unmercerised piece just becomes blue, the mercerised sample remains a bright red colour. The difference is not due to any alkali remaining in the mercerised material, for this may be treated with acid until the shade becomes blue, and being returned to the dye-bath, the red shade will reappear. As regards oxycellulose, a piece of cotton spotted with bleaching powder, or other agent capable of producing oxycellulose, then rinsed in acid and finally with water, may be dyed a deep shade with Benzopurpurin ; upon placing in acid so that the shade becomes blue and then rinsing in water until the red colour on the ordinary cotton reappears, those parts which have been converted into oxycellulose will remain blue-black in colour.—F. M.

Cotton ; Effect of drying on the affinity of ordinary and mercerised —— *for dyestuffs.* E. Knecht. J. Soc. Dyers and Col., 1908, **24**, 107—109.

IN a preliminary trial two weighed skeins of bleached, two-fold American yarn were mercerised with caustic soda of 45° T., without tension, washed, soured and washed till neutral. One skein was kept wet and the other was dried at 100°—110° C.; they were then dyed together in a bath containing Benzopurpurin 4B, lightly rinsed and dried. The skein which had been kept wet was much more deeply dyed than the other, and the amount of colour on the fibre, estimated by the indirect titanous chloride method, was found to be 1·74 per cent. on the skein dyed without drying, and 1·16 per cent on that which had been dried after mercerising. Similar variations were shown, on dyeing with Benzopurpurin 4B and Chrysophenin, samples of cotton which had been mercerised with caustic soda of 38° T., under tension, in the works.

	Benzopurpurin taken up.	Chrysophenin taken up.
	per cent.	per cent.
Dyed without drying	3·24	0·96
Air-dried before drying ..	3·03	0·92
Dried at 110° C. before dyeing	2·51	0·84
Ordinary cotton	1·77	0·58

Another trial with material mercerised without tension in caustic soda of 50° T. and then dyed in weaker dye-baths gave—

	Benzopurpurin taken up.	Chrysophenin taken up.
	per cent.	per cent.
Dyed without drying	2·49	0·97
Air-dried before dyeing ..	1·57	0·77
Dried at 110° C. before dyeing	1.27	0·54
Ordinary cotton	0·83	0·31

There was no difference in the amount of colour taken up by unmercerised cotton which had been: (1), steeped for 24 hours in water; (2), steeped and air-dried before dyeing; and (3), steeped and dried at 110° C. before dyeing. The effect of substances which would prevent complete drying were qualitatively tested. Thus a piece of material, mercerised under tension in the works, was printed whilst still moist with a 25 per cent. solution of glycerin thickened with British gum. When dried thoroughly on a steam-heated cylinder and dyed (after removal of the glycerin by washing), the parts which had been prevented from becoming dry were much more deeply dyed than those which had not been protected by the glycerin. If dried after mercerising, and the glycerin then printed on, the printed and unprinted parts showed little difference on dyeing. Hygroscopic substances such as zinc chloride and calcium chloride acted in the same way as glycerin. The change in the degree of affinity brought about by drying appears to be permanent, prolonged steeping in water or exposure to air not tending to restore it, but treatment with dilute acids does not apparently diminish the affinity of the undried mercerised material for dyestuffs. After stripping the dyeings with hydrosulphite, and re-dyeing, the difference, in the portions which have been dried and those which have been maintained moist, reappears. Materials which, by standing after mercerising, have become partly dry, will give even dyeings by being remercerised, and to get the full benefit of the increased affinity for dyestuffs, cotton should be dyed immediately after mercerising.—F. M.

Turkey Red; Brightening of —— in water under high pressure. Report on sealed note 985, (*J. J. Romann*), *June* 24, 1897. F. Binder. Bull. Soc. Ind. Mulhouse, 1907, **77**, 474—476.

The author of the sealed note states that cotton fabrics dyed with alizarin, when subjected to the action of water at 200° C., acquire a brilliancy of shade superior to that obtained by steaming under 30 lb. pressure. This fact was however previously known and the author of the report describes a series of experiments made by himself in 1886, from which he concluded that treatment with water at a pressure of 75 lb. (= 152° C.) imparts a brilliancy equal to that produced by padding with Turkey-red oil and subsequently steaming for 4 hours without pressure. Pressure above 75 lb. is without further effect.—R. B. B.

Indigo; Fixation of —— on cotton. P. Jeanmaire. Rev. gén. mat. col., **11**, 383.

The author finds that by printing on cotton an intimate mixture of indigo and concentrated caustic soda, and steaming for several minutes with steam free from air, a good solid blue is obtained, the previous reduction of the indigo to indigo white, hitherto considered necessary, being dispensed with.

Pile or raised fabrics; New effects on ——. [*Drag printing.*] L. Baumann and G. Thesmar. Sealed note 1698, Jan. 15, 1907. Bull. Soc. Ind. Mulhouse, 1907, **77**, 476—479.

In the process known as "drag printing" in which colours or discharges are lightly furnished to the extremities of the pile or raised surface of fabrics such as velvets, flannelettes, etc., great difficulty has been caused by the slipping of the material and special machines have been necessary for this class of work. The authors employ an ordinary printing machine with additional drag rollers; these are wooden rollers covered with a narrow spiral band of perforated tin-plate, the edges of the perforations giving a rough surface which effectually prevents the fabric from slipping.—R. B. B.

Aniline Black; Process for rendering —— ungreenable. P. Jeanmaire. Sealed note 925, Oct. 29, 1896. Bull. Soc. Ind. Mulhouse, 1907, **77**, 468.

Pieces printed or dyed with Aniline Black, after fixing and de-gumming without the use of soap, are padded with an acid solution of an oxidising agent, dried, steamed, and washed. Normal ammonium chromate gives fairly good results, but the oxidising bath which has proved most useful in practice contains 40—50 grms. of potassium chlorate, 40—50 grms. of aluminium sulphate and 3—5 grms. of potassium ferricyanide per litre. The blacks obtained show a fine bluish tone and are absolutely ungreenable.—R. B. L.

Aniline Black; Ungreenable ——. F. Oswald. Sealed note 955, March 2, 1897. Bull. Soc. Ind. Mulhouse, 1907, **77**, 469.

The dyed or printed pieces are padded in a solution of potassium chlorate with an addition of a small quantity of a vanadium salt and are then dried on cylinders at a high temperature. This operation does not affect injuriously even the palest tints of coloured discharges. The author recommends a padding liquor containing 10 grms. of potassium chlorate and 1 grm. of a 1 per cent. solution of vanadium chloride per litre.—R. B. B.

Aniline Black; Azo and other resists under ——. M. W. Pluzanski. Sealed note 962, March 16, 1897. Bull. Soc. Ind. Mulhouse, 1907, **77**, 471—472.

The process described consists of the following operations:—(1). Pad in sodium-β-naphthol; (2), print with a diazo compound with addition of calcium, lead, or zinc acetate according to the nature of the coloured resist; (3), precipitate the metal by means of a solution of sodium carbonate or with gaseous ammonia; (4), wash in hot water; (5), dry; (6), pad with an Aniline Black mixture; (7), age; (8), soap and dry. For resists containing Paranitraniline Red or similar colours, calcium carbonate is most effective; for a yellow resist, lead carbonate is precipitated on the material as above and the cloth subsequently passed through a bichromate bath. By printing an acid on the precipitated metallic carbonate, the azo colour is not affected, but the Aniline Black is no longer resisted in the portions thus printed.—R. B. B.

Aniline Black; Azo and other resists under ——. (*Report on the above communication.*) H. Schmid. Bull. Soc. Ind. Mulhouse, 1907, **77**, 472—473.

The practicability of the above process is confirmed and an analogy pointed out with the process of Kurz and

Kunert (this J., 1897, 438) for the production of resist patterns with Paranitraniline Red, etc., under Indigo.
—R. B. B.

Sulphide dyestuffs; White and coloured reserves for ——. L. Baumann and G. Thesmar. Z. Farben-Ind., 1908, 7, 123—127.

To produce white and coloured effects on cloth dyed with sulphide dyestuffs, discharges containing oxidising and reducing agents have been used. Chlorate discharges were employed, but it was found that on oxidation, the sulphide colours did not give white products so that the discharged parts of the cloth were not as desired. Further, the chlorine and chlorine peroxide gases evolved during the steaming of the prints affected the tone of the sulphide colours. Reducing agents gave no better results because the reduced dyestuffs were not removed from the fibres. When oxidising and reducing discharges are used, tendering of the fibre can scarcely be avoided. The authors print reserves containing certain metallic salts which form insoluble compounds with the leuco-compounds of the sulphide dyestuffs and thus prevent these bodies from being attracted by the fibres. Salts of manganese, cadmium, iron, zinc, tin, aluminium and magnesium may be used and also mixtures of salts of these metals. Zinc chloride is very suitable as it is very soluble in water and possesses strong acid properties; if it contains no mineral acid it does not injure the cotton fibre. After printing with the reserve, the cloth is padded (a concentrated bath is used and a short passage given), squeezed, steamed, washed, soured, washed and soaped. The method may be used for coloured as well as white reserves. Mercerised cotton gives even better results than ordinary cotton when printed in this way.—S. H. H.

"*Cell-pitch*" *from sulphite wood pulp waste liquors.* W. Sembritzki. *See* XIX.

Panama fibre; Preparation of ——. Pall Mall Gazette, April 25, 1908. [T.R.]

The veritable panama is manufactured from the *Planta de Toquilla*, or *Carludovica Palmata*, which grows wild in the swamps of Central America. Of late years this plant, which is low and shrubby in appearance, has been cultivated extensively, but without the success which was anticipated. They mature in about a year and a half, and live to the age of forty or fifty. The leaves used in making hats are the young ones, which are plucked before they have fully expanded. They are then boiled in water in which a little lemon juice has been mixed, and afterwards hung up to dry in an airy though shady spot. Throughout the operation of hat plaiting the straw is never exposed to the sun, for the hat would have in that case a streaky appearance, all the strips not being bleached to the same degree. When the leaves are almost dry, they are split up into very narrow strips of the same width, and then again tied in a bunch and left to dry. When this state is reached, the plaiting of the hats can commence. After the plaiting is finished the hats are cleaned with soap and lemon juice, polished, and then sent to the market. The natives employed in this industry declare that the most difficult part of the whole work is the boiling of the straw, which constitutes a real art. It is only after this stage that they can decide the quality of the hat, on which its future and the plaiters' wages depend. The largest market of the hat industry of the West Indies and Central and South America is at Azoquay, in Ecuador, where last year more than five thousand dozen were sold. There are comparatively few hat manufactories, the majority of the work being done in the houses by the women.

A large quantity of the straw is exported for manufacture abroad. This is done up in a perfectly dry state in ninety pound bales. It fetches about eighty cents a pound, though during the past year ninety cents has been touched; six years ago the price was fifteen cents the pound. The finest hats come from the Manabi province, and fetch a minimum price of $150 each. Owing to the very fine straw which must be used, and the long time it is necessary to spend on each hat, only about one hundred and fifty dozen of these are made each year.

Patents.

Artificial fabrics; Process for obtaining ——. M. Ratignier and H. Pervilhac et Cie. Fr. Pat. 384,934, Feb. 19, 1907.

See Eng. Pat. 13,518 of 1907; this J., 1907, 1196.—T. F. B.

Bleaching of vegetable textile materials. H. F. J. Crepin. Fr. Pat. 384,455, Feb. 4, 1907.

It is claimed that the time required for bleaching cotton, linen, hemp, etc. may be very much curtailed by immersing the materials, in the cold, in a liquor prepared by mixing a solution of sodium carbonate with bleaching powder, drawing off the clear liquid, and to this adding oxalic acid. The goods are finally rinsed with dilute acid and water or, after rinsing with water alone are neutralised in a bath saturated with carbon dioxide.—F. M.

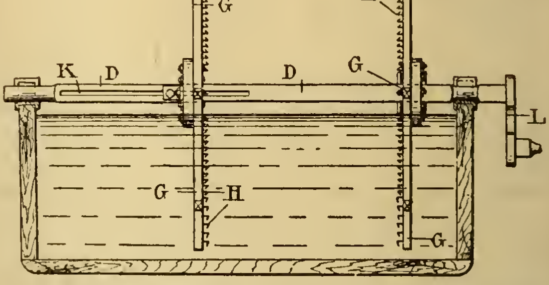
Flax, hemp, and like yarns; Process and apparatus for bleaching or dyeing ——. J. D. Quern, Belfast. Eng. Pat. 7306, March 27, 1907.

See Fr. Pat. 381,783 of 1907; this J., 1908, 221.—T. F. B.

Wool and the like; Apparatus for the treatment of ——. H. Giesler, Dorlisheim, Germany. Eng. Pat. 13,831, June 14, 1907.

See Fr. Pat. 374,606 of 1907; this J., 1907, 869.—T. F. B.

Piece-dyeing; Machine for ——. A. Faure. Fr. Pat. 383,856, Jan. 19, 1907.

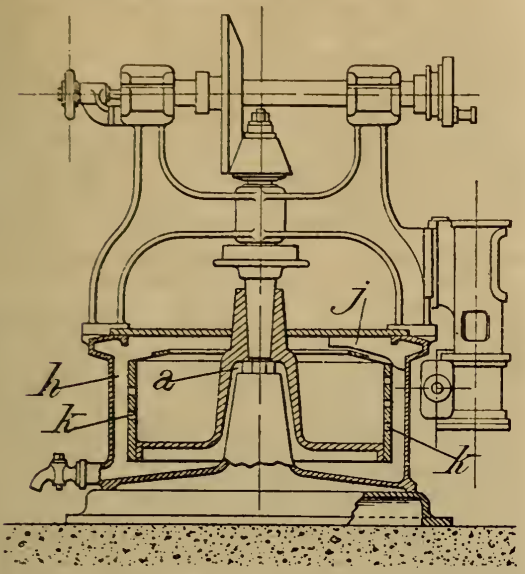


The machine is intended for the dyeing of goods in the piece, especially for velvets, plushes and other fabrics with a pile. It consists of a dye-vat above which an axle, D, may be made to revolve. This axle supports two frames, G,G, consisting of radiating laths furnished with hooks, H, on their opposing faces. The distance between the two frames can be adjusted by sliding one along the axis, D, in the slot, K, and this is done until the distance between them corresponds to the width of the piece. The latter is then mounted on the frames in spiral fashion, starting from the centre, by means of a false selvage which is attached to the hooks, H. The axle, D, is revolved during dyeing by means of the handle, L. The object of the arrangement is to prevent any damage to the pile of the fabric by friction or other mechanical action.
—E. F.

Cops and cheeses; Dyeing of ——. H. L'Huillier. 5th Addition, dated Nov. 8, 1907, to Fr. Pat. 350,981, Jan. 24, 1905 (this J., 1905, 888; 1906, 475; 1907, 92; 1908, 18, 73).

In the fourth addition, an arrangement is described, which prevents the wooden core of the perforated metal tube, upon which the yarn is wound, from slipping. An improvement is here described, the metal cylinder having one end slightly flanged inwards, so that when the spindle on the winding frame is pressed home in the wooden core, the latter is prevented by the flange from protruding. A metal tube, carrying a disc of wood is then forced down between the spindle and the core, and the disc, pressing upon the flanged end of the perforated metal cylinder, brings the latter into proper alignment with the spindle, so that the cheese may be truly wound. The metal tube and wooden core being removed, the cheese, wound upon the perforated metal cylinder, is ready for fixing in the dyeing machine.—F. M.

Silk ; Apparatus for weighting —— and for other dyeing operations with circulation of the liquid. C. Lumpp et Cie. Fr. Pat. 383,941, Nov. 13, 1907.



The apparatus consists of a centrifuge the pivot of which bears into the top of a hollow central shaft at *a*, revolving in a closed vat, *h*, provided with a plate, *j*, either inclined, or vertical, which throws the liquid, forced out of the holes *k*, back into the centrifugal apparatus when this latter is revolved. The advantage claimed for the apparatus is, that the bearing, *a*, is protected by an air-cushion from the action of the liquid in the dye-vat, and that the process is continuous, the fibre in the cage of the centrifugal apparatus also not needing to be removed during various consecutive operations.—E. F.

Hair ; Process for dyeing ——. E. P. L. Schueller. Fr. Pat. 383,920, Nov. 14, 1907.

The process claimed consists of the use of a liquid obtained by adding a reducing agent to a solution of substances of phenolic character together with a metallic salt. Sulphurous acid and its salts, formaldehyde, and formic acid are suitable reducing agents. As phenolic substances those are employed which give with metallic salts, with or without oxidation, coloured lakes ; for instance certain aminophenols, " 1.2.3-phenotriol " and other substances behaving similarly, such as hæmatoxylin and analogous products and certain dye-wood extracts. As suitable salts those of cobalt, nickel, iron, copper and other metals are employed. The reducing agent is first added to one of the other constituents and the mixture treated with the third constituent. Aqueous or alcoholic solutions are used. The shade may be further varied by the addition of various dyestuffs. Lake-formation is prevented by the reducing agent until the liquid is exposed to the air, as is the case when it is applied to the hair. After application it is allowed to dry and the hair then rapidly washed, or the hair may simply be moistened with it when brushed. The dyeings are said to be very fast and the process to be simpler than those ordinarily employed.—E. F.

Alizarin Red or other alizarin colours on cotton and other vegetable fibres ; Dyeing of ——. Schlesische Türkischrotfärberei. Fr. Pat. 384,479, Nov. 29, 1907. Under Int. Conv., Dec. 11, 1906.

The fibres are given the usual preparation, but instead of preparing the dyebath with alizarin, alkali, and hard water, soft water (rain or condensed water) is used and an addition of clear lime water is made. A small quantity of tannin is also added to the bath. The improvement is very marked in the dyeing of yarn on bobbins, etc., where the outer layers used to act as a filter, preventing the dyeing of the interior of the bobbins, the material is now dyed as thoroughly as though it had been treated in the hank. When replenished with fresh alizarin solution and lime water, the dye-liquors may be used repeatedly. The dyeing is started in the cold and the temperature is raised slowly. On leaving the dye-bath, the cotton is treated with dilute acetic, formic or lactic acid or a dilute mineral acid to which a little " tin salt " has been added. It is finally steamed and brightened.—F. M.

Textile printing ; Removing the excess of colour in ——. E. Mertens. Ger. Pat. 196,421, Oct. 23, 1906.

The printing is effected by means of machines in which a roller with a soft surface is interposed between the printing rollers and the pressure rollers. The colour deposited on this intermediate roller is transferred to the pressure roller, from which it is removed by one of the known methods.—A. S.

Sizing yarns ; Process of ——. J. Verrière. Fr. Pat. 384,443, Nov. 26, 1907.

In sizing yarn in the hank, it is not possible to use a size which is not only sufficiently liquid to penetrate the hank easily, but which will give sufficient stiffness without the threads sticking together on drying. This difficulty is overcome by producing the size on and in the fibre. The starch or farina is suspended in water, the yarn is impregnated with the " milk," evenly wrung, and then steamed so that the starch grains swell and the paste is produced in the fibre. Before drying, the yarn is well opened out. Other sizing ingredients may be incorporated, by adding the same to the starch milk, and the process may be employed in the sizing of warps, or yarns on bobbins, etc.—F. M.

Finish on textile materials ; Method and apparatus for rendering the —— permanent. J. R. Denison and J. F. Preussner, Bradford. Eng. Pat. 23,130, Oct. 19, 1907.

The material, the finish on which is to be rendered permanent, is not folded up with press papers but each lot is placed in the press between steam-heated cavity plates or steam coils, and, the press being closed, is subjected to the action of steam and more or less gentle pressure. When steam coils are used, plates are inserted between the coils and the cloth. The cavity plates have flexible connections with the steam pipes, and may be independently raised or lowered by means of chains passing over shafts, the ends of which are fitted with ratchet wheels and pawls.—F. M.

Cloth ; Machine for extracting liquid from ——. E Gessner, Aue, Germany. U S. Pat. 883,536, March 31, 1908.

See Eng. Pat. 7928 of 1906 ; this J., 1906, 845.—T. F. B.

Leather ; Artificial ——. Addition to Fr. Pat. 380,302. *See* XIV.

VII.—ACIDS, ALKALIS, AND SALTS, AND NON-METALLIC ELEMENTS.

Water and solutions of sulphuric acid ; Evaporation of ——. P. Vaillant. Compt. rend., 1908, **146**, 811—814.

The ratio, $\frac{p}{F-f}$, where p is the weight evaporated in a certain time, F is the maximum vapour pressure, and f is the vapour pressure in the atmosphere at the time, is constant for water and mixtures of water and sulphuric acid. The value of this constant depends not only on the temperature, but also on the distance between the surface of the liquid and the rim of the vessel, lessening, in the author's experiments, from 0·93 to 0·65 mgrm. as the surface was lowered from the rim-level to 5 mm. below it. When the cylindrical vessel is greatly heightened, by placing around it a zinc cylinder 25 cm. high, the rate of evaporation is no longer proportional simply to F—*f*, but is expressed by two constants, and terms involving both the first and second powers of F − *f*.—J. T. D.

Alkali nitrites ; Manufacture of ——. Le Pelet and G. Corni. Rev. gén. mat. col., **11**, 343—348.

A NUMBER of patented processes for making nitrites have been put to the test by the authors, *viz.*, those in which the following reducing agents are employed :—Sulphur, pyrites, ferrous sulphide, iron, ferrous oxide, and carbon. The preparation of nitrite is a delicate operation, and only by the exertion of much care can a good yield be secured. The fused mass must be constantly stirred to keep the temperature between 300° and 350° C. ; for if this exceed 500° C., the nitrite is partially or wholly decomposed with evolution of nitrogen and nitrogen peroxide. The presence of a fusible base, like sodium hydroxide, aids reduction of the nitrate. The easily oxidisable reducing agents (sulphur, pyrites, etc.) are liable to cause deflagration with explosive violence, and partial or entire decomposition of the nitrite. The best yields are gained by the use of the less active reducing agents, and their state of aggregation is of importance. Thus, granulated substances like coke and iron filings give better results than finely divided ones, like iron in powder form, and charcoal. For the manufacturing process, the use of coke, or iron filings, was found best.

Silicates ; Preparation of some ——. G. Stein. Sprechsaal, 1908, **41**, 199—201.

A NUMBER of silicates were prepared by heating together silica (quartz) and the metallic oxide in a carbon tube placed in an electric carbon-tube furnace. The temperatures reached were measured by a Wanner optical pyrometer, or by means of a thermocouple. It was found that quartz, heated alone, became viscous at 1600° C. and formed a mobile liquid at 1750°. Above this temperature it sublimed readily, probably owing to reduction by the carbon, and subsequent oxidation of the volatilised silicon. The sublimate consisted partly of small crystals of tridymite, sp. gr. 2·4. Crystals could not be obtained from the molten residue. The heating and cooling curves of quartz showed a break at 552° C., even after repeated heating. With chalcedony the break occurs at 173°, while flint shows no irregularity at all between 100° and 600° C. In the following table some of the properties of the silicates prepared are given. The zinc silicate was made in a porcelain tube instead of a carbon tube :

	M.p.	Specific gravity :		Crystalline structure, etc.
		crystallised.	amorphous.	
Metasilicates.	°C.			
$BeSiO_3$	above 2000	2·35	—	Very small crystals.
$MgSiO_3$	1565	3·06	—	Short rods.
$CaSiO_3$	1512	2·92	2·90	Small plates.
$FeSiO_3$	1500—1550	3·44	—	Brownish.
$MnSiO_3$	1470—1500	3·58	3·36	Needle-shaped, pink.
$ZnSiO_3$	1479	3·42	3·86	Two forms.
$SrSiO_3$	1287	3·91	—	
$BaSiO_3$	1368	3·77	3·74	Two forms.
$NiSiO_3$	—	—	—	Was not obtained.
Orthosilicates.		artificial.	natural.	
$2BeO + SiO_2$	above 2000	2·46	—	Could not be obtained in the amorphous state.
$2MgO + SiO_2$	above 1900	3·2	3·19—3·24	
$2ZnO + SiO_2$	1484	3·7	3·4—3·7	When cooled rapidly forms a transparent greenish glass.
$2SrO + SiO_2$	1953	3·84	—	Large, highly refractive crystals.

A few double silicates were also prepared, their specific gravities only being given : Na_2O, Al_2O_3, $2SiO_2$, crystalline, 2·50 ; K_2O, Al_2O_3, $2SiO_2$, crystalline, 2·60 ; CaO, Al_2O_3, $2SiO_2$, amorphous, 2·81 ; Li_2O, Al_2O_3, $4SiO_2$, crystalline, 2·42 ; Na_2O, Al_2O_3, $4SiO_2$, amorphous, 2·43 ; K_2O, Al_2O_3, $4SiO_2$, amorphous, 2·44. They all begin to sublime at about 1300°, and form mobile liquids at 1600°. Silicates containing 1 mol. of alumina to 0·3—0·5 mol. of silica were completely liquid at 1900°, and solidified to crystalline masses. The silicate, Al_2O_3,SiO_2, gave only one kind of crystals, sp. gr. 3·03. Bodies with more silica crystallised in two forms. Cerium silicates show similar properties.

The silicates of the other rare earth metals form mobile liquids at 1700°, and begin to sublime at this temperature. Nd_2O_3, SiO_2 is violet, Pr_2O_3, SiO_2 green, and Er_2O_3. SiO_2 pink. The crystalline silicates of lanthanum, praseodymium, didymium, and neodymium fall to powder in a few days, even if air is excluded. All are readily attacked by dilute acids, but slowly by caustic alkalis. No silicate of zirconium could be obtained, even at 2000°. Molybdenum and tungsten oxides were reduced by the carbon of the tube before they reacted with the silica. A mixture of 1 mol. of silica with 1 of titanium dioxide gave a mobile liquid at 1750°, and on cooling yielded a shining black mass, consisting of amorphous silica, large opaque crystals and small blue crystals. These last may be a silicate derived from titanium sesquioxide.—A. G. L.

Hydrogen peroxide ; Observations on the formation of ——. F. Fischer and O. Ringe. Ber., 1908, **41**, 945—954.

HYDROGEN peroxide is formed in an analogous manner to ozone at high temperatures (see this J., 1906, 314, 808 ; 1907, 200, 416), and can be detected if care be taken not to expose it for any length of time to temperatures at which the amount formed is very small whilst the rate of decomposition is very great. It is formed : (1), when a steam blast is blown across a glowing Nernst electrode ; (2), when a mixture of oxygen and steam is forced with sufficient velocity through a capillary tube of magnesia heated externally ; (3), when a steam blast is blown across a hydrogen flame. If a spark discharge or a high-tension arc be subjected to a blast of oxygen, ozone is formed ; with a steam blast, hydrogen peroxide is produced, whilst in still air, the chief product is nitric oxide. Hydrogen peroxide is also produced in an ozonising tube (silent electric discharge) if a mixture of oxygen and steam be led through the tube at a sufficiently high temperature. In all cases traces of ozone are formed, in addition to the hydrogen peroxide.—A. S.

Carborundum ; Technical examination of amorphous ——. G. Chesneau. Ann. Chim. anal. appl., 1908, **13**, 85—89.

IN the preparation of crystallised carborundum, some of the amorphous modification is always formed. This is now used, either alone, or mixed with clay, for the manufacture of retorts for zinc distilling, etc. When it is examined under the microscope, black specks of carbon can be seen, but the main portion consists of an opaque green mass of the amorphous carborundum ; the presence of crystallised carborundum (sharply defined dark blue crystals) and of a silicate of aluminium, iron, calcium, and magnesium, of approximately the same composition as anorthite (colourless, translucent, doubly refracting crystals) can also be detected. For the analysis of the carborundum, the material is finely powdered, first in a porcelain and then in an agate mortar, and is next sifted, and the fine powder heated for two hours in a muffle at a bright red heat. One grm. of the material prepared in this manner is ignited in a platinum crucible for the determination of the carbon, the residue is treated with 20 c.c. of pure concentrated hydrofluoric acid and 1 c.c. of sulphuric acid, and slowly evaporated to dryness, then treated with concentrated hydrochloric acid, boiled for a few minutes and transferred to a porcelain dish. After diluting with hot water and warming for a few minutes, the mixture is filtered, and the filter and residue washed first with water acidulated with hydrochloric acid and then with boiling water. The residue consists of pure carborundum. If it be desired to determine the silica, 0·2 grm. of the material is fused with a mixture of 5 parts of alkali carbonate and 1 part of alkali nitrate in a platinum crucible at a bright red heat, and the silica is separated from the reaction-product in the usual manner. Pure carborundum yields 150 per cent. of its weight of silica, and in any case the yield of silica should not fall below 140 per cent.—A. S.

Colloidal elements ; Preparation of ——. A. Lottermoser. Z. angew. Chem., 1908, 21, 632—639.

A review of the nature and methods of preparation of colloidal elements, together with a brief account of their application in medicine and in the manufacture of porcelain, glass, and filaments for electric incandescence lamps.—A. S.

Vanadic and molybdic acids ; Determination of —— *in presence of each other.* G. Edgar. *See* XXIII.

Bauxite discovery in Georgia. Eng. and Mining J., April 4, 1908. [T.R.]

A discovery of bauxite has recently been made in Central Georgia, three miles east of McIntyre, Wilkinson county, and about 1½ miles north of the Central of Georgia Railway. The lateral extent of the deposit has not yet been determined. It is known, however, to reach a thickness of 10 ft., and from the outcrops and a small amount of prospecting, 100,000 tons are known to occur at the point of discovery. The mining of the ore would present no special difficulties, and water for power and other purposes is abundant.

Patents.

Catalytic bodies, more especially intended for use in the manufacture of nitric acid ; Manufacture of ——. G. W. Johnson, London. From Chem. Fabr. Griesheim-Elektron, Frankfort, Germany. Eng Pat. 13,954, June 17, 1907.

See Fr. Pat. 380,884 of 1907 ; this J., 1908, 22.—T. F. B.

Nitrous gases ; Absorption of dilute ——. Det Norske Aktieselskab for Elektrokemisk Industri, and B. F. Halvorsen, Christiania. Eng. Pat. 16,885, July 23, 1907. Under Int. Conv., July 26, 1906.

See Fr. Pat. 380,190 of 1907 ; this J., 1907, 1280.—T. F. B.

Nitric acid ; Concentration of dilute —— *by means of [anhydrous] nitrates.* O. Boeters and R. Wolffenstein. First Addition, dated Nov. 4, 1907, to Fr. Pat. 371,797, Nov. 26, 1906 (this J., 1907, 408). Under Int. Conv., Nov. 24, 1906, and April 27, 1907.

The process described in the principal patent may be carried out as follows :—The dilute nitric acid to be concentrated is heated alone in a small retort, into which it may be continuously admitted, and the vapours are passed through a series of receivers, heated to about 100° C., and containing an anhydrous nitrate or other suitable dehydrator, to combine with the water. Any one of these receivers may be temporarily cut out from the system, and connected with an exhaust, in order to dehydrate the nitrate again without raising the temperature. Other dilute acids may be concentrated in a similar manner.—F. Sodn.

Sulphuric and nitric acids ; Process of producing mixtures of ——. J. H. Nield, Hackensack, N.J., Assignor to General Chemical Co., New York. U.S. Pat. 884,035, April 7, 1908.

Gaseous sulphuric anhydride is passed upwards through a scrubber into the upper end of which a mixture of sulphuric acid and weak nitric acid is sprayed. From the mixed acid discharged at the lower end of the scrubber, a portion is withdrawn as final product. The remainder is mixed with a further quantity of weak nitric acid, any nitric acid vapour evolved is condensed and returned to the mixed acid, and the latter is cooled and again sprayed into the upper end of the scrubber.—A. S.

Ammonia stills ; Treatment of the effluents from ——. J. Grossmann, Manchester. Eng. Pat. 7932, April 5, 1907.

Calcium sulphate and other compounds, present in the effluents from ammonia stills, may be removed by means of barium carbonate, and the liquors thus rendered suitable for coke quenching, or coal washing, or for use in steam boilers, without excessive incrustation or priming. In order to ascertain the proportion of barium carbonate necessary, a preliminary experiment is made, after first determining the quantity of sulphate present in the clear settled effluent. A measured volume of this is agitated for several hours with an amount of barium carbonate equivalent to the sulphate present, preferably after being neutralised or slightly acidified by treatment with carbon dioxide or waste flue gases. After standing for 12 hours, the amount of sulphate left in the clear solution is determined, and the least excess of barium carbonate required for complete reaction calculated. Barium carbonate, in this excess, is now added to the same effluent on the large scale, the mixture being agitated, by the passage of flue or other gases for instance, until the reaction is complete. After settling for about 12 hours, during which time the mixture may be heated, the clear liquid is separated. Or, a large excess of barium carbonate may be used, and, after removal of each batch of treated liquor, a further amount, equivalent to the sulphate present, added to the sediment, until its bulk becomes too great. The sediment consists chiefly of calcium carbonate and barium sulphate, and these may be separated by levigation, or it may be so treated as to produce marketable products or barium carbonate again. The barium carbonate used is finely ground, preferably by wet grinding, and its place in the process may be wholly or partially taken by strontium carbonate. When the treated effluent is used in steam boilers, the blow-offs may be utilised for the recovery of thiocyanates, ferrocyanides, thiosulphates, or other compounds, or these may be previously removed at any stage of the process.—F. Sodn.

Ammonia ; Method of producing ——. O. Serpek, Madulein, Switzerland. U.S. Pat. 884,423, April 14, 1908.

See Fr. Pat. 367,124 of 1906 ; this J., 1906, 1096.—T. F. B.

Iron, copper, and zinc ; Recovery of —— *from liquors containing the same.* J. Raschen, J. M. Taylor, and The United Alkali Co., Ltd., Liverpool. Eng. Pat. 6337, Mar. 15, 1907.

Iron, copper, and zinc may be fractionally precipitated, as hydroxides or carbonates, from liquors containing them, by treating these with an alkaline-earth (lime, for example) or alkali, or with a carbonate of such groups. To the liquors, such, for instance, as those obtained in the so-called wet copper process, the precipitant is first added in quantity sufficient to neutralise any free acid and to precipitate the ferric iron present. This precipitate is filtered off and a further quantity of the precipitant added, equivalent to the copper. In the filtrate from the copper hydroxide or carbonate, the zinc is precipitated by the addition of a third quantity of the precipitant, equivalent to it. If a caustic alkaline-earth be used, it is preferably added as a cream, the mixture being suitably agitated, and if a carbonate be used, the liquor should be heated. When working with lime, precipitation at 30°—60° C. gives the best results.
—F. Sodn.

Zinc and iron ; Recovery of —— *from liquors containing the same.* J. W. Kynaston and The United Alkali Co., Ltd., Liverpool. Eng. Pat. 12,575, May 30, 1907.

Liquors containing iron and zinc, *e.g.*, from the wet copper process, are treated with calcium carbonate, preferably "Chance waste," in quantity equivalent or nearly equivalent to the iron present. Air is then blown through the mass, when nearly all the iron is precipitated. From the supernatant liquid the zinc is then precipitated by adding lime.—A. G. L.

Arsenic; Treating ores containing ——. T. B. McGhie and T. Barton, London. Eng. Pat. 7034, Mar. 23, 1907.

Ores or speiss containing 30 per cent. or more of arsenic after being ground and mixed with slight excess of an alkali carbonate are roasted. By this means the metals are oxidised and an arsenate of the alkali is formed. The latter is dissolved out and obtained in a solid form by evaporation.—J. W. H.

Cobalt and nickel; Process for the separation of salts of ——. T. B. McGhie and T. Barton, London. Eng. Pat. 7035, March 23, 1907.

A solution of the mixed chlorides of cobalt and nickel, such as is obtained in the treatment of a mineral containing these metals, when evaporated, yields a crop of mixed crystals of the two chlorides; but by evaporation in the presence of a slight excess of hydrochloric acid, nearly the whole of the cobalt salt may be crystallised out, leaving a concentrated solution of the nickel salt, from which the remaining cobalt may be removed by a known method. The proper degree of concentration may be gauged by occasionally cooling a sample, and rapidly testing the ratio of cobalt to nickel in the mother liquor. By two crystallisations, conducted in this way, a cobalt chloride may be obtained containing only about 0·5 per cent. of nickel.—F. Sodn.

[Calcium] carbide; Method of manufacturing ——. H. L. Hartenstein, Duluth, Minn., U.S.A. Eng. Pat. 20,649, Sept. 17, 1907.

See Fr. Pat. 383,054 of 1907; this J., 1908, 261.—T. F. B.

Aluminium oxides; Method of manufacturing and treating composite ——. M. Buchner, Mannheim-Waldhof, Germany. U.S. Pat. 883,286, March 31, 1908.

See Fr. Pat. 377,964 of 1906; this J., 1907, 1049.—T. F. B.

Zinc chloride; Process of making ——. R. R. Rust, Waukegan, Ill. U.S. Pat. 883,426, Mar. 31, 1908.

Oxidised zinciferous material is mixed with water, or other suitable liquid, into a thick slime, which is allowed to pass, in divided masses, from top to bottom of a "retainer chamber," fitted with a number of partitions, or through a series of such chambers, where it is subjected to the action of hydrochloric acid gas passing in the opposite direction. Additions of the pulverised material to the charge may be made at intermediate points of the system.—F. Sodn.

Precipitates; Process of purifying ——. H. H. Dow, Midland, Mich., and W. S. Gates, Worthington, Canada, Assignors to The Ontario Nickel Co. U.S. Pat. 883,792, April 7, 1908.

A mixture of precipitates, of varying degrees of solubility, but which are all relatively insoluble, is agitated with a solution of a salt of that metal which forms the least soluble precipitate. The amount of salt in the solvent is such that the more soluble precipitate is extracted and the cycle of operations may be repeated until each metal has been successively dissolved out.—C. A. W.

Solutions containing ferrous salts in suspension or dissolved; Process for preparing and preserving in flasks —— *to prevent their oxidation.* Eli Lilly and Co. Fr. Pat. 384,883, Dec. 10, 1907.

See U.S. Pat. 876,366 of 1908; this J., 1908, 122.—T. F. B.

Hydrogen peroxide; Preparation of ——. Consortium für elektrochem. Ind. Ger. Pat. 195,351, July 16, 1905.

The process consists in first preparing, electrolytically, persulphuric acid or a persulphate, decomposing this to obtain hydrogen peroxide, separating the latter, and returning the residual solution to the electrolytic apparatus for the preparation of a further quantity of persulphuric acid or persulphate. Other compounds, such as percarbonates or perborates, may be used as oxygen-carriers in place of persulphates. By extracting the solution of the percarbonate or perborate (obtained electrolytically) with ether, an ethereal solution of hydrogen peroxide is obtained, and the residual aqueous solution of carbonate or borate may be electrolysed for the preparation of further quantities of percarbonate or perborate.—A. S.

Hydrogen peroxide solutions; Rendering —— *stable.* J. Arndts. Ger. Pat. 196,370, April 19, 1907.

It is claimed that small quantities of compounds of the tannic acid group, such as gallic acid or pyrogallol, have the power of greatly retarding the decomposition of hydrogen peroxide. For example, it is stated that a 3 per cent. solution of hydrogen peroxide to which a small quantity of tannin or ratanhia-tannic acid has been added, can be kept for six months without suffering any decomposition.—A. S.

Cyanides; Preparation of —— *from nitrates or nitrites.* G. Müller. Ger. Pat. 196,372, Feb. 7, 1907.

When nitrates or nitrites are mixed with excess of charcoal, and the mixture ignited, cyanides are produced. For example, a mixture of 170 grms. of sodium nitrate, 168 grms. of iron powder, 40 grms. of wood charcoal, and 150 grms. of potassium chloride is ignited in a vessel capable of withstanding pressure. Potassium cyanide is extracted in the ordinary way from the reaction-product. —A. S.

Hydrogen; Process of generating —— *[from sodium and water].* H. Foersterling and H. Philipp, Assignors to The Roessler and Hasslacher Chem. Co., New York. U.S. Pat. 883,531, Mar. 31, 1908.

Water, in a finely-divided state, is made to react successively with relatively small masses of sodium, separated from each other, in the same containing vessel, in such a way that the supply of hydrogen is continuous, and at a rate that substantially prevents a solution being formed. —F. Sodn.

VIII.—GLASS, POTTERY, AND ENAMELS.

Porcelain; Chemico-physical nature of ——. A. Zoellner. Chem. Ind., 1908, **31**, 212—217.

The author has studied the interactions of felspar, quartz and clay substance at the temperatures of the porcelain kiln. He found that:—(1.) Felspar is saturated with from 2·5 to 3·5 per cent. of alumina, corresponding with a molecular formula of $K_2O,1{\cdot}15—1{\cdot}20Al_2O_3,6SiO_2$. Up to this limit the melt gave clear glasses, but beyond it, highly polished enamels with a granular fracture were obtained. (2.) Felspar is saturated with from 13 to 14 per cent. of clay substance (Zettlitz kaolin) corresponding with the formula, $K_2O,1{\cdot}3Al_2O_3,6{\cdot}6SiO_2$. The higher members of this series showed a porcelain-like character. Under the microscope very small crystals could be detected as soon as the limit of saturation was passed, and as the amount of clay was increased, the vitreous base became filled with a net-work of needles. In the felspar-alumina mixtures on the other hand no trace of crystallisation was observed, but only undissolved particles of alumina. (3.) Felspar can take up from 64 to 70 per cent. of quartz, the limit corresponding to $K_2O,Al_2O_3.12—12{\cdot}5SiO_2$. Under the microscope the supersaturated test-pieces showed undissolved quartz particles, with rounded edges in a zone of highly silicious glass. (4.) Contrary to expectation, the limits of saturation of felspar, quartz, and alumina remain the same, namely, $K_2O,1{\cdot}15Al_2O_3,12SiO_2$. This mixture gave a clear glass, in which undissolved particles could be seen if more alumina or silica were introduced (5.) With mixtures of felspar, quartz and Zettlitz kaolin, the limit of saturation is not raised, but even below this limit, crystalline separations occur. By means of the microscope, it was found that hard burnt felspathic porcelain consists of a mixture of a vitreous ground mass, undissolved quartz, and numerous small rod-like crystals, which form

an interlocked, felt-like framework. The optical characters, in polarised light, of some of these crystals were determined, and were found to be identical with those of sillimanite (Al_2SiO_5). Bünzli has suggested that sillimanite might be formed from felspar by loss of alkali on heating, but the author found that felspar when repeatedly raised to a white heat neither lost weight, nor altered in composition. When felspar is melted on a clay ground, however, crystals identical with sillimanite are formed, resulting directly from the interaction of the felspar with the clay substance or body. The author has also separated the vitreous base from the crystalline portion of porcelain by means of hydrofluoric acid of 25 to 50 per cent. strength. After immersion for from 3 to 8 days in the acid, a piece of hard porcelain, although softened, retains its shape on account of its felted structure, whilst soft porcelain and enamels, in which clay substance is replaced by equivalents of alumina, fall to a loose white powder. The residue from the hydrofluoric acid treatment was treated with dilute ammonia and caustic soda solution until a pure crystalline powder, consisting of small fine needles, was obtained, which on analysis was found to be Al_2SiO_5. About 8 to 10 per cent. of sillimanite was found in porcelain by this method. Experiments also showed that sillimanite crystals begin to form in porcelain at 1400° C. and increase with a rise of temperature and with longer exposure to heat. Since crystallisation only occurred with fusions of felspar and clay substance, sillimanite may be formed either by the interaction of these two bodies, or from the clay substance alone. Zettlitz kaolin, when burnt at 1470° C. and treated with hydrofluoric acid, yielded a residue of sillimanite crystals, and clay substance at higher temperatures also undergoes a change by which a molecular separation occurs, giving rise to crystalline Al_2SiO_5, and a highly-silicious amorphous aluminium silicate. Consequently unaltered clay substance cannot be present in highly fired porcelain.
—W. C. H.

Zirconia as a refractory material; Application of Brazilian ——. R. Ricke. Sprechsaal, 1908, **41**, 214—215.

Zirconium is usually met with in the form of the silicate, zircon, $ZrSiO_4$, but recently there has come into commerce, at Hamburg, a mineral, known as "Brazilian zirconia," which consists mainly of the oxide of zirconium, together with ferric oxide, alumina, and small quantities of titanic acid and thoria, and some free and combined silica. It consists generally of nodular aggregates, with a spherulitic structure, like brown iron-ore. It is extremely hard, has a specific gravity of 5·5—6·0, and a greyish-green colour, and is often striped, in crevices and hollow spaces, with reddish-brown iron oxide. Owing to the high content of zirconia the material is highly refractory. A recent sample, bought in the ground condition, contained about 90 per cent. of zirconia, ZrO_2, and by digestion for an hour with concentrated hydrochloric acid lost about 6 per cent. of impurities, chiefly composed of ferric oxide. The purified powder was mixed with flour and made into tubes which could be heated to cone 41—42 in an electric furnace. After repeated use the tubes became conductors, owing to fusion on one side. Apparently also some of the fused zirconia combined with some carbon of the resistance to form zirconium carbide. The total contraction on burning amounted to about 14 to 15 per cent. When burnt at cone 15, the objects were very porous, and showed a further contraction of 1 to 2 per cent. at cone 30, but became "dense burnt" on longer exposure to heat. Another sample contracted about 1—2 per cent. on drying, and about 4 per cent. when burnt at cone 15, and was very porous, but when burnt at cone 30, the porosity was only about 3 per cent., and the total contraction amounted to 9—10 per cent. Rapid cooling of the articles, or too rapid heating caused them to crack, but this was overcome by the addition to the raw material of from one-third to two-thirds of some of the mineral that had been hard burnt and coarsely ground. This mixture showed a contraction of only about 7—8 per cent., was very resistant to sudden changes of temperature, and when burnt at temperatures above cone 30 showed no complete sintering. When heated in direct contact with carbon, as in the case of heating tubes in an electric furnace, the articles become more porous, owing to the volatilisation of the more easily fusible impurities, such as silica, ferric oxide, etc., but the material is very suitable for the production of extraordinarily refractory crucibles.
—W. C. H.

Silicates; Preparation of some ——. G. Stein. *See* VII.

Patent.

Porcelain; Process for the manufacture of fire-resisting ——. A. Schöfl, F. Trautmann, and C. Mayer, München, Germany. Eng. Pat. 9394, April 23, 1907.

See Fr. Pat. 376,359 of 1907; this J., 1907, 1009.—T. F. B.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Patents.

Artificial stone and mortar impermeable to water; Production of ——. G. Schruf, Wiener-Neustadt, Austria. Eng. Pat. 28,745, Dec. 31, 1907.

The artificial stone is prepared by mixing together 200 kilos. of sand, 50 kilos. of cement, 2 litres of tar and 16 litres of water. For ceilings, the mixture used consists of 300 kilos. of sand, 200 kilos. of blast-furnace slag, 100 kilos. of Portland cement, 4 litres of tar and 80 litres of water. The mortar consists of 150 kilos. of well-dried fine sand, 50 kilos. of cement, 4 litres of tar, and 12 litres of water. To promote rapid setting, 4 kilos. of "soda" may be added. Part of the sand may also be replaced by blast-furnace slag, with the objects of decreasing the weight and increasing the heat-insulating properties.
—A. G. L.

Portland-cement mortar; Waterproof ——, *and process of making the same.* R. H. Gaines, New York. U.S. Pat. 883,683, Mar. 31, 1908.

The mortar is made by intimately mixing dry Portland cement with unburnt sedimentary colloidal clay, and then mixing with sand in the presence of a dilute solution of a salt corresponding to an oxide, M_2O_3, for example, a solution containing 1 to 3 per cent. of aluminium sulphate.
—A. T. L.

Cement and hydraulic lime and dry mortar-mixtures prepared from them with sand or powdered stone; Process for protecting —— *from the action of moisture during storage.* J. Junge. Ger. Pat. 195,603, June 1, 1907.

Instead of using sand alone, a mixture of sand and quicklime is used in the preparation of the mortar-mixture. Preferably the lime is first mixed with one of the constituents of the mortar, and then the other constituents are added.—A. S.

Cement clinker; Mode of producing —— *in the manufacture of cement.* H. G. Barnhurst and J. W. Fuller, Catasauqua, Pa., U.S.A. Eng. Pat. 15,434, July 4, 1907.

See U.S. Pat. 861,699 of 1907; this J., 1907, 1010.—T.F.B.

Electric furnace [for manufacture of slag cement]. Eng. Pat. 7742. *See* XIA.

X.—METALS AND METALLURGY.

Castings; Manufacture of sound —— *by the addition of deoxidising agents.* T. Geilenkirchen. Stahl und Eisen, 1908, 28, 592—596.

Sound castings, free from ferrous oxide and gas-bubbles, are obtained in the case of cast-iron as well as steel, by adding deoxidising agents to the molten metal, the tensile strength also being increased. The first deoxidising agents used were ferromanganese and ferrosilicon, of which comparatively large quantities must be added. More recently, it has been shown that the same end can be attained by the addition of small quantities of aluminium, sodium, magnesium, calcium, or vanadium. In the case of aluminium, 0·02—0·05 per cent. gave dense hard castings with an iron poor in silicon (friction-wheels). The addition of 0·05 per cent. of magnesium, in the form of a ferro-alloy, raised the tensile strength from 13 to 18 kilos. per sq. mm., and gave sound castings; further addition of magnesium was without effect. Calcium is used in the form of briquettes containing an equal weight of aluminium (Brandenburg and Wiens, Ger. Pat. 187,414). The action of the calcium, besides the reduction of the ferrous oxide, is said to consist in the formation of calcium carbide from the carbon present, which compound is then re-converted into calcium by the dissolved hydrogen, acetylene being evolved. About 0·06 per cent. of calcium is used. From tests carried out by Moldenke it appears that the addition of small quantities (0·05—0·15 per cent.) of vanadium, in the form of a ferro-vanadium rich in carbon, is also highly beneficial, but the results are not conclusive, as the quantities of vanadium found in the castings were always much larger (0·22—0·45 per cent.) than those intended to be added.—A. G. L.

Cast into malleable iron; Theory of conversion of ——. F. Wüst. Metallurgie, 1908, 5, 7—12.

The earlier theory of this process is disputed. The author considers that the migration of the temper carbon in a piece of solid iron to the surface to be oxidised, is inconceivable, and he would rather suggest that the oxygen penetrates the iron, thus removing the carbon as carbon dioxide. A fragment of cast iron containing 4·71 per cent. of carbon was heated for two hours at 950° C. It was found that 71 per cent. of the carbon was converted into temper-carbon. The metal was then placed in a boat and heated in a porcelain tube to 1000° C., the tube also containing a small boat filled with oxide of iron, not in contact with the iron itself. After 25 hours, it was found that 56 per cent. of the carbon had been eliminated. The conclusions are finally drawn: (1) That the conversion is effected through the agency of oxygen, which forms carbon dioxide with the carbon in the metal. (2) The carbon dioxide penetrates the heated iron, and vaporises the temper-carbon therein as carbon monoxide. (3) Carbon dioxide is re-formed by the action of carbon monoxide on iron oxide. (4) If oxygen in the form of oxide be lacking, carbon dioxide will not be decomposed, and the proportion of carbon monoxide may rise so high in the gaseous mixture that a reverse reaction may ensue, so that the carbon monoxide formed may exert a carburising action on the metal.

Platinum-thallium alloy. L. Hackspill. Compt. rend. 1908, **146**, 820—822.

Spongy platinum dissolves in melted thallium. The alloy corresponding to the formula, PtTl, melts at 685° C., and is extremely brittle. Micrographically, alloys richer in thallium than this consist of a eutectic with crystals of the compound, PtTl; those richer in platinum are more homogeneous under the microscope, but slight oxidation in the Bunsen flame differentiates the excess of platinum from the other constituent.—J. T. D.

Copper; Leaching of copper ores and winning of pure ——. O. Frölich. Metallurgie, 1908, **5**, 206—212.

Copper pyrites is rendered readily soluble in acids and ferric chloride by heating for a short time at above 200° C. in the absence of air, preferably in rotating drums (Ger. Pat. 180,307; this J., 1907, 1283), one-quarter of the sulphur present being volatilised. The leaching of the heated ore is carried out in a vat provided with a central vertical cylinder having openings in its bottom and near the top. In this cylinder rotates a vertical screw conveyor, which draws ore and liquid into the cylinder at the bottom and discharges them back into the vat at the top, if finely crushed ores are used; if coarse ores are employed, only the liquid is circulated. To further hasten the extraction, the vat can be heated by passing steam into an outer jacket containing water. Experiments have shown that the energy E (in h.p.) necessary to rotate the screw is given by the formula

$$E = k\frac{g}{100} \times \frac{Q-q}{100} \times \frac{n}{100},$$

where k is a constant (about 0·254), g the height of the screw, in cm., Q the cross-section of the screw, q the cross-section of its shaft, and n the number of revolutions per minute. Thus, for a screw having a total volume of 62 cb. m., and making 450 revolutions per minute, the energy necessary is 33·2 h.p. With this apparatus, leaching is very quickly and completely effected. Deposition of the copper by means of iron is carried out in a similar apparatus, at about 60° C. A certain amount of a black oxide of iron is also formed in this operation. This oxide adheres to the copper, especially if a sulphate solution is used. It may be separated by agitation and washing, by electro-magnetic means, or by treatment with sulphuric or hydrochloric acid in the same apparatus, air being excluded. The purified copper is stated to be of the same quality as electrolytic copper. The leaching solution is regenerated by bringing it into contact with air, a part of the iron being precipitated as ferric hydroxide and the remainder oxidised to ferric chloride or sulphate.—A. G. L.

Zinc; Determination of —— [*by evolution of hydrogen*]. *Necessity for avoiding india-rubber joints.* L. de Koninck. Bull. Soc. chim. Belg., 1908, 22, 113.

The author has previously shown that in determining the metallic zinc in zinc dust by measuring the hydrogen evolved on treatment with acid, it is necessary to avoid india-rubber connections in the apparatus, as otherwise there is a loss of hydrogen. In order to determine whether this is due to absorption or diffusion, an india-rubber tube was placed in a measured volume of hydrogen within an outer tube of glass. As the volume of hydrogen showed not the slightest diminution under these conditions the difficulty mentioned above must be due to diffusion only.—E. F.

Ammonium phosphomolybdate; Variations in composition of ——. *Application to the determination of phosphorus in iron and steel.* G. Chesneau. *See* XXIII.

Mercury vapour; Determination of —— *in air.* A. Ménière. *See* XXIII.

"*Cell-pitch*" *from sulphite wood pulp waste liquors.* W. Sembritzki. *See* XIX.

Patents.

Zinc; Appliances used in the extraction of ——. The New Delaville Spelter Co., Ltd., Birmingham, and E. H. Shortman, Bloxwich. Eng. Pat. 7223, Mar. 26, 1907.

An addition is made to the ordinary retort and condenser used in zinc extraction, consisting of a short pipe or sleeve containing a medium (*e.g.*, small pieces of coal or coke) capable of removing lead from the zinc vapours. This receptacle is carried in the end of the condenser adjacent to the retort, so that all the zinc vapours must pass through it. At any stage in the process, the receptacle may be removed from operation by being pushed by a crowbar into the retort.—J. W. H.

Zinc; Extraction of ——. The New Delaville Spelter Co., Ltd., Birmingham, and E. H. Shortman, Bloxwich. Eng. Pat. 7223a, Mar. 26, 1907.

Anthracite, non-bituminous coal or hard coke is used to intercept lead vapours during the extraction of zinc. The medium acts physically, and is carried in a displaceable receptacle (see preceding abstract).—J. W. H.

Zinc; Process and apparatus for extracting ——. The New Delaville Spelter Co., Ltd., and E. H. Shortman. Fr. Pat. 384,637, Dec. 3, 1907. Under Int. Conv., March 26, 1907.

See Eng. Pat. 7223 of 1907; preceding.—T. F. B.

Zinc ores; Treatment of oxidised —— (calamines, oxides, silicates). A. H. Imbert. Fr. Pat. 384,754, Feb. 13, 1907.

See Eng. Pat. 12,592 of 1907; this J., 1908, 339.—T. F. B.

Zinc; Reduction of —— from powdered ores. E. Blass. Ger. Pat. 196,473, April 7, 1906.

According to Fr. Pat. 356,097, the powdered ore mixed with a quantity of charcoal sufficient to prevent as far as possible, any re-oxidation of the zinc, is "blown" in a furnace, an air-blast at the ordinary temperature being used. According to the present patent, the blast is previously heated to 800°—1000° C. It is stated that in this way re-oxidation of the zinc is entirely prevented. —A. S.

Ores containing iron, zinc, lead, etc.; Metallurgy of ——. M. Liebig. Ger. Pat. 196,284, Sept. 27, 1904.

The roasted ore, whilst still warm, is mixed with a quantity of coke sufficient for the reduction of the ore to metal, with formation of carbon monoxide. The charge is then mixed with suitable fluxes, and subjected to a reduction process in order to reduce iron compounds to spongy iron, whilst leaving zinc oxide, lead oxide, etc., unacted upon. It is next smelted in a furnace resembling the lower part of an iron blast-furnace, whereby the iron is melted, and the other metal oxides are reduced by the molten iron. The metallic lead produced partly collects below the iron and is partly volatilised along with the zinc. The fumes (zinc and lead) are condensed in annular receptacles arranged around the furnace. Uncondensed fumes escape with the furnace-gases. A portion of these is used for the reduction of the next charge of ore, whilst the remainder is passed through a dust-chamber or scrubber and then used for heating or power purposes. —A. S.

Cast-iron; De-siliconising or purifying of —— which can be utilised in the manufacture of basic open hearth steel and for other purposes. W. Muirhead, Shettleston, N.B. Eng. Pat. 7946, Apr. 5, 1907.

Cast iron scrap (6 tons) is melted in an open-hearth furnace, preferably acid lined. Cast iron borings or iron or steel turnings (2 to 3 tons) are then gradually added, 50 to 75 per cent. of the silicon and carbon present being oxidised during this operation. The metal is then transferred to a basic open-hearth furnace already containing a charge of molten iron or steel (9 to 11 tons) or else it is treated in a converter.—A. G. L.

Steel for armour plates and other uses; Manufacture of ——. C. P. E. Schneider, Le Creusot, France. Eng. Pat. 17,519, July 31, 1907.

See Fr. Pat. 379,188 of 1906; this J., 1907, 1202.—T. F. B.

Steel; Art of hardening and toughening ——. J. Churchward, New York. U.S. Pat. 883,698, April 7, 1908.

An alloyed steel is formed containing nickel, chromium, tungsten, manganese and vanadium, the temperature of the metal bath being raised to about 1960° C. when metallic chromium is used, or from 1600° C. to 1960° C. if ferro-chromium be employed. After keeping at the necessary temperature for a short time, the whole is cast in a mould. It may then be pressed and finally subjected to a series of alternate heatings and quenchings at temperatures about 50° C. below the retardation points of the several alloying metals, starting at the highest of these and continuing downwards. The result it is claimed, is a hardened and toughened steel.—C. A. W.

Steels; Art of producing alloyed ——. J. Churchward, New York. U.S. Pat. 884,009, April 7, 1908.

The iron or steel is melted with the alloying metals, nickel and manganese, and the temperature of the bath maintained at about 3600° F. for 15 to 60 minutes. After the addition of chromium, or chromium and tungsten together, the bath is kept at a temperature of not less than 3000° F. for 15 to 40 minutes when, finally, the charge is run off.—C. A. W.

Steel; Manufacture of ——. A. Reynolds. Fr. Pat. 384,599, Dec. 2, 1907. Under Int. Conv., Dec. 8, 1906.

See Eng. Pat. 28,030 of 1906; this J., 1908, 26.—T. F. B.

Metals such as steel or steel alloys; Treatment of ——, to alter, improve, or accentuate their qualities or properties. W. F. L. Lowndes. Fr. Pat. 384,689, Dec. 5, 1907. Under Int. Conv., Dec. 7, 1906.

See Eng. Pat. 27,914 of 1906; this J., 1908, 79.—T. F. B.

Ore or like material; Process and apparatus for treating —— by the aid of heat. J. H. Reid, Cornwall, Canada. Eng. Pat. 10,750, May 8, 1907.

See Fr. Pat. 379,566 of 1907; this J., 1907, 1242.—T. F. B.

Reverberatory furnaces. A. J. Boult, London. From T. S. Blair, Elmhurst, Ill., U.S.A. Eng. Pat. 21,010, Sept. 21, 1907.

See Fr. Pat. 382,135 of 1907; this J., 1908, 232.—T. F. B.

Incombustible materials having different melting points; Separation of ——. M. Leitch, Brooklyn, N.Y., Assignor to Metal Process Co., New York. U.S. Pat. 883,208, March 31, 1908.

The materials, of which one at least is oxidisable and both of which are solid at ordinary temperatures, are fed continuously into a centrifugal machine wherein there is a deoxidised atmosphere, obtained by a process of combustion, the heat evolved in which is used to raise the gases to a temperature at least equal to the melting point of the low-melting substance, but not so high as that of the other substance. On rapidly rotating the apparatus, the materials may be separately collected. The products of combustion pass out through the feeding aperture and so prevent access of air at that point. (See following abstract.)—C. A. W.

Tin-scrap; Method and apparatus for treating (detinning) ——. M. Leitch, Elizabeth, N.J., Assignor to Metal Process Co., New York. U.S. Pats. 883,210, 883,211, 883,410, and 883,411, March 31, 1908. (See preceding abstract.)

The scrap is heated in a deoxidized atmosphere and torn apart, while still hot, by sets of teeth working against each other and by means of a cutting arrangement in connection therewith. The apparatus may consist of a revolving cylinder, slightly inclined to the horizontal and having an opening at the upper end for the reception of the material, the discharge being made at the lower extremity through an aperture sealed against the atmosphere. By some arrangement at this latter point, a heated deoxidized atmosphere is maintained within the apparatus. The combustion chamber at the lower end is surrounded with projections which can be rapidly revolved, similar projections being provided on the internal walls of the exterior cylinder. The removal of the tin is afterwards effected, in a closed chamber, by surrounding the scrap alternately with dry chlorine gas and anhydrous stannic chloride. The apparatus for this consists of a detinning chamber which can be exhausted of air, when necessary, after the removal of the chloride. Before recharging with chlorine gas the chamber may be cooled in order to condense any vapours contained therein. —C. A. W.

Detinning; Method of ——. E. A. Sperry, Brooklyn, N.Y. U.S. Pat. 883,500, March 31, 1908.

The scrap is classified according to the foreign matter associated with it, the scrap forming one of the classes being cleaned by subjecting it to the action of a saponifying solution, and, after removal of excess of the reagent, heated to a high temperature. The whole of the material, of which part has been treated in this way, is afterwards heated preparatory to the removal of the tin by some dry process.—C. A. W.

Metals and alloys; Process and apparatus for obtaining —— by reduction. E. Viel, Rennes, France. U.S. Pats. 883,594 and 883,595, March 31, 1908.

See Fr. Pat. 359,042 of 1905 and addition thereto; this J., 1906, 323, and 1907, 419.—T. F. B.

Blast-furnace slag; Treatment of ——. F. W. Wood, Baltimore, Md. U.S. Pat. 883,770, April 7, 1908.

The molten slag is allowed to pass gradually downward over an inclined cooling surface while, at the same time, the mass is subjected to a continual agitation by an alternating movement across the line of flow. In this way the material is obtained in a granular condition. —C. A. W.

Copper; Process for obtaining pure —— from a solution of copper. L. Jumau, Paris. U.S. Pat. 883,962, April 7, 1908.

See Addition of Oct. 27, 1906, to Fr. Pat. 367,452 of 1906; this J., 1907, 419.—T. F. B.

Copper; Apparatus for making ——. M. A. Jullien and E. L. Dessolle, Levallois-Perret, France. U.S. Pat. 884,021, April 7, 1908.

See Fr. Pat. 369,746 of 1906; this J., 1907, 210.—T. F. B.

Sulphide ores; Treatment of —— by the precipitation process. A. H. Imbert. Fr. Pat. 384,717, Feb. 12, 1907.

See Eng. Pat. 12,591 of 1907; this J., 1908, 339.—T. F. B.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(*A.*)—ELECTRO-CHEMISTRY.

Hydrogen peroxide cell. H. T. Barnes and G. W. Shearer. J. of Phys. Chem., 1908, **12**, 155—162.

With an electrolytic cell composed of magnesium, aluminium sulphate solution, and aluminium, it was found that a considerable current could be obtained, and further that on addition of hydrogen peroxide, the E.M.F. was increased to 1·7 and even to 2·1 volts. The E.M.F. of the cell on closed circuit shows a gradual rise to a maximum and then a gradual fall, but addition of fresh hydrogen peroxide always results in a rise of the E.M.F. to the maximum value. Experiments showed that metallic aluminium, in contact with water and oxygen, develops hydrogen peroxide, the probable reaction being:

$$2Al + 6H_2O + 6O = Al_2(OH)_6 + 3H_2O_2.$$

The explanation of the abnormally high E.M.F. developed between magnesium and aluminium, two metals close together in the ordinary electrochemical series, would appear to be that the hydrogen peroxide formed as mentioned above acts as an electrode. The addition of fresh hydrogen peroxide serves merely to augment the concentration of this compound around the aluminium and thus increase the effect. When the cell supplies current, the cathodic action of the aluminium is to remove the surface film of hydroxide and to decompose the hydrogen peroxide. The first action is accompanied by an increase in E.M.F. and current, whilst the decomposition of the peroxide causes the slow falling-off in E.M.F. and current after the maximum value has been reached. The authors were unable, by means of the potassium iodide and starch test, to detect any formation of hydrogen peroxide by the action of water and oxygen on zinc.—A. S.

Fused calcium chloride; Decomposition-potential of ——. K. Arndt and K. Willner. Z. Elektrochem., 1908, **14**, 216—218.

The authors have determined the potential of polarisation of electrolysed calcium chloride as 3.25 volts at 800° C., and the E.M.F. of the cell, $Ca/CaCl_2/Cl_2$, at the same temperature as 3.23 volts. The rate of change of this with temperature, calculated from the equation:

$$E = Q - T\frac{dE}{dT}$$

and putting Q (heat of formation of calcium chloride) as 85 calories, is $\frac{dE}{dT} = -0{\cdot}0004$. —J. T. D.

Nickel; Electrolytic determination of —— in solution as nitrate, and its separation from copper. A. Thiel. *See* XXIII.

Bismuth; Electrolytic determination of ——. F. J. Metzger and H. T. Beans. *See* XXIII.

Patents.

Electric furnaces [for manufacture of slag cement]. S. O. Cowper-Coles, London. Eng. Pat. 7742, April 2, 1907.

The furnace is designed especially to eliminate sulphur by electrolysis in the manufacture of cement from slag. It consists of a reverberatory furnace, having an inclined hearth, sloping from the feeding hopper to the tap-hole. Close to the latter are placed two horizontal electrodes, between which the material fused on the upper part of the hearth has to pass on its way to the tap-hole. The quantity of material flowing to the electrodes is regulated by a vertical slide, which can be raised or lowered on to the hearth close to the electrodes.—A. G. L.

Furnace; Electric arc ——. S. D. Spence, Chattanooga, Tenn., Assignor to L. Shepherd and D. L. Snodgrass. U.S. Pat. 880,338, Feb. 25, 1908.

The furnace is of oblong rectangular form and is provided with a removable cover. Through holes along this cover pass vertical electrodes; these are fastened above the furnace to a horizontal bar which can be raised or lowered as required. The shape of the electrodes is that of an inverted T, and they are so placed within the furnace that the extremities of their horizontal arms are opposed to holes along the sides. Through these holes, which are contracted inwardly, horizontal electrodes are passed, these last being pivoted so that they may be turned vertically together through a small angle; in this way their extremities can be raised or lowered within the furnace and so kept at the same level as the inner carbons. By a further adjustment they may be partially removed from the furnace. The several arcs, which can be varied in length as required, are made between the horizontal extremities of the T-shaped electrodes and the opposing points of the pivoted carbons.—C. A. W.

Furnace; Electric ——. E. Appleby, Chicago, Ill. U.S. Pat. 882,733, March 24, 1908.

A receptacle, vertically disposed, is mounted in a frame, together with a pair of electrodes, the latter extending into the lower part of the receptacle. The bottom of the vessel is supported by a strut, which may be moved downwards away from the electrodes, and the walls are so made as to permit of a considerable range of vertical movement of the bottom of the vessel, without breaking the continuity of the walls. The receptacle is provided with horizontal trunnions, and, when the vessel is lowered clear of the electrodes, these engage with a pair of Y-shaped bearings carried on a car. The strut, operated by mechanism below the tracks supporting the car, may be lowered still further, so as to be clear of the receptacle, and permit the latter to be moved on the tracks and afterwards tilted on its bearings for discharging its contents. —B. N

Furnace; Electric ——. A. L. Marsh, Lake Bluff, Ill., Assignor to Hoskins Co., Chicago, Ill. U.S. Pat. 882,788, March 24, 1908.

The furnace chamber forms a variable resistance rheostat, which constitutes the furnace-resister, this being composed of a series of rings of solid carbonaceous material. The chamber is enclosed in a metal-sheathed casing of insulating material, through the base of which passes a terminal, the latter being attached to a head in contact with the rings. By means of a screw working in a stationary nut below the furnace, the head may be raised or lowered, in order to increase or decrease the pressure between the sections of the resister. The second terminal is attached to the cover of the furnace, both connections being made in a suitable manner with lead.—B. N.

Furnace; Electric resistance ——. E. R. Taylor. Fr. Pat. 384,356, Nov. 26, 1907.

See U.S. Pat. 871,971 of 1907; this J., 1908, 27.—T. F. B.

Ozone; Electrodes for the evolution of —— from oxygen or atmospheric air. J. R. Craig, Glasgow. Eng. Pat. 8036, April 6, 1907.

The invention is an improvement on Eng. Pat. 16,681 of 1906. The electrodes generally consist of metallic springs, supported in a state of tension on the edges of thin sheets of a dielectric, *e.g.*, "micanite" (a composition of mica and shellac) or glass, the two electrodes being at such a distance from one another that a spark could not cross the gap even in air. Less efficient but noiseless electrodes consist of metal bands or gauze, supported in the same way. The electrodes, as well as the sheets of dielectric material, are mounted as readily detachable units in a frame composed of metal hoops.—A. G. L.

Ozone; Electrical treatment of gases or vapours and especially of air or oxygen for the production of —— and apparatus therefor. J. E. Richardson and J. A. Vaughan, Belfast. Eng. Pat. 13,342, June 8, 1907.

The air, oxygen, or other gas, is passed through an unobstructed cylindrical or tubular chamber forming one electrode, a wire or its equivalent being disposed axially in the chamber without the interposition of dielectrics, and forming the second electrode. With an appropriate current, the chamber may thus be filled with a silent electrical discharge, or a sparking discharge may be passed between the enclosing and axial electrodes. The gas may be passed through a series of such chambers, or the chamber may be lengthened and provided with successive pairs of electrodes, the discharges in the different chambers or sections being created by currents of different nature, potential, frequency or rate of discharge.—B. N.

Insulating materials adapted for electric insulation, waterproof and like materials, and for other like uses, and method of producing the same. A. G. Brookes, London. From Asbestos Wood Co., Portland, U.S.A. Eng. Pat. 16,865, July 23, 1907.

See U.S. Pat. 865,606 of 1907; this J., 1907, 1097.—T.F.B.

Chromic acid; Electrolytic production of ——. M. Le Blanc, Karlsruhe, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 883,651, March 31, 1908.

See Eng. Pat. 27,009 of 1905; this J., 1906, 1052.—T. F. B.

Electrolytic cell. A. S. Gray, Assignor to R. J. Beatty, Chicago, Ill. U.S. Pat. 884,015, April 7, 1908.

The cell is provided with an upper cathode and lower anode, these being separated by a diaphragm. The electrolyte is circulated throughout the cell, passing away at an outlet below the cathode and entering above the anode. A separate circulation may be maintained within the cathode chamber and multiple vents are provided in this compartment for the escape of the evolved gases.—C. A. W.

Electrolysis of fluid salts or compounds. H. S. Blackmore, Mount Vernon, N.Y. U.S. Pat. 884,124, April 7, 1908.

In addition to the electrolyte, an independent liquid is provided, the two being separated from each other by some conducting fluid of greater density, and diffusion prevented throughout the whole by permeable partitions. The liquids may be arranged in a series of successive divisions, but in any case the current is arranged to pass through the electrolyte and the independent bodies of fluid.—C. A. W.

Fusing materials; [Electrolytic] Process of ——. G. F. Brindley, Niagara Falls, Assignor to The Roessler and Hasslacher Chemical Co., New York. U.S. Pat. 884,563, April 14, 1908.

See Fr. Pat. 366,523 of 1906; this J., 1906, 1053.—T. F. B.

Electrode for reversible galvanic batteries. E. W. Jungner, Kneippbaden, Assignor to Nya Ackumulator Aktiebolaget Jungner, Stockholm. U.S. Pat. 884,930, April 14, 1908.

See Eng. Pat. 21,402 of 1904; this J., 1905, 94.—T. F. B.

Conductors for electricity in the cold; Production of —— from conductors of the second class. E. von Seemen. Fr. Pat. 384,105, Nov. 18, 1907.

Conductors belonging to Nernst's second class, for instance:—silica, alumina, magnesia, lime, etc., are mixed with a suitable proportion of a metallic oxide and melted in an electric furnace. If the metallic oxide is liable to be reduced to metal at the temperature necessary for fusion, it is either mixed with an oxygen carrier such as nitre, or a current of air or oxygen is passed through the furnace.—W. H. C.

Active mass of accumulators; Agglutinating material for consolidating the ——. Q. Marino and E. W. Barton-Wright. Fr. Pat. 384,295, Nov. 23, 1907. Under Int. Conv., Nov. 29, 1906.

To castor oil is added 5 to 6 per cent. of its weight of finely-divided litharge and 3 to 4 per cent. of manganese dioxide, the mixture being boiled and then allowed to clarify. The oil is separated from the powder by decantation, and is then dissolved in benzene or alcohol, the solution being mixed with a fresh quantity of litharge, in the proportion of 10 per cent. of oil and 90 per cent. of litharge. Sulphuric acid, containing one part of acid to six parts of water, is then added in order to form a paste.—B. N.

Metal filaments from colloidal metals. Eng. Pat. 20,372. *See* II.

Incandescence filaments, etc. Fr. Pats. 384,413, 384,414, and 384,421. *See* II.

(*B.*)—ELECTRO-METALLURGY.

Copper sulphate solutions; Use of sulphur dioxide from furnace gases in the electrolysis of ——. K. Reinartz. Metallurgie, 1908, **5**, 202—205.

In electrolysing (with insoluble anodes) crude copper sulphate solutions containing iron, such as are obtained by leaching roasted ores, the current efficiency is greatly improved if sulphur dioxide is passed into the liquid at the anode. In the author's experiments, three compartments of triangular section were formed at the bottom of the depositing vat by means of six inclined perforated lead plates, which served as anodes. From the apex of each of these compartments a perforated lead plate coated with acid-proof paint extended vertically upwards, dividing the interior of the vat into four additional large compartments, in the centre two of which two copper drums revolved. These constituted the cathodes. The three lower compartments were filled with coarse sand, and traversed by a mixture of 95 per cent. of air and 5 of sulphur dioxide at such a pressure that the gases did not bubble upwards through the liquid. With a current of 5 ampères at 2 volts a current efficiency of 90 to 100 per cent. was obtained at the cathode (deposition of copper), the efficiency at the anode (formation of sulphuric acid) being 65 per cent. When solutions free from iron were used, the efficiency at the anode dropped to 60 per cent. Using solutions containing iron, but without leading in sulphur dioxide, the efficiency at the cathode was 26 per cent.—A. G. L.

Patents.

Electrodeposition of metal on hollow articles. E. Friedheim. Paris. Eng. Pat. 7563, March 30, 1907. Under Int. Conv., March 30, 1906.

See Fr. Pat. 364,736 of 1906 and Addition thereto; this J., 1906, 994, and 1907, 1018.—T. F. B.

Metals; Electroplating ——. H. Schmidt, Cologne. Eng. Pat. 18,480, Aug. 15, 1907. Under Int. Conv. Sept. 5, 1906.

A "poreless" deposit is produced by first giving the metal article a coating of a metal or alloy which melts at a lower temperature than the desired outer layer. The latter is next deposited electrolytically and the inner coating is then melted.—B. N.

Metals; Apparatus for the electrodeposition of ——. S. O. Cowper-Coles, London. Eng. Pat. 25,126, Nov. 12, 1907.

The electrolyte is supplied to a central chamber and passes through perforations in the walls, issuing in the form of jets which impinge on the surface of the cathodes. The anodes are in the form of strips, between which the electrolyte is sprayed on to the cathodes. The latter, which are arranged adjacent to the anodes, have an "up-and-down and to-and-fro" movement imparted to them by means of eccentrics.—B. N.

Manganese silicide; Producing —— [*electrically*]. E. F. Price, Niagara Falls, N.Y., Assignor to Central Trust Co., New York. U.S. Pat. 882,582, March 24, 1908.

The charge, containing compounds of manganese and silicon together with carbon, is smelted by passing an electric current through the mass, the current or energy density being increased to a point where reduction is effected.—B. N.

Tin; [*Electrolytic*] *Cyclic process of recovering metallic* ——. F. von Kügelgen, Holcombs Rock, Va., and G. O. Seward, New York. U.S. Pat. 883,139, March 24, 1908.

A charge of the tin-bearing material is treated with an anhydrous "selective" solvent of tin, such as chlorine, in order to produce stannic chloride. This compound is hydrated, and decomposed electrolytically into metallic tin and an acid radical, the latter being dried and again used for treating another charge of the material.—B. N.

Tin; Electrolytic production of pure ——. A. J. M. Thirot, Bourges, Assignor to L. A. Mage, Avignon, France. U.S. Pat. 883,589, March 31, 1908.

See Fr. Pat. 364,589 of 1906; this J., 1906, 892.—T. F. B.

Electrode for recovery of metals by electrolysis. S. B. Christy, Berkeley, Cal. U.S. Pat. 883,170, March 31, 1908.

Compound electrodes are made of some pervious conducting material, such as powdered charcoal, treated in a suitable manner and arranged in a box of some non-conducting substance with permeable sides, so as to permit a free circulation of the liquid throughout the system. These electrodes are arranged at suitable intervals between an ordinary anode and cathode in such a way that, on passing the current, their alternate faces will be negatively or positively electrified, that face nearest the anode being negatively charged.—C. A. W.

Copper; Electrometallurgical process for extracting —— *from its ores.* L. Jumau, Paris. U.S. Pat. 883,961, April 7, 1908.

See Addition of July 11, 1906, to Fr. Pat. 359,913 of 1905; this J., 1907, 24.—T. F. B.

Iron; Electrodeposition of ——. S. O. Cowper-Cowles, London. U.S. Pat. 884,075, April 7, 1908.

See Eng. Pat. 28,897 of 1906; this J., 1907, 699.—T. F. B.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

Oils; Japanese vegetable ——. M. Tsujimoto. J. Coll. Engineering, Imp. University, Tokio, 1908, **4**, 75—88.

Tsubaki oil is obtained from the seeds of the tsubaki tree (*Thea japonica*), which grows to a height of 10 to 20 feet, notably in the island of Idzu. The kernels examined contained 64·33 to 66·42 per cent. of oil, 4·24 to 5·58 per cent. of moisture, and 1·60 to 1·75 per cent. of ash. The commercial oil ranges from yellow to reddish-yellow in colour, and has a rancid odour, but the cold-drawn oil from fresh seeds has a pale yellow colour, and a pleasant taste, and little odour. It is a non-drying oil, closely resembling olive oil in its properties, but differing in the fact that it does not begin to solidify until cooled to -10° C. It yields a hard elaidin, does not form bromides insoluble in ether on brominating either the oil or its fatty acids, and from the results of Hazura's oxidation test appears to consist solely of olein. Twelve samples, including some extracted in the laboratory, gave the following results:—Sp. gr. at 15·5° C., 0·9159 to 0·9166; acid value, 1·63 to 8·84; saponification value, 189·9 to 192·6; iodine value (Wijs), 80·07 to 81·32; refractive index at 20° C., 1·4679 to 1·4691; Hehner value (two samples), 95·3, 95·6; and Reichert-Meissl value (two samples), 0·48, 0·53. Tsubaki oil is chiefly used as a hair oil and for lubricating delicate machinery. Owing to its high price it is largely adulterated, usually with rape, cottonseed, bean, and arachis oils. Bieber's reagent (a mixture in equal parts by weight of water, fuming nitric acid and concentrated sulphuric acid) affords a test of purity. When 7 c.c. of the reagent are added to 2 c.c. of the oil, a green coloration is produced at the zone of contact, and when shaken, the liquid becomes bluish-green, changing to yellowish and finally, after standing for some hours, to greenish-yellow. In the case of adulterated oils the green coloration is not of a bluish shade, and, on standing, a reddish tint is developed.

Sasanqua oil is obtained from the seeds of *Thea sasanqua*, a plant resembling tsubaki. The kernels of the seeds yielded 58·1 to 59·39 per cent. of a pale yellow oil having the following values:—Sp. gr. at 15° C., 0·9163—0·9188; acid value, 0·36—6·78; saponification value, 193·36—193·9; iodine value, 81·67—82·31; refractive index at 20° C., 1·4691; Hehner value, 96·35; and Reichert-Meissl value, 1·17. The oil became turbid at —5° C., and solidified at —9° C. It yielded a hard mass in the elaidin test, and was found to consist chiefly of olein. It is used principally as a hair oil and as a substitute for tsubaki oil, from which, however, it may be distinguished by the fact that when tested with Bieber's reagent it gives a yellowish-green colour changing, after 24 hours, to orange yellow.

Kaya oil is expressed from the seeds of *Torreya nucifera*, a plant growing in the mountainous districts of Japan. The kernels contain about 51 per cent. of a light yellow oil with a faint odour and mild taste. When heated in a thin layer for three hours at 100° C., it dries, forming an elastic film, but its drying capacity is inferior to that of linseed oil. It can be cooled to —20°C. without becoming turbid, and does not yield a solid mass in the elaidin test, or any precipitate in the hexabromide test. The following results were obtained:—Sp. gr. at 15° C., 0·9233—0·9244; acid value, 1·48—12·66; saponification value, 187·95—188·38; refractive index at 20° C., 1·4760—1·4757; Hehner value, 95·7; and Reichert-Meissl value, 0·93. The mixed fatty acids yielded linolic tetrabromide (m. pt. 114° C.). Kaya oil is used as an edible oil, for burning, in the manufacture of oil-papers, as an insecticide, etc., and is suitable for the manufacture of paints and varnishes.

Inukaya oil from the seeds of an evergreen plant *Cephalotaxus drupacea* (*Taxaceæ*) is a light yellow liquid with a slightly resinous odour. A cold-drawn sample from seed kernels containing 67 per cent. of oil did not solidify at —15° C. It dried in four hours at 100° C. and gave the following values:—Sp. gr. at 15·5° C., 0·9250; saponification value, 188·54; iodine value (Wijs) 130·33; and refractive index at 20° C., 1·4760. This oil could be used for the same purposes as kaya oil, though its odour might prevent its being used for food.

Kusu oil is contained in the fruit of the camphor-yielding tree, *Cinnamonum camphora Nees* (*Lauraceæ*) and may be extracted by powdering and expressing the fruit at a somewhat high temperature. The oil is a white crystalline mass with an odour recalling that of cocoanut oil. A sample gave the following results:—Sp. gr. at 25° C., 0·9267; at 100° C., 0·8760: m. pt., 22·8° C.; acid value, 4·70; saponification value, 283·76; iodine value (Wijs), 4·49; refractive index at 25° C., 1·4517; Reichert-Meissl value, 0·53; *Fatty acids*:—Sp. gr. at 100° C., 0·8412; m. pt., 21° C.; neutralisation value, 292·83; mean molecular weight, 191·57; and iodine value, 5·07. The high saponification value and low Reichert-Meissl value point to the presence of laurin as the chief constituent. The oil could probably be used for the same purposes as cocoanut oil.

Inukusu oil is obtained from the fruit of the tree, *Machilus Thunbergii*, belonging to the *Lauraceæ*. It is a brownish-yellow liquid which yields crystalline deposits when chilled. A sample gave the following results :—Sp. gr. at 25° C., 0·9347 ; acid value, 19·31 ; saponification value, 241·39 ; iodine value (Wijs) 66·08 ; refractive index at 25° C., 1·4646 ; and Reichert-Meissl value, 2·05. The oil resembles kusu oil, but its lower saponification value and higher iodine value indicate the presence of glycerides of higher unsaturated fatty acids.—C. A. M.

Chrysalis oil ; Composition of ——. M. Tsujimoto. J. Coll. Engineering, Imp. University, Tokyo, 1908, **4**, 63—74. (See also this J., 1907, 24, 622).

The chrysalis waste was formerly used as a fertiliser or as fish-bait, but is now used as a raw material for oil throughout the silk-producing districts of Nagano and other parts of Japan. The oil, obtained by steaming the dried powdered substance and expressing it in a screw or wedge press, is used in the manufacture of soap, whilst the press-cake is a valued fertiliser. The chrysalis waste examined by the author contained 5·48 per cent. of moisture, 26·26 per cent. of oil, and 3·77 per cent. of ash. The oil was a yellowish-red liquid with unpleasant odour. It solidified at 0° C., and gave analytical values differing considerably from those observed by Lewkowitsch (this J., 1907, 24) :—Sp. gr. at 15·5° C., 0·9280 ; acid value, 18·68 ; saponification value, 194·12 ; iodine value (Wijs), 131·96 ; Hehner value, 94·5 ; Reichert-Meissl value, 3·38 ; true acetyl value (Lewkowitsch) 19·72 ; refractive index at 20° C., 1·4757. *Fatty acids* :—Sp. gr. at 100°/15·5° C., 0·8513 ; m. pt., 36·5° C. ; solidification point, 27°—28° C. ; neutralisation value, 199·34 ; mean molecular weight, 281·43 ; iodine value, 135·83 ; unsaturated acids (iodine value, 178·73), 75 per cent. ; and m. pt. of saturated acids, 57° C. The unsaponifiable matter (1·63 per cent.) was found to consist in the main of phytosterol (m. pt., 143·5° C.), (not cholesterol as in the oil examined by Lewkowitsch, this J., 1907, 622), together with a wax-like substance melting below 100° C. and probably identical with the hydrocarbon described by Lewkowitsch. The oil contained 9·42 per cent. of glycerol, and the unsaturated fatty acids consisted of oleic, linolenic and isolinolenic acids and perhaps some isomerides of linolic acid. From the amount of hexabromide obtained it was calculated that the linolenic acid constituted 4·38 per cent. of the mixed fatty acids. The fatty acids yielded no insoluble tetrabromide, but several tetrahydroxy acids were obtained by Hazura's oxidation method. Palmitic acid was identified among the solid fatty acids, but no stearic acid was found.—C. A. M.

Fat and unsaponifiable matter in animal substances ; New process for the determination of ——, *and a criticism of some of the present methods.* M. Kumagawa and K. Suto. Biochem. Zeits., 1908, **8**, 212—347.

A comprehensive paper, including a bibliography, the subject-matter being classified under the following headings :—(1), Comparative investigation of different extraction agents ; (2), nature of the ether extract ; (3), detection and determination of the residual fat in the flesh residue after extraction with alcohol ; (4), direct saponification of the "flesh powder" ; (5), comparative investigation of direct saponification with the present methods for the determination of fat ; (6), determination of cholesterol and other unsaponifiable substances ; (7), elementary composition of the fatty acids prepared by the authors' method ; (8), description of the authors' method ; (9), basis and justification of the authors' saponification method for the determination of fat. The method is as follows :—From 2 to 5 grms. of the material are boiled on the water-bath with 25 c.c. of 5-*N* sodium hydroxide solution for two hours, during which the mixture is stirred occasionally with a glass rod. The whole is then transferred, whilst still hot, to a stoppered separating funnel, and the containing vessel washed two or three times with 5 c.c. of warm water. The solution is next acidified with 30 c.c. of 20 per cent. of hydrochloric acid after being cooled to 40°—50° C. ; 20 c.c. of the acid are first added, and after thorough agitation and cooling, the remainder introduced. After again cooling, 70—100 c.c. of ether are added, and the whole well shaken. The clear aqueous layer is run off, and the brown ethereal solution transferred to a beaker, the separating funnel being rinsed twice with 5—10 c.c. of ether. The residue in the separator is now dissolved in 5 c.c. of $N/_1$ sodium hydroxide solution, well shaken with 30—50 c.c. of ether, and the acid aqueous solution from the first separation added. After shaking, the ethereal solution is separated, mixed with that obtained previously, and the whole evaporated. The residue is re-dissolved in ether, the solution filtered through asbestos, and again evaporated. The residue is dried at 50° C., extracted with petroleum ether, and the extract filtered through asbestos and evaporated to dryness, the residue being dried at 50° C. For the determination of the unsaponifiable matter, including cholesterol, the mixture of fatty acids, etc., prepared as described above, is dissolved in 50—70 c.c. of petroleum ether, and the solution shaken well with 30—40 times its volume of a $N/_5$ solution of potassium hydroxide in absolute alcohol. A volume of water equal to that of the alkali is now added, and the whole shaken once or twice. The petroleum ether solution of the unsaponifiable matter is separated from the aqueous alcoholic layer, and the latter washed with 30—40 c.c. of petroleum ether. The mixed petroleum ether solutions are evaporated, the residue dissolved in a small quantity of alcohol, treated with 0·5—1 c.c. of $N/_{10}$ alcoholic sodium hydroxide, and evaporated to dryness. The residue is dried for 15—30 minutes at 100° C., extracted with petroleum ether, the solution filtered through asbestos, and evaporated, and the residue dried at 100° C.
—A. S.

Patents.

Fatty or waxy bodies ; Treatment of —— *to facilitate saponification with alkalis, and apparatus therefor.* C. Mason and F. G. Geldart, Chiswick, and P. J. Fryer, London. Eng. Pat. 7561, March 28, 1907.

The fat or wax is made to pass successively through a series of vessels or chambers connected by narrow openings, and is subjected at the moment of issuing from these openings to the action of fine jets of steam under pressure. In the special apparatus claimed for carrying out this process, a vessel is divided into a series of chambers by means of conical truncated partitions, whilst a steam pipe passes through the centre, leaving small annular openings between itself and the partitions, so that the fatty substances can fall from chamber to chamber and meet the steam under pressure which issues from perforations in the pipe immediately below each annular opening. The product leaving the apparatus passes into a boiling solution of alkali, and immediate combination takes place.—C. A. M.

Compounds of ammonia and the higher fatty acids ; Application or utilisation of —— *for candle making and for other illuminating and heating purposes.* C. F. Boehringer und Soehne, Mannheim, Germany. Eng. Pat. 23,796, Oct. 28, 1907. Under Int. Conv., Nov. 13, 1906.

See Fr. Pat. 383,531 of 1907 ; this J., 1908, 326.—T. F. B.

Fatty compounds ; Process for preparing stable, clear solutions of certain ——. Kalle und Co., A.-G. Fr. Pat. 384,712, Dec. 6, 1907. Under Int. Conv., April 16, 1907.

See Eng. Pat. 27,383 of 1907 ; this J., 1908, 420—T. F. B.

Soap ; Process for the manufacture of floating ——. A. Stöhr, Harthau, Germany. U.S. Pat. 883,360, March 31, 1908.

See Eng. Pat. 13,451 of 1904 ; this J., 1904, 871.—T. F. B.

Beeswax ; Process of bleaching ——. A. Müller-Jacobs, Huntingdon, N.Y., Assignor to C. Müller-Jacobs, Huntingdon, and E. Weingärtner, Englewood, N.J. U.S. Pat. 883,661, March 31, 1908.

The beeswax is mixed with fullers' earth and heated to a temperature between 130° and 170° C. ; or the beeswax may be first heated to 130° C., the fullers' earth added, and the temperature raised to about 170° C.—C. A. M.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(*A.*)—PIGMENTS, PAINTS.

Patents.

Lithopone; Non-darkening ——, and process of making the same. I. P. Lihme. Assignor to the Grasselli Chemical Co., Cleveland, Ohio. U.S. Pat. 883,142, March 24, 1908.

Commercial barium sulphide and zinc sulphate are mixed in solution, so as to form barium sulphate and zinc sulphide. The product is heated in a muffle, and a soluble nitrate is added. in quantity corresponding to the reacting or darkening impurities, in order to prevent reaction amongst them.—B. N.

(1) *and* (5). *Paint compound.* (2), (6), (8). *Paint compound and process of making the same.* (3), (7), (9), (10). [*Paint*] *Oil.* (4). *Pigment compound and process of making the same.* W. N. Blakeman, jun., New York. U.S. Pats. 883,513—883,522, March 31, 1908.

A fatty oil is hydrated in several ways. (*a*) By exposure in shallow vessels with broad surfaces, to the action of air and light until sufficiently aerated, which may require several months, the time depending on climatic conditions. To test the oil, the film test may be resorted to: When 100 parts of the oil are ground with 240 parts of either lead sulphate or "sublimed lead," with the usual quantity of commercial liquid drier, and, being spread as a paint, it follows the brush in a smooth, homogeneous, and uniform film, does not run, or crack, and dries in from 3—5 hours, then the oil may be deemed in a satisfactory state for use as a vehicle for the pigment employed, and the hydration process may be arrested. Other ways of hydrating are given:—(*b*) The oil may be placed in thin layers, over the surface of a body of water. This vaporous atmosphere will shorten the process to a few weeks. (*c*) The oil may be placed in vessels with broad surfaces, and with 1/25 to 1/20 of 1 per cent. of pure water distributed on the bottom; the vessels are exposed to light, and the oil agitated at intervals, till the water has been absorbed and combined with the oil. The process is shortened from a few weeks to 6 or 8 days, by exposure to sunlight. (*d*) The oil is heated to about 140° F. with from 1/25 — 1/20 of 1 per cent. of pure water. (*e*) The oil may be first oxidised by heating the raw oil on "oxidisers," or by submitting it, with heat, to the action of pure oxygen under pressure; or by passing through it, whilst heated, well-dried air; or by adding to it a percentage of highly oxidised, or "boiled" oil of commerce. After oxidising, the oil may then be hydrated in any of the ways already described. After hydration the oil may be immediately used as a vehicle, but is best after "ageing" or "standing" for a few days. (1). A pigment deficient in spreading power is incorporated with a fatty oil which has thus been "hydrated." (2). A fatty oil is mixed with a "hydrated" fatty substance, such as hydrated tung oil, and the mixture incorporated with a pigment which contains no hydroxyl and is deficient in covering power. (3). A compound or mixture of a drying fatty oil with a "hydrated" fatty substance, such as "hydrated" tung oil. (4). A pigment deficient in covering power is ground into a paste with a fatty liquid previously hydrated, an attenuating oil being added if desired. (5). A pigment deficient in covering power is incorporated with an oil (*e.g.*, linseed oil) which has been made rancid. (6). A pigment containing no hydroxyl and deficient in covering power is incorporated with a mixture of a fatty oil, such as linseed oil, with a "hydrated or rancid" oil. (7). A mixture or compound of a drying fatty oil with linseed oil which has been made rancid. (8). A pigment containing no hydroxyl and deficient in covering power is ground into a paste with a fatty substance previously rendered rancid, an addition of an attenuating oil being made if desired. (9). Claim is made for the use of tung oil containing water in chemical combination, or for a mixture of "hydrated" tung oil with another oil (which may also be hydrated) with or without the addition of a drier. (10). The oil consists of tung oil "hydrated" and rendered rancid, or of a mixture thereof with another oil (which may also be hydrated) with or without the addition of a drier.—C. A. M.

(*B.*)—RESINS, VARNISHES.

Copals; Manila and Pontianak ——. G. Coffignier. Bull. Soc. Chim., 1908, **3**, 453—459.

Manila copal occurs in three forms; hard, semi-hard, and friable. The two extreme types have been examined. Hard Manila copal is met with in large pieces, varying in colour from dull white to red or brown; it is very brittle and has a very bright fracture. Some pieces are milky in the centre; the odour is aromatic. A specimen of the white variety had the sp. gr. 1·065 at 17° C.; acid value, 72·80; saponification value, 87. It melted at 190° C., softening at 80° C. These figures vary considerably from those found by other workers, with different specimens. Friable Manila copal occurs in mammilated pieces varying in colour from white to brown; it is brittle and the fracture is fairly brilliant, and frequently moist; the odour is aromatic; sp. gr. 1·060 at 17° C.; acid value, 145·2; saponification value, 185·1. It melts at 120° C., softening at 45° C. Pontianak copal has only been used during the last few years. It forms bulky pieces, generally transparent, sometimes milky; the colour ranges from bright yellow to reddish-brown; the fracture is slightly brilliant, sometimes moist. It powders easily. The odour is aromatic, resembling that of elemi. Sp. gr. 1·037 at 16° C.; acid value, 134·3; saponification value, 186·5. It melts at 135° C., softening at 55° C. The action of ordinary solvents is summarised as follows, the figures given indicating the percentage of insoluble resin.

Solvent.	Hard Manila copal.	Friable Manila copal.	Pontianak copal.
Ethyl alcohol	55·90	soluble	soluble
Methyl alcohol	64·60	7·30	13·50
Amyl alcohol	soluble	soluble	soluble
Ether.............	58·50	28.70	46·00
Chloroform	36·70	52·40	50·30
Benzene	63·90	57·90	63·00
Acetone...........	52·00	soluble	soluble
Oil of turpentine ..	73·20	64·10	66·40
Benzaldehyde	1·10	1·70	soluble
Aniline	soluble	soluble	soluble
Amyl acetate......	soluble	soluble	soluble
Carbon tetrachloride	69·00	62·00	61·90

In general properties, Pontianak copal closely approaches the friable Manila resin, except in the degree of solubility in ether, and in methyl alcohol.—J. O. B.

Japanese lacquer. K. Miyama. J. Coll. Engineering, Imp. University, Tokyo. 1908, **4**, 89—110.

Japanese lacquer, *Urushi*, is the milky juice that exudes from the trunk of the lacquer tree, *Rhus vernicifera.* On exposure to sunlight, or when warmed, it loses its moisture and becomes a brown oily liquid, to which oils, pigments, etc., are added to form the finished lacquer. The author finds that the chief constituent of the crude lacquer is an unsaturated polyhydric phenol, $C_{34}H_{50}O_4$, containing at least two hydroxyl groups in the ortho-positions, and absorbing 8 atoms of halogen, and for this substance he suggests the name *urushiol.* Specimens of lacquer collected from the same tree at different periods gave the following results:—Moisture, 17·81 to 27·62; urushiol, 64·14 to 77·63; gum, 2·62 to 7·57; and nitrogenous matter, 1·78 to 2·47 per cent. The lacquer collected during the summer is the best, and in the dried state contains 94·5 per cent. of urushiol. Lacquers imported from China and India contained more moisture, less urushiol (36·88 per cent. in inferior Chinese, and 26·39 per cent. in medium Indian), and more gum (23·5 and 37·78 per cent. in the Chinese and Indian samples respectively). The greater the proportion of urushiol the better the quality of the lacquer, whilst the more gum there is, the poorer the quality. The nitrogenous matter contains an oxidising enzyme essential to the drying of the lacquer at low temperatures. The drying process is retarded by raising the temperature above 50° C., and is suspended at 70° to 80° C.; but at temperatures above 100° C., drying takes place without enzymic action in 4 to 5 hours, at 150° C. within 30 minutes, and at 180° C. within 10 minutes. Lacquer which has lost the drying capacity at low temperatures, and urushiol, which does not dry by itself, readily dry above 100° C. The only change that takes place in the composition of the lacquer in drying at the ordinary temperature is slow absorption of oxygen, finally amounting to 5·75 per cent. increase of weight on the original substance; but during the drying at a high temperature, partial decomposition occurs in addition to absorption of oxygen. Urushiol may be dried by means of manganese peroxide, barium peroxide, litharge, magnesium peroxide, manganese hydroxide, potassium bichromate, or manganese resinate. But these driers rapidly blacken the lacquer and therefore cannot be used in transparent preparations. The drying is injured by acids, alkalis and some salts, including sodium chloride and ferrous sulphate. The lacquer is turned black when mixed with metallic powders, with the exception of silver, aluminium, gold, and platinum, whilst white pigments become black when mixed with it. Most organic lakes are also completely changed by it. The value of a lacquer depends upon the durability, transparency, lustre, and smoothness of the film it gives, and upon the time of drying and viscosity of the substance itself. The following method of analysis is recommended:—*Moisture*: About 1 grm. of the raw, or 2 grms. of finished lacquer, filtered through cotton, are dried on the water-bath until transparent, and then in the hot-water oven for 30 minutes. *Urushiol* is detected by its giving in very dilute solution a green coloration with ferric chloride, turning red on the addition of sodium carbonate. With barium hydroxide it gives a green precipitate, and with ammoniacal silver nitrate solution yields a silver mirror in the cold. The barium salt obtained when freshly-precipitated barium urushiolate is immediately thrown into a large volume of water is almost definite in composition, $BaC_{34}H_{48}O_8$, though the fresh precipitate varies in composition, the quantity of barium hydroxide absorbed by the urushiol varying with the strength of the barium solution. For the determination of the urushiol, the lacquer, free from moisture, is dissolved in 10 c.c. to 20 c.c. of absolute alcohol and left for 30 minutes to 1 hour, after which the liquid is filtered through a weighed filter, and the residue washed with absolute alcohol. The filtrate and washings are divided into two parts, in one of which the substances soluble in alcohol are determined. In the other the urushiol is determined by titration with $N/1$ barium hydroxide solution with phenolphthalein as indicator, one grm. of urushiol corresponding to 6·14 c.c. The reaction approximates to that in the equation:—$C_{34}H_{50}O_4 + 2Ba(OH)_2 = C_{34}H_{46}O_4Ba_2 + 2H_2O$. *Oils*: The difference between the matter soluble in alcohol and the urushiol gives the quantity of oils. *Gum arabic* is determined by extracting the residue on the filter with boiling water, and evaporating the solution, whilst the final insoluble residue gives the amount of *nitrogenous substances*. In the case of black finished lacquer, one or two drops of $N/2$ hydrochloric acid are added to the alcohol used in the determination of the substances soluble in alcohol to assist the solution. The substances soluble in alcohol are washed, first with hot water, then with hot sodium carbonate solution, and again with hot water, and redissolved in alcohol.—C. A. M.

Rosin oil; Contribution to the knowledge of ——. W. Schultze. Annalen, 1908, **359**, 129—144.

10,000 kilos. of American colophony were subjected to destructive distillation, the following products being obtained:—"crude rosin spirit" (sp. gr. up to 0·940), 5 per cent.; "light oil" (sp. gr. up to 0·960), 10; "crude oil" (sp. gr. 0·960—0·990), 60; "heavy oil" ("Brandöl") (sp. gr. 0·990—1·000), 5; and coke, 2·5 per cent. The "crude oil" fraction was re-distilled, the following portions being collected:—"light rosin spirit" (sp. gr. about 0·880), about 4 per cent.; "light oil" (sp. gr. 0·880—0·950), about 20; "medium oil" (sp. gr. 0·950—0·980), about 60; and "heavy oil" (sp. gr. 0·980—1·000), about 13 per cent. The "medium oil" fraction after washing with alkali and water formed the raw material for the author's experiments. It was found that this oil consisted of a complex mixture of saturated and unsaturated hydrocarbons. On treatment with concentrated sulphuric acid, the unsaturated hydrocarbons are removed, leaving behind a residue of saturated hydrocarbons amounting to about 37 per cent. On heating the mixture of saturated hydrocarbons with sulphur, the only products obtained were retene and a compound, $C_{18}H_{16}S$, which can itself be prepared by heating retene with sulphur. It would appear therefore that the mixture of saturated hydrocarbons contains hydrogenised derivatives of retene. On distilling the saturated hydrocarbons at a pressure of 11—12 mm., 35·6 per cent. comes over between 178° and 193° C., 36 per cent. at 193°—198·5° C., and 13·6 per cent. at 198·5°—230° C. The fraction distilling at 193°—198·5° C. at 11—12 mm., yielded when heated with manganese dioxide and dilute sulphuric acid, trimellitic acid and a hydrocarbon boiling at 198·5°—200° C. at 18·5—20 mm. The original refined rosin oil may be distinguished from the mixture of saturated hydrocarbons by two colour reactions. When dissolved in chloroform and treated with a few drops of concentrated sulphuric acid, the former gives a Bordeaux red coloration, soon changing to the colour of permanganate. When dissolved in chloroform and shaken with hydrochloric acid containing ferric chloride, it gives an intense violet coloration. The mixture of saturated hydrocarbons gives neither of these reactions.—A. S.

Patents.

Wood; Process and apparatus for extracting products from ——. F. Pope, New York, and W. C. Clark, Pittsburg. Eng. Pat. 6831, March 21, 1907.

See U.S. Pat. 852,078 of 1907; this J., 1907, 626.—T. F. B.

Resin; Manufacture of products resembling ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen, Germany. Eng. Pat. 16,245, July 15, 1907.

Substances resembling resins are obtained by heating 1 molecular proportion of naphthalene, in presence of acid, with more than half of a molecular proportion of formaldehyde or an equivalent quantity of a substance capable of generating formaldehyde. The products can be used in the manufacture of varnishes, sealing wax, etc. —A. S.

Synthetical resins; Manufacture of —— *for use as shellac substitutes.* Farbenfabriken vorm. F. Bayer und Co. Fr. Pat. 384,425, Nov. 27, 1907. Under Int. Conv., April 15, 1907.

o-Cresol is heated for several hours at 100° C. with formaldehyde, or substances capable of producing it, in the presence of acids, and the cooled mass washed with water and purified by treatment with steam. The resulting product is a hard resin, varying in colour from yellow to light brown, and melting at about 110° to 128° C. It is soluble in methyl and ethyl alcohols, dilute caustic alkali solutions, acetone, ether, carbon bisulphide, chloroform, etc.; less soluble in benzene, dichlorhydrin, carbon tetrachloride, turpentine oil, fatty oils, and acids. Used as a substitute for shellac it gives varnishes which dry well on wood or metal. The hardness of the product depends upon the proportion of formaldehyde used. —C. A. M.

Resins adapted for polishing purposes; Process for the production of ——. Chem. Fabr. Dr. Elkeles und Co., Berlin. Eng. Pat. 25,459, Nov. 16, 1907. Under Int. Conv., Nov. 16, 1906.

See Fr. Pat. 383,950 of 1907; this J., 1908, 412.—T. F. B.

Copals; Treatment of hard and semi-hard ——, *and the preparation of varnishes.* H. Terrisse, Assignor to Fabr. de Vernis et Prod. Chim. (Soc. Anon.), Vernier, Switzerland. U.S. Pat. 883,842, April 7, 1908.

A mixture of naphthalene, "oil," and a resin is heated until the resin is dissolved, and then boiled to expel the naphthalene and "oil." The product is mixed with linseed oil at a temperature of about 280° C., and oil of turpentine and a siccative are finally added.—A. S.

(*C.*)—INDIA-RUBBER, &c.

Latex of Hevea brasiliensis (Para rubber); Formic acid as a coagulant for ——. D. Spence. India-rubber J., 1908, **35**, 425—427.

The Hevea latex, as received, was a thick, white, milky fluid of faintly alkaline reaction, and contained 27·5 per cent. of technically pure, washed, dry rubber. It had been preserved by means of "formaline," of which six teaspoonfuls had been added per pint of latex. In coagulating it in bulk, it was found best to proceed by drawing off small but measured volumes (10 c.c. each) of the latex, adding to these varying amounts of the standard formic acid solution. After mixing the dilute acid with the latex, the various tests were set aside and observations made as to the time required for the complete separation and coagulation of the caoutchouc content of the various samples. The physical qualities of the clots were also determined, and thus an accurate estimate of the amount of acid required to produce the best results, was obtained. The amount of acid added to each of the small quantities of latex, was noted, and having determined the amount giving the best result when added to the standard volume of latex, it became a matter of simple calculation to find the amount of formic acid solution required to ensure the best conditions for coagulation with any given quantity of latex. For the sample in question, it was found as the result of three separate determinations, using 6 samples of latex, to which measured quantities of 5 per cent. formic acid were added, that the most rapid and complete coagulation, resulting in a product of standard quality, was obtained when to each 500 c.c. of latex, 20 to 25 c.c. of a 5 per cent. formic acid solution were added. This determination method does away with the use of litmus paper or any other such indicator, and requires only 4 or 5 test tubes and a graduated cylinder to carry it out. A comparison of results with those obtained with the usually employed acetic acid, indicated great advantages on the side of formic acid, one of which was that of its superior action as an antiseptic and preservative, whilst another was that formic acid has more than double the coagulating power of acetic acid. It so far combines the qualities of coagulant and antiseptic, that in cases where before (as with moist black rubber) a mixture of acetic acid and creosote was necessary, formic acid alone, answers perfectly. In combination with centrifugal processes, formic acid gave excellent results.

Caoutchouc; Determination of —— *as tetrabromide.* G. Fendler and O. Kuhn. Gummi-Zeit, 1908, **22**, 710—713.

A reply to the criticisms of Budde (Gummi-Zeit., 1908, 22, 333—334). It is pointed out that the time required for complete interaction between dissolved rubber and bromine is considerably in excess of that proposed by Budde, and that only after about 24 hours can the action be said to be complete. It is also pointed out that, in order to eliminate the small error in the weight of the "tetrabromide" from vulcanised rubber (see this J., 1907, 1058), due to the presence of combined sulphur, it is only necessary to determine the amount of sulphur in the bromide itself, and to substitute for this the equivalent weight of bromine, since it has been shown (Axelrod, this J., 1907, 1058) that the sulphur of vulcanisation is all contained in the bromo-derivative.—E. W. L.

Cyclooctadiëne from pseudopelletierine; Constitution of the ——. C. Harries. *See* XX.

Patents.

Indiarubber, gutta-percha, and their artificial substitutes; Process for the agglomeration and regeneration of ——. E. A. L. Rouxeville, Paris. Eng. Pat. 7714, April 2, 1907. Under Int. Conv., April 2, 1906.

See Fr. Pat. 378,801 of 1907; this J., 1907, 1207.—T. F. B.

Rubber; Preparation of —— L. Radclyffe, London, and P. Olsson-Seffer, Fruitvale, Cal., U.S.A. Eng. Pat. 8150, Apr. 8, 1907.

The latex is first treated with formalin, to prevent coagulation, and strained, to remove bark and other impurities. A small quantity of a preservative (creosote, salicylic acid, etc.) is added, and the latex partially coagulated by warming to about 115° F. It now passes to the "creaming" or settling tank where it remains until separation is complete. The liquor is then drawn off and water run in at the bottom of the tank until the level of the liquor rises to the height of an overflow pipe through which the latex runs off and is collected in suitable receptacles. It is next placed upon a sliding table, conveyed to washing rollers and rolled into strips, which are partially dried, then folded and pressed, and prepared for shipment. Special mention is made of Castilloa latex, but the treatment may be applied to other rubber-producing juices.—F. M.

Rubber waste; Process for treating commercial ——. J. Dupont. Addition dated Feb. 19, 1907, to Fr. Pat. 383,689, Jan. 14, 1907 (this J., 1908, 347).

After the last washing with denatured alcohol as described in the main patent, the caoutchouc is treated with 1½ times its weight of petrol, and then finally boiled with water as described before.—H. G. B.

Vulcanised rubber; Process for regenerating waste ——. G. Wunderlich. Fr. Pat. 384,546, Nov. 30, 1907.

See Ger. Pat. 195,417; following.—T. F. B.

Rubber; Regeneration of waste ——. G. Wunderlich. Ger. Pat. 195,417, Dec. 2, 1906.

The waste rubber is mixed with 10 per cent. of a drying oil, such as linseed oil, castor oil, etc., which has been "thickened" by boiling, and the mixture is heated in a steam bath for 2—3 hours under a pressure of about 4 atmospheres. The product is washed on the rolls in the usual manner, and then dried at a moderate temperature. The separation of the rubber from the oil, after the latter has taken up the sulphur, can be effected in any other suitable manner instead of by washing.—A. S.

Rubber substitute; Process for the preparation of a ——. R. Köster. Ger. Pat. 190,817, Nov. 17, 1905.

Oleic acid or other unsaturated fatty acid is heated with freshly-precipitated aluminium hydroxide, in presence of water, and with continuous agitation. The product, either alone or mixed with caoutchouc, may be used as a rubber substitute, or it may be mixed with asbestos for the preparation of a packing material, or dissolved in suitable solvents and employed for impregnating textiles, paper, leather, etc., or as a rust-preventive. —A. S.

XIV.—TANNING, LEATHER, GLUE, SIZE.

Tannin; New method for determining ——. G. Metzges. Chem.-Zeit., 1908, **32**, 345.

Hide powder of uniform quality is very difficult to obtain; in the following method, the employment of this substance is avoided:—A slow-phase alternating current is passed through the tannin solution (100—120 c.c. prepared in the customary way) which is contained in an aluminium dish of 10 cm. diameter and 250 c.c. capacity; this dish, and a perforated aluminium disc which is immersed in the solution to a depth of about 1 cm., constitute the electrodes. The solution is kept stirred with a glass rod and precipitation of the tannin is complete in about half an hour. The solution is filtered through a dry filter, the amount of non-tannin in 50 c.c. of the filtrate being determined in the usual way. The alternating current is obtained from a continuous current at about 110 volts passing round a circuit which includes four 16 candle-power glow lamps in parallel, a resistance box, and a rotating commutator.—L. E.

Acidity of tan liquors ; [*Determination of* ——.] J. W. Phelan and P. S. Fiske. J. Amer. Leather Chem. Assoc., 1908, **3**, 99—108.

The method suggested by the authors is a modification of the method for determining carbon dioxide in carbonates. 50 c.c. of the tan liquor are boiled with 2 grms. of calcium carbonate in a flask fitted with a reflux condenser. The carbon dioxide evolved is conducted to two drying tubes, one containing calcium chloride and the other sulphuric acid, and afterwards into two absorption tubes containing soda-lime. After ten minutes' boiling, air freed from carbon dioxide is sucked through the apparatus for twenty minutes to sweep all carbon dioxide into the absorption tubes. The increase in weight in the soda-lime tubes gives the amount of carbon dioxide evolved, from which the percentage of free acid in the tan liquor is calculated, expressing the result in terms of acetic acid. The method was tested with mixtures of lactic and acetic acids in solutions of known strength, and was found to estimate 98·3 to 98·7 per cent. of the total acid. The acidity of some samples of yard liquors was also determined by this method, and the results compared with those obtained with the gelatin method, with which it is in fair agreement. When tested with solutions of pure tannin and of tanning extracts, however, the results were found to increase rapidly with the time of boiling, owing to the decomposition of the tannins into acids which attack the calcium carbonate, and this decomposition was also found to take place in the cold though to a lesser extent. As liquors with a high tannin content usually contain also a high acid content, the error from this source is less important than it would be otherwise, for the results are made too high, by an almost constant factor, and hence bear the correct relation to each other.—H. G. B.

Glucose in leather ; Note on the determination of ——. F. P. Veitch. J. Amer. Leather Chem. Assoc., 1908, **3**, 108.

The author points out that in concentrating the detannised aqueous extract of leathers for the determination of glucose, some of the latter is destroyed, and therefore suggests an alternative method in which less of the aqueous extract is taken and this concentrated to a less extent.—H. G. B.

Blackwattle bark Export of —— *from Natal.* Board of Trade J., April 23, 1908. [T.R.]

The export of blackwattle bark from Natal during 1907 amounted to 23,839 tons, valued at £136,873, as compared with 14,756 tons, valued at £89,856, in 1906. The stripping season last year was unusually wet, and in consequence of damaged bark reaching Europe, importers in Hamburg—the chief market for Natal wattle bark—imposed a condition to guard themselves against the delivery of inferior bark, and this has had some effect in depressing the average price, which for 1907 was about 6s. per ton less than that for 1906.

Patents.

Leather ; Manufacture of many-coloured varnished ——. W. and G. Feldmann, Berlin. Eng. Pat. 21,906, Oct. 4, 1907.

See Fr. Pat. 378,643 of 1907 ; this J., 1907, 1153.—T. F. B.

Leather ; Manufacture from split leather of a waterproof, fast-coloured —— *which is of equal value with the upper grain leather.* S. Pianko and M. Knaster, Wloclawek, Russia Eng. Pat. 28,743, Dec. 31, 1907.

Castor oil is mixed with a suitable colouring matter so as to obtain a mass of butter-like consistence, to which is added, very gradually, with continuous stirring, a solution of celluloid, in the proportion of 9 parts of celluloid to 1—2 parts of castor oil. The resulting mass may, if desired, be diluted with amyl acetate or acetone. This mixture is applied to the split leather and rubbed in, and the leather is afterwards treated in an ordinary graining machine, and finally dried at about 40° C.—A. S.

Leather ; Process of making artificial ——. F. Baum. First Addition, dated Nov. 15, 1907, to Fr. Pat. 380,302, July 27, 1907 (this J., 1908, 30).

The process described in the original specification is modified so that the muscles, etc., may be converted into threads or fabric. For this purpose, the muscles are macerated or treated with a chemical agent, and then pulverised. The fibrous mass is tanned, and, after being dried, is spun into threads. The latter bear a strong resemblance to silk threads.—W. P. S.

Jelly ; Method of and apparatus for testing ——. J. Alexander. U.S. Pat. 882,731, March 24, 1908.

The block of jelly is compressed in one direction to a predetermined degree, whilst free to expand in another direction. The compression is brought about by a carrier adapted to be weighted and movable in a vertical direction between guides. The bottom of the carrier is of electrically conducting material. On the base of the apparatus are two adjustable uprights forming the terminals of an electric circuit including a signalling device. The circuit becomes closed when the jelly is compressed so that the bottom of the carrier comes in contact with the adjustable uprights.—H. G. B.

Glue ; Manufacture of ——. I. Kitsee, Philadelphia, Pa. U.S. Pat. 883,722, April 7, 1908.

The glue or gelatin, in a liquid or semi-solid state, falls from a receptacle in a continuous thin stream, and after the surplus moisture has evaporated, the thin sheet of glue is wound on a drum together with a band of paper, in such manner that the paper prevents the different layers of glue from adhering to each other.—A. S.

Gelatin ; Process for purifying ——. M. Siegfried. Ger. Pat. 185,862, Dec. 2, 1905.

Aqueous solutions of gelatin are treated with ammonia, or alkali hydroxides, or soluble organic bases, or the ammonium or alkali salts of feeble acids.—T. F. B.

XV.—MANURES, &c.

Soil ; Enrichment of —— *in nitrogen by free bacteria and its significance for plant nutrition.* A. Koch, J. Litzendorff, F. Krull, and A. Alves. J. Landwirtsch., 1908, **55**, 355—416.

The authors find that by adding dextrose, sucrose, soluble starch and probably also corn-stalks, to the soil, the activity of the nitrogen-fixing bacteria is increased so that the nitrogen assimilated can be determined analytically. The amount of nitrogen that was fixed per grm. of sugar rose until it attained a maximum of from 8 to 10 mgrms., and the assimilation of nitrogen increased with the increase of sugar, up to 8 per cent. of sugar. With the addition of stronger sugar solution, the nitrogen fixation diminished. The maximum amount of nitrogen fixed in 100 grms. of soil was 80 mgrms. To attain this, 2 per cent. of sugar were added weekly for 13 weeks. Smaller amounts of sugar, 0·5 and 1 per cent., are very useful. The addition of molasses causes decrease of nitrogen in the soils. Inoculation with *azotobacter* slightly increased the nitrogen in clay soils. Lime, potassium sulphate and chloride, and also carbon bisulphide, diminished the fixation of nitrogen. Phosphoric acid, in the forms of superphosphate and Thomas-meal, and ferric sulphate, increased the fixation of nitrogen.

XVI.—SUGAR, STARCH, GUM, &c.

Sugar beet ; Accumulation and migration of sugar in the ——. F. Strohmer. Oesterr.-ung. Zeits. f. Zucker-Ind. u. Landw., **37**, 18—31.

In the second year of growth of the beet, at the time of flowering, sugar migrates from the root and is utilised in the development of the portions of the plant above ground. Both in the side stems and the main stem, more invert sugar than sucrose is present at this period ; hence it appears that the actual migration from the root is of monosaccharides, which form sucrose subsequently. The character of the light to which the plants are exposed, has great influence on the accumulation of sucrose in the sugar beet: beets which throughout the entire period of growth, were shaded during half of the day, yielded only from one-third to one-half of the quantity of sucrose obtained from beets grown under identical conditions, except that they were always exposed to the light. Shading also caused an increase in the quantity of constituents other than sugar, and thus diminished the commercial value of the beets.—A. S.

Sugar beet; New lævorotatory substance in ——. J. Slobinski. Westnek. sacch. prom., 1907, **38**, 369. Centr. Zuckerind., **16**, 401.

On extracting beet pulp, the sugar of which had already been fully exhausted, and using for this extraction an aqueous solution of lead acetate in excess, the author obtained a solution polarising strongly to the left, and not reducing Fehling's solution. At first it was thought that this must be due to the presence of Scheibler's metapectic acid, but ultimately it turned out to be a nitrogenous substance, probably a nucleïn. The author then tested other vegetable substances such as young beets before ripening, green gooseberries, green asparagus, and strawberries, to discover if such a substance was to be found in them. They were first treated for the removal of all sugar, and then heated for two hours in a mixture of lead acetate and water (1 : 1). In each case, but most in that of the asparagus, there was a strong lævorotation in the lead acetate solution. In the case of the beets, this lævorotation was smallest.

Sugar production and sugar duties in Germany. Z. angew. Chem., 1908, **21**, 657.

In the past working year (Sept. 1, 1906, to Aug, 31, 1907) the German production and exports of sugar diminished somewhat as compared with the preceding year, but the consumption of sugar increased. The production, reckoned as raw sugar, amounted to 22,420,463 dz. (dz.= double zentner=100 kilos.), as compared with 24,007,711 dz. in the previous year. The exports were 11,035,714 dz. (11,453,139 dz.), and the consumption, 11,612,497 dz. (11,286,007 dz.). England is still the largest importer of German sugar, but took a considerably smaller quantity than in the preceding year. The exports to England of raw sugar were 705,656 dz. less, and of refined sugar, 264,211 dz. less than in the preceding year. The second largest importer is the United States who took 1,259,108 dz. of raw sugar as compared with 117,984 dz. in the preceding year. The exports of raw sugar to Denmark amounted to 83,159 dz. more than in the previous year. The East Indies in consequence of the increased domestic production and of the importation of Java sugar no longer occupies the important position it formerly held as a market for German sugar. Japan whose imports of sugar from the Dutch Indies and the Philippines greatly increased, imported 96,886 dz. of refined sugar less from Germany than in the preceding year. The exports of German refined sugar to Finland also decreased by 84,282 dz. The consumption of sugar in Germany surpassed all previous records, amounting to 18·72 kilos. (reckoned as raw sugar) per head of population, as compared with 18·49 kilos. in the previous year. The sugar tax yielded 145·9 million marks, which together with 400,000 M. from the import duty on foreign sugar, gave a total sum of 146·3 million marks or 2·36 M. per head.—A. S.

Dextrose, lævulose and galactose; Behaviour of —— towards dilute sodium hydroxide. J. Meisenheimer. Ber., 1908, **41**, 1009—1019.

Buchner, Meisenheimer, and Schade have shown that lævulose is quickly decomposed by 2 per cent. sodium hydroxide solution in presence of hydrogen peroxide or air, with the production of much formic, a little glycollic, and an appreciable quantity of a polyhydric hydroxy-acid (probably erythritic acid). The author has now examined the action of dilute sodium hydroxide solution on dextrose, lævulose, and galactose, in absence of an oxidising agent. A stoppered flask, filled to the neck with a solution of the hexose in 20—50 times the quantity of $N/1$ sodium hydroxide solution (in some cases, sodium sulphite was added, but the reaction was not appreciably affected thereby) was kept for some time at the room temperature, in the dark, the reaction-product being then investigated. Dextrose and lævulose behaved similarly; both sugars yielded 50—60 per cent. of their weights of inactive lactic acid, and 30—50 per cent. of polyhydric hydroxy-acids in the course of about 1—3 months' interaction; the other substances formed from these sugars were only produced in small quantities; they included formic acid, carbon dioxide, and, probably, alcohol. No glycollic or oxalic acid, glycol or glycerol was formed. Galactose yielded about 18 per cent. of lactic acid, about 70 per cent. of polyhydric hydroxy-acids, and small quantities of formic acid, glycol and glycerol, in 188 days. The formation of lactic acid from these sugars would appear to be preceded by the decomposition of the sugar into an aldehyde or ketone possessing a 3-carbon atom chain (see this J., 1908, 31) such as dihydroxyacetone, glyceric aldehyde or methylglyoxal. The production of formic acid may be due in part to incomplete exclusion of air, but probably also to direct decomposition of the sugar. The production of the mixture of hydroxy-acids is more difficult to explain. According to Nef, this mixture consists of numerous saccharinic acids (*loc. cit.*), but the author points out that this investigator's analyses of the calcium salts show that these compounds contain too high a proportion of calcium to bear out this view. The author considers that the mixture of hydroxy-acids contains, not only saccharinic acids, but also analogous compounds containing four or five carbon atoms and his analyses accord with this view.—L. E.

Laevulose [d-fructose] in presence of other natural sugars; Detection of ——. J. Pieraerts. Bull. Assoc. Chim. Sucr. et Dist., 1908, **25**, 830—848.

The presence of free lævulose in a mixture of sugars cannot be detected by Seliwanoff's test (Ber., 1887, **20**, 181), since the same reaction is given by sugars which contain a lævulose residue. Pinoff's ammonium molybdate method for the detection of lævulose (this J., 1905, 1192) is not trustworthy according to Schoorl and van Kalmthout (this J., 1906, 200). The author has elaborated a method for detecting lævulose, which is based on the fact that this sugar reduces alkaline copper solutions more rapidly than do other sugars. To this end reduction experiments were executed with various sugars and mixtures of sugars, at different temperatures, and with several copper solutions. The main results with the various reagents tried, were as follows:—

(1). *Fehling-Soxhlet solution* cannot be used for detecting free lævulose in presence of other reducing sugars. (2). *Ost's modified solution I.* (250 grms. of potassium carbonate, 100 grms. of potassium bicarbonate, and 17·5 grms. of crystallised copper sulphate per litre). To detect lævulose in presence of other sugars, excepting pentoses, 10 c.c. of the reagent and 1 c.c. of the solution (containing 1—5 per cent. of reducing sugar) are heated on a water-bath for 1 hour at 35° C. If pentoses are present, the presence of lævulose may be detected by carrying on the reduction for 2½ hours at the ordinary temperature or for 1 hour at 30° C. The method is not applicable to mixtures containing less than 20 per cent. of lævulose. (3). *Ost's modified solution II.* is not recommended. (4). *Ost's modified solution III.* (140 grms. of potassium carbonate, 100 grms. of potassium bicarbonate, and 15 grms. of crystallised copper sulphate per litre). This reagent is preferable to that given in (2). If pentoses are absent, lævulose is easily detected by heating the mixture of reagent and solution for 1 hour at 35° C.; in presence of pentoses, the reduction is carried on for 1½ hours at the ordinary temperature. (5). *Alkaline cupric hydroxide I.* (100 grms. of potassium carbonate, 50 grms. of potassium bicarbonate, and 6 grms. of cupric hydroxide per litre). With this reagent, lævulose may be detected with certainty, even in presence of much pentose, by treatment for 3 hours at the ordinary temperature; in absence of pentoses, the same treatment for 1 hour at 30° C., suffices. (6). *Alkaline cupric hydroxide II.* (100 grms. of potassium carbonate, 75 grms. of potassium bicarbonate, and 6 grms. of cupric hydroxide per litre). The results are identical with those in case (5). (7) *Cupro-asparagine solution* requires further investigation. (8) *Cupro-glycocoll solution* (12 grms. of glycocoll, 6 grms. of cupric hydroxide, and 50 grms. of potassium carbonate per litre). This reagent gives excellent results. Free lævulose reduces it abundantly at the ordinary temperature in 12 hours, whereas pentoses do not cause any reduction in 24 hours under the same conditions. Lævulose is the only naturally occurring sugar which reduces this reagent under the given conditions. These methods may be used to detect lævulose in commercial products. The solution (20—25 grms. of material dissolved in 150—200 c.c. of cold water) is clarified with basic lead acetate and filtered, any lead in the filtrate being removed with saturated sodium sulphate solution. After standing for half an hour, the solution is filtered and the reducing sugar-content of the filtrate is determined. The solution is then so diluted that the concentration of reducing sugar (calculated as dextrose) is diminished to 5 per cent., and tested for lævulose as described above.—L. E.

Saccharin and alkali saccharinates; Properties, and in especial, rotatory power of ——. E. Rimbach and E. Heiten. Annalen, 1908, **359**, 317—335.

Saccharin, the lactone of saccharinic acid, was prepared by Kiliani's process, viz., by leaving a mixture of invert sugar solution and calcium hydroxide to stand for a month at the ordinary temperature. The authors did not get Kiliani's yield, not more than 100 grms. of pure saccharin being obtained by them from 5 kilos. of sucrose, at the highest. The product consisted of large, well-defined, colourless, rhombic crystals (m. pt. 160°—161° C.); the optical rotation was determined with various sources of light and at different concentrations. The specific rotation of aqueous saccharin solution falls slightly with increasing concentration: thus, at concentration $p=1{\cdot}47$, $[a]_{\mathrm{D}}^{20^\circ} = +93{\cdot}82^\circ$, whilst with $p=16{\cdot}055$, $[a]_{\mathrm{D}}^{20^\circ} = +93{\cdot}13^\circ$ (p=grms. of saccharin per 100 grms. of solution. The rotation dispersion, which is slightly greater than that of quartz, presents no anomalies. The rotation in other solutions (methyl and ethyl alcohols, acetone and acetic acid) is somewhat greater than in water; it falls with increasing concentration, but at different rates in the individual cases. Since, in aqueous solution, saccharin is partially converted into lævorotatory saccharinic acid, the dextrorotation of the solution must decrease with time; this decrease is very slow, however, and is not perceptibly accelerated by rise of temperature. The sodium, potassium, and rubidium salts of saccharinic acid are all lævorotatory; the lævorotation increases with the concentration; it decreases, in the case of the potassium and sodium salts, with increasing temperature. Experiments on the electrical conductivity of solutions of the potassium and rubidium salts indicated that the acid is a very weak one, its alkali salts readily undergoing hydrolysis.—L. E.

Molasses waste liquors; Destructive distillation of —— *with special reference to molasses tar.* P. Rinckleben. See III.

Starch; Action of formaldehyde on ——. A. Reichard. *See* XVII.

Patents.

Sugar, starch, organic salts, and other substances; Process for extracting —— *from materials containing them.* G. Pereire. Fr. Pat. 384,358, Nov. 26, 1907.

The material, such as grains, seeds, fruits, roots, berries, leaves, etc., is dried (the drying process being modified as required by the nature of the material) or roasted, and ground to a fine powder. The constituents are then separated by subjecting the powder to centrifugal action in cylinders turning at the rate of 4000 revolutions per minute, or by drawing the powder by means of a suction pump into a cylinder of special construction. An alternative way of effecting the separation is to deliver the powder on to the surface of a horizontal rotating cylinder which has been electrified. The sugar and salts fall off the cylinder when it has made about a quarter revolution, whilst the cellulose adheres for a longer time and is delivered into a separate receptacle.—W. P. S.

Extraction and desiccation of solids contained in natural fluids, etc. Eng. Pat. 18,549. *See* XVIII*A*.

XVII.—BREWING, WINES, SPIRITS, &c.

Malt analysis; Should —— *be carried out with fine meal or coarse grist?* F. Eckhardt. Z. ges. Brauw., 1908, **31**, 118—122, 125—129, 139—142, 153—158.

The author discusses this question at length and arrives at the following conclusions. In malt analysis an extract determination should first be carried out with finely-ground malt (meal), since the most important point to be determined is, how much extract can be formed by the action of the diastase present on the extract-forming materials in a given time, and without the use of complicated methods of working. The term fine grist or fine meal requires, however, more accurate definition and the author describes as such a grist giving at least 95 per cent. of meal when a sieve, having 196 holes per sq. cm. and rotated at 350 revolutions per minute for 5 minutes, is employed. But analysis of the fine grist gives no complete measure of the character or quality of the malt. It should, therefore, be supplemented by an examination of the various physical characters of the malt and by an analysis in which coarse grist is employed. It is pointed out that the setting of the Seck mill at 25° is quite arbitrary and does not correspond with the conditions obtaining in practical working, where the setting of the malt-rolls depends on the water-content, hardness, character (pale or high-dried), thickness of the corns and the mash-tun yield. When the analysis is made with grist obtained from the Seck mill at 25°, the composition of the grist should be determined with sieves of accurate mesh and thickness of wire. In the case of the analysis of coarse grist, the conditions for uniform treatment, and the sources of error arising in the grading of grist, are to form the subjects of further study.—T. H. P.

Starch; Action of formaldehyde on ——. A. Reichard. Z. ges. Brauw., 1908, **31**, 161—163.

Though the grain residues from mashing processes are not quite free from starch, they do not always give the iodine reaction after boiling with water. If, however, the material is treated with $N/1$ sodium hydroxide, neutralised, and then treated with iodine, it will be found to give a blue colour or sometimes (probably owing to further degradation) a yellow colour. A similar result is obtained if the grain is boiled for a short time with 2 per cent. formaldehyde solution (not neutralised) prepared from commercial formalin, before applying the iodine test. The author has examined the action of formaldehyde solution on potato starch (1 grm. of starch to 10 c.c. of solution) and has found that this agent reduces the temperature of gelatinisation of the starch, the reduction of temperature increasing with the concentration of the formaldehyde and the period of its action. One grm. of starch is completely gelatinised by 10 c.c. of 37 per cent. (not neutralised) formaldehyde in 7—8 hours at 25° C.; the same formaldehyde solution, neutralised and diluted in the ratio 10 : 14, gelatinises the starch less rapidly. Even at 15°—16° C., 38 per cent. formaldehyde gelatinises starch completely in two days. These formaldehyde-starch mixtures give with iodine, at first a blue colour, and later, when the gelatinous state has been attained, a brownish-red colour; if the gelatinised starch is dissolved in water, the solution gives a yellow colour with iodine; these results explain the fact that grains heated with dilute formaldehyde, give with iodine sometimes a blue and sometimes a yellow colour; in the latter case the action of the formaldehyde has gone too far. The author confirms Syniewsky's opinion with regard to the formation of a formaldehyde-amylodextrin compound by the action of concentrated formaldehyde on starch at the ordinary temperature (see this J., 1902, 1341), and his experiments indicate that the same compound is very rapidly formed by heating starch with formalin of about 37 per cent. Owing to its power of hydrolysing starch, dilute formaldehyde may prove a valuable agent for the disintegration of raw grain for analytical purposes as well as of difficultly saccharifiable starch.—L. E.

Hydrolytic enzyme in the resting seeds of some gramineæ. Y. Tanaka. J. Coll. Engineering, Imp. University, Tokyo, 1908, **4**, 39—52.

The diastase in the ungerminated seeds of glutinous millet (*Setaria italica*) and of common millet differs greatly from the diastase of ungerminated barley investigated by Baker (this J., 1902, 1177). Its optimum temperature (50°—55° C.) is higher than that of the latter. It liquefies starch paste very rapidly with the formation of soluble starch, and in the hydrolysis of the latter the final dextrin formed is achroodextrin, whilst there is only a relatively small amount of maltose simultaneously produced. Owing to its strong liquefying but weak saccharifying action, it produces equal quantities of maltose in equal intervals from starch paste and from soluble starch. The products of the intermediate stages of the hydrolysis consist of erythrodextrin and α-erythrodextrin. The latter, which is regarded as more complex than erythrodextrin, gives a red coloration with iodine, and is very slowly saccharified by millet diastase. Starch paste from glutinous varieties of starch (*e.g.*, that of glutinous millet itself) are liquefied more rapidly, but saccharified more slowly than ordinary starch paste by millet diastase. The combined action of millet and barley diastase upon starch paste is more energetic and gives a higher yield of maltose than the action of either diastase used alone.
—C. A. M.

Tyrosinase from Russula delica ; Action of —— on tyrosine and polypeptides containing tyrosine. E. Abderhalden and M. Guggenheim. Z. physiol. Chem., 1908, **54**, 331, 353.

Small quantities of monobasic amino-acids have no influence on the action of the oxydase from *Russula delica* on *l*-tyrosine, but larger quantities of these acids and small quantities of dibasic amino-acids exert an influence. Very dilute solutions of mineral acids and alkalis also have a powerful retarding effect. *d*-Tyrosine, which does not occur in nature, is attacked much more slowly by the oxydase than *l*-tyrosine. Tryptophane, oxytryptophane and homogentisic acid are oxidised by the tyrosinase to coloured derivatives, whilst phenylalanine and di-iodotyrosine are not changed. Polypeptides containing the tyrosine group are all intensely coloured by the oxydase, but no hydrolysis, *i.e.*, no change in the rotatory power, takes place. The oxydase is strongly affected by the addition of certain amino-acids, *e.g.*, proline. Treatment of the various substances with ozone does not produce the same colorations as the enzyme. The oxidising power of an aqueous solution of tyrosinase decreases considerably on keeping or even by shaking. The enzymes of yeast and pancreas show a similar sensitiveness towards shaking.—J. F. B.

Yeasts ; Characters of top-fermentation ——. W. Rommel. Jahrb. Vers. Lehr. Brau. Berl., 1907, **10**, 604 ; Z. ges. Brauw., 1908, **31**, 135.

No specific distinction can be made between top- and bottom-fermentation yeasts so far as the size and shape of the cells are concerned. In the case of vaseline-ring preparations in beer-wort, this is, however, more feasible, the top-fermentation yeasts being in most cases distinguished by the characteristic form of their growth in budding chains and generally by the greater vigour of their development as compared with bottom yeasts under similar conditions. The behaviour of the yeasts when stirred and shaken with water is still more characteristic. The top-fermentation yeasts generally show, in contrast to the bottom yeasts, a dust-like character, yet still there are numerous intermediate grades. This method gave a satisfactory result in all the cases of pitching yeasts investigated. The behaviour of the yeasts in solutions of melitriose was fairly similar ; they showed little or no sign of fermentation. In fermentation tests, all the top-fermentation yeasts studied regularly showed top-fermentation. But the top or bottom character of a yeast cannot be accurately inferred from its behaviour in small fermentation tests, and specific gravity affords no decisive guidance in this direction. The total protein-contents of top-fermentation yeasts vary very considerably, and the determination of the nitrogen cannot serve as a means of distinguishing between top and bottom yeasts. The ash-contents of the yeast are strongly influenced by the nature and composition of the nutrient medium. On the average the top-fermentation yeasts examined contained a somewhat higher percentage of ash than the bottom yeasts. The top or bottom character of the yeast has no connection with its keeping qualities ; these are determined rather by the percentage and still more by the nature of the protein matters present.—J. F. B.

Yeasts and waters ; Biological analysis of ——. Stockhausen. Jahrb. Vers. Lehr. Brau. Berl., 1907, **10**, **717** ; Z. ges. Brauw., 1908, **31**, 146—147.

The microscopic examination of yeast is of only superficial value, as it does not indicate whether the organisms present are dead or living or whether they are capable of development on the nutrient media of the brewery ; besides which it is often difficult to distinguish between wild and culture yeasts. Drop-cultures in wort have the disadvantage that the culture yeasts grow rapidly in wort, whilst only after several days do the other organisms develop sufficiently for purposes of observation. Such drop cultures do, however, give indications concerning the competition which takes place between the foreign organisms and the culture yeasts. The detection of foreign organisms is best effected by means of drop cultures in sterile water, in which only the most vigorous cells of the culture yeast develop and these but slightly, whilst the wild yeasts rapidly give well-formed colonies and the bacteria grow readily ; even sarcinæ develop freely under these conditions and the method is perhaps too sensitive. By Bettges and Heller's method (this J., 1906, 227 ; 1907, 427), sarcinæ forms can be detected in two days. The author carries out the biological analysis of water as follows. (1). The number of germs is estimated in 1 c.c. and in 1 drop (0·05 c.c.) of the water by means of wort-gelatin. The numbers obtained in parallel experiments may, however, differ from one another by 100 per cent. (2). Flasks containing 10 c.c. of wort together with 0·5—1 c.c. of the water and a trace of a pure culture yeast are kept in a thermostat at 6—8° C. for 6—8 days ; if the fermentation is abnormal, the water should be suspected. (3). The behaviour of the water towards sterile beer is examined by keeping a mixture of 10 c.c. of pasteurised beer and 0·5—0·1 c.c. of the water at room temperature for some days and also by keeping some of the inoculated beer in a Petri dish, in which acetic bacteria and film-forming organisms develop more freely than in narrow-necked flasks. (4). Pure culture yeast is mixed to a thick paste with the water and kept at the temperature of the fermenting room for a couple of days, at the end of which time it is generally strongly infected. The water is then poured off and replaced by sterile wort in order to ascertain which of the germs can compete successfully with the weakened yeast ; in this way the suitability of the water for washing yeast is determined. In more accurate examinations the following points may be studied. (5). The behaviour of the water towards diluted and undiluted wort with and without addition of tartaric acid, which favours the development of wild yeasts. (6). A numerical expression of the harmfulness of the organisms present for wort and beer is obtained by determining the power of destruction according to Wichmann's method. (7). Detection of sarcina by Bettges and Heller's method.—T. H. P.

Amino acids ; Action of beer yeast on ——. J. Effront. Compt. rend., 1908, **146**, 779—780.

Ehrlich (this J., 1907, 28 and 480) has shown that beer yeast decomposes racemic amino-acids with production of higher alcohols. This phenomenon is

intercellular; no ammonia can be detected in the liquid and the enzyme concerned is not present in the cell-juice expressed from the yeast. The author has studied another action of yeast on amino-acids, which is attributable to a specific enzyme, "amidase," which decomposes amino-acids and their amides into ammonia and volatile acids. The action of amidase may be studied by mixing 2 grms. of asparagine with 10 grms. of yeast and a little water, adding 6 c.c. of $N/_1$ sodium hydroxide and diluting with water to 100 grms. The solution is incubated at a temperature of 40° C. and the ammoniacal nitrogen is determined from time to time by distillation with magnesia. After 72 hours the whole of the nitrogen of the asparagine and the greater part of that of the yeast is converted into ammonia. If the liquid be filtered after 60 hours, the enzyme, amidase, is present in the filtrate and its presence may be demonstrated by the addition of a further 1 grm. of asparagine, which will be converted into ammonia in 6 hours. The active substance in autolysed yeast also decomposes aspartic acid, leucine and glutamic acid in a similar manner. The production of ammonia and volatile acids from the amino-acids in this way takes place without the formation of alcohol; the presence of alkalis is favourable. From 10 grms. of asparagine, 5·5 grms. of volatile acids, b. pt. 110°—145° C., consisting chiefly of propionic acid, were obtained. Amidase is present in top-fermentation yeasts and wild yeasts; it has also been observed in *Amylobacter butyricus*, but its presence in bottom-fermentation yeasts is doubtful.
—J. F. B.

Acetaldehyde in alcoholic fermentation; Formation of ——. A. Trillat. Compt. rend., 1908, **146**, 645—647.

Several observers have recorded the fact that small quantities of acetaldehyde, amounting sometimes to as much as 80 mgrms. per litre, are produced during fermentation by yeasts, particularly certain wine yeasts and lactose yeasts from cheese. The author has carried out experiments in order to determine whether this aldehyde is a primary product of the break-up of the sugar molecule or whether it is formed by the secondary oxidation of the alcohol, *i.e.*, whether its production can take place under rigidly anaërobic conditions. Lactose yeasts, which ordinarily had given the highest yields of acetaldehyde, were sown in large quantities in nutrient media containing lactose. In one series of experiments, in which the greatest care was taken to eliminate all traces of air from the flasks and liquid and to conduct the fermentation in an atmosphere of carbon dioxide or hydrogen, no acetaldehyde was produced. In another series, in which various quantities of air were admitted to the flasks, it was found that acetaldehyde was formed in quantities varying with the conditions of aeration and that very minute quantities of air were sufficient to cause the production of visible traces of aldehyde. Hence it is concluded that acetaldehyde is not a normal product of alcoholic fermentation but is produced by the oxidation of the alcohol.—J. F. B.

Acetaldehyde in alcoholic fermentation; Formation of ——. E. Kayser and A. Demolon. Compt. rend., 1908, **146**, 783—784.

Referring to a recent note by Trillat (see preceding abstract) the authors point out that they had previously arrived at a similar conclusion (this J., 1907, 1060). They found that during the storage of wine on the lees, with free access of air, the formation of aldehyde was more rapid than in the case of brandies by simple oxidation. The formation of aldehyde was shown to be intimately connected with the presence of living aerobic yeast near the surface of the liquid, being considerably retarded by the addition of yeast-poisons. The presence of yeast previously killed by boiling has no influence on the formation of aldehyde; living yeast is the essential agent, and the oxidation of the alcohol by purely chemical action is quantitatively of minor importance.—J. F. B.

Filtration of the mash. A. Schifferer. Z. ges. Brauw., 1908, **31**, 137—138.

The author discusses the advantages of filtering the mash by means of filter-presses instead of running off the wort and sparging the goods in the ordinary way. The flavour of the beer obtained is improved, owing to more vigorous fermentation and to a diminution of the time during which the grains are left in contact with the wort and exposed to the action of the air. Further, the brewer is less dependent on the quality of the malt used, as hard malts or malts which are too new give good results by the filter-press methods. Filter-pressing does not diminish the value of the grains, which should, however, be sold by weight and not by measure. The press used by the author consists of a combination of chamber-filter and frame-filter which permits of an increase in the amount of mash treated, a considerable diminution in the number of filter-cloths and a decrease in the length of the press. The entry- and exit-channels for the mash, water and filtrate lie outside the filter-cloths, so that these are not perforated. By this means, and by employing planed packing-surfaces and special packing material, the cloths are preserved so that their cost does not amount to more than 2 pfennige (one farthing) per centner (110 lb.) of malt mashed. With a 40—60 centner (13—20 quarter) plant, the use of filter-presses results in a saving of 19,000 marks (£950) capital outlay for plant alone, while the diminution of ground-area and building would involve a further economy of about 7,000 marks (£350). The use of filter-presses is recommended: (1), in new plants; (2), in cases where the extract obtained is 2 per cent. less than would be expected, were filter-presses employed; and (3), in breweries where the plant is worked to its utmost capacity and where an increased output is desired.
—T. H. P.

Beer; Temperatures necessary for efficient pasteurisation of ——. F. Schönfeld and W. Hoffmann. Woch. für Brau., 1908, **25**, 221—224, 229—234.

The experiments were made with beers containing large proportions of yeast, added either in the form of "Kräusen" or of pitching yeast. It was found that an exposure of the beer in bottles to a temperature of 60° C. for half an hour (not counting the time occupied in heating up and cooling down) afforded an efficient pasteurisation in all cases, but for special purposes sufficiently good results could be obtained at lower temperatures. For instance, in the winter months beers intended for rapid consumption may be pasteurised by heating for half an hour at 50° C., but in the summer it is necessary to employ a temperature of 55°—56° C. in order to ensure an equally satisfactory degree of stability. These lower temperatures are only efficient if the beer be practically free from bacteria. In the case of Berlin "Weissbier," which contains large quantities of bacteria, a temperature of 60° C. must be used. Pasteurisation does not absolutely destroy infecting bacteria and disease yeasts, but merely inhibits secondary activities to a sufficient extent for ordinary practical purposes. As a general characteristic, top-fermentation yeasts resist higher temperatures than bottom yeasts, and "Weissbier" yeast is more resistant than ordinary top-fermentation beer yeast. The zymase of the yeast is destroyed first: that of bottom yeasts at 45°—50° C., that of top-fermentation yeasts at 45°—55° C., whilst that of "Weissbier" yeast may sometimes resist temperatures of 58° C. When the beers were allowed to undergo secondary fermentation, after the addition of the yeast, for one day before pasteurisation, the fermentative properties of the yeast were more readily destroyed by pasteurisation than when the beers were pasteurised at once. The destruction of the reproductive property of the yeasts required a higher temperature than that of the fermentative property. When transferred to gelatin plates, bottom yeasts only ceased to grow after pasteurisation at 55°—56° C.; top yeasts lost their reproductive power at temperatures about 60° C., whilst "Weissbier" yeasts retained their vitality at temperatures above 60° C., although at such temperatures the survival of yeast was only small. The temperature required for the destruction of the invertase of the yeasts was the same in all cases, namely 60° C.—J. F. B.

Beer; Metallic-albuminoid turbidities in ——. J. Dehnicke. Woch. f. Brau., 1908, **25**, 224—226.

An American brewers' association has collected information on the action of metals on beer. The Wahl Henius Institute reports on the injurious effects of iron at different stages of the manufacture. Iron dissolved in the wort may sometimes, but only rarely, affect the finished beer. Generally, even if the wort be coloured quite black with iron the whole of the latter is separated during fermentation and the yeast becomes black. Even a momentary contact of the finished beer with iron may be followed by serious consequences. For instance, as the result of an iron pipe in a bottling machine, the beer developed a considerable turbidity after pasteurisation in bottle, particularly in those bottles which were filled first. In the case of iron pipes conveying compressed air, particles of rust are liable to be carried into the beer. Sugars used for "Kräusen" may introduce iron into the beer. A tin turbidity which has appeared in a wort and been re-absorbed may appear again in the fermented beer. The protective coating of beer-scale on tinned vessels should be carefully preserved, and no chemical stronger than a 1 per cent. solution of sodium carbonate should be used for cleaning; caustic soda should be rigidly excluded. Hard waters rich in chlorides may injure the scale. The use of waters rich in aluminium salts for washing the filtering pulp may cause alumina turbidities in the filtered beer. Hantke's Brewers' School reports that beers which are sensitive to chill and pale beers which are strongly hopped are particularly liable to tin turbidities. Experiments on certain metals showed that they were objectionable in the following order: steel, cast-iron, galvanised iron, brass, and copper, the last having a very feeble action. From St. Louis it is reported, contrary to Nathan's observations, that galvanised iron is worse than wrought iron, owing to the arsenic in the former. Freshly enamelled vessels are liable to cause turbidities because the alkalinity of the enamel neutralises some of the acid of the beer which holds the albuminoids in solution. Lacquered copper pipes are recommended whenever possible. Although an electrolytic action may probably occur when several metals are present simultaneously, experimental proofs of this are still lacking.—J. F. B.

Wine; Manganese in ——. G. Paturel. Staz. agron. di Saône-et-Loire. Riv. Scuola Vit. Enol., **13**, 529.

On adding ammonia to a Beaujolais wine, manganese was found to occur both in the precipitate produced, and also in the filtrate therefrom, and hence in both the organic and inorganic forms. In this wine, 3·4 mgrms. of manganese per litre, were found in the precipitate, and 1·7 mgrms. in the filtrate. The author believes that the manganese plays an important part in the production of the delicate aroma characterising this wine.

Continuous alcohol distillation apparatus. E. Hausbrand. *See* I.

Patents.

Brewing waters; Preparing ——. M. Wallerstein, New York. U.S. Pat. 879,843, Feb. 18, 1908.

Definite quantities of calcium sulphate are added to the water to be used for brewing purposes. The calcium sulphate is prepared in a crystalline condition by treating a solution of a calcium salt, such as calcium chloride, with the requisite quantity of a suitable sulphate, from 1 to 5 oz. of gelatin being added to each 30 gallons of solution of the calcium salt before adding the sulphate. The precipitated calcium sulphate is added to the water, either alone or mixed with other salts. For example, 1 lb. of a mixture consisting of calcium sulphate, 65 parts; calcium chloride, 15 parts; mangesium chloride, 5 parts; sodium chloride, 10 parts; and potassium chloride, 10 parts, may be added to every 200 or 300 galls. of water.
—W. P. S.

Hops and yeast; Process of forming extracts from ——. F. S. Davidson and W. P. Burra, Ashford. U.S. Pat. 883,174, March 31, 1908.

See Eng. Pat. 23,113 of 1906; this J., 1907, 707.—T. F. B.

Malting; Apparatus for ——. E. G. Adlam, Bristol. U.S. Pat. 883,848, April 7, 1908.

See Eng. Pat. 8900 of 1907; this J., 1907, 1156.—T. F. B.

Malt; Process of preparing —— by means of chloride of lime or other hypochlorite salts. J. Effront, Brussels. U.S. Pat. 884,725, April 14, 1908.

See Eng. Pat. 1639 of 1906; this J., 1906, 439.—T. F. B.

Spirits; Process for the manufacture of ——. G. Fritsche, Strzebowitz, Germany, Assignor to Roessler and Hasslacher Chemical Co., New York. U.S. Pat. 884,576, April 14, 1908.

See Eng. Pat. 18,611 of 1906; this J., 1907, 835.—T. F. B.

Wash distilling apparatus for continuous and intermittent working. F. C. Hager and A. Gebauer. Ger. Pat. 196,560, June 18, 1907.

The distillation chamber is divided by partitions into several contiguous chambers, which the wash traverses in a zig-zag direction. Steam is supplied to each chamber by a separate pipe, in such a manner that the height of the layer of wash which it has to penetrate, is small. In this way, overheating of the wash is avoided, the temperature rising only to 70°—80° C., so that no appreciable evaporation of fusel oil takes place. The device can be adapted to the ordinary forms of distilling apparatus.
—A. S.

Non-alcoholic drink containing the aromatic constituents of natural wine; Preparation of —— from wine. C. R. and W. Wagner. Ger. Pat. 193,879, Dec. 29, 1906.

The wine is distilled *in vacuo* in order to separate the volatile aromatic substances of lower boiling point than alcohol, these being absorbed directly by a mixture of must, sugar juice and de-alcoholised wine from a previous distillation. A suitable apparatus is described for carrying out the process, so arranged that the volatile aromatic substances and the alcohol can be collected in separate receivers. The solution of the aromatic substances in the mixture of de-alcoholised wine, must, and sugar juice, and the de-alcoholised wine from the still are separately cooled, filtered with exclusion of air, and mixed together, and the resulting drink is impregnated with carbon dioxide.—A. S.

Tartaric acid manufacture. Addition to Fr. Pat. 382,824. *See* XX.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, AND DISINFECTANTS.

(*A.*)—FOODS.

Coffee; Contribution to the knowledge of ——. *II.* K. Gorter. Annalen, 1908, **359**, 217—244.

A continuation of the previous investigation (see this J., 1908, 242) has shown that chlorogenic acid is decomposed by alkalis into caffeic acid and quinic acid:

$$C_{32}H_{38}O_{19} + H_2O = 2C_9H_8O_4 + 2C_7H_{12}O_6.$$

On acetylation, it yields pentacetylhemichlorogenic acid, $C_{16}H_{13}O_9(C_2H_3O)_5$. From the mucilaginous material separated in the preparation of potassium-caffeine chlorogenate (*loc. cit.*), a pectin substance was isolated, which on oxidation with nitric acid yielded mucic acid, and on hydrolysis, furnished galactose and a pentose. Further, from the mother-liquors, after separation of the potassium-caffeine chlorogenate and the pectin substance, a new crystalline acid, *coffalic acid*, was isolated. This has the composition, $C_{34}H_{54}O_{15}$, melts at 255° C., and yields isovaleric acid when decomposed with acids or alkalis. Liberian coffee berries contain an oxydase, which produces a yellow to reddish-brown coloration in a solution of potassium-caffeine chlorogenate. It is stated that the caffeetannic acid of earlier workers is a mixture of chlorogenic and coffalic acids and other substances.—A. S.

Patents.

Dietetic products or compositions [*caramel, salt, sugar, etc.*]. T. D. Lichtenstein, London. Eng. Pat. 6742, March 20, 1907.

Dry, powdered caramel is mixed with dry sodium chloride and the mixture is pressed into blocks, the pressure being applied to the composition when the latter is either cold or hot. About 25 parts of caramel may be used with 75 parts of salt. The blocks can be pulverised afterwards without danger of the two constituents separating from each other. Dry sugar or an acetate mixed with an organic acid may be employed in place of the salt, and to the mixture may be added spices, herbs, meat extracts, gelatin, etc. An instance is given in which dry caramel powder, 1 part; sugar, 10 parts; citric acid, 20 parts; sodium acetate, 25 parts; and dried mint, 4 parts, are mixed.—W. P. S.

Butter; Manufacture of renovated or process ——. A. J. Boult, London. From American Farm Products Co., New York. Eng. Pat. 7500, March 28, 1907.

See U.S. Pat. 854,383 of 1907; this J., 1907, 709.—T. F. B.

Extraction and desiccation of the solid parts contained in natural fluids or in solutions; Process and apparatus for the ——*, particularly for the production of milk powder and the extraction of sugar from saccharine juices.* P. Bevenot, Paris. Eng. Pat. 18,549, Aug. 16, 1907. Under Int. Conv., Aug. 20, 1906.

The apparatus is on the same principle as that described in Eng. Pat. 28,767 of 1906 (this J., 1907, 628), but the current of heated air is introduced at the top of the atomising chamber, and leaves by pipes reaching nearly to the bottom of the chamber. These pipes extend upwards into a fixed drum above which is placed a rotating drum provided with a number of horizontal tubular arms. The air laden with moisture and particles of powder passes into this latter drum and is forced by centrifugal action through the tubes, the particles of powder being thus separated and thrown against the sides of the outer casing of the upper part of the apparatus. The air then leaves through a central chimney which is fitted with a valve to regulate the current of air.—W. P. S.

Coffee; Process for the roasting, refrigeration, and preservation of ——. H. J. Haddan, London. From E. de Mattia, Recoarco, Italy. Eng. Pat. 27,036, Dec. 6, 1907.

The coffee is roasted in a rotating receiver communicating with an aspirator and two Woulff's bottles. One of these contains water to absorb pyridic compounds produced in the early stages, and the other a 0·25 per thousand solution of fuchsin, decolorised by sulphur dioxide, which becomes violet when acted upon by the gases formed when the roasting process is complete. At this stage the coffee is passed into an ice-refrigerator containing carbon dioxide, where the rapid chilling prevents volatilisation and oxidation of the volatile oils, and it is finally sealed up in suitable vessels in which the air has been replaced by carbon dioxide.—C. A. M.

Coffee free from caffeïne; Preparation of ——. K. H. Wimmer. Fr. Pat. 384,233, Jan. 29, 1907.

Coffee berries are saturated with water by steeping them in water or dilute alcohol, preferably warm, in a rotary drum, or else by treating them with moist steam. When the berries are sufficiently softened, they are transferred to an extraction apparatus in which they are treated with suitable organic solvents, such as benzene or chloroform, or a mixture of the two, until the caffeïne is extracted. The solvent is then evaporated and the coffee is dried in rotating drums.—J. F. B.

Baking powder. F. Blumenthal, Biebrich, Germany. U.S. Pat. 883,165, Mar. 31, 1908.

The baking powder is composed of sodium bicarbonate and glycollic acid or "acid salts of this acid."—W. P. S.

Food product [*resembling human fat*]*, and method of making the same.* J. E. Bloom, New York. U.S. Pat. 883,930, April 7, 1908.

Olein, palmitin, and "a triglyceride of a fatty acid having a higher melting point than stearin," are added to a food material in such proportions that the fat contained in the latter has approximately the composition of human fat; a further quantity of a mixture of olein, palmitin, and the higher glyceride, in the proportions in which they exist in human fat, is also added to the food material. The approximate ratio of the olein to the palmitin should be 12 of the former to 1 of the latter and the entire fat of the material should contain 98 per cent. of olein and palmitin together. The food material may comprise an egg ingredient.—W. P. S.

Emulsifying and rendering homogeneous milk, cream, and similar liquids. J. V. M. Risberg. Fr. Pat. 384,310, Nov. 23, 1907. Under Int. Conv., Nov. 26, 1906.

The milk is first separated in a centrifugal machine into cream and skim-milk and then the cream is broken up into an extremely fine state of division in the separator. The finely divided cream, owing to the large surface presented by the fine particles, is taken up by and intimately mingled with the skim-milk and the two leave the apparatus together as a very perfect emulsion. —W. H. C.

(*B.*)—SANITATION; WATER PURIFICATION.

Mercury vapour; Determination of —— *in air.* P. Minière. *See* XXIII.

Patent.

Water; Apparatus for separating foreign substances from ——. V. Antoine, Lambermont, Belgium. U.S. Pat. 883,608, March 31, 1908.

See Fr. Pat. 374,040 of 1907; this J., 1907, 775.—T. F. B.

(*C.*)—DISINFECTANTS.

Disinfecting gas [*formaldehyde*]*; Simple reaction producing* ——. G. Carteret. Compt. rend., 1908, **146**, 819—820.

If to a mixture of 1 part of paraformaldehyde and 2 parts of bleaching powder be added 3 parts of water, the temperature of the mass rises gradually to 108° C., and a considerable evolution of gas takes place. This gas contains no chlorine, and consists apparently of formaldehyde alone. About 70 per cent. of the polymer used is thus converted, and the reaction may be used as the basis of a convenient method of disinfection. —J. T. D.

Petroleum benzine; Germicidal power of ——. F. J. Farrel and F. Howles. J. Soc. Dyers and Colour., 1908, **24**, 109—112.

It has been stated in articles on dry cleaning that benzine is an antiseptic and a disinfectant, and that goods cleaned therein are rendered sterile. To be of any value, it must be very active, as the time during which it is in contact with the materials to be cleaned is very short. The authors have compared the germicidal action of American petroleum benzine (sp. gr. 0·765) with that of benzol and carbon tetrachloride, upon *B. typhosus*. Infected threads were covered with the liquids to be compared, and after definite intervals of time a few threads were removed, drained, and dried for a few minutes in an incubator at 37° C. They were then removed to tubes containing nutrient broth and incubated at 37° C. for 70 hours. Acting for 6½ hours, benzine and benzol show no germicidal action, whereas carbon tetrachloride acting for half an hour destroyed the bacillus mentioned.—F. M.

Glycerol; Bactericidal action of ——. E. Levy and E. Krencker. Hygien. Rundsch., 1908, **18**, 323—330.

Warington (Dict. encycl. des sc. med. Ser. 4, T. 9) first discovered the antiseptic power of glycerol in 1846, and that it will prevent the putrefactive decomposition of meat. The authors have studied the action of glycerol at concentrations of from 10 to 100 per cent. on different micro-organisms at 37°, 24°, and 12° C. respectively. The development of mould fungi is prevented only when the concentration of glycerol rises to 30—35 per cent.

Tubercle bacilli are killed in 48 hours in 80 per cent. glycerol at 37° C. The higher the temperature, the more intense is the action of the glycerol. A 10 per cent. solution of glycerol at 37° C. kills staphylococci in 12 days, typhus bacilli in 13 days, and diphtheria bacilli in 3 days At 37° C., with certain kinds of bacteria, the germicidal effect of glycerol increases only up to a concentration of 50 per cent., but not further. The effect of the glycerol is considered to be due not to chemical action, but to an action analogous to that of solutions of high osmotic pressure on swollen colloidal substances.—A. S.

XIX.—PAPER, PASTEBOARD, &c.

Paper ; Influence of starch on the qualities of ——. A. Lutz. Papier-Zeit., 1908, **33**, 1098—1100, 1142—1143.

THE author has studied the effect on the paper of adding various proportions of different starches in different forms to the pulp in the vat. The experiments were necessarily carried out on hand-made papers, but the results are comparative. They may be considered under two heads: yield, *i.e.*, the percentage of total starch added to the pulp which remains in the paper, and the effect on the physical properties of the paper. The yield depends on the nature of the starch, the condition of beating of the pulp, and the state in which the starch is added. In one series of experiments 10 per cent. (on the weight of fibre) of three different starches were added to a well-beaten wood pulp: (*a*), raw; (*b*), gelatinised by boiling with water. The yields were as follows:—(*a*), potato, 73·6; wheat, 71·7; rice, 53·4 per cent.; these differences correspond with the different dimensions of the raw starch granules. The results of the (*b*) series were quite different, and showed:—potato, 46·2; wheat, 58·3; rice, 58·9 per cent.; these results are explained by the fact that potato starch is relatively soluble in boiling water, whereas rice starch has a high gelatinising temperature, and gives a stiffer paste. The increase in strength of the paper due to the addition of starch is proportional to the yield, and for a unit quantity of the different starches retained, the increase in strength is fairly constant. The use of starch, particularly of low grade starches, injuriously affects the whiteness of the paper. The kind of starch used will be governed by price, but the above data as regards yield will be a useful guide in its selection. For most purposes potato starch, when added in the raw state, is most economical, but wheat starch gives rather the best results all round. Except in the case of loaded papers (see below) there is no advantage, but rather the reverse, in boiling the starch to a paste before adding to the pulp; the yield is generally lower (except with rice starch), and sticky deposits are liable to form in the stuff-pipes. Another series of experiments was made to ascertain the influence of starch when used in conjunction with china clay. In this case 5 per cent. of starch, calculated on the fibre, was boiled to a paste with water and clay, and added to the pulp; the results being compared with those from pulp similarly loaded, but without starch. Two experiments were made: (*a*), pulp sized with 5 per cent. of rosin and loaded with 15 per cent. of clay; (*b*), pulp unsized and loaded with 50 per cent. of clay. The results of the ash-determinations in the papers were as follow:—(*a*), plain, 11·0; with starch, 12·3; (*b*), plain, 28·8; with starch, 31·5, all in percentages. The slight increase in the percentage of clay retained by the paper under the influence of starch does not compensate for the cost of the latter, but its beneficial effect is noticed when the paper is dried. The particles of clay are surrounded by an envelope of paste, which thickens on drying and fixes the mineral to the fibres. Thus the limp feel which mineral loading imparts to the paper is counteracted by the starch, the trouble caused by "dusting" during printing is largely prevented, and it was found by the author that the tensile strength and stretch of the papers were increased by 25 per cent. —J. F. B.

"Cell-pitch" from sulphite wood-pulp waste liquors. W. Sembritzki. Papier-Zeit., 1908, **33**, 872.

AT Walsum on the Rhine, the hot sulphite liquors discharged from the digesters flow through cooled lead pipes into an acid-proof reservoir. Thence the liquor is pumped into wooden vats, in which it is neutralised with lime; it is filtered through coke, heated to about 97° C. by passage through an economiser, and concentrated to a density of 35° B. in an evaporator. Much of this syrup is exported to England for use as a binder for moulds in foundries. The rest is evaporated to dryness by means of revolving steam-heated drums, from which the pitch, containing 90 per cent. of dry substance, is detached by scrapers, and then falls into boxes in which it sets to blocks of about 1 cwt. each. The pitch has the appearance of black, opaque rosin, but it is readily soluble in water. The yield of pitch is 10 per cent. of the liquors, and a ton of coal is required to make a ton of pitch. This "cell-pitch" is used for briquetting blast-furnace dust, hitherto a waste product, although containing about 40 per cent. of iron. The dry dust is mixed with ground "cell-pitch," and the mixture is treated in a mixer with superheated steam at a temperature of 350°—420° C. The mixture, which must not be so moist as to become sticky, is then pressed into bricks weighing about 3 kilos.; the proportion of pitch is 4—5 per cent. The bricks do not lose their shape in the blast-furnace at a temperature of 1600° C., since the pitch does not volatilise at a high temperature, but only cokes. The price of the pitch is 50 marks per ton. "Cell-pitch" may also be used for briquetting coal dust; it is also employed as a filling material and for the preparation of a cheap black dyestuff for cotton fabrics, and for impregnating sail-cloths and ropes. The crude waste liquors are valued at 5 Pfennige per ton, and the author states there is no question that a profitable means of disposing of these wastes has now been found.—J. F. B.

PATENTS.

Cellulose (wood-pulp) ; Manufacture of ——. E. Morterud, Christiania, Norway. U.S. Pat. 883,328, Mar. 31, 1908.

IN the manufacture of pulp by the sulphite process a heating device is provided externally to the digester, connected at its lower end with the bottom of the digester and having a discharge pipe at its upper end, which enters the digester and discharges the heated liquid at a point sufficiently below the surface of the contents of the digester to maintain a circulation by producing an upward current of liquid through the central part of the digester.—J. F. B.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

Morphine ; 18th Communication. Hydrolysis of a- and β-chlorocodide. L. Knorr and H. Hörlein. Ber., 1908, **41**, 969—975.

THE authors give the following table shewing the principal constants of six halogen derivatives of morphine and codeine.

	M.pt.	$[\alpha]^D$.
	° C.	
α-Chloromorphide	204	−375°
β-Chloromorphide	188	−5°
α-Chlorocodide	152—153	−380°
β-Chlorocodide	152—153	−10°
Bromomorphide	169—170	+66°
Bromocodide	162	+56°

The authors consider that α- and β-chlorocodide are optical isomerides possessing the same structural formula. On hydrolysis, α-chlorocodide gives about 45 per cent. of pseudocodeine, 15 per cent. of allopseudocodeine (β-isocodeine), and 25 per cent of isocodeine. β-Chlorocodide when hydrolysed, gives 10 per cent. of pseudocodeine, 20 per cent. of allopseudocodeine, and 55 per cent. of isocodeine.—F. SHDN.

Digitalis ; Colour reactions of the toxic glucosides of ——. L. Garnier. J. Pharm. Chim., 1908, **27**, 369—371.

THE active glucosides of digitalis, viz., digitoxin or crystalline digitalin, and amorphous digitalin, may be characterised by the following reactions:—*Keller's* *reaction.* A reagent (a) is prepared with 100 c.c. of glacial acetic acid, and 1 c.c. of 5 per cent. aqueous solution of ferric sulphate. Another solution (b) is made with 100 c.c. of strong sulphuric acid and 1 c.c. of 5 per cent. aqueous ferric sulphate solution. A particle of the glucoside is dissolved in 1 or 2 c.c. of (a), in a narrow test-tube; 2 c.c. of (b) are then introduced slowly, without mixing, by means of a pipette. With digitoxin a bluish-black colour is developed at the zone of contact; after two hours at the ordinary temperature, the whole of the supernatant acetic acid layer is tinted bright blue, passing to deep blue in five hours, the line of separation becoming black. With amorphous digitalin a cherry-red colour is at once formed in the upper stratum of the sulphuric acid reagent, immediately below the zone of contact. *Brissemoret-Derrien's reaction.* The reagents are:—(a), 30 c.c. of glacial acetic acid mixed with 20 c.c. of 4 per cent. oxalic acid, reduced to glyoxylic acid by treatment with sodium amalgam until neutral; (b), strong sulphuric acid. A particle of the glucoside, which dissolves with difficulty, is dissolved in 2 c.c. of (a), and then 2 or 3 c.c. of (b) are added as described above. Digitoxin slowly develops a grey or greyish-green tint at the zone of contact. After two hours this becomes bottle-green; after five hours the line of separation is blackish, with a pale green border. Amorphous digitalin gives a cherry-red colour in the lower liquid, as in Keller's reaction. *Lafon's reaction.* The reagents are:—(a), a mixture of equal volumes of 95 per cent. alcohol and of strong sulphuric acid; (b), a very dilute, almost colourless, aqueous solution of ferric chloride. A crystal of the glucoside, in a watch glass, is moistened with one drop of (a), when a yellowish tint appears, at the ordinary temperature. A drop of (b) is placed in proximity to this. On contact, a rapid formation of an intense greenish-blue colour occurs with digitoxin; the amorphous glucoside does not afford the reaction. For toxicological application, Lafon's reaction is most convenient, since it may be applied directly to the evaporation residue of the chloroform extract; Keller's reaction is also readily applied, since the residue is easily soluble in glacial acetic acid. But the Brissemoret-Derrien reaction is not available, on account of the insolubility of the residue in aceto-glyoxylic acid, so that sufficiently marked reactions cannot be obtained under these conditions. If, however, the residue be first dissolved in a few drops of glacial acetic acid, the characteristic reactions may then be obtained with the solution.—J. O. B.

Commercial crude drugs; Variation in activity of ——. F. H. Carr and W. C. Reynolds. Pharm. J., 1908, 80, 542—544.

The following tabulated results of analysis, show the highest and lowest observed percentages of active ingredients found in a number of drugs, which had been previously selected as of apparently good quality:—

Drug.	Lowest observed percentage.	Highest observed percentage.	Active principles determined.
	per cent.	per cent.	
Aloes Curaçoa	12·6	27·9	Aloïn.
Atropa Belladonna root	0·29	0·55	Total alkaloid.
Atropa Belladonna, dried herb	0·23	1·08	,, ,,
Broom tops (*Cytisus scoparius*)	0·07	1·06	Sparteïne sulphate.
Calabar beans (*Physostigma venenosum*)	0·04	0·27	Eserine.
Cinchona succirubra	1·06	4·64	Quinine and cinchonidine.
	2·70	8·30	Total alkaloid.
Coca leaves	0·018	0·79	Alkaloid sol. in petrol. ether.
Colchicum seed	0·12	0·57	Colchicine.
Hydrastis canadensis root	1·14	3·17	Hydrastine.
	2·30	5·80	Berberine sulphate.
Hyoscyamus niger leaves	0·06	0·21	Total alkaloid.
Pilocarp. jaborandi	Too small to determine	0·05	Pilocarpine nitrate.
Pilocarp. microphyl.	ditto	0·99	Ditto.
Pomegranate root bark	0·12	0·29	Total alkaloid.
Ipecacuanha root	1·76	2·77	Total alkaloid.
Ipecacuanha root (Rio.)	0·93	1·83	Emetine.
	0·48	1·29	Cephaeline.
Jalap (*Ipomœa purga*)	5·10	15·8	Resin.
Leptandra Virginica	6·90	12·6	Oleoresin.
Nux Vomica beans	0·81	2·0	Strychnine.
Podophyllum peltatum	3·80	6·65	Resin.
Scammony root	7·75	10·80	Resin.

It will hence be seen that in no less than nine cases, the maximum variation exceeds the ratio of 4 to 1, and, that in all cases where the active principle is alkaloidal (except ipecacuanha), this ratio is greater than 2 to 1. It is pointed out that the remedy for this dangerous state of things, is the standardisation of the galenical preparation, but it is further pointed out that unfortunately, chemical methods have not yet been devised for testing many of the more potent drugs, and physiological methods have to be resorted to. The authors further shew that climate, time of harvesting, and methods of drying all affect the activity of drugs, and hence again the great importance of chemical and physiological standardisation.

Sparteine in Cytisus Scoparius. (*Ibid.*)

It has been found in a series of experiments that the percentage of sparteïne contained in broom tops (*Cytisus scoparius*) varies according to the season. The following are the results of analyses of the herb gathered month by month from the same locality, during a year. *August*, 0·07 per cent. of sparteïne sulphate, *September*, 0·17 per cent., *October*, 0·34 per cent., *November*, 0·46 per cent., *December*, 0·36 per cent., *January*, 0·36 per cent., *February*, 0·38 per cent., *March*, 0·53 per cent., *April*, 0·44 per cent., *July*, 0·23 per cent. It thus appears that during the flowering and growing period, there is a rapid loss of alkaloid, which is slowly replaced during the quiescent months of autumn and winter.

Rhapontic root and Austrian rhubarb. O. Hesse. J. prakt. Chem., 1908, 77, 321—352. (Compare Tschirch and Christofoletti, this J., 1906, 1065, and Hesse, this J., 1899, 1152.)

A re-investigation of the drugs, rhapontic root and Austrian rhubarb, has been carried out as follows:—The powdered root was first extracted with boiling ether for about 45 hours. A semi-crystalline substance was deposited, and this, together with a further quantity resulting from a partial evaporation of the ether, was warmed with 90 per cent. alcohol, and the residue (A) separated. The ethereal mother liquor was completely evaporated and the residue dissolved in hot alcohol. On cooling, a solid (B) separated, and the mother liquor, when allowed to evaporate, furnished a brown amorphous residue containing crystals (C); the crystals were separated by careful addition of alcohol, which dissolved the brown substance. The alcoholic solution was allowed to drop into water, and, after some days, the clear liquid was evaporated at 50° C. to a small bulk, filtered from resin, saturated with common salt, extracted with ether, and the extract evaporated. A brownish residue (D), becoming crystalline, was thus obtained. The drug remaining after treatment with ether was further extracted with boiling acetone for 6 hours. A crystalline body (E) soon separated, and, on cooling, a gelatinous substance (F). The separated solution, on evaporating to dryness, gave a brown residue, becoming crystalline, to which acetone was gradually added, thus separating crystals (G) from a solution, which, on addition of water, gave a resin (H) and mother liquor (J). Fractions, A, E. and G, consisted of crude rhapontin, $C_{21}H_{24}O_9$. Isorhapontigenin, $C_{15}H_{14}O_4$, was found in C. D consisted principally of gallic acid. A glucoside, $C_{21}H_{20}O_{10},H_2O$, for which the name *glucochrysarone* is proposed, was isolated from F. Fraction, B, was found to contain chrysophanic acid (and its methyl ether) and traces of rhabarberone. H, on hydrolysis, furnished chrysarone, $C_{15}H_{10}O_5$, (and its methyl ether), an acid provisionally named *rhapontic acid*, chrysophanic acid, a little gallic acid, and dextrose, indicating the probable presence of the glucosides, chrysophanin and glucogallin, in the drug. Glucogallin also was found in J. *Rhapontin* (identical with the rhaponticin of Tschirch and Christofoletti, *loc. cit.*; and the ponticin of Gilson. Bull. acad. roy. méd. Belg. 1903, 106) was extracted from the crude material by adding water and an excess of calcium hydroxide, and then acetic acid to the filtrate. It is present in the drug to the extent of 4·3 per cent. On acetylation, a penta-acetyl derivative, m. pt. 95° C., or a hexa-acetyl derivative, m. pt. 138° C., is obtained, according to the conditions. Pure rhapontin, which is best obtained by the saponification of its acetyl derivative, has the rotatory power, in dilute acetone, at 15° C., $[\alpha]_D = -63{\cdot}0°$. When boiled with a 5 per cent. solution of sulphuric acid, it yields dextrose and *rhapontigenin*. The latter has the formula, $C_{15}H_{14}O_4,H_2O$, and the hydrolysis is represented by the equation: $C_{21}H_{24}O_9 + H_2O = C_6H_{12}O_6 + C_{15}H_{14}O_4$. When pure, rhapontigenin melts at 190°—191° C.; it gives a triacetyl derivative, m.pt. 112° C. *Anhydrorhapontin*, $C_{15}H_{12}O_3$, yellow leaflets, m. pt. 203° C., was obtained on one occasion by heating rhapontin with acetic anhydride. *Isorhapontigenin*, m. pt. 192° C., was isolated from fraction, C, by treating this with sodium carbonate solution to remove resin and rhapontin, then with benzene to remove chrysophanic acid, then dissolving it in ether, decolorising with animal charcoal, and evaporating. The crystalline residue was taken up with hot glacial acetic acid and water added, until crystals separated. The colourless crystals soon turn brown in moist air. They are readily soluble in alcohol, ether, and acetone, insoluble in benzene and petroleum ether. The alcoholic solution is neutral. *Glucochrysarone*, obtained from fraction, F, after boiling with benzene, by repeated solution in hot strong alcohol, is a yellow powder, insoluble in ether, benzene, and chloroform, sparingly soluble in hot alcohol and hot acetone. It has a bitter taste, and its alcoholic solution is neutral. It dissolves in alkalis with a purple colour. When boiled with a 5 per cent. solution of sulphuric acid in 80 per cent. alcohol, it yields chrysarone and dextrose, according to the equation, $C_{21}H_{20}O_{10} + H_2O = C_6H_{12}O_6 + C_{15}H_{10}O_5$. *Chrysarone* separates on cooling; it forms golden leaflets (from alcohol), m. pt. 165° C. The chrysopontin and chrysorhapontin of Tschirch and Christofoletti appear to be identical with rhabarberone and chrysophanic acid respectively.—F. Sodn.

Simaruba bark; Constituents of ——. C. Gilling. Pharm. J., 1908, **80**, 510—513.

This bark is found to contain: (1), a fixed oil; (2), resin; (3), a crystalline bitter substance, $C_{22}H_{30}O_9$, giving a violet coloration with concentrated sulphuric acid; and (4), a crystalline, non-bitter substance. The presence of a fluorescent principle was also indicated. Simaruba has proved to be a specific in cases of cholera and dysentery. The tree grows wild in Jamaica, the root-bark forming the true Cortex Simarubæ. There are two species, one *S. amara*, growing in Brazil and Guiana; the other, *S. glauca*, D.C., in the West Indies, Cuba, Florida, Panama, and Central America.

Arbutin and its derivatives; Rotatory power and hydrolysis by emulsin of ——. E. Bourquelot and H. Hérissey. Compt. rend., 1908, **146**, 764—766.

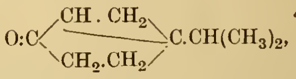
In the course of their work on glucosides the authors have been led to formulate the hypothesis that "all the glucosides which are hydrolysable by emulsin are derivatives of dextrose and are lævorotatory." In the present note the authors show that this rule applies to arbutin, a glucoside which yields on hydrolysis 1 molecule of dextrose and 1 molecule of quinol (hydroquinone). The authors find that ordinary arbutin contains a certain amount of methylarbutin. After purification, the dried substance has a specific rotatory power $[\alpha]_D = -64{\cdot}7°$. The authors have prepared from arbutin, methylarbutin, benzylarbutin, and dinitroarbutin, and have recorded their properties. All these conform to the above rule; they are hydrolysed by emulsin and are lævorotatory.—J. F. B.

Peruvian balsam; Distinctive test for genuine and artificial ——. K. Dieterich. Ber. d. pharm. Ges., 1908, **41**, 279. Pharm. Zeit., 1908, **53**, 279.

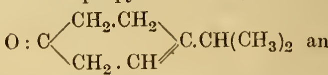
A small quantity of the balsam is dissolved in ether; a little strong sulphuric acid is run in to form a lower layer, then very cautiously some hydrochloric acid is added, so as to obtain three strata of liquid. Artificial Peruvian balsam, under these conditions, gives a red coloured under zone, and a very characteristic green upper zone. With natural Peruvian balsam both upper and lower zones are red with the colourless hydrochloric acid layer between them. The green reaction of the so-called "synthetic" balsam is due to the presence of Tolu balsam. The test will detect the presence of 30 per cent. of Tolu balsam in Peruvian balsam.—J. O. B.

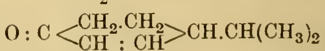
Terpenes and essential oils. Parts 90 *and* 91. O. Wallach. Annalen, 1908, **359**, 265—286, 287—316. (See also this J., 1907, 1214.)

By oxidising sabinene with alkaline permanganate in the cold, sabinenic acid is formed, and the latter yields sabinaketone,



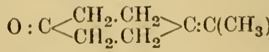
on treatment with sulphuric acid and permanganate. According to Semmler, the semicarbazone of this compound yields a hydrocarbon, C_9H_{14}, when treated with sulphuric acid. The author has found, however, that by treating sabinaketone, or its semicarbazone, with sulphuric acid, two isomeric isopropylhexenones,





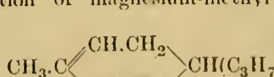
$$O:C{<}\begin{matrix}CH_2.CH_2\\CH:CH\end{matrix}{>}CH.CH(CH_3)_2$$

are produced. The former is probably the primary reaction product, being subsequently partially transformed into the latter, which is the chief constituent of the end-product. The second (Δ_2) isomeride readily polymerises, and the polymerides are also produced in the preparation of the isopropylhexenones. By treating sabinaketone in ether-methyl alcohol solution with dry hydrogen chloride, the monohydrochloride, $C_9H_{15}OCl$, is formed, whilst, in glacial acetic acid solution, the compound, $C_{18}H_{29}OCl_3$, is produced. By heating the monohydrochloride with dimethylaniline and treating the reaction product with oxalic acid, the first (Δ_3) of the above-mentioned isopropylhexenones, and a third isomeride, propylidenehexanone,

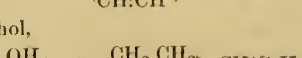


$$O:C{<}\begin{matrix}CH_2.CH_2\\CH_2.CH_2\end{matrix}{>}C{:}C(CH_3)_2,$$

are formed. On treating Δ_2-isopropylhexenone with an ethereal solution of magnesium-methyl iodide, α-phellandrene,



and an alcohol,



$$\begin{matrix}OH\\CH_3\end{matrix}{>}C{<}\begin{matrix}CH_2.CH_2\\CH:CH\end{matrix}{>}CH(C_3H_7),$$

are formed. This is the first example of the synthesis of phellandrene from a compound containing a smaller number of carbon atoms. *Methenecyclohexane and* Δ_1-,

Δ_2-, and Δ_3-*methylcyclohexenes.* Methenecyclohexane was obtained by distilling pure, dry, Δ_1-cyclohexeneacetic acid, and characterised by its properties and those of its derivatives. Δ_1-Methylcyclohexene was prepared by dehydrating 1·1-methylcyclohexanol with (*a*) zinc chloride, (*b*) phthalic anhydride. The boiling point of the product obtained by the first method was 111°—112° C., whereas that obtained by the second method boiled at 106·5°—107·5° C.; in other respects, however, the compounds were identical. By dehydrating 1.4-methylhexanol with zinc chloride, a mixture of Δ_1- and Δ_3-methylcyclohexenes was obtained; as to whether the Δ_2-isomeride is formed in this reaction was left undecided. Amongst the products obtained by oxidising Δ_1-cyclohexeneacetic acid, a considerable quantity of δ-acetylvaleric acid was found. Cyclohexylethylamine, on treatment with nitrous acid, was found to yield a small quantity of hydrocarbon (probably chiefly cyclohexylethylene) and two alcohols whose behaviour indicated that they possess the formulæ, $C_6H_{11}CH_2{\cdot}CH_2{\cdot}OH$ and $C_6H_{11}CH(OH)CH_3$, respectively. The production of an alcohol containing a 7-carbon-atom ring was not observed.—L. E.

Borneol; A new ——. O. Aschan. Ber., 1908, **41**, 1092—1094.

Terecamphene (b. pt. 159°—159·5° C.) forms a hydrochloride melting at 148°—149° C. When this is treated with bases in the presence of water, it passes into a new alcohol, $C_{10}H_{17}OH$. This is best prepared by heating camphene hydrochloride with milk of lime to 50°—60° C. for 12—18 hours. The product is distilled with steam and taken up with ether. The camphene hydrate, $C_{10}H_{17}OH$, produced in this way and purified by distillation, forms a hard, white crystalline mass, boiling at 205° C., and melting at 142° C. After subliming, it forms highly refracting tetrahedra, and then melts at 150°—151° C. It readily loses water when warmed with dilute mineral acids with the formation of camphene. It appears to be a tertiary alcohol.—F. Shdn.

Adrenine solutions; The coloration of ——. A. Gunn and E. F. Harrison. Pharm. J., 1908, **80**, 513.

Adrenine may be dissolved in water with the aid of a smaller quantity of hydrochloric acid than one molecular equivalent. Such a solution even when kept out of contact with air, gradually acquires a red colour. Contact with alkaline glass and exposure to air greatly accelerate such coloration; also exposure to light, or the presence of a minute quantity of a ferric salt, increases the tint. A solution not readily discolouring even after exposure to light and air for some weeks, is obtained by using about 0·3 part of hydrochloric acid to each part of adrenine—*i.e.*, about half as much again as one molecular equivalent. To prepare such a solution for 1 grm. of adrenine, 2·8 mgrms. of the official dilute hydrochloric acid are required; or about 3 minims for 1 grain. It is important to note that discoloured solutions show greatly reduced physiological activity, the reduction being, approximately, proportional to the degree of coloration.

Cyclo-octadiëne from pseudopelletierine; Constitution of the ——. C. Harries. Ber., 1908, **41**, 671—678.

The author studied the action of ozone on the cyclo-octadiëne prepared by Willstaetter and Veraguth from pseudopelletierine (this J., 1905, 687; also Ber., 1907, **40**, 957). When a solution of the hydrocarbon in carbon tetrachloride is treated with ozone, there separates immediately an insoluble saturated diozonide (yield about 80 per cent. of the theoretical). This ozonide when decomposed with water yields succinic dialdehyde or succinic acid, and is therefore cyclo-octadiënediozonide-(1·5). The carbon tetrachloride mother-liquor contains a second oily, unsaturated mono-ozonide, probably derived from the hydrocarbon designated bicyclo-octene by Willstaetter and Veraguth. The behaviour with ozone thus shows that Willstaetter and Veraguth's cyclo-octadiëne is a mixture of two hydrocarbons, of which about 80 per cent. consists of cyclo-octadiëne-(1·5). The action of ozone on the polymerisation products of cyclo-octadiëne was also studied. Dicyclo-octadiëne yields an insoluble explosive ozonide, apparently a mixture of a tri- and a diozonide, indicating that the polymerised hydrocarbon is partially depolymerised by the ozone. Polycyclo-octadiëne on treatment with ozone yields an insoluble ozonide, different from that yielded by the original cyclo-octadiëne, and is therefore quite distinct from gutta-percha, which it somewhat resembles in appearance, since the latter is depolymerised by ozone and yields cyclo-octadiënediozonide-(1·5) (this J., 1905, 448, 1906, 33). Attempts to obtain a polymerisation product of similar properties to gutta-percha or caoutchouc, from the cyclo-octadiëne, gave no satisfactory results.—A. S.

Light; Chemical action of ——. *XII.* G. Ciamician and P. Silber. Ber., 1908, **41**, 1071—1080.

Cyclohexanone and the three isomeric methylcyclohexanones when exposed to the light undergo hydrolysis in a similar manner to menthone (see this J., 1906, 563; 1907, 777), the ring being opened and a saturated fatty acid, $C_nH_{2n}O_2$, and an unsaturated aldehyde, $C_nH_{2n-2}O$, produced. Cyclohexanone yields caproic acid and probably the hexenealdehyde, $CH_2:CH(CH_2)_3CHO$. *o*-Methylcylohexanone yields œnanthylic acid and an unsaturated aldehyde, $CH_3.CH:CH(CH_2)_3CHO$. *m*-Methylcyclohexanone yields a methylhexane acid of b.pt. 215°—216° C. *p*-Methylcyclohexanone gives an acid of the constitution, $CH_3.CH_2.CH(CH_3).(CH_2.CH_2.COOH$, and an aldehyde, probably $CH_2:CH.CH(CH_3).(CH_2)_2CHO$. Comparative experiments on the action of light on solutions of acetone, cyclohexanone, and menthone, with and without the addition of chlorophyll, showed that the effect of the latter substance is to retard the hydrolysis of the ketones.—A. S.

Thorium; Compounds of ——, *with sulphur.* A. Duboin. Compt. rend., 1908, **146**, 815—817.

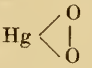
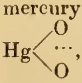
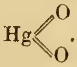
Thorium chloride is prepared by passing over ignited thoria a stream of chlorine containing carbon tetrachloride vapour, and this chloride (containing some oxychloride) is mixed with excess of sodium chloride, and heated to bright redness in a stream of hydrogen sulphide. There are thus obtained:—*Thorium sulphide*, ThS_2, dark-brown micaceous plates, not well crystallised, readily attacked by nitric acid; and *thorium oxysulphide*, ThOS, orange-yellow or pyrites-yellow quadratic crystals, but slightly acted on by nitric acid.—J. T. D.

Oxalates of the rare earths; Carrying down of soluble oxalates by ——. G. P. Baxter and H. W. Daudt. J. Amer. Chem. Soc., 1908, **30**, 563—572.

Specimens of the rare earth oxalates for these investigations were prepared by the oxalate method of Stolba (Chem. News, 1880, **41**, 31). Hot solutions of oxalic acid containing a small quantity of nitric acid are stirred into hot nitric acid solutions of the rare earths until precipitation is complete. The precipitate is dried at 125° C., and before weighing out for analysis is well ground to insure uniformity in water content. The oxide is determined by igniting weighed portions of about half a grm. of the oxalate in a platinum crucible, while the oxalic acid is determined by titrating weighed quantities of the oxalate, dissolved in 2-*N*-sulphuric acid, with standard potassium permanganate.

Precipitation of potassium, sodium and ammonium oxalate solutions were carried out with the oxalates of neodymium, lanthanum, samarium and yttrium. The results point to the formation of highly crystalline double salts, containing a molecule of the rare earth oxalate to one molecule of alkali oxalate. Potassium and ammonium oxalates are precipitated to a much greater extent than sodium oxalate. The precipitation is in most cases almost wholly prevented in strongly acid solution and is greater at high than at low temperatures. In the case of yttrium the precipitation of the double salt takes place in neutral or in acid solution. To obtain a rare earth oxalate as pure as possible by means of an alkali oxalate or ammonium oxalate, the reaction should be carried out in cold dilute solution in presence of a quantity of a strong acid considerably more than equivalent to the oxalate added.—W. S.

Mercury peroxidate [peroxide] and the hydrogen peroxide salts of mercury. A. von Antropoff. J. prakt. Chem., 1908, **77**, 273—320.

The periodic character of the rate of decomposition of hydrogen peroxide solution, in contact with mercury as a catalyst, is apparently connected with the formation of a film on the surface of the metal (Bredig, this J., 1903, 514). By using 30 per cent. hydrogen peroxide solution and working at a low temperature, a highly unstable black substance is obtained, which, from theoretical considerations, is probably a mercurous salt of hydrogen peroxide. As the reaction proceeds, this black mass becomes reddish-brown in colour and less unstable, and it gives mercuric oxide, when decomposed, whereas the black substance yields metallic mercury. This new body, for which the formula, HgO_2, has been established, is more conveniently prepared by the action of hydrogen peroxide on the red oxide of mercury, which in a few minutes is converted into a dark red product. When carefully removed to a porous plate, previously cooled to 0° C. in a cold desiccator, it can be dried, and is then much more stable than in the moist state. It explodes violently when warmed or rubbed, or by percussion, and with water readily hydrolyses to mercuric oxide and hydrogen peroxide, the reaction, $HgO + H_2O_2 \rightleftarrows HgO_2 + H_2O$, being a reversible one. This shows that the compound is a salt of hydrogen peroxide and divalent mercury, its constitutional formula being  or , and not . The name *peroxidate* is proposed for a peroxide of this class, this substance being mercuric peroxidate and the film-substance probably mercurous peroxidate. For the analysis of the compound, on account of its partial decomposition during drying, it is necessary to obtain the ratio, Hg : O, with the moist substance, the hydrogen peroxide present being allowed for by van Bijlert's method as follows:—Hydrogen peroxide is saturated with barium nitrate and left in contact with the substance for half an hour. The ratio between the barium and hydrogen peroxide in the mother liquor is then determined and the weight of barium with the moist separated substance is also ascertained; then, by proportion, the weight of hydrogen peroxide present with the substance is calculated and deducted from the total quantity found after hydrolysis. Mercuric peroxidate is not obtained by the action of ozone on mercury or its oxide.—F. Sodn.

Sicilian essential oils. Pharm. J., April 25, 1908. [T.R.]

The exports of essential oils from Sicily and Calabria during 1907 surpassed those of 1906 in weight by 108,570 kilos., in value by 5,616,977 lire Italian, being about 11½ per cent. in weight and 30½ per cent. in value. The prices of all essences in 1907 reached a height not known for nearly a generation. While in previous years, at the advent of the new crop, some stocks of old oil had to be carried over, in 1905 and 1906, notwithstanding a constant increase in the production, the export of all essences absorbed nearly the entire production. The exports from 1904 to 1907 were as follows:—1904, 1,006,103 kilos.; 1905, 868,244 kilos.; 1906, 948,328 kilos.; 1907, 1,056,898 kilos. Of this export total in 1907, 66 per cent. went to the United States and Great Britain combined, as against 57 per cent. in 1903.

Patents.

Substances useful in therapeutics; Manufacture of —— [from glyoxime derivatives]. A. Zimmermann, London. From Chem. Fabr. auf Actien, vorm. E. Schering, Berlin. Eng. Pat. 13,600, June 12, 1907.

By reduction of 3.4-dihydroxyphenylglyoxime or 3.4-dihydroxyphenylalkylglyoximes (see Eng. Pat. 13,599 of 1907; this J., 1908, 420) with a suitable amalgam in presence of acids, products are obtained which are stated to have the property of raising the pressure of the blood to nearly as great a degree as adrenaline. They probably possess the constitution, $(HO)_2C_6H_3.C(NH_2):CX.NH_2$, where X is hydrogen or alkyl. The substances have not yet been isolated either as free bases or in the form of salts.—T. F. B.

a-Bromoisovalerianic acid; Manufacture of borneol ester and menthol ester of ——. Lüdy und Co., Burgdorf, Switzerland. Eng. Pat. 4359, Feb. 26, 1908. Under Int. Conv., March 9, 1907.

Isovalerianic chloride is converted, by treatment with bromine, into *a*-bromoisovalerianic chloride (b.pt. 156°—160° C.); this combines readily with borneol or menthol to form the respective esters, which possess medicinal value.—T. F. B.

Blood albumin preparations; Process of manufacturing ——. Blood compound of glycerophosphate of lime and calcium. A. Langer, Friedrichsberg, Assignor to K. A. Lingner, Dresden, Germany. U.S. Pats. 884,025 and 884,026, April 7, 1908.

See Eng. Pat. 7830 of 1905; this J., 1905, 1027.—T. F. B.

Tartaric acid; Manufacture of —— from cream of tartar, etc. J. M. Perigny and L. Mazet. First Addition, dated Jan. 16, 1907, to Fr. Pat. 382,824, Dec. 18, 1906 (this J., 1908, 296).

The yields, obtained by the electrolytic method described in the main patent, are improved when one or more of the secondary alcoholic groups are esterified with an acid radical which can afterwards be easily eliminated. Antimonious and boric acids have been found to be the most suitable. The acid in the tartriferous material is converted into soluble tartrate or bitartrate, and the mass, after being mixed with the necessary quantity of one of the above-mentioned acids, is electrolysed. An advantage of this method for the treatment of wine lees, is that the colouring principles are destroyed and the usual treatment with animal charcoal, for decolorising, is rendered unnecessary.—F. M.

Lactic acid; Process for preparing pure —— by distilling commercial lactic acid. Chem. Fabr. Flörsheim Dr. H. Noerdlinger. Fr. Pat. 384,468, Nov. 28, 1907. Under Int. Conv., Dec. 1, 1906.

See Eng. Pat. 26,415 of 1907; this J., 1908, 246.—T.F.B.

Hæmoglobin products; Preparation of clear, stable —— which keep their red colour. Sicco med. chem. Institut F. G. Sauer. Fr. Pat. 384,845, Dec. 9, 1907.

See Ger. Pat. 178,902 of 1905; this J., 1907, 779.—T.F.B.

Aminoalcohols; Process for preparing ——. J. D. Riedel A.-G. Ger. Pat. 189,481, March 3, 1905. Addition to Ger. Pat. 169,746, Oct. 8, 1903 (this J., 1906, 909).

By the action of ammonia on halogenhydrins of the composition, $HO.C(R_1R_2)CH_2X$, X being a halogen, aminoalcohols of the composition, $HO.C(R_1R_2)CH_2NH_2$, and $NH(CH_2.C.R_1R_2.OH)_2$, are obtained. R_1 and R_2 may be alkyl, aryl, or arylalkyl groups.—T. F. B.

Perfumes from pseudoionone; Process for preparing ——. Haarmann und Reimer, Chem. Fabr. zu Holzminden. Ger. Pat. 183,855, April 6, 1905.

Pseudoionone is treated with dimethyl sulphate, and the product distilled in steam. The product contains ionone and a methylionone.—T. F. B.

Benzoyl ester of dimethylaminoisopropyl alcohol; Process for preparing the ——. Chem. Fabr. auf Actien, vorm. E. Schering. Ger. Pat. 189,482, June 18, 1905. Addition to Ger. Pat. 175,080, Sept. 21, 1904.

Dimethylaminoisopropyl alcohol or one of its salts is treated with a benzoylating agent. The products possess local anæsthetic properties.—T. F. B.

Coumarincarboxylic acid; Process for preparing ——. Haarmann und Reimer, Chem. Fabr. zu Holzminden. Ger. Pat. 189,252, July 27, 1905.

Molecular proportions of salicylic aldehyde and cyanoacetic acid are condensed, in cold aqueous solution, in presence of alkali, to o-hydroxybenzylidenecyanoacetic acid, which is converted into coumarincarboxylic acid by heating with mineral acids, ammonia being formed. —T. F. B.

p-Aminobenzoic acid alkamine esters; Process for preparing ——. E. Merck. Ger. Pat. 189,335, Feb. 6, 1906.

p-Aminobenzoic acid alkamine esters are obtained by action of chloroethyldialkylamines, $Cl.CH_2.CH_2.NAlk_2$, on *p*-aminobenzoates.—T. F. B.

Double compound from glucose and sodium iodide; Process for preparing a crystalline anhydrous ——. J. A. Wülfing. Ger. Pat. 196,605, March 16, 1907.

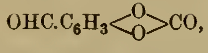
A compound is obtained by the interaction of sodium iodide and glucose in presence of concentrated alcohol, which is crystalline and anhydrous, and has the formula, $NaI,2C_6H_{12}O_6$.—T. F. B.

Pine oil; Process for purifying ——. C. Kaas. Ger. Pat. 180,207, April 25, 1906. Addition to Ger. Pat. 170,543, Sept. 11, 1902.

Dry alkalis or alkaline-earths are employed in place of the aqueous solutions used in the original process (see this J., 1907, 769).—T. F. B.

Carbonic acid esters of protocatechuic aldehyde: Process for preparing cyclic ——. H. Pauly. Ger. Pat. 190,788, May 8, 1906.

By treating dichloropiperonal with anhydrous acids, cyclic carbonic esters of protocatechuic aldehyde,



$$OHC.C_6H_3{<}{}^{O}_{O}{>}CO,$$

are formed. Suitable acids are formic acid, oxalic acid, etc. The product is decomposed by water, with formation of protocatechuic aldehyde. It is analogous to catechol carbonate, and is suitable for preparing perfumes and pharmaceutical products.—T. F. B.

Tetraalkyldiaminodibenzyltetrahydroxyanthraquinones; Process for preparing ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 188,597, Aug. 19, 1906.

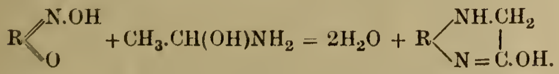
Dialkylanilines and formaldehyde are allowed to act simultaneously on anthrachrysone.—T. F. B.

Camphoric acid alkyl ester; Process for preparing a normal ——. J. D. Riedel A.G. Ger. Pat. 189,840, Nov. 6, 1906.

Dialkyl sulphates or arylsulphonic esters are allowed to act on salts of *d*-camphoric acid in aqueous or alcoholic solution.—T. F. B.

2-Hydroxydihydro- or 1-alkyl-2-ketodihydroquinoxalines; Preparation of ——. M. Lange. Ger. Pat. 196,563, Dec. 23, 1906.

Aromatic o-hydroxynitroso compounds are condensed with the reaction products of ammonia or primary aliphatic amines on acetaldehyde; derivatives of hydroxylated *p*-diazines are thus obtained (quinoxaline derivatives), thus,



$$R{<}{}^{N.OH}_{O} + CH_3.CH(OH)NH_2 = 2H_2O + R{<}\begin{array}{l}NH.CH_2\\ \quad\ \ |\\ N=C.OH.\end{array}$$

—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Patents.

Cellulose films; Manufacture of —— Soc. Civile des Pellicules Nouvelles pour Cinématographes et áutres usages. Fr. Pat. 384,111, Jan. 25, 1907.

A very thick collodion, prepared by increasing the usual ratio of alcohol to ether by about 15 per cent., is caused to flow very slowly, under a pressure of 3—10 atmospheres, from a rectangular orifice, which may be from several centimetres up to 1 metre in length and up to 0·8 mm. in width. The sheet of fluid collodion thus discharged does not coagulate immediately, and the rate of flow must be such that it is exposed to the air without any support for 1—2 minutes before it is caught and carried away as a continuous ribbon by a slowly moving endless band of cloth. This band carries the film through a chamber in which it is dried by a current of heated air. The film is denitrated by any of the known processes, and is then bleached and partially dried to such a point that it does not curl up. Finally the moist film is fully dried and polished under pressure by means of a calender with heated rolls.—J. F. B.

Celluloid films; Manufacture of ——. Soc. Civile des Pellicules Nouvelles pour Cinématographes et áutres usages. Fr. Pat. 384,112, Jan. 25, 1907.

A thick solution of celluloid, containing about 100 kilos of pyroxylin in 400 litres of alcohol and ether, together with sufficient camphor or other agent to impart the desired flexibility, is discharged from an orifice in the form of a continuous film in the manner described in the preceding abstract. The film, after drying in hot air, is subjected to a calendering and drawing-out process. For this purpose it is passed through a calender with polished metal rolls, which not only flattens and smoothes the surface but also rolls out the celluloid film so that the resulting increase in length may amount to as much as 20 per cent.—J. F. B.

Cellulose films; Manufacture of ——. Soc. Civ. des Pellicules Nouvelles pour Cinématographes et autres usages. First, second and third Additions, dated Jan. 28 and Feb. 1, 1907, to Fr. Pat. 384,111, Jan. 25, 1907 (preceding).

(1). In the original specification, provision was made for glazing the films of cellulose by means of a calender with heated rolls. According to this addition, such glazing may be effected by placing the films in alternate layers between polished metal plates, and pressing a number of such films and plates in a powerful press at a temperature of about 100° C. (2). The head of the apparatus, containing the orifice for delivering a continuous film of a solution of cellulose, consists of two portions with accurately planed surfaces. The lower portion is attached to the vessel containing the cellulose solution, and the delivery orifice may be made by interposing strips of metal of suitable thickness around three sides of the joint between the two portions of the head, which are then clamped together. Or else the orifice may be made by cutting smooth rectangular grooves in one or other of the surfaces of the head-pieces. (3). The continuous films of cellulose made by the process specified, may be coated superficially with pyroxylin or celluloid by passing them through a bath containing a solution of pyroxylin, which may be either plain or mixed with a substance, such as camphor, castor oil, acetanilide, etc. A cellulose film so coated is capable of receiving impressions with inks designed for celluloid films and made with a medium which has an affinity for that substance.—J. F. B.

Gelatin; Process for the preparation of films and other thin sheets of ——. J. Rey. Fr. Pat. 384,206, Nov. 21, 1907.

The process is adapted for making photographic films. A non-porous paper is covered with a preparation containing 1 per cent. of collodion in solution, and also a certain amount of soap dissolved in alcohol. A layer of dry gelatin is now deposited, and upon it a layer of collodion solution, and upon this another layer of gelatin. The films thus made are non-curling, and are adapted for the cinematograph.—H. G. B.

Photographic, heliographic, and similar papers; Manufacture of ——. M. Roth. Fr. Pat. 384,327, Nov. 25, 1907.

Unsized paper is passed through a size bath, and while still damp, is treated by a tanning agent or by a dilute solution of acetic acid or a mineral acid; it is finally treated with ammonia to neutralise the acid. A modification of the process consists in slightly sizing the paper, and then passing it through concentrated solutions of tanning agents or acids. The advantages claimed for paper so prepared, are that it is easily impregnated with liquid, without softening of the fibre, and that it is unaffected by alkalis, and only slowly wetted by alcohol.—T. F. B.

XXII.—EXPLOSIVES, MATCHES, &c.

Explosives authorised for importation into British India. Gazette of India, March 14, 1908. Through Board of Trade, Commercial Branch. [T.R.]

The following explosives are at present authorised for importation into British India for general sale :—

Class 1 : Gunpowder.

Class 2 : Nitrate mixture. Ammonal, ripplene.

Class 3 : Nitro-compound. Every explosive in this class, and every explosive ingredient thereof, shall be so thoroughly purified and otherwise of such character as to satisfy the heat test.

Division 1.—Albionite, amberite No. 1, ballistite, blasting gelatin, carbonite, celtite, cordite, cordite M.D., dynamite, gelatin dynamite No. 1, gelatin dynamite No. 2 or gelignite, monobel powder, Phœnix powder. Provided that every explosive in this division shall be of such character and consistency as not to be liable to liquefaction or exudation.

Division 2.—Amberite No. 2, ammonite, Cooppal's powder, E. C. sporting powder, Empire powder, guncotton, henrite, Schultze gunpowder, Kynoch's smokeless sporting powder, negro powder, picric acid, picric powder, rifleite, roburite, S. R. powder, S. S. powder, smokeless powder, smokeless blasting powder.

Class 4 : Chlorate mixture, *nil.*

Class 5 : Fulminate, *nil.*

Class 6 : Ammunition.

Division 1.—Safety fuzes for blasting, safety electric fuzes, percussion caps, railway fog-signals, safety cartridges.

Division 2.—Cartridges for cannon, shells, mines, blasting, or other like purposes ; cartridges for small arms which are not safety cartridges, electric fuzes, fuzes for blasting which are not safety fuzes, fuzes for shells, tubes for firing explosives, war rockets.

Division 3.—Cartridges for small arms which are not safety cartridges, detonators, electric detonators, fuzes for blasting which are not safety fuzes, friction tubes, fuzes for shells, fuzes for firing explosives.

Class 7 : Fireworks.

Division 1 : *Nil.*

Division 2.—Manufactured fireworks, amorces, Chinese crackers.

Patent.

Drying oven for explosive substances. Ver. Köln-Rottweiler Pulverfabr. Ger. Pat. 196,151, July 30, 1907.

In one or more of the walls of the drying oven, parts are provided soldered on with a solder melting at a few degrees above the highest temperature reached in the drying process. If the material being dried should take fire, the solder is immediately melted, and the gases of combustion can thus escape freely.—A. S.

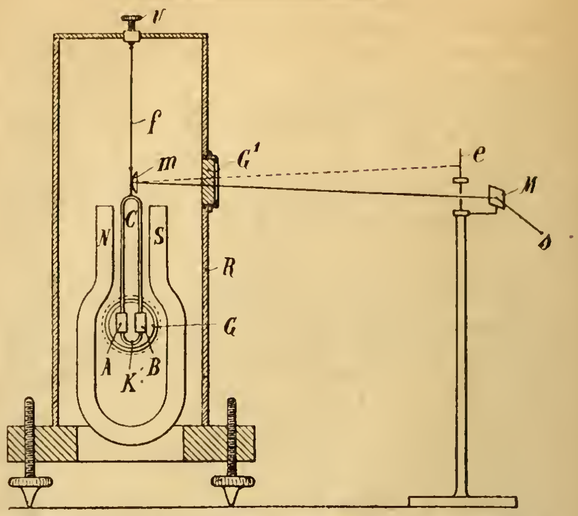
XXIII.—ANALYTICAL CHEMISTRY.

APPARATUS, &c.

Patent.

Photometer ; Direct reading ——. C. Féry. Fr. Pat. 384,392, Nov. 26, 1907.

A source of light emits two kinds of radiations, heat- and light-giving rays and the so-called dark rays which give only heat. The method of measuring the light is as follows :—The rays are first passed through a glass cell filled with a green aqueous solution which stops the obscure rays but allows the light rays to pass. The light rays are then passed through a lens to which a rocking movement is given at right angles to the direction of the beam of light and the concentrated rays are directed alternately upon one of two thermo-junctions. The latter consist of a U-shaped bend of copper, C, and an inverted U bend, K, of constantan connected by silver pieces, A, B, which form the thermo-junctions. The whole is suspended between the poles, N, S, of a magnet, contained in the copper casing, R, by the wire, *f*. The light enters through G, falls on one or other of the junctions, A, B, and according to its intensity sets up a greater or less current in the suspended coil which is consequently deflected. The amount of deflection is indicated by the movement of a reflected beam of light on the scale. *e*.—W. H. C.



INORGANIC—QUANTITATIVE.

Vanadic and molybdic acids ; Determination of —— *in presence of each other.* G. Edgar. Amer. J. Sci., 1908, 25, 332—334.

Continuing the work of Gooch and Edgar (this J., 1908, 335), the author finds that whilst, as is well known, vanadic acid is readily reduced by sulphur dioxide to the condition of tetroxide, molybdic acid is not affected by sulphur dioxide even at a concentration of 0·4 grm. of molybdenum trioxide in 25 c.c., provided there be present at the same time 5 c.c. of concentrated sulphuric acid. To determine the two acids together, then, a quantity containing about 0·4 grm. of the mixed acids is diluted to 75 c.c., 2—3 c.c. of concentrated sulphuric acid are added, the liquid is heated to boiling, and a current of sulphur dioxide is passed through till the reduction of the vanadium compound is complete. Carbon dioxide is now passed through, and the liquid boiled till the sulphur dioxide is completely expelled ; the reduced vanadium tetroxide is now titrated with *N*/10 potassium permanganate, which converts it into the pentoxide. The solution is then passed through a Jones' reductor (preceded by 100 c.c. of hot water and 125 c.c. of 2½ per cent. sulphuric acid, and followed by 100 c.c. of the sulphuric acid and 200 c.c. of hot water), and received in iron alum solution (50—60 c.c. of 10 per cent. solution), which, after addition of 8—10 c.c. of syrupy phosphoric acid to decolorise the ferric salt, is titrated with *N*/10 permanganate. The amount of permanganate required for the vanadium (V_2O_2 to V_2O_5) is three times that used in the former titration (V_2O_4 to V_2O_5), and the remainder is that required for the molybdenum (Mo_2O_3 to MoO_3).—J. T. D.

Iron ; Determination of ——, *by permanganate, after reduction by titanous sulphate.* H. D. Newton. Amer. J. Sci., 1908, 25, 343—345.

The iron compound is dissolved in sulphuric acid ; to the solution in the cold is added titanous sulphate solution in slight excess, bismuth oxide added to destroy excess of titanous sulphate, the solution filtered into about a litre of cold distilled water, and titrated with *N*/10 permanganate. The author prepares the titanous sulphate by fusing 20 grms. of commercial titanic acid with potassio-sodium carbonate, dissolving the ground reaction-product in hot concentrated sulphuric acid, filtering, reducing by excess of zinc, and filtering into 2 litres of water. The solution is best kept in an atmosphere of hydrogen, as suggested by Knecht (this J., 1903, 825).—J. T. D.

Ammonium phosphomolybdate; Variations in composition of ——. Application to the determination of phosphorus in iron and steel. G. Chesneau. Compt. rend., 1908, **146**, 758—761. (See also this J., 1907, 1201.)

Quantities of sodium phosphate containing from 6·648 to 0·277 mgrms. of phosphorus, were precipitated by 50 c.c. of a reagent containing in a litre 50 grms. of ammonium molybdate and 500 c.c. of nitric acid of sp. gr. 1·20, and similar quantities by 50 c.c. of the same reagent together with 5 grms. of ammonium nitrate. The liquids were kept at 45° C. for 2½ hours. In the first series, the proportion of phosphorus in the precipitate increased, as the amount of phosphate was lessened, from 1·69 to 2·25 per cent., whilst in the second series it decreased from 1·62 to 1·28 per cent. Similar differences in composition occurred during precipitation in presence of ferric salts, and were intensified by the co-precipitation of ferric molybdate when ammonium nitrate was present. In these cases it is desirable to dissolve the precipitate in ammonia and re-precipitate by nitric acid. Besides this precaution, the following details should be attended to in determining phosphorus in iron or steel:—for each grm. of metal, 50 c.c. of molybdate reagent and 5 grms. of ammonium nitrate should be used; precipitation should take place at 65°—70° C. (1½ hours); the precipitate should be re-dissolved in the same quantity of ammonia (50 c.c. of 1 : 4), re-precipitated by concentrated nitric acid, and after complete precipitation, 15 c.c. of the molybdate reagent should be added; the liquid and precipitate should be kept for 2 hours at 40° C., and after filtration, the precipitate should be washed with pure water. The precipitate so formed, after drying at 105° C., contains 1·60 per cent. of phosphorus.—J. T. D.

Nickel; Electrolytic determination of ——, in solution as nitrate, and its separation from copper. A. Thiel. Z. Elektrochem., 1908, **14**, 201—208.

Nickel can be accurately determined by electrolysis of the nitrate, provided (1), no nitrite be present, (2), a sufficient excess of ammonia be added, and (3), a straight wire of passive iron be used as anode (platinum anodes are more or less irregularly attacked, and the dissolved platinum is deposited with the nickel). Accurate separation of nickel from copper, and determination of both metals, can thus be effected. The metals (0·4—0·5 grm. in all), or compounds containing them, are dissolved in nitric acid, so that the solution contains about 5 c.c. of the strong acid in excess; any nitrous acid is expelled by boiling, or destroyed by the addition of urea in not too great excess, the volume made up to 100 c.c., and the copper precipitated by a current of $ND_{100}=1$ ampère at the ordinary temperature, warming towards the end of the operation (1½—2 hrs.) not above 50°—60° C. To the bath is now added 80 c.c. of ammonia (sp. gr. 0·91), the iron wire anode (cleaned in hydrochloric acid and rendered passive in strong nitric acid) substituted for the platinum one, the coppered cathode replaced, and the nickel deposited on it by a current of $ND_{100}=5$ ampères; the current heats the liquid to about 70° C. When the liquid is decolorised and gas-evolution occurs at the cathode, the latter is withdrawn without stoppage of current, washed, dried and weighed. The anode is again rendered passive, and the electrolysis continued for another 5 minutes, when the cathode should not have increased in weight. The deposition of the nickel should not need more than 50—55 minutes. The ammonium sulphide test for complete removal of the nickel is useless in solutions containing so much free ammonia, hence the second electrolysis and weighing.—J. T. D.

Bismuth; Electrolytic determination of ——. F. J. Metzger and H. T. Beans. J. Amer. Chem. Soc., 1908, **30**, 589—593.

The apparatus employed consists of a slightly modified form of that proposed by Gooch and Medway (this J., 1903, 823), using a rotating cathode. The platinum thimble, used as cathode, is connected to the shaft by means of a rubber stopper wound with fine platinum wire for contact. The thimble, driven at about 700 revolutions per minute, has an available surface of 40 sq. cm. To a quantity of bismuth nitrate solution (containing 25 c.c. of concentrated nitric acid per litre), sodium hydroxide is added until the solution is alkaline to phenolphthalein. The precipitate of bismuth hydroxide formed is re-dissolved by addition of acetic acid. 2 grms. of boric acid are added to the solution, which is then diluted, heated to 70°—80° C., and electrolysed by a current of 0·2 to 0·16 ampère. The voltage remains constant at about 2·0 to 2·7 until all but the last trace of bismuth has been deposited in a bright compact form, when it rises to a maximum. At this point, if there be no boric acid present, the last traces of metal are deposited as a granular layer, darker and less firmly adherent. The presence of boric acid insures a smooth bright adherent deposit to the end, and prevents the formation of bismuth peroxide as a yellow deposit on the anode. The electrolysis is continued 5 to 10 minutes after the maximum voltage has been attained, and takes about 3½ hours to complete. The thimble is detached, washed with alcohol and ether, allowed to dry, and weighed.—W. S.

Manganese; Separation of iron from ——. R. B. Moore and I. Miller. J. Amer. Chem. Soc., 1908, **30**, 593—594.

The method depends upon the separation of manganese from iron by means of pyridine. If to a solution of ferric chloride, containing free hydrochloric acid, pyridine is added in slight excess, the iron is completely precipitated as hydroxide, whilst, if the solution of a manganous salt is made acid with hydrochloric acid and then a slight excess of pyridine added, the solution may be heated for ten minutes without oxidation. In carrying out the separation, it is necessary to wash the precipitated ferric hydroxide with pyridine water (1 : 500) to obviate the precipitate passing through the filter in the colloidal state.—W. S.

Mercury vapour; Determination of ——, in air P. Ménière. Compt. rend., 1908, **146**, 754—756.

A water-aspirator draws the air through nitric acid contained in two glass bulbs (125 grms. in the first and 75 grms. in the second), each bulb being provided above with a glass condensing spiral. The acid is brought to ebullition before the aspiration is begun, and the air after passing successively through the two bulbs and their condensers, passes through a meter on its way to the pump. After the requisite quantity (100 to 1000 litres) of air has passed, the acid is evaporated at 50° C. to a fraction of a c.c. and 20 c.c. of water are added. Of this, 5 c.c. are placed in a graduated colorimeter-tube, and 1 c.c. of solution of diphenylcarbazide (0·25 grm. dissolved at 40° C. in 100 grms. of alcohol, and filtered after 24 hours). The tint struck is compared with a series obtained from solutions containing known amounts of mercury (a table of tints is given with the paper), and the corresponding one will be found unless the concentration of mercury exceeds one in ten thousand. If it does exceed this, another quantity of 5 c.c. of the mercury solution is taken, and to it is added from a burette sodium iodide solution (4·5 grms. in a litre) till the precipitate formed is just redissolved. Each c.c. used corresponds to 1 mgrm. of mercury. Air passed over amalgams, metallic mercury, mercurial ointment, etc., at temperatures of 12° to 100° C. was found to contain 0·0004 to 0·42 grm. of mercury per cubic metre. A room, closed, containing a trough of mercury 90 by 40 c.m., gave after five and nine days respectively 3 and 9 mgrms. of mercury per cub. metre of air, whilst one in which a rabbit was rubbed daily with mercurial ointment shewed after three days 6, and after eight days 12 mgrms. of mercury per cubic metre of air.—J. T. D.

Carborundum ; Technical examination of amorphous ——. G. Chesneau. *See* VII.

Zinc ; Determination of —— [*by evolution of hydrogen*]. *Necessity for avoiding india-rubber joints.* L. de Koninck. *See* X.

ORGANIC—QUALITATIVE.

Mercerised cotton and oxycellulose ; Qualitative tests for ——. A. B. Knaggs. *See* V.

Laevulose [*d-fructose*] *in presence of other natural sugars ; Detection of* ——. J. Pieraerts. *See* XVI.

Digitalis ; Colour reactions of the toxic glucosides of ——. L. Garnier. *See* XX.

Peruvian balsam ; Distinctive test for genuine and artificial ——. K. Dieterich. *See* XX.

ORGANIC—QUANTITATIVE.

Phosphorus ; Determination of ——, *in organic substances.* J. Bay. Compt. rend., 1908, **146**, 814—815.

The substance is burnt with sodium carbonate and magnesia, as already described for sulphur (this J., 1908, 298) ; the contents of the tube are dissolved in acetic acid, and the phosphoric acid determined volumetrically by uranium nitrate and ferrocyanide.—J. T. D.

Fat and unsaponifiable matter ; Determination of ——. M. Kumagawa and K. Suto. *See* XII.

Caoutchouc ; Determination of —— *as tetrabromide.* G. Fendler and O. Kuhn. *See* XIIIC.

Tannin ; New method for determining ——. G. Metzges. *See* XIV.

Acidity of tan liquors[; *Determination of* ——.] J. W. Phelan and P. S. Fiske. *See* XIV.

Glucose in leather ; Determination of ——. F. P. Veitch. *See* XIV.

Malt analysis ; Should —— *be carried out with fine meal or coarse grist ?* F. Eckhardt. *See* XVII.

Yeast and water ; Biological analysis of ——. Stockhausen. *See* XVII.

XXIV.—SCIENTIFIC & TECHNICAL NOTES.

"*Semicatalysis*" ; *Oxidation of hydrocarbons in air in presence of phosphorus.* A. Colson. Compt. rend., 1908, **146**, 817—818.

When, during the dissolution of white phosphorus in oil of turpentine (see this J., 1908, 159), air is allowed access, the liquid becomes turbid, and a white deposit forms, insoluble in water, but soluble in ether or acetic acid. This deposit contains oxygen, but no free phosphoric acid or turpentine ; a resin, obtained by the evaporation of an ethereal solution of the deposit, had a composition corresponding to the formula, $PO_4H_3(C_{10}H_{16}O_3)_2$. The turpentine had become oxidised under the influence of the phosphorus, which itself had become oxidised at the same time : the author gives the name "semicatalysis" to this phenomenon.
—J. T. D.

Peroxydiastases [*peroxydases*] ; *Artificial* —— *and the part played by iron in their action.* J. Wolff. Compt. rend., 1908, **146**, 781—783.

In a previous note (this J., 1908, 185) the author showed the resemblance between the action of minute quantities of iron salts and that of the natural peroxydiastases (peroxydases). Traces of ferrous sulphate give the blue reaction with guaiacum tincture and hydrogen peroxide, but they fail to give certain other reactions of the peroxydases in presence of hydrogen peroxide, *e.g.*, formation of quinhydrone from quinol (hydroquinone) and of purpurogallin from pyrogallol. These latter reactions, but not the guaiacum reaction, are shown by appreciably larger quantities of an alkali ferrocyanide. By combining the two iron compounds in a very dilute state and thus obtaining a colloidal ferrous ferrocyanide, the author has succeeded in reproducing all the properties of a natural peroxydase. The maximum activity is obtained by a solution free from excess of either component, at a concentration of 10 mgrms. of iron per litre. This solution, in presence of small quantities of hydrogen peroxide oxidises both quinol and pyrogallol, and the course of the reaction has been followed quantitatively in the latter case. The slightest excess of iron salt is extremely prejudicial but an excess of ferrocyanide has not much effect on the activity of the catalyst. The artificial peroxydase further resembles the natural enzymes in that it can be filtered without loss through paper but becomes inactive when filtered through collodion; its activity is destroyed by boiling for 1 minute and mineral acids seriously affect it ; it is likewise injuriously affected by an excess of hydrogen peroxide. Ferrous ferricyanide and ferric ferricyanide possess similar properties in a minor degree.—J. F. B.

Trade Report.

Census of chemicals in the United States. Oil, Paint, and Drug Rep., April 20, 1908.

The following is an advance abstract of the report of the Bureau of the Census, prepared by Dr. Chas E. Monroe, on the chemical production of the United States in 1905, with figures for 1900 added for comparison :—

Product.	1905.	1900.
Total—		
No. of establishments	1786	1691
Capital ....dollars	323,997,131	238,471,290
Value of products ..... ,,	282,169,216	202,506,076
Cost of materials ...... ,,	176,400,680	124,018,044
Sulphuric, nitric, and mixed acids—		
No. of establishments	32	34
Capital ....dollars	12,761,920	13,981,506
Cost of materials ...... ,,	4,972,838	4,033,238
Value of sulphuric acid . ,,	4,286,312	4,071,848
Value of nitric acid ... ,,	1,446,471	1,028,266
Value of mixed acids .. ,,	1,222,295	1,109,758
Value of other products . ,,	2,097,568	2,386,518
Other acids—		
No. of establishments........	11	13
Capital ....dollars	4,857,350	2,360,787
Cost of materials ...... ,,	1,605,649	945,955
Value of all products .. ,,	2,726,487	1,848,348
Value of hydrochloric acid ,,	1,730,231	1,173,900
Value of acetic acid ... ,,	597,235	446,326
Soda—		
No. of establishments	39	38
Capital ....dollars	22,728,369	14,951,960
Cost of materials ...... ,,	8,255,037	5,331,823
Value of products :—		
Sodium bicarbonate . ,,	1,135,610	1,332,765
Caustic soda .... ,,	3,185,959	3,170,280
Sal soda .... ,,	831,869	875,243
Soda ash .... ,,	8,204,545	4,859,656
Potashes—		
No. of establishments	39	67
Products ....pounds	1,811,037	8,864,766
Do. value ....dollars	104,655	178,180
Alums—		
No. of establishments	8	4
Capital ....dollars	11,836,933	5,553,313
Cost of materials ...... ,,	2,583,173	1,318,906
Value of products—		
Ammonium alum .... ,,	59,774	2,882,421
Burnt alum .... ,,	364,328	
Concentrated alum .. ,,	972,892	
Potassium alum ..... ,,	156,448	
Sodium alum .... ,,	4,923	
Alum cake .... ,,	161,906	
Other alums .... ,,	1,236,573	
Other products ...... ,,	2,101,551	
Coal tar products—		
No. of establishments	6	15
Capital ....dollars	837,991	2,095,363
Cost of materials ...... ,,	538,617	1,341,561
Value of products ..... ,,	820,309	2,227,544
Cyanides—		
No. of establishments	6	12
Capital ....dollars	342,233	1,250,941
Cost of materials ...... ,,	348,490	1,283,949
Value of products* .... ,,	586,581	1,769,736

* Including ferrocyanides, thiocyanates, and cyanamides.

Product.	1905.	1900.
Wood distillation—		
No. of establishments........	141	102
Capital ....dollars	10,506,979	6,729,127
Cost of materials ...... ,,	4,847,770	3,455,015
Value of products ..... ,,	7,813,483	6,001,023
Fertilisers—		
No. of establishments	400	422
Capital ....dollars	69,023,264	60,685,753
Cost of materials ...... ,,	39,343,914	28,958,473
Value of products ..... ,,	56,632,853	44,657,385
Superphosphates .... ,,	2,452,332	1,624,062
Bleaching materials—		
No. of establishments	9	5
Capital ....dollars	221,874	95,713
Cost of materials ...... ,,	160,547	37,096
Value of products* .... ,,	418,730	104,801
Chemicals produced by aid of electricity—		
No. of establishments	20	13
Capital ....dollars	11,495,537	9,170,750
Cost of materials ...... ,,	2,442,596	900,554
Value of products ..... ,,	7,048,246	2,036,261
Dyestuffs—		
No. of establishments	51	44
Capital ....dollars	7,507,837	6,279,877
Cost of materials ...... ,,	3,471,236	3,725,147
Value of products —		
Artificial dyestuffs ... ,,	2,665,134	5,637,464
Natural dyestuffs .... ,,	1,766,273	
Dyewoods, mordants, gum, etc. .... ,,	846,116	
Tanning materials—		
No. of establishments	47	33
Capital ....dollars	7,396,313	1,559,157
Cost of materials ...... ,,	3,358,104	1,020,763
Value of products ..... ,,	5,615,590	1,713,284
Paints and varnishes—		
No. of establishments	664	615
Capital ....dollars	77,149,357	60,834,921
Cost of materials ...... ,,	60,030,070	44,844,229
Value of products ..... ,,	91,487,326	69,922,022
Explosives—		
No. of establishments	124	97
Capital ....dollars	42,307,163	19,465,846
Cost of materials ...... ,,	17,203,667	10,334,974
Value of products ..... ,,	29,602,884	17,125,418
Plastics (pyroxylin, casein, glue, etc.) —		
No. of establishments	10	8
Capital ....dollars	8,689,547	7,558,720
Cost of materials ...... ,,	1,952,053	1,255,841
Value of products ..... ,,	4,877,380	3,035,656
Essential oils (including turpentine and petroleum distillates)—		
No. of establishments	52	47
Capital ....dollars	723,004	576,286
Cost of materials ...... ,,	1,110,470	588,594
Value of products ..... ,,	1,464,662	813,495
Fine chemicals—		
No. of establishments	43	29
Capital ....dollars	13,347,431	8,029,764
Cost of materials ...... ,,	9,629,567	3,271,388
Value of products ..... ,,	13,566,955	5,461,513
Products included—		
Acetone..............pounds	1,589,215	1,638,715
Alkaloids .... oz.	5,797,925	4,054,478
Bromides ....pounds	403,997	314,399
Camphor .... ,,	1,103,372	598,708
Esters .... ,,	403,260	785,300
Ether................ ,,	4,239,174	1,485,942
Gold salts........... oz.	47,641	12,347
Iodides ....pounds	84,702	20,714
Rare earth salts .... ,	90,558	5,373
Silver salts .... oz.	1,899,081	1,606,108
Vanillin .... ,,	579,877	124,874
General chemicals—		
No. of establishments	74	97
Capital ....dollars	14,986,703	12,433,065
Cost of materials ...... ,,	12,646,513	9,290,485
Value of products ..... ,,	18,874,897	13,123,757
Products included—		
Lead acetate .... lb.	1,202,383	1,296,991
Ammonia solution ... ,,	22,485,732	25,089,110
Ammonium nitrate .. ,,	3,253,061	694,438
Calcium chloride .... tons	98,653	3,540
Ferrous sulphate..... lb.	9,700,104	27,595,909
Cream of tartar ..... ,,	15,650,000	10,981,680
Magnesium sulphate . ,,	20,566,443	9,239,809
Sodium sulphate .... ,,	14,665,456	32,659,907
Glycerin .... ,,	19,311,997	15,383,778
Nitre cake .... tons	35,221	15,481
Sodium phosphates .. lb.	9,659,519	4,679,160
Salt cake .... tons	38,244	48,296
Saltpetre .... ,,	7,234	6,136
Tin compounds ..... lb.	11,621,378	6,259,794
Zinc salts .... ,,	11,579,546	9,511,909

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* Including hypochlorites, hydrogen peroxide, sulphur dioxide, bisulphites, and chlorine.

New Books.

THE STRUCTURE OF THE COTTON FIBRE IN ITS RELATION TO TECHNICAL APPLICATIONS. By F. H. BOWMAN, D.Sc., &c. Macmillan & Co., Limited, St. Martin's Street, London. 1908. Price 8s. 6d. net.

8vo volume, containing 456 pages of subject matter, with 79 illustrations, mostly beautifully tinted, and a frontispiece. There is a copious glossary of terms used in the work, and an alphabetical index. The subject matter is classified under the following heads:— I. Preliminary, or Introduction, containing explanations of the following terms: (i), Tensile strength. (ii), Uniformity. (iii), Flexibility. (iv), Evenness. (v), Surface friction. (vi), Porosity and permeability. (vii), Permanence of structure. (viii), Lustre. (ix), Quantity. II. Classification of fibres. III. Method of Research. IV. History, sources, and botany of cotton. V. Origin and development of the cotton fibre. VI. Chemistry of the cotton fibre. VII. Strength and variation in cotton fibres. VIII. Strength and variation of yarn. IX. Theory of dyeing. X. Relation of the cotton fibre to the dyeing process. XI. Method of analysis, and detection of various fibres.

A LABORATORY OUTLINE FOR DETERMINATIONS IN QUANTITATIVE CHEMICAL ANALYSIS. By ALBERT F. GILMAN, Professor of Chemistry, Ripon College, Ripon, Wisconsin. The Chemical Publishing Company, Easton, Pa. 1908. Price 4s. net.

SMALL, elementary guide to quantitative chemical analysis, in pocket book form, containing the specific course followed by the author's students at Ripon College. For each substance to be analysed, there are :—(1) General instructions. (2) Questions to be answered. (3) Page with plan of procedure printed in, and blanks left for the figures. The booklet contains 86 pages.

THERMOELEMENTE UND THERMOSAEULEN; IHRE HERSTELLUNG UND ANWENDUNG. Von Professor Dr. FRANZ PETERS. Dozent an der Königl. Bergakademie zu Berlin. Wilhelm Knapp's Verlag, Halle a. S. 1908. Price, M.10.

8vo volume, containing 162 pages of subject matter, with 192 illustrations, and alphabetical indexes of names and subjects. The manner of treatment of the entire subject may be gathered from the following classification : I. History of thermoelectricity. Thermic currents. II. Preparation of thermo-elements. Chemical composition of thermo-elements. Mechanical condition of the thermo-elements. III. Construction of piles of the thermo-elements. IV. Use of the thermo-elements and thermo-piles. Measurement of high temperatures. Different uses. V. Thermo-elements with electrolytes and thermo-accumulators.

EXERCISES IN ELEMENTARY QUANTITATIVE CHEMICAL ANALYSIS, FOR STUDENTS OF AGRICULTURE. By AZARIAH THOS. LINCOLN, Ph.D., Asst. Prof. of Chemistry, Illinois Univ., and JAMES H. WALTON, Ph.D., Asst. Prof. of Chemistry, Wisconsin Univ. The Macmillan Company, New York. 1907. Price 6s. 6d.

8vo volume, containing 214 pages of subject matter, a table of answers to problems, and the alphabetical index. There are 32 illustrations, and the text is sub-divided as follows:—I. Introduction. Apparatus and general methods, etc. II. Gravimetric analysis. III. Volumetric analysis. IV. Agricultural analysis. This includes the analysis of milk, butter, cereals and feeding materials, fertilisers, and soil. V. Stoichiometry. Appendix, referring to special reagents, etc., and tables of specific gravities of acids and ammonia. Tables of logarithms, atomic weights, etc.

TECHNICAL METHODS OF ORE ANALYSIS. ALBERT H. LOW. Third edition. John Wiley and Sons, New York. Chapman and Hall, Limited, London. 1908. Price 12s. 6d. net.

8vo volume, containing 334 pages of subject matter, with 14 illustrations, and an alphabetical index. The following subdivision of the subject indicates the course of its treatment:—I. Apparatus. II. Electrolysis. III. Logarithms. The elementary substances and metals are dealt with in chapters IV. to XXX. XXXI. "Combining determinations." XXXII. Boiler water. XXXIII. Coal and coke. XXXIV. Testing crude petroleum. A series of tables occupies pages 283—293, and an appendix devoted to (i.), Rowell's method for estimating antimony in ores and alloys. (ii.), Determination of antimony and tin in Babbitt, type metal, and other alloys. (iii.), Standard methods for analysing iron. (iv.), Bichromate method for determining lead in ores, etc. (v.), Bismuth method for determining manganese. (vi.), Volumetric method for nickel, etc.

Official Chemical Appointments, The Institute of Chemistry of Great Britain and Ireland, 30, Bloomsbury Square, London, W.C. 1908. Compiled by Richard B. Pilcher, Registrar and Secretary of the Institute, by direction of the Council and under the supervision of the Proceedings Committee. Second edition, revised and enlarged. Price 2s. net. Post free 2s. 3d.

This publication contains a list of official appointments which are held by professional chemists, including professors and teachers of chemistry, in all parts of the British Empire. In the preparation of the second edition, the scheme adopted in the first, which was published in June, 1906, has been adhered to; the information has been carefully corrected, and considerable additions have been made, including an alphabetical index of names. The list is arranged in two main divisions:—The first, contains appointments in Great Britain and Ireland, under the various Departments of State, Local Authorities and Public Institutions, and the teaching appointments in Universities, Colleges, Technological Institutions, Medical, Agricultural, and Veterinary Colleges, and in Public and Secondary Schools.

The second, contains professional and teaching appointments in the Empire of India, the Dominion of Canada, the Commonwealth of Australia, the British Colonies and Protectorates, and in Egypt and the Sudan provinces, together with an Appendix giving concise information as to Societies and Institutions for the advancement of chemical science and of professional chemical interests. In many instances particulars are given as to the Acts of Parliament under which the appointments are made, and the regulations and conditions governing the selection of candidates for them.

Painting; Rôle of Chemistry in ——. E. Lemaire. Smithsonian Rept., 1906. Govt. Printing Office, Washington, 1907. (No. 1767).

Patent List.

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

Applications.

8208. Klauser (Scheer und Co.). Apparatus for separating liquid and dirt from gases.* April 13.

8267. Stafford. Heating apparatus and method of heating materials.* April 14.

8548. Fieldhouse, and Oxychlorides, Ltd. Apparatus for regulating the flow of liquids.* April 16.

8821. Diederichs. *See under* V.

8956. Benkö. Production of a vacuum.* April 24.

Complete Specifications Accepted.

8862 (1907). Mecredy and Hawes. Atomising apparatus. April 23.

9229 (1907). Hill. Separating vapour from the material from which it is generated. April 29.

9389 (1907). Vallat. Plates for alcohol, petroleum, and other distilling or rectifying columns. April 29.

9941 (1907). Harrison, Bate, and Perks. Recovery of volatile liquids. April 29.

17,323 (1907). Hawes. Obtaining dry products from liquids and semi-liquids. April 29.

22,408 (1907). Scard. Evaporating apparatus. April 29.

24,357 (1907). Richmond, and Lister & Co. Centrifugal liquid separators. April 29.

24,958 (1907). Dor-Delattre. Obtaining an intimate mixture of substances of different nature and dimensions. April 23.

25,225 (1907). Fürmeyer. Mixing machines. April 23.

2165 (1908). Jäger. Filtering and apparatus therefor. April 23.

II.—FUEL, GAS, AND LIGHT.

Applications.

8028. Fabry. Horizontal regenerative coke ovens.* April 13.

8186. Wellington and Everest. Manufacture of gas. April 13.

8416 and 8421. Wolfram-Lampen A.-G. Incandescent filaments for electric lamps. [Ger. Appls., April 26 and May 13, 1907.]* April 15.

8508. Dunal and Masse. Treatment of coke.* April 16.

8524. Botley and Cutler. Gas generators. April 16.

8536. Keeble. Utilising peat for making combustible gas and ammonia. April 16.

8656. Fabry. Horizontal by-product coke ovens.* April 21.

8715. Pettibone. Apparatus for manufacturing gas.* April 21.

8729. McIlhenny. Methods of treating gas.* April 21.

8737. Hopton. Filaments for incandescent electric lamps.* April 21.

8746. Auger. Manufacture of incandescent filaments.* April 21.

8931. Jones. Treatment of furnace gases. April 24.

9063. Chiappero. Promoting combustion of fuel in furnaces and obtaining ammonium nitrate and sodium cyanide as by-products. April 25.

Complete Specifications Accepted.

8512 (1907). Chutter. Producer gas generators. April 23.

10,346 (1907). Tully. Apparatus for making gas for heating and illuminating purposes. April 29.

12,139 (1907). Planchon. Manufacture of filaments for electric lamps. April 29.

14,893 (1907). Jowett. Treatment of coal for fuel and gas manufacture. April 23.

16,530 (1907). British Thomson-Houston Co. (General Electric Co.). Refractory metallic conductors for electric lamps. April 23.

17,991 (1907). Ernst. Production of lighting gas. April 23.

21,360 (1907). Clauss. Fuel for industrial purposes. April 29.

1553 (1908). Coales. Manufacture of artificial fuel. April 29.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

Application.

8764. Kibblewhite. Process whereby the softening point of asphalts and bitumens is greatly raised. April 24.

Complete Specifications Accepted.

8486 (1907). Fama. Treatment of benzines and mineral essential oils. April 23.

9389 (1907). Vallat. *See under* I.

IV.—COLOURING MATTERS AND DYESTUFFS.

Applications.

8381. Imray (Meister, Lucius, und Brüning). Manufacture of products from thioindigo dyestuffs. April 15.

8530. Imray (Soc. Chem. Ind. in Basle). Manufacture of vat dyestuffs. [Addition to No. 6490 of 1907.]* April 16.

8531. Imray (Soc. Chem. Ind. in Basle). Manufacture of vat dyestuffs. [Addition to No. 6106 of 1907.]* April 16.

8967. Act.-Ges. f. Anilinfabr. Manufacture of polyazo dyestuffs. [Ger. Appl., July 6, 1907].* April 24.

Complete Specifications Accepted.

10,327 (1907). Imray (Soc. Chem. Ind. in Basle). Manufacture of halogen derivatives of β-naphthylindigo. April 29.

10,978 (1907). Bloxam (Act.-Ges. f. Anilinfabr.). Manufacture of *p*-amino-*p*'-oxydiphenylamine. April 23.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

Applications.

8142. Newton (Bayer und Co.). Printing with the aid of sulphide dyestuffs. April 13.

8302. Sperry. Preparation of silk dyers' products.* April 14.

8393. Payne and Wallace. Dyeing machines.* April 15.

8594. Ashton. Dyeing fabrics with sulphur dyestuffs. April 18.

8620. Ashton. Printing textile fabrics. April 18.

8726. Johnson (Badische Anilin und Soda Fabrik). Discharge of colouring matters of the thioindigo and indigo classes. April 21.

8821. Diederichs. Apparatus for treating textile material and for mixing chemical materials and like liquids.* April 22.

8876. Düring. Producing embossing effects on yarns, fabrics, etc. [Ger. Appl., May 3, 1907.]* April 23.

Complete Specifications Accepted.

5881 (1907). Waddell. Apparatus for forming filaments in making artificial silk, etc. April 23.

8568 (1907). Friedrich. Dyeing apparatus. April 23.

8631 (1907). Imray (Meister, Lucius, und Brüning). Dyeing with sulphurised dyestuffs. April 23.

10,578 (1907). Thies and Mathesius. Treatment of skeins, fabrics, etc. April 29.

11,902 (1907). Ashton and Ashton. Machines for bleaching, scouring, or otherwise treating yarns or fabrics. April 29.

12,215 (1907). Campbell. Treating textile fibres. April 23.

25,310 (1907). Johnson (Zeidler und Wengraf). Production of aniline black on the fibre. April 29.

7690 (1908). Waddell. Filtering and spinning heads for machines for forming filaments of metamorphosed cellulose, etc. April 23.

VII.—ACIDS, ALKALIS, AND SALTS.

Applications.

8426. Allgem. Elektricitäts-Ges. Concentrating nitric oxide. [Ger. Appl., April 19, 1907.]* April 15.

8433. Turner and Clifford. Manufacture of iron carbonate from iron sulphides. April 16.

8529. Tcherniac. Manufacture of sodium cyanide. April 16.

8536. Keeble. *See under* II.

8767. Dieffenbach and Moldenhauer. Preparation of hydrocyanic acid. [Ger. Appl., April 22, 1907.]* April 22.

8768. Dieffenbach and Moldenhauer. Transformation of hydrocyanic acid into oxynitrogen compounds. [Ger. Appl., April 24, 1907.]* April 22.

8959. May and Baker, Ltd., and Bates. Mercury compound. April 24.

9003. Price. Manufacture of compounds containing sulphur or selenium. April 25.

9063. Chiappero. *See under* II.

VIII.—GLASS, POTTERY, AND ENAMELS.

Applications.

8453. Adams. Method of setting pottery. April 16.

8652. Butler. *See under* IX.

Complete Specification Accepted.

8704 (1907). Lindemann and Lindemann. Glass or vitreous substance, and its production and use. April 23.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Applications.

8307. Eggenhöffner and Sbertoli. Magnesia cement system.* April 14.

8652. Butler. Manufacture of bricks, tiles, pottery, etc. April 18.

8964. Kibblewhite. *See under* III.

Complete Specifications Accepted.

5764 (1907). Mackenzie (Bolle und Co.). Electrically fusing, refining, and moulding refractory substances such as quartz. April 23.

9316 (1907). Marmetschke and Brüning. Impregnating wood, etc., with heavy metal salts and aluminium compounds under pressure. April 29.

18,101 (1907). Wunner'sche Bitumen-Werke. *See under* XI.

X.—METALLURGY.

Applications.

8168. Messier. Improvements in the basic Bessemer process.* April 13.

8534. Bradley. Prevention of oxidation and corrosion of metals.* April 16.

8692. Vielet. Converting into steel cast iron, soft steel, cast steel, etc. April 21.

Complete Specifications Accepted.

6237 (1907). Holman and Holman. Treatment of metalliferous slime, etc. April 23.

9073 (1907). Twynam. Treating slags from steel and iron making processes. April 29.

13,692 (1907). Kauffmann. Ore-roasting furnaces. April 29.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

Application.

8904. Bonneau. Electrical furnaces. [Fr. Appl., April 24, 1907.]* April 23.

Complete Specifications Accepted.

5764 (1907). Mackenzie (Bolle und Co.). *See under* IX.

13,891 (1907). Tate. Apparatus for treating liquids electrolytically. April 29.

18,101 (1907). Wunner'sche Bitumen-Werke. Manufacture of electric insulating materials, also suitable for building purposes. April 29.

24,807 (1907). Viel. Electric furnace. April 23.

401 (1908). Edison. Electrolytes for alkaline storage batteries. April 23.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

Application.

8832. Bilton. Liquid soap. April 23.

Complete Specifications Accepted.

12,210 (1907). Barbé, Garelli, and De Paoli. Saponification and treatment of fatty matters. April 23.

28,364 (1907). Bernard. Carbon tetrachloride apparatus for extracting on a large scale fatty matters from products. April 29.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(*A.*)—Pigments, Paints.

Application.

8549 and 8550. Heckman. Pigments.* April 16.

Complete Specification Accepted.

28,189 (1907). Aug. Wegelin A.-G. f. Russfabrik. und Chem. Ind., and Wegelin. Manufacture of lampblack. April 29.

(*C.*)—India-Rubber.

Complete Specification Accepted.

1254 (1908). Fischer. Manufacture of solutions of caoutchouc. April 29.

XIV.—TANNING, LEATHER, GLUE, SIZE, &c.

Complete Specifications Accepted.

15,253 (1907). Weeber. Leather substitutes. April 29.

5377 (1908). Röhm. Preparation of hides in the manufacture of leather. April 23.

XV.—MANURES, &c.

Applications.

8478. Robinson and Dixon. Fertilisers. April 16.

8779. Marks (Dokkenwadel). Insecticide-fertiliser.* April 22.

Complete Specification Accepted.

24,891 (1907). Riiber. Manufacture of manure products containing phosphor. April 23.

XVI.—SUGAR, STARCH, GUM, &c.

Application.

8299. Baker and Ling. Starch product and method of preparing the same. April 14.

XVII.—BREWING, WINES, SPIRITS, &c.

Complete Specification Accepted.

9389 (1907). Vallat. *See under* I.

XVIII.—FOODS; SANITATION, WATER PURIFICATION; AND DISINFECTANTS.

(*A.*)—Foods.

Applications.

8279. Snelling. Manufacture of margarine. April 14.

8532. Simon, Ltd. (Thomas). Treatment of flour. April 16.

Complete Specifications Accepted.

8262 (1907). Okazaki and Yenjo. Manufacture of vegetable nitrogenous nutrient. April 23.

28,418 (1907). Wislocki. Manufacture of coffee extract. April 23.

(*B.*)—Sanitation; Water Purification.

Applications.

8436. Grossmann. Treatment of sewage. April 16.

8463. Petter. Apparatus for treating sewage. April 16.

8722. Beddoes. Charging sewage, &c., with air or gas. April 21.

(*C.*)—Disinfectants.

Complete Specification Accepted.

26,603 (1907). Little and Morris. Manufacture of cleansing fluids for use as sheep dips, for disinfecting, &c. April 23.

XIX.—PAPER, PASTEBOARD, &c.

Applications.

8268. Cross and Russell. Treatment of by-products from esparto grass. April 14.

8708. Lilienfeld. Manufacture of cellulose derivatives from viscose. April 21.

8727. Johnson (Knoll und Co.). Manufacture of cellulose derivatives and their solutions.* April 21.

8742. Verein. Kunstseidefabrik. Manufacture of viscose solutions. [Ger. Appl., April 22, 1907.]* April 21.

Complete Specifications Accepted.

6492 (1907). Imray (Meister, Lucius, und Brüning). Manufacture of variegated paper. April 29.

9537 (1907). Lederer. Manufacture of products resembling celluloid. April 29.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

Applications.

8249. Wellcome and Pyman. Manufacture of therapeutic compounds. April 14.

8514. Zimmermann (Chem. Fabr. auf. Actien, vorm. E. Schering). Pancreas preparation suitable for the treatment of diabetes. April 16.

9059. Löloff. Preparing bacillus vulgaris culture for therapeutic purposes. April 25.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Application.

8875. Hansen. Photographic plates or films.* April 23.

Complete Specification Accepted.

24,214 (1907). Anthés, and Lloyd, Ltd. Reproduction of images on glass, porcelain, metallic, or other surfaces. April 23.

XXII.—EXPLOSIVES, MATCHES, &c.

Application.

8358. Trench and Smart. Manufacture of gunpowder. April 15.

Complete Specification Accepted.

26,791 (1907). Winchester. Explosive substance. April 29.

Journal of the Society of Chemical Industry.

No. 10, Vol. XXVII. MAY 30, 1908. No. 10, Vol. XXVII.

Official Notices.

BY-LAWS.

Take Notice that under the provisions of By-law 40 of the Society of 1881 the President and Council hereby convene an Extraordinary General Meeting of the Society to be held at five o'clock in the afternoon of Monday, June 15th, next, at the Offices of the Society, Palace Chambers, Westminster, for the purpose of considering and if thought fit passing the subjoined Resolutions setting forth certain amendments to the draft By-laws printed in the Journal of the 31st January last which were adopted without alteration at the General Meeting held on the 13th March last.

RESOLUTIONS.

(*a*) "That the words 'such investigation of all the circumstances as the Council may think fit' in the third and fourth lines of By-law 15 (Suspension or Determination of Membership by Council) be deleted and the following words be substituted in their place: 'the member first having had an opportunity of being heard.'"

(*b*) "That in paragraph (*b*) (V.) of By-law 19 (Constitution) the words 'The Trustees' be deleted."

(*c*) "That the words 'as the Council' in the sixth and seventh lines of the last paragraph of By-law 19 (Constitution) be deleted."

(*d*) "That the word 'them' in the third line of By-law 20 (The President) be deleted and the words 'the Council' be inserted in its place."

(*e*) "That the word 'them,' in the third line of By-law 21 (Vice-Presidents) be deleted and the words 'the Council' be inserted in its place."

(*f*) "That the words in the second paragraph of By-law 26 (Election of Council), 'names of retiring Trustees and' be deleted, and the words 'name of the retiring' be inserted in their place."

(*g*) "That the words 'and shall prepare' in the tenth line of By-law 33 (Hon. Treasurer) be deleted and the words 'prepare or' be inserted between the words 'shall' and 'cause' in the ninth line thereof."

(*h*) "That the word 'but' in the twelfth line of By-law 52 (Contents of Journal) be deleted and the word 'and' be inserted in its place."

(*i*) "That the words 'names of the Trustees of the Society' in the sixth and seventh lines of By-law 58 (Investments) be deleted, and the words 'name of the Society or in the names of three members of the Society who shall not be members of the Council' be inserted in their place; and that the words 'to the Trustees' in the tenth line be deleted.

(*j*) "That the whole of By-law 59 (The Trustees) be deleted and that the rest of the By-laws be renumbered accordingly."

(*k*) "That the words in the second and third lines of By-law 60 (Auditor) 'in manner provided by the By-laws for the election of a Trustee' be deleted."

(*l*) "That the words 'the Trustees' in the eighth line of By-law 63 (Annual General Meeting) be deleted."

(*m*) "That the words 'any of them' in the fifth line of By-law 70 (Minutes to be Evidence) be deleted and the words 'the Council or a Local Section' be inserted in their place."

(*n*) "That all the words after the word 'auditor' in the fifth line of By-law 77 (Custody of Charter Deeds and Securities) be deleted."

The above amendments are necessary in order to obtain the approval by the Privy Council of such By-laws in pursuance of Clause 40 of the Charter.

By order of the Council,

Charles G. Cresswell,
Secretary.

ANNUAL GENERAL MEETING.

The Annual General Meeting will be held in the Armstrong College, Newcastle-on-Tyne, on Wednesday, July 22nd, at 10.30 a.m. A programme and request form are contained in this number of the Journal.

In accordance with the provisions of By-law 18 of the Society of 1881, notice is hereby given that those members whose names are printed in *italics* in the list of Council (see p. 363, April 30th number) will retire from their respective offices at the forthcoming Annual Meeting.

Prof. R. Meldola, F.R.S., has been nominated to the office of President under By-law 8; Dr. J. T. Dunn, Mr. A. R. Ling, Mr. George C. Stone, and Mr. R. C. Woodcock, have been nominated Vice-Presidents under By-law 8; Sir Boverton Redwood has been nominated a Vice-President under By-law 11; and Dr. T. B. Wagner has been nominated a Vice-President under By-law 26. Prof. P. Phillips Bedson and Mr. H. Van der Linde have been nominated Ordinary Members of Council under By-law 26; and Mr. Thomas Tyrer and Dr. Ludwig Mond, F.R.S., have been nominated Hon. Treasurer and Hon. Foreign Secretary respectively under By-law 9.

By order of the Council,

Charles G. Cresswell, Secretary.

Birmingham Section.

Meeting held at Birmingham on Thursday, February 13, 1908.

MR. HARRY SILVESTER, B.SC., F.I.C., IN THE CHAIR.

THE CHEMIST'S RELATION TO THE COPPER AND BRASS INDUSTRIES.

BY ERNEST A. LEWIS, F.C.S.

During the past few years, the position of chemists in metallurgical industries has improved, manufacturers having found that it is advantageous to avail themselves of modern scientific work applied to manufacturing processes, as well as purely analytical work. The copper and brass industry is one which can obtain the greatest possible advantage from the employment of modern metallurgical research. With the exception, perhaps, of the commercial part, the management of a copper and brass works should be in the hands of a metallurgical chemist, assisted by a competent engineer—not, as is often the case, of an engineer and a chemist merely kept to do routine analyses.

The power for driving the plant is of purely engineering concern; but the chemist is concerned with the fuel, water, oil, and occasionally leaky brass fittings. As regards water, it is not economy to soften waters of less than 10 degrees of hardness; but with harder waters some process of softening should be used. Oil ought to receive more attention than it does; the heavier the machinery, and the slower the speed, the higher should be the viscosity of the oil. With cylinder oils, the temperature of the cylinder must be considered. It is useless putting in the cylinder of a high pressure engine an oil which would decompose at the temperature of the steam. Archbutt states that the best test for cylinder oils is to heat them in a current of air for 1 hour to the temperature corresponding to the steam pressure at which they are to work. The loss in weight should not exceed 0·5 per cent. This is a far better test than the flashing point. The oils for tube drawing require careful selection; one gallon of a good oil will often draw twice as many tubes as two gallons of a slightly cheaper oil. All oils used for lubricating machinery should be free from acid and grit, as either of these will cause hot bearings, and may be the cause of stopping a mill for several hours. If a bearing begins to run hot, it may be cooled in many cases, without stopping the engine, by oiling with good castor oil. A hot bearing may be caused by using an unsuitable alloy containing a large proportion of zinc; the only cure for this is to cast a new brass. Leaky brass fittings are caused by too much lead in the alloy. The composition of the fittings and other brass parts of machinery should be as follows:—Brass fittings, taps, etc.: copper, 88 per cent.; tin, 8 per cent.; zinc, 2 per cent.; lead, 2 per cent. Bearings: Copper, 82 per cent.; tin, 8 per cent.; lead, 10 per cent. When the bearing is lined with white metal the composition of the brass is not very important.

Fuel.—The best method of sampling a boat of rough slack is to put a shovelful on one side out of every fifth barrow-load, then to turn the small heap obtained three times, heap it up into a small pyramid, then level it down and divide it into four quarters. Throw two opposite quarters on one side, any large lumps in the remainder are broken up into small pieces, and the quartering process repeated after mixing three times. The quartering and breaking up process is repeated until about 28 lbs. is obtained. This must be broken up on a sampling plate until it will all pass through a ¼-inch riddle, again mixed three times, and if a very wet coal, two lots of 1 lb. each are weighed out and dried in a steam oven to determine the moisture. If a dry coal is being sampled, the portion which has been through a ¼-inch riddle should be quartered, and the 14 lbs. obtained passed through an ⅛-inch riddle, then mixed and two lots of 1 lb. each taken for drying. The drying must be stopped as soon as it ceases to give off moisture, as determined by a cold watch glass not condensing any moisture when held close to the coal. The dry coal is then crushed to pass through a 30-mesh sieve. This is thoroughly mixed, and about 4 oz. crushed to go through a 90-mesh sieve for the analysis. With lump coal, 20 to 40 lumps are taken as the boat or truck is unloaded, according to the weight, and each lump broken up into pieces to go through an inch riddle; it is then quartered down as described above. Knocking a piece off the corners of the lumps will not give a representative sample. It is advisable to have coal as free as possible from sulphur for muffles, but for furnaces where the products of combustion touch molten metal, the necessity for sulphur-free coal is increased; this applies especially to copper refineries. The best way to use coal, except for boilers, copper refineries, and reverberatory melting furnaces, is to burn it as producer gas. It is far cleaner and uses less coal if the men regulate the supply of gas as required. Instead of the coal being taken to each furnace and the ashes wheeled away as they accumulate, the coal is burnt in a convenient spot near the canal or railway siding, and the gas is taken through flues to each furnace. At the back of each furnace is a wheel valve for regulating the gas supply. For brass and copper re-heating furnaces the continuous type of air regenerator is used. The furnaces must be designed specially for the work, and the depth from the bottom of the crown to the furnace hearth must not be so great as in coal fired furnaces. It is sometimes stated that it is impossible to anneal brass sheets without making dense smoke; this is quite wrong, for with gas fired furnaces brass can be annealed perfectly without dense smoke. For reheating copper and brass an enclosed muffle in which the flame does not touch the metal is best. This is not general, as it takes more fuel to heat this kind of muffle.

Crucible furnaces can be heated with gas. The old form of coke crucible furnace is being replaced in large works by more modern coke furnaces forced by a blast, and the whole furnace can be tilted to pour out the metal which economises in crucibles. Furnaces heated by petroleum under blast are now also used. One advantage of this kind of furnace and also of gas-fired furnaces is that there are no caster's ashes, so that any metal spilt can be used up again. The coke used in pot fires should not contain more than 10 per cent. of ash or 2 per cent. of sulphur, and it should not be too hard. Gas-fired furnaces have been used on the Continent for copper refineries and melting brass in reverberatory furnaces, but they are more expensive to build than coal furnaces.

As to the general construction of furnaces, the joints of firebricks should be as close as it is possible to put them; the arches of reverberatory furnaces should be made of firebricks simply dipped into a thick wash of fireclay; the outsides of melting furnaces should be plastered over with fireclay. Furnaces requiring high temperatures, such as for refining copper, are best built of silica bricks set in silica cement. For other furnaces the Stourbridge class of brick is best. The composition of the fireclay used should be as nearly as possible of the same composition as the brick.

Metals.—Chemical analysis is of the greatest importance in the proper selection of metals for various purposes of the copper and brass trade. High-grade brass sheets should only be made of the best metals, whilst sheathing metal may be made of ordinary material. The reason for this is that the alloys containing from 64 to 80 per cent. of copper consist mainly of one constituent, called α, and which will not dissolve lead or tin; so that if the metal contains a large excess of these metals, it is liable to crack when rolled hot. In alloys with 58 to 63 per cent. of copper, there are two constituents, α and β, the latter of which is malleable at a red heat and dissolves lead and tin, of which, consequently, more may be present with impunity.

Copper.—The purest brands of commercial copper are the various electrolytic brands and Lake Superior copper. Electrolytic copper of 99·97 per cent. purity is occasionally £1 or £2 per ton cheaper than B.S. ingot of only 99·6 per cent. purity, owing to manipulation of the markets in London and New York. The "best selected" brands of copper are rarely made now according to the method described in text books, as crude bar coppers made by the Bessemer process are often free from any large quantity of arsenic and antimony. Lastly, there are the tough coppers, which are generally arsenical, and are used for the bulk of manufactured copper articles, such as tubes, rods, sheets, etc. It is usually safest to use the purest copper for all brass alloys, for rolling, and for tube drawing. Arsenic must not be present in quantity over 0·05 per cent., antimony over 0·01 per cent., or bismuth over 0·005 per cent. This prevents the use of tough copper for this kind of work. The best methods of estimating arsenic and antimony are the distillation method, and for bismuth the method depending upon the brown coloration produced by dissolving bismuth iodide in potassium iodide. Billets for copper tubes, rods, and plates are now usually cast direct from the refinery; the copper is generally made to contain about 0·5 per cent. arsenic, which neutralises the ill-effects of small quantities of bismuth and lead, and also gives the copper a higher tensile strength at temperatures of 200° C., which is important for some engineering work. Another kind of tough copper practically contains oxygen as the neutralising agent, as well as a small quantity of arsenic. The oxygen is present as cuprous oxide, which is alloyed with the copper. Some makers still make tubes by the old crucible method, and very good results have been obtained in practice with this class of copper; it can only be made from the purest brands of best select and electrolytic copper. The oxygen is removed by adding about 0·1 per cent. of phosphorus. The finished tubes usually contain 99·8 per cent. of copper and 0·07 per cent. of phosphorus. The greatest care is necessary in the heat treatment of the different kinds of copper used for tube making, etc. A reducing atmosphere may spoil the copper. The roller will blame the refiner or caster, and they generally put the blame on the raw material. It is best to have a neutral atmosphere in the furnace, but an oxidising is better than a reducing one. At a red heat the copper oxide can be easily reduced, and this upsets the equilibrium of the metal. It is the business of a chemist to know the proper heat for treating the various kinds of copper. Arsenical copper should never be heated above 750° C. in any part of the rolling process, whilst ordinary refined oxidised copper with 0·1 to 0·2 per cent. oxygen can be heated to 900° C. without injury. On the other hand, the copper tubes made from very pure copper in pots, deoxidised with phosphorus, should not be heated above 700° C. As a general rule, the lower the temperature at which copper is rolled and annealed, the tougher and better is the manufactured product. Also, the thinner the manufactured article, the lower must the temperature of working be. This remark applies to all rolled metals.

Spelter.—The quality of spelter of recent years has improved considerably. English brands are now made of a purity equal to if not superior to the best foreign makes. English spelter guaranteed to contain 99 to 99·95 per cent. of zinc can be obtained. To sample a parcel of zinc plates, 10 plates of a 10 ton parcel should be drilled right through in three places and the drillings mixed. Then a portion taken for analysis. It is useless to break pieces off the corners and to drill them. For analysing pure zincs, 20 grms. should be taken.

Tin and lead can be obtained very pure.

Scrap metals.—In the proper selection of scrap, chemical analysis is important. The price of scrap metals being below the cost of new ones, a substantial profit is made by using scrap in place of new metal. In a brass rolling mill the use of brazed and tinned copper is very inadvisable, its quality being so doubtful, but for sand casters it is nearly as good as ingot copper. The small amount of tin and zinc makes very little difference in alloys where these metals are added in relatively large quantities. Old arsenical copper tubes and plates make very good gun-metal, but very inferior sheet brass. Old phosphorised copper tubes make gun-metal hard but they are always very pure and make good phosphor bronze. Scrap high-conductivity copper wire makes good metal of any kind, and if it is pressed together in small bundles, the loss in melting is small, but scrap telephone wire is useless for brass making as it often contains silicon. Clean old brass tubes can replace the more expensive ingot metals in all brass work. Old condenser tubes very often contain tin as well as a coating of tin. The loss on melting is much higher than with ordinary brass tubes, as they are very thin. The best way to use them is to melt down 1 cwt. in a crucible, and cast the resulting metal into ingots. Brass borings are largely used but they are difficult to sample. The best way is to take one or two cwt. properly sampled, melt them down, and analyse the resulting ingots. When buying brass borings, it has to be remembered that two different borings of the same composition when analysed before melting may vary 2 or 3 per cent. after melting down, if the one lot is a coarse boring and the other a thin boring. Of course it is easy enough to use up scrap of known composition which is made in the works; these remarks apply to unknown scrap.

Heat treatment of brass and bronze.—The proper heat treatment of copper alloys is a subject requiring considerable skill. The alloys used by sand casters may be divided into two types, gun metal alloys and brass alloys. The most difficult to cast are the gun metals. The brass alloys will give good castings at a lower temperature than gun metal. A complicated casting or a very small one must be cast at a much higher temperature than a plain one, hence complicated castings should be cast first and plain ones last when casting a series of boxes of castings. Brass alloys for the rolling mill are much more easy to cast. The metal for this work should never be boiled in the furnace; it will alloy perfectly without boiling. It should be cast at as low a temperature as possible without being pasty. All brass and bronze should be skimmed perfectly clean before pouring; this is especially necessary in alloys for the rolling mill, as dirt will show up at a later stage.

The annealing of rolled brass requires care. A portable pyrometer at a reasonable price which could be relied upon for temperatures up to 900° C. would be invaluable. The higher the copper contents, the more heat the brass will stand, and the purer the metal the more heat will it stand without burning. Thin sheets will not stand so much heat as thick ones of the same composition.

The treatment of residues.—In the course of manufacture, large quantities of waste products are obtained. Large works with their own refinery can use them by running them in a cupola with the refinery slag. When there is no refinery it is better to sell the residues than to attempt to smelt them. This does not apply to clean skimmings and clean brass dust and borings; this latter should be put through a magnetting machine to remove iron.

Large quantities of residues should always be sold on the assay—it is more satisfactory to buyer and seller. To sample a parcel of brass ashes is by no means easy. While the ashes are being loaded into trucks or carts, a small shovelful is taken out of each barrow and put on one side. The sample so obtained is thoroughly mixed and quartered down until from 2 cwt. to 10 cwt., according to the size of the parcel, is obtained. This sample is then ground up in a clean mortar mill or on a sampling plate with a heavy hammer. It is well mixed up and 1 lb. dried to determine moisture. About 7 lb. is dried, then 5 lb. of the dry material weighed on a rough scale; this is then crushed up until every particle except the metallic particles will go through a 30 sieve; any pieces of zinc, lead, or iron are picked out and their exact weight of dry sand added to the fines. The metallic portion is weighed and the weight of the fines obtained by difference. The fines are well mixed, and three packets, containing about 4 oz. each, are made up; inside these are put a small packet made up of chippings from the metallics, the three packets are sealed up in the presence of the buyer's and seller's representatives, and each takes one packet and assays it; if their assays do not agree the reserve packet goes to a referee assayer, whose decision is final. The label on the packet has the weight, date of sampling, amount of moisture, and percentages of fines and metallics written on it. All mill sweepings and such like residues should be burnt to get rid of waste, paper, oil, etc., then riddled through a ¼ in. riddle to remove pieces of brass, copper and iron. The fine material can then be easily sampled. Copper scale is easily sampled; in all cases a good representative sample should be taken and quartered down. If a number of bags are being sampled, a small handful must be taken out of each bag.

Another residual which causes trouble is waste sulphuric acid containing copper sulphate in solution. The simplest way of treating it is to evaporate it to half its bulk, using waste heat from a furnace, and allow most of the copper sulphate to crystallise out. The sulphate contains from 90 to 94 per cent. of pure sulphate, but it can be sold without much difficulty. The mother liquor still contains some copper, which can be precipitated by means of scrap sheet iron, steam being passed into the liquor at the same time. The copper precipitate is filtered off through coarse sacking or similar material, washed with water, and allowed to dry. It can then be melted in a refinery or sold. The resulting acid liquid is neutralised with lime before being run into the sewers. The sludge obtained should be dried, and if it contains over 4 per cent. of copper, it can be sold; if the precipitation with iron is properly carried out, it should not contain more than 1 per cent. of copper. Another method of treatment is to precipitate the copper by means of sheet iron without preliminary evaporation; precipitation is accelerated by heating with steam. In this case there is double the amount of waste liquid to neutralise.

In conclusion, it is only by employing the most scientific methods that manufacturers can hold their own against severe competition: such methods can only be applied by properly trained chemists, and there is little doubt that in the future the managers of all metallurgical works will be chemists.

DISCUSSION.

The CHAIRMAN said that the annual consumption of copper in the Birmingham district was at least 40,000 tons, Surely a metallurgical industry using so much of a comparatively costly metal ought to employ the best scientific aid. Yet until quite recently, comparatively few metallurgists were employed locally in the copper industry, though he believed the importance of utilising the best technical aid was now being recognised more and more. A short time ago he visited works producing Muntz metal, where in a well equipped laboratory as many as 100 determinations of copper were made per day by the electrolytic method, the object being to confine the variation of the copper to very narrow limits to avoid bad rolling results, and preferential solution of the zinc in sea water, which latter happened when the copper fell below 60 per cent. in the alloy. He understood Mr. Lewis to say that he estimated zinc directly in high grade spelters, say, with 99·5 to 99·8 per cent. of zinc. He (the Chairman) always found it necessary to do so by difference, carefully estimating directly the small amounts of impurities. Was this Mr. Lewis's practice ?

Mr. F. **Platten** said he had visited works in America and Germany, and he found that motor driving was the vogue, and would be increasingly used in the future. He was rather surprised that the author omitted any reference to the later developments in regard to steam annealing. By this method the metal never came into contact with any of the furnace gases, and as it left the furnace it passed through a water seal, so that in annealing copper wire the metal left the furnace quite bright and clean, requiring no pickling. He was astonished to hear that the use of producer gas for refining had been given up on account of the question of cost. He had visited works fitted with producer plant for copper refining and understood that difficulty was experienced in maintaining that neutral atmosphere so necessary for refining copper. There were many intricate problems in copper refining to be solved. Nearly all researches up to the present had been conducted with crucible cast copper ; and the researches of the future must be to a large extent carried out at the industrial works possessed of refineries. Some time ago the University of Birmingham addressed a circular to the large metal houses asking if they would permit advanced students from the metallurgical department to visit the works and to spend a certain time in them. He did not know what the responses had been, though he was glad to know that the proprietors of one large metal works were throwing open their doors to such students.

Mr. O. F. **Hudson** said that he regarded the ideal works manager as the man who possessed a good general metallurgical and chemical training, and who had good subordinates in the engineering and chemistry departments. In scientific works there were many matters which required more careful handling than they received now. Pyrometers, for instance, should be worked or checked carefully, only by experienced men. Such instruments were easily put out of order ; and unless carefully worked were liable to give misleading results.

Mr. H. C. **Heathcote** asked for information respecting the tensile strength of cast brass. What was the maximum strength ? Much was being done by the University for the equipment of the chemist, but in regard to Mr. Lewis's advocacy of a chemist being the works manager, he thought it would be agreed that the present-day chemist, speaking generally, required teaching much before he could accept such responsibility.

Mr. A. E. **Tucker** said that the object of so many analyses being taken at copper works was one of economy and in order to better control the consumption of copper. In reference to the action of sea water, some time ago some sheet brass was used as a protection for some piles used in the construction of marine work. To reduce the action of the sea water, the metal was surrounded with a sheathing of bituminous felting. The result of that arrangement was to establish an electric pile ; and instead of any of the brass sheathing as such being found after some years there was a thin layer of copper mud, the zinc having been entirely removed. Referring to waste products, a most effective method of treating metalliferous liquors was by the introduction of the dynamo. A fairly pure copper was obtained which might be treated in the ordinary way. The acid was recovered to a great extent, and so was available for a fresh pickling bath.

Mr. F. H. **Alcock**, referring to the fact that many engineers received much higher salaries than chemists, although they were not always as highly trained, said it was deplorable that in large industrial concerns the chemist did not take a higher position. He attributed the subordination of the chemist to the fact that his education had not been of the kind which was necessary in the administration of large works. He appeared to have been taught to think in grains, but when he got to the great works he had to think in tons. Except in a few instances the chemist was not an engineer. To be successful the chemist needed to combine some engineering capacity with a good-class common-sense analytical knowledge. Then he would be able to command first-rate terms. In regard to the use of brass in the bedstead trade, there was one kind which was giving an enormous amount of trouble—he referred to that in which the iron tube was coated with a very thin sheet of brass, which was exceedingly porous. The metal was then treated in the lacquering department and finally the bedsteads were shipped long distances and often suffered seriously in consequence of porosity and rottenness. No amount of lacquering seemed able to preserve the metal.

Mr. F. R. **O'Shaughnessy** said it was clear that the expert in brass and copper must be a man of many parts. Some years ago waste liquors were submitted to him which contained strong acid solutions having appreciable quantities of copper. Latterly, however, the strength of the products had diminished with regard to the copper. He should be glad to think they had diminished in the strength of acid before the refuse was discharged into the sewer. Mr. Lewis had suggested that the acid should be neutralised with lime, but he was afraid this was not often done. He desired to know what was the best means of protecting an electric cable which had to pass through, and remain in, a sewer containing slightly alkaline liquid. In one instance the cable had been covered with canvas steeped in pitch ; while in another the cable was insulated, and surrounded with a thin layer of lead.

Mr. W. T. **Collis** complained that the average chemist in industrial concerns had not many opportunities to fit himself for advancement to good positions outside the laboratory.

Mr. **Lewis**, in reply, said he always determined zinc by difference, as the lead, copper, iron and tin could be determined accurately. In pure spelters other metals were rarely present. It was not necessary to make analyses of every heat cast in Muntz metal. An increase of over 62·5 per cent. in the copper contents caused great difficulty in the rolling. It made the metal hard, and it was liable to crack in the process of rolling. Rolling could be done with 63 per cent. copper and 37 per cent. of zinc, if the metals were very pure. The best alloy for withstanding corrosion contained 61·5 per cent. of copper ; but it was necessary to have in the alloy about 0·2 per cent. of tin. Muntz metal made years ago was better for resisting corrosion, as it was made purer nowadays, and seldom contained tin. He had not had any experience of steam annealing of copper and brass, but he believed it was an improvement on ordinary annealing. The porosity of sheet brass (referred to by Mr. Alcock) must be due either to bad casting, or to the fact that the standard of quality of the metal was too low. It should contain 80 per cent. of copper and 20 per cent. of zinc and be made from pure copper and spelter. Then there would be no difficulty in rolling to extreme thinness. He was able to roll brass containing 70 per cent. of electrolytic copper, 29·5 per cent. of electrolytic zinc and 0·5 per cent. of manganese at a red heat as easily as Muntz metal. This kind of brass could be welded to iron by rolling, thus covering the iron with a thin brass sheet, but the process was not a commercial success. The tensile strength of brass cast in sand would not be more than 12 tons per square inch. He doubted whether there was any copper alloy which would withstand sewage for any length of time. Lead should, however, withstand corrosion very well.

Liverpool Section.

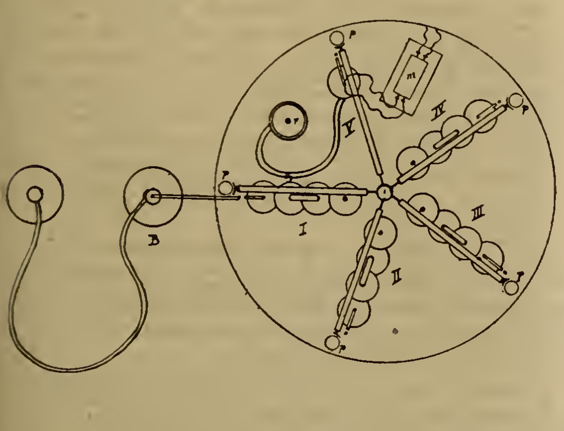
Meeting held at University, on Wednesday, April 8, 1908.

DR. JAMES T. CONROY IN THE CHAIR.

AN ARRANGEMENT TO FACILITATE THE USE OF HEMPEL'S PIPETTES.

BY J. S. STUDER.

The Orsat gas analysis apparatus is very useful for testing the exit gases of steam boilers, and its portability adds considerably to its practical value in various investigations and technical processes. To obtain, however, a full analysis of a producer gas, I consider that the adoption of Hempel's method is essential, but having recognised the possibility of the results being slightly inaccurate, I introduced some two or three years ago a new method of manipulation of Hempel's pipettes. The adoption of this new method has the effect of reducing the margin of error so much that for works purposes and general technical operations it may be ignored.

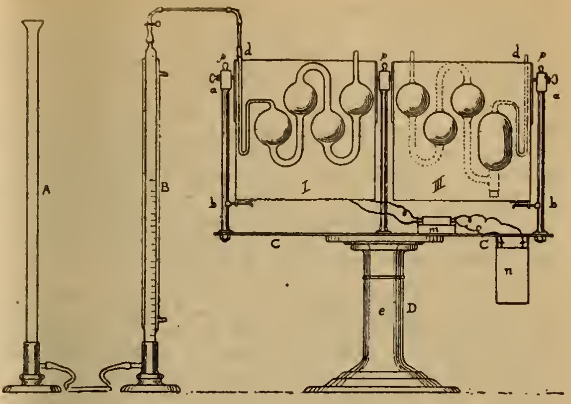


— PLAN —

The new arrangement consists of a circular disc, C, which rests horizontally on the central support, D. This support is of metal and is hollow from the top to the point, *e*. On this point rests the small piston, which projects from the centre of C. In this manner a free circular horizontal movement can be given to the disc, and the various absorbing vessels, and the explosion pipette can be easily brought in consecutive order to the point where the gas burettes are manipulated. When it is necessary to agitate the solutions in one of the pipettes, the small semi-circular fork bolt, *b*, is drawn back, and an easy backward and forward movement can be given to the absorbing vessels. The movement is facilitated by the arrangement of small fulcrums, *a*, which are the only supports of the pipettes.

By rotating the disc, C, consecutively about 72°, each pipette is brought in position of that of No. 1, and in transferring the gases under examination from the burette, B, to the various pipettes, and then again to No. 1, an analysis of the principal constituents of a producer gas can be carried out in about 20 minutes.

On comparing this arrangement of Hempel's pipettes with that generally in use, it will be obvious that by suspending the various pipettes, with the exception of the explosion pipette, on a fulcrum, and yet maintaining great stability of the whole arrangement, the shaking of the pipettes is easily carried out without the risk of drops of the reagent finding their way to the capillary tubes. Leakage or fracture at the point *d* is almost impossible.



— ELEVATION —

The fact, that the burette, B, is in this method a fixture throughout the whole series of manipulations, enables a water jacket to be more easily placed round it.

The various pipettes are filled with the following solutions:—No. 1 contains caustic soda or potash; No. 2, bromine water or fuming sulphuric acid; No. 3, sodium or potassium pyrogallate; No. 4, an ammonical solution of cuprous chloride; and No. 5 is an explosive pipette filled with mercury (*r*, mercury reservoir bulb; *m*, induction coil; *n*, storage battery.)

The absorption of ethylene by bromine water is very frequently omitted, (published results of analysis of producer gas rarely mention ethylene) and may be a cause of error when testing for methane. The importance of estimating ethylene will be recognised from the fact that its calorific value is much greater than that of any other constituent of a producer gas. The calorific power of gases, expressed as calories per cubic meter, is, according to Lunge, as follows:—Carbon monoxide, 3066; hydrogen, 2581; methane, 8697; ethylene, 14,045. It is evident therefore, that by omitting the estimation of ethylene, appreciable inaccuracies may result. It is well known that cuprous chloride will absorb ethylene, and for this reason alone it is important that the heavy hydrocarbons should be absorbed, either in bromine water or fuming sulphuric acid, before determining carbon monoxide when testing producer gas.

It has been said that, in the analysis of producer gas, the use of water instead of mercury gives rise to some error in the results obtained. In practice, where one is not limited to the use of the quantity of gas to be examined, one meets that objection by saturating all water to be used with the gas to be examined. In a works where a great number of analyses have to be carried out during a day, the use of water is a great and indispensable convenience, especially when the samples to be analysed have to be fetched from various parts of the works.

London Section.

Meeting held at Burlington House on Monday, May 4, 1908.

DR. J. LEWKOWITSCH IN THE CHAIR.

THE MANUFACTURE OF SODIUM NITRITE.

BY GILBERT T. MORGAN, D.SC.

Sodium nitrite is practically the only salt of nitrous acid which is prepared on a manufacturing scale and it finds extensive use in the production of several classes of artificial colouring matters and also in the preparation of various pharmaceutical products and other fine chemicals.

I. *Production from sodium nitrate.*

Hitherto nitrite has generally been prepared from sodium nitrate, and the following are some of the principal methods by which this chemical change can be effected.

1. *Thermal decomposition.*—The alkali nitrates when heated above their fusion point evolve oxygen and furnish nitrites, but this reaction is of no practical importance owing to the simultaneous occurrence of a further decomposition to oxide. The difference in the behaviour of the two alkali nitrates is of some theoretical interest, the potassium salt giving a final residue of the dioxide, whilst the sodium salt yields the monoxide.

2. *Reduction by metals.*—Finely divided copper has been suggested by Persoz and by Müller and Pauly, but owing to the infusibility of this metal at the temperature of molten nitre it is difficult to ensure a uniform reduction throughout the heated materials, and, moreover, this process involves the regeneration of the comparatively expensive copper from the resulting copric oxide. Zinc dust has been tried but I am not aware that a successful method has been based on the use of this metal. Sturm (Fr. Pat. 321,498 of 1902; this J., 1903, 212) obtains nitrite by heating sodium nitrate with finely divided metals in a muffle furnace. More recently iron has been recommended as a reducing agent for sodium nitrate.

The heating of a concentrated solution of lead nitrate with finely divided lead leads to the formation of insoluble basic lead nitrite, which furnishes sodium nitrite by double decomposition with sodium carbonate. This reaction is, however, only of theoretical interest.

Lead is undoubtedly the most convenient metal for the reduction of sodium nitrate; it is comparatively cheap, and its melting point (330—335° C.) lies so close to that of the nitrate (314° C.), that the two reagents can be brought together in the liquid condition at a temperature considerably lower than that at which the thermal decomposition of nitrite occurs. (Hampe, Annalen, 1863, **125**, 336.) The reduction is effected on a manufacturing scale in shallow cast-iron pans, 4 ft. in diameter and about 18 inches deep, fitted with a stirring gear which agitates thoroughly the whole mass of molten material. The pans are supported on perforated fire-brick arches, arranged so that the products of combustion of the coal fires circulate uniformly round the pan before passing to the flues. Each pan is charged with 200 lbs. of sodium nitrate and 3 cwts. of lead, which are heated and stirred until all the metal is oxidised. At this stage 50 lbs. of nitre are added and thoroughly stirred in until the mixture is of uniform consistence when 3½ cwts. of lead are gradually added, with constant agitation, the mechanical stirring being supplemented by the use of long-handled rakes employed to "pull out" the mixture of metal and salt from the central and hottest part of the pan. The success of the reduction depends very largely on the skill and experience of the workman, who generally controls two pans, and whose duties are to regulate the firing of the pan and the rate of addition of the metal.

The reaction occurring in the nitrite pan is not so simple as that represented by the equation, $Pb + NaNO_3 = PbO + NaNO_2$, for the higher oxides of lead are also produced both by aërial oxidation and by further reaction with the nitrate. In this connection it should be noted that litharge itself has been suggested as a reducing agent for nitrate, $3PbO + NaNO_3 = NaNO_2 + Pb_3O_4$, although the large proportion of this oxide required would militate against its adoption.

During the reaction a portion of the lead becomes converted into a singularly inert substance of high specific gravity; this product is regarded as a sub-oxide, but may be a passive form of the metal contaminated with higher oxides and sodium plumbite.

The fusions are allowed to run for one-half to three-quarters of an hour after all the lead has been added, when the product, which now has a yellowish brown tint, is tested for nitrite. With careful working the soluble constituent of the melt should contain 90 per cent. or even more of sodium nitrite. When rich in nitrite the cooled melt has on its surface a characteristic crystalline incrustation which is never noticed on specimens containing a relatively small percentage of the required salt.

Satisfactory results are, however, only obtained when both the lead and nitrate are of good quality. The former should be good commercial lead which has been remelted, skimmed and cast into small bars. The latter should be crystallised Chili saltpetre of the best quality. The presence of sodium iodate is especially harmful, as this salt appears to act catalytically in promoting the destruction of the molten nitrate and nitrite. The appearance of the characteristic violet vapour of iodine arising from the melt shows that inferior nitrate is being employed and in these circumstances the salt should be recrystallised, when the harmful impurities are eliminated.

The reduction being complete, the molten contents of two pans are ladled into 120 gallons of warm water contained in a covered cylindrical washing box fitted with powerful stirrers rotating on a horizontal axis. The curved lid of this box contains two small circular apertures for the introduction of the melt, and within, the soluble nitrite is separated from the litharge by agitating the mixture for one hour and then allowing the precipitate to subside. The clear liquor is then run off into a neutralising tank and here the solution, which is distinctly alkaline, is neutralised with dilute sulphuric acid or, if possible, with the solution obtained by absorbing nitrous fumes in water.*

This neutralisation causes the decomposition of sodium plumbite and the precipitation of a small amount of lead hydroxide. The neutralised liquors are now evaporated in wrought iron pans heated either directly or with internal steam pipes. At 45° Bé. the concentrated solution shows a thin film of nitrite on its surface and is then run off into rectangular cast iron crystallisers and left for at least 12 hours, when the first crop of sodium nitrite crystals is collected, the mother liquors being again concentrated and allowed to crystallise. These crystals, when dried in a centrifugal hydro-extractor and then in an air-oven, should contain 96 per cent. of $NaNO_2$.

The washing of the oxides of lead is repeated, the more dilute washing liquors being flushed off together with the litharge into settling tanks. These liquors are used to lixiviate subsequent melts, whilst the litharge is either dried for sale or mixed with the "sub-oxide" and smelted to lead in a small blast furnace.

As received from the settling tanks the pasty litharge contains varying proportions of the higher oxides of lead. It may, however, be rendered more uniform by conversion into flake litharge or red lead in suitable reverberatory furnaces.

The working up of these large quantities of lead compounds is one of the chief disadvantages of this process, another is the baleful effect of the lead on the workmen, a certain incidence of plumbism being almost unavoidable.

3. *Reduction by non-metals.*—The well-known detonation of charcoal and nitre leads to the formation of a carbonate and only small quantities of nitrite. When brought under control by the addition of caustic soda and lime the reaction between sodium nitrate and graphite has been patented as a process for preparing sodium nitrite (Grossmann, Eng. Pat. 1452 of 1904; and also Knop, Eng. Pat. 4747 of 1897).

A similar process involving the use of sulphur, which has been successfully worked out on a manufacturing scale by Messrs. Read Holliday and Sons, of Huddersfield, is based on the following reaction:—

$$3NaNO_3 + S + 2NaOH = Na_2SO_4 + 3NaNO_2 + H_2O.$$

The fusion is carried out in open pans fitted with stirring gear, but of larger capacity than those employed in the lead process. The nitrate containing a portion of the caustic soda (about 1/10th) is melted and treated alternately with sulphur and more molten caustic soda until the nitrate is practically all reduced. The fused product is added while still hot to sufficient warm water to dissolve the whole of the nitrite and only a portion of the sodium sulphate, a large proportion of which is left behind in a granular condition. The liquor is drained through a vacuum filter and evaporated to a smaller bulk when a further portion of sulphate separates and the solution on cooling deposits sodium nitrite while the final mother liquors furnish more Glauber's salt.

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* These fumes are obtained in such nitric acid oxidation processes as the manufacture of arsenic acid.

This process yields without troublesome by-products a nitrite of good quality, which is obviously quite free from lead, and apart from the separation by fractional crystallisation of the nitrite from the dissolved sulphate, the operations involved present no serious practical difficulties.

Carbon monoxide either pure or in the form of producer gas has no action on molten sodium nitrate but in the presence of fused caustic soda there is an intermediate formation of formate which then reduces the nitrate in the following manner :—

$$NaNO_3 + HCO_2Na + NaOH = NaNO_2 + Na_2CO_3 + H_2O.$$

(Goldschmidt, Eng. Pat. 17066 of 1895.)

4. *Reduction by metallic sulphides and sulphites.*—Etard formerly recommended sodium sulphite as a reducing agent for sodium nitrate (Bull. Soc. Chim., 1877, **27**, 434), and a modification of his process has recently been patented (D.R.-P. 138,029). The percentage yield of nitrite is excellent but the high proportion of sodium sulphate in the melt—about two-thirds of the total—renders the separation of sodium nitrite somewhat troublesome. Closely allied to this method is the process devised by the firm of Gebrüder Flick, which consists in passing sulphur dioxide over sodium nitrate and calcium hydroxide heated in retorts. The nitrite is then readily separated from the sparingly soluble calcium sulphate.

The commonly occurring sulphides react with fused sodium nitrate, furnishing nitrite. Messrs. McGougan have patented the use of galena which gives a melt containing litharge, sodium nitrite and sulphate with a small amount of sodium plumbite (Eng. Pat. 7715 of 1897). I have noticed that stibnite, the fusible sulphide of antimony, very readily reduces the nitrate giving a high percentage of nitrite but the cost of this reducing reagent is prohibitive.

Sodium sulphide and nitrate interact energetically forming a nitrite melt which contains only a relatively small proportion of sodium sulphate. Le Roy has advocated the use of barium sulphide, a mixture of this substance and sodium nitrate being heated in an iron dish when a vigorous reaction sets in and sodium nitrite and barium sulphate result. The intensity of this reduction is moderated by the admixture of barium sulphate (Compt. rend., 1900, **108**, 1251).

II. *Production of nitrite from nitrous fumes.*

It was shown conclusively by Divers (Trans., 1899, **75**, 85) that pure sodium nitrite could be readily prepared by absorbing nitrous fumes in aqueous sodium carbonate or hydroxide, provided that these gases contain a slight excess of nitric oxide. Excess of nitrogen peroxide would result in the formation of nitrate. Nitric oxide itself was shown by Debray to unite with barium peroxide forming barium nitrite, a similar reaction with the alkali peroxides would lead to sodium and potassium nitrites.

Raschig's observation that nitric oxide combines very rapidly with oxygen to form nitrous anhydride whilst the further change of the latter oxide to nitrogen peroxide occurs comparatively slowly suggests a method of utilising atmospheric nitrogen in the production of nitrite. The absorption of the nitrous fumes within a few seconds of their formation in the electric arc is an operation involving considerable practical difficulty, which however has to some extent been overcome by the method recently patented by the Badische Anilin- und Soda- fabrik (Fr. Pat. 363,643 of 1906). According to this patent the nitrous fumes are maintained at a temperature of 300° C. until they are absorbed by an alkaline solution of sodium nitrite from a former operation. A strong solution of this salt is employed in order to reduce as far as possible the vapour pressure of the liquid, and thus minimise the dilution of the hot reacting gases with steam.

According to Eyde (Eng. Pat. 28,613 of 1904) the gases of the electric furnace containing much air when quickly brought into contact with the hydroxides of the alkalis or alkaline earths, yield nitrites

$$2NO + NaOH + O = 2NaNO_2 + H_2O.$$

Electrolytic reduction of nitrates.—Various attempts have been made to utilise the electric current in the reduction of nitrates to nitrites. Among the most recent are the experiments made by E. Müller and F. Spitzer (Zeit. Elektrochem., 1905, **11**, 509) with cathodes of different metals, the most favourable results being obtained with spongy silver.

Miscellaneous agents.—The interaction between barium hydroxide, manganese dioxide and sodium nitrate has been patented by Huggenberg. Zinc and ammonia have been employed by Stahlschmidt. The oxidation of ammonia in the presence of metallic oxides at 650—750° C. leads to the production of "nitrous anhydride" which is absorbed by alkalis (U.S. Pat. 763,491 of 1904). This oxidation of ammonia to nitrite has also been effected electrolytically in aqueous solution in the presence of sodium and cupric hydroxides (Traube and Biltz, Ber., 1904, **37**, 3120).

III. *Production of nitrite from calcium nitrate.*

As it has been predicted that calcium nitrate will gradually displace the sodium salt as the commercial source of nitre, I have made some experiments on the production of sodium nitrite from calcium nitrate, or from mixtures of this salt with calcium nitrite.

Calcium nitrate melts in its water of crystallisation becomes solid again at higher temperatures and finally fuses. When maintained in a pasty state for some time the anhydrous salt loses oxygen and oxides of nitrogen; some nitrite is produced but the yield is very small. Reducing agents increase the production of nitrite very considerably and when mixed with sodium sulphite and sulphide the calcium nitrate on heating furnishes a yield of more than 60 per cent. of the calculated amount of sodium nitrite. The object of taking the two reducing agents in these proportions is to ensure the conversion of both sulphur compounds into sparingly soluble calcium sulphate.

i. $2Ca(NO_3)_2 + Na_2S = CaSO_4 + Ca(NO_2)_2 + 2NaNO_2.$

ii. $Ca(NO_3)_2 + 2Na_2SO_3 = CaSO_4 + Na_2SO_4 + 2NaNO_2.$

The combined changes may be represented as follows :—

$$3Ca(NO_3)_2 + Na_2S + 2Na_2SO_3 = 6NaNO_2 + 3CaSO_4.$$

By taking the sulphide and sulphite in these proportions the product after lixiviation consists chiefly of very soluble nitrite and sparingly soluble gypsum which are readily separated. The sulphide and sulphite are melted together until their water of crystallisation is driven off and the residue intimately mixed with the calcium nitrate. This mixture is heated until the water contained in the last salt is eliminated. A portion of the dried mixture is then heated strongly until a re-action sets in accompanied by incandescence and the remainder is added sufficiently rapidly to ensure the continuance of this interaction. The greyish white product is lixiviated with warm water, the sulphate removed and the nitrite obtained from the solution.

With a mixture of nitrate and nitrite the sulphide may be omitted as in this case sulphite alone suffices to convert all the calcium into sulphate.

$$Ca(NO_2)_2 + Ca(NO_3)_2 + 2Na_2SO_3 = 4NaNO_2 + 2CaSO_4.$$

Instead of the sulphide and sulphite, a mixture of sulphur, caustic soda and calcium nitrate may be employed.

$$3Ca(NO_3)_2 + 2S + 6NaOH = 2CaSO_4 + Ca(OH)_2 + 6NaNO_2.$$

The introduction of carbon dioxide or dilute sulphuric acid into the aqueous solution of the melt ensures the precipitation of the calcium hydroxide in the form of calcium carbonate or sulphate.

METANIL YELLOW: ITS USE AS A SELECTIVE INDICATOR.

BY ERNEST LINDER, B.SC.

In 1906, attention was drawn by Mr. E. G. Ballard to the behaviour of "Dolly Cream"-dye in presence of various acid fumes (43rd Alkali Report, p. 19). He ascertained by direct test in the laboratory that a strip of filter paper stained with the dye and exposed in the dry state to vapours of hydrochloric acid were coloured violet, while little or no change resulted from contact with chlorine gas or sulphur dioxide. These results led Mr Ballard to suggest that the dye might be applied as a selective indicator for the identification of hydrochloric acid in gaseous mixtures. The present research was undertaken to determine the properties of the violet compounds obtained when various acids act upon the dry test paper with a view to its general application for the differentiation of noxious gases.

The active principle of "Dolly Cream" dye is stated on trustworthy authority to be metanil yellow, the sodium salt of *m*-benzenesulphonic acid-azo-diphenylamine,

$$NaSO_3.C_6H_4.N:N.C_6H_4.NH.C_6H_5,$$

a body isomeric with the well-known indicator tropæolin OO. A supply of metanil yellow, however, was not obtainable until the work was nearly completed; it has not been found possible, therefore, to repeat all the experiments with this dye, but the results of preliminary research indicate that metanil yellow is far more sensitive to acid fumes than "Dolly Cream." It should be employed, therefore, in preference to the latter in all selective testing where traces of mineral acid have to be identified in gaseous mixtures.

No attempt has been made in the present research to determine the exact composition of the violet compounds obtained when mineral acids act upon these dyes in the dry state, but their mode of formation and general properties indicate that we are dealing with acid derivatives of a yellow colour acid, stable only in absence of water; in presence of water dissociation takes place to a greater or less extent, according to the concentration of the mineral acid.

Experimental.

Preparation of Test Papers.—Pieces of Schleicher and Schüll filter paper were stained by soaking for a few minutes in cold, dilute, aqueous solution of the dyes; and dried horizontally in an air oven at 90° C. The quality of paper and depth of tint affect the sensitiveness of the indicator and stability of the violet compound produced to a marked degree. It is necessary, therefore, in comparative testing, to employ test papers of precisely the same quality. The best results were obtained with porous filter paper (S. and S. No. 589, black band) dyed to a medium depth of orange yellow by immersion for 1 to 2 minutes in aqueous solutions containing 0·1 per cent. of metanil yellow or tropæolin OO; with "Dolly Cream" dye stronger solutions should be employed. The test papers should in every case be used dry; acid is better absorbed by the damp paper, but moisture inhibits the formation of the desired colour product.

Limits of Sensitiveness.—Acid gases.—The sensitiveness of the test papers was determined with rough approximation by hanging strips of the dry paper for a given length of time in a litre Erlenmeyer flask in which a known volume of standard acid was evaporated by gentle heat. Tested in this way, it was found that both metanil yellow and tropæolin O O papers were far more sensitive to acid fumes than "Dolly Cream." Thus, with 0·1 c.c. of *N*/100 hydrochloric acid solution per litre of air (equivalent to 0·016 grain of HCl per cubic foot), the change of tint from yellow to violet could be detected within two minutes in the case of metanil yellow and tropæolin; "Dolly Cream" paper remained unchanged under the same condition. With 0·05 c.c. of *N*/10 hydrochloric acid (0·08 grain of HCl per cubic foot) the two former papers were turned deep violet within one minute; the latter faintly violet in two minutes. With longer exposure, doubtless, the limits of sensitiveness could be greatly extended, as the effect appears to be cumulative.

Acids in aqueous solution.—A drop of dilute acid was placed on the paper, which was then redried at 30° to 40° C. Again metanil yellow and tropæolin test papers proved to be far more sensitive than "Dolly Cream." Thus, metanil yellow and tropæolin OO papers, with one drop of *N*/500 sulphuric acid both assume a distinct violet colour, and even respond to *N*/1000 acid. "Dolly Cream" paper is unaffected by *N*/1000 acid: with *N*/500 acid the change of tint is only just noticeable.

Effect of moisture.—If two similar pieces of test paper be exposed to the same body of acid gas, one dry and the other moist, the dry paper at once assumes a violet tint, the moist remains yellow. If the latter be now dried in the air oven, the colour changes to violet. Acid is absorbed by the moist paper under these conditions, therefore, but the violet compound appears to be dissociated; on removing the water, the acid and dye react to form the characteristic violet coloured acid body. Similarly, if the violet coloured test paper be moistened with water, the yellow tint is restored: water produces the same colour change as alkali, fumes of ammonia instantly causing a reversion of violet to yellow, but with this difference, redrying the paper in the first case will restore the violet colour; no such result is obtained after application of alkali—moisture effects dissociation, alkali neutralisation of the violet compound. Metanil yellow and tropæolin OO test papers behave in precisely the same way.

The behaviour of the violet-coloured acid derivatives of all three dyes towards ether and alcohol is equally characteristic. Thus, if the dry violet test papers be moistened with ether, the colours at first are unaffected. As the ether evaporates, they change to yellow, remain so for a few seconds, then return to violet. With "absolute" alcohol, the yellow stage persists longer, but the difference is one of degree, not of kind. In both cases, the sequence of colour changes appears to be controlled by the proportion of water present on the paper. Both ether and alcohol contain traces of water, or are capable of absorbing it from the air. The proportion of water present is at first insufficient to cause dissociation of the acid compound; it rapidly increases, however, as water is less volatile than the ether or alcohol with which it is associated; at a certain limiting strength the violet compounds are dissociated and the acid set free, only to recombine again as the water itself is removed.

Stability of "Dolly Cream" violet acid compounds.—The stability of the violet compounds varies to a remarkable degree. Not only are specific differences noticed between the rates of fading of various acid products, but the same product behaves differently according to the manner of its production and the conditions under which it is kept. Thus, if a dry test paper be somewhat deeply stained by exposure to vapour of hydrochloric acid, and then kept on a glass plate in the dark in contact with ordinary air, it gradually fades from day to day, the bright blue violet tint characteristic of the fresh colour fading first to red violet and ultimately to yellow; the rate of change, however, is extremely slow, and is only completed after many weeks. If the paper, instead of being placed on a plate, is enclosed in an envelope, or between two sheets of paper, the fading is extremely rapid, the yellow colour being restored within a week. On the other hand, if the violet test paper be placed in a desiccator over sulphuric acid or caustic soda, so as to effectually exclude moisture, no fading ensues. The test paper may even be kept in contact with paper, if moisture be excluded by carefully heating both test paper and envelope before bringing them into contact, the whole being then placed in sealed tube or desiccator. Once the violet colour is discharged, however, by exposure to moist air, it cannot be restored by reheating in an air oven: the hydrochloric acid liberated by moisture is removed from the paper, by evaporation or by some other cause. The yellow body obtained on the test paper in place of the violet compound is, however, still sensitive to acid fumes, and again becomes violet in contact with them. The active agent inducing change is moisture, therefore, and it acts by causing dissociation of the violet compound into constituent mineral acid and dye, the former being subsequently removed, the latter remaining on the paper in a condition sensitive to further contact with acid. Similar behaviour characterises the violet compound yielded by hydrofluoric acid gas. But the product is remarkably unstable under all conditions allowing access of moisture to the test paper, three hours' contact with paper being sufficient to restore the colour to yellow. In absence of moisture, the colour is stable. On the other hand, the acid product obtained by exposing the indicator paper to fumes of sulphuric acid possesses remarkable stability, contact with paper for many weeks, and even months, in some cases, being insufficient to completely destroy it. And generally, one finds that while the violet compounds of volatile acids, *e.g.*, hydrofluoric, hydrochloric, nitric acid, &c., in presence of moisture possess a low degree of stability, those of non-volatile acids, *e.g.*, sulphuric, hydrofluosilicic, phosphoric, &c., are characterised by great stability under the same conditions. The process of dissociation and removal of free acid proceeds continuously to completion with greater or less rapidity in the case of the compounds of the dye with volatile acids; with non-volatile acids, the process appears to be retarded by the liberated acid, which remains in the test paper and tends to reverse the colour change. It should be stated, however, that the characteristic differences of behaviour of various acid products under the same conditions is only observed with violet stains of some degree of intensity. The stabilities of the compounds approximate at extreme dilution.

Effect of vacuum upon the colours.—The effect of placing the violet compounds *in vacuo* has not yet been fully investigated, but the results of preliminary experiments appear to indicate that when dry granulated caustic soda is present to reduce the amount of water vapour derived from occluded moisture necessarily introduced with the filter paper and left in the exhausted cylinder by the pump, the violet compounds are stable; if the caustic soda be omitted, the colours slowly fade to yellow; but results are somewhat anomalous and obscure. In every case, where the violet colours of volatile acids proved to be stable under vacuum or desiccator conditions, they rapidly faded to yellow when the test papers were removed and placed between two sheets of paper.

Dissociation of "Dolly Cream" violet compounds in presence of moisture, and withdrawal of liberated acid from the test paper.—The dissociation undergone by the violet compounds in presence of atmospheric moisture has been already discussed. The conditions that control the removal of mineral acid thereby liberated have now to be considered.

If a hydrochloric acid violet test paper be carefully heated in an air oven to expel occluded moisture, and then placed in contact with a piece of dry, yellow indicator paper and exposed to the air for 24 hours, a distinct violet image of the test paper is obtained, the former absorbing acid and becoming stained violet at the expense of the latter, which becomes proportionately paler. If the two papers are placed in contact in a desiccator, so as to exclude moisture, the yellow paper remains practically unaffected. A similar result is obtained if a sulphuric acid stain is placed in contact with yellow test paper, but the image obtained is fainter; less acid is transferred and the fading is proportionately less marked. Foolscap paper in contact with hydrochloric stain and on exposure to moist air behaves in the same way as "Dolly Cream" test paper, *viz.*, there is a transference of acid, and corresponding loss of colour; but in this case the paper remains white. If the hydrochloric acid stain be merely exposed to air containing moisture the fading is less rapid, but none the less proceeds to completion if sufficient time be given. If the faded paper be then heated, it remains yellow, but on re-exposure to acid fumes at once assumes a violet tint. Fading is due to loss of acid, therefore, not to destructive changes proceeding in the dye.

The question arises, what becomes of the acid set free in the paper, is it merely volatilised or withdrawn by the agency of the capillary surfaces with which the paper is placed in contact, or is it removed by interaction with the fibre substance itself or its contained impurities? It is believed that the loss is mainly, if not entirely, due to volatilisation:—Apart from the fact that the rate of fading is directly related to the volatility of the acid, we find that if the cellulose be entirely excluded, and the purple compounds formed on the surface of platinum foil or glazed porcelain, they exhibit their characteristic colour changes under conditions which allow of access of moisture. The compounds, however, are redder in colour than those obtained with the test paper, and may or may not have the same composition. Further evidence that the cellulose is more or less a silent spectator of the colour changes that proceed on its surface is afforded by the fact that if filter paper is impregnated with $N/10$ acid and redried at 30° C., "acid test paper" is obtained which behaves, as regards loss of acid on exposure to air or on contact with note paper, in a manner precisely similar to that of the violet acid compound corresponding thereto; while the loss of acid is attended by no appreciable change in the physical properties of the paper.

The "acid test papers" were prepared as follows: Filter papers (11 cm. diam., ash, 0·0001 grm.) were divided by creasing into four equal sections A. 1, 2, 3, 4; B. 1, 2, 3, 4, &c. The surface of each paper was then evenly wetted with the minimum quantity of $N/10$ acid from a burette, each quarter receiving 0·3 c.c. of acid; the whole paper 1·2 c.c. The papers were then dried horizontally for 30 mins. on a glass ring in an air oven at 30° C. and cut into four equal pieces, and the pieces recombined to form standard paper approximately uniform as regards distribution and amount of acid. Thus, four pieces, A_1, B_2, C_3, D_4, together formed one paper; B_1, C_2, D_3, A_4, another, and so on. The rate of loss of acid was then determined by placing each set of four papers under selected conditions for a given length of time, and finally extracting with cold water, and titrating with $N/10$ alkali. Errors of experiment would be about $\pm 0{\cdot}1$ c.c. $N/10$.

It is an interesting fact that conditions favourable for dissociation of a given violet compound may not coincide with those favouring volatilisation of the liberated acid. Thus, if the hydrofluoric acid compound be held in dry steam, the colour instantly reverts to yellow; on removing the paper from the moist atmosphere, the violet colour reappears. Merely heating the paper to 100° C. produces no such effect. The liberated acid appears to be retained in the paper by the excess of moisture absorbed from the steam: conditions are favourable to dissociation, but not to volatilisation. On removing the paper, this moisture is rapidly evaporated, but at the same moment acid and dye recombine: conditions are now favourable to volatilisation, but not to dissociation; the acid is fixed. The colour left on the test paper after this treatment had all the properties of hydrofluoric acid violet compound, *e.g.*, kept in envelope it faded to yellow in 24 hours.

Action of acetic acid, acid oxides, chlorine, and sulphuretted hydrogen on dry "Dolly Cream" test paper.—Acetic acid is without action on metanil yellow, tropæolin, or "Dolly Cream" test paper, if mineral acid be absent.

Acid oxides.—1. Nitrogen oxides. The red fumes obtained when nitric oxide gas is mixed with air produce a slight violet tint on the test paper; the colour rapidly changes to canary yellow, insensitive to acid fumes. 2. Sulphur trioxide. The strong vapour rapidly chars the dry test paper. If the strip be withdrawn the moment the end begins to blacken, it is seen to be yellow; on exposure to air the colour rapidly changes to violet in the immediate neighbourhood of the charred portion. This colour change is attributed to hydration of the absorbed trioxide, the sulphuric acid formed thereby yielding its characteristic compound with the dye. Sulphur trioxide as such, would appear therefore to be incapable of forming a violet coloured compound with "Dolly Cream" dye. Experiments on catalytic sulphuric acid gases confirm this conclusion. 3. Sulphur dioxide. No action. The specific action of mineral acids is unaffected by sulphur dioxide. This enables the presence of small quantities of such acids to be detected in gaseous mixtures containing the dioxide.

Chlorine.—Air containing 10 grains of chlorine per cubic foot has a slight bleaching action upon the dry test paper; the moist paper is rapidly bleached. Air containing 1 grain chlorine per cubic foot is without action on the dry paper.

Sulphuretted hydrogen.—No action.

Application of Metanil Yellow or "Dolly Cream" test paper for selective testing.

1. *Gaseous mixtures.*—It would appear that the indicator has a definite though somewhat limited value for selective testing in cases where other than traces of acid gases are present. Thus, it enables one, with

certainty, to identify mineral acid in gaseous mixtures associated with sulphur dioxide, chlorine, sulphuretted hydrogen, or acetic acid, since mineral acids alone produce a violet stain upon the paper; and to differentiate with certainty between hydrofluoric acid on the one hand and hydrochloric, nitric, and sulphuric acids on the other:—the violet compound of hydrofluoric acid in contact with foolscap paper fades to yellow in 2 to 3 hours; the derivatives of nitric and hydrochloric acids survive for nearly a week, that of sulphuric acid for several months when kept under the same conditions.

It is less easy to distinguish between the colours produced by sulphuric, nitric, and hydrochloric acids, as the stabilities of the various violet compounds tend to approach one another at extreme dilution, and are markedly divergent only when gases and vapours of some degree of concentration act upon the paper. It would be impossible to distinguish, for instance, between hydrochloric and sulphuric acid in chimney gases under ordinary conditions. We can say that mineral acid is present or absent, nothing more. In certain cases, however, negative indications may be of value. Thus, it is found that flue gas from sulphuric acid rectifying plant, containing total acid (including sulphur dioxide) equivalent to 1 grain of sulphur trioxide per c. ft., imparts a deep violet tint to "Dolly Cream" test paper on 2 minutes' exposure, and that the resultant colour has great stability; at another work, gases from chimney draughting Chance process, possessing a total acidity (including sulphur dioxide) equivalent to 2·9 grains of sulphur trioxide per c. ft., failed to impart, on 2 minutes' exposure, any sensible violet tinge to dry test paper. It is reasonable to conclude from this that sulphuric acid was practically absent from chimney gases in the latter case—a matter by no means easy of proof by quantitative test. On the other hand, it was found that the gases from a copper works chimney, T. A. 2·4, calculated as sulphur trioxide in grains per cb. ft., did impart a distinct heliotrope tint to the dry test paper on one minute's exposure. Mineral acid must have been present here, but in small amount.

It is an interesting fact that fumes from sulphur burning in air containing aqueous moisture impart a deep violet tint to "Dolly Cream" test paper; the colour obtained has a high degree of stability. Sulphuric acid is therefore a product of combustion under these conditions. It would be of interest to ascertain the effect upon the test paper of fumes from sulphur burning in dry air or oxygen.

Fumes of ammonium chloride do not affect the indicator, if the test paper becomes coated with condensed solid. If, however, the paper is bent into half circle and the fumes allowed to impinge centrally and flow up the sides, the upper portion of the paper turns violet; the presence of free acid can thus be detected in presence of its equivalent of ammonia.

2. *Acids in aqueous solution.*—The action of dilute acids on the dry test paper has already been noticed (p. 486). The extreme delicacy of the test, and the fact that the indicator is indifferent towards acetic acid, suggested that it might, with advantage, be applied for the identification of "mineral acid" in adulterated vinegar. Experiment shows that the sensitiveness of the test is in no way interfered with by the colouring matters present.

The test is best carried out by placing a drop of the suspected liquid on a dry test paper prepared according to the directions given on p. 486; the paper is then redried at 40 to 50° C. Presence of "mineral acid" is shown by the purple stain produced on the paper. Such stains are not very permanent when kept in contact with paper, but appear to be very resistant to fading if sealed up in glass tubes. The stability is not increased if the paper is kept *in vacuo* over caustic soda or phosphoric acid. It is possible, therefore, that the test might be placed on a quantitative basis by preparation of standard colours obtained with dilute solutions of sulphuric acid of known strength and preserved in sealed tube.

"Dolly Cream" test paper is not sensitive to acid below a strength of one-five hundredth normal (0·01 part of sulphuric acid per cent.); but metanil yellow paper is distinctly stained by 1 drop of $N/1000$ sulphuric acid (0·005 per cent.), and its use on this account is much to be preferred.

It should be remembered that acetates are normally present in pure vinegar. "Mineral acid" added to such vinegars would not begin to affect the test paper until the whole of the acetate had been decomposed. Further, that "pure" glacial acetic acid is very apt to contain traces of sulphuric acid, and discolours the test paper unless the "mineral acid" present is first neutralised by adding a crystal of ammonium acetate.

Having had no practical experience with the testing of vinegars, the method was submitted to Mr. S. R. Trotman, Public Analyst for the City of Nottingham, who very kindly undertook to try it. He writes, 10th January 1908:—"I have carefully tried the test ('Dolly Cream') with an artificial vinegar containing 4 per cent. of acetic acid and 0·1 per cent. of free sulphuric acid, and find that the result is quite satisfactory. I think that the test papers will be of great use." Later, Mr. Trotman's attention was drawn to the greater delicacy and certainty of the metanil yellow test paper, and he was good enough to repeat his tests. He writes 18th February, 1908, "I have tested your papers and confirm your results."

The greatly increased sensitiveness of these indicators when applied in the dry state suggests that the methyl violet test for "mineral acid" in vinegar might, with advantage, be applied in the same way. Experiment shows that the stains obtained are stable, but methyl violet test paper is far less sensitive than metanil yellow.

In conclusion, I desire to express my grateful thanks to Mr. E. G. Ballard, to Dr. Fryer, and to Mr. Sutton, Mr. Fletcher, and Mr. Porter, Inspectors under the Alkali Act, for the results of experiments undertaken by them under working conditions; and to the Chief Inspector of Alkali, &c., Works, Mr. R. Forbes Carpenter, at whose request, and in whose laboratory, the work was carried out, and who has kindly granted permission for the results to be presented to the Society for publication.

Discussion.

Dr. G. T. **Morgan** asked if the author had any views with regard to the constitution of the colours produced by the aqueous mineral acids. At first sight it seemed as if these strong acids would simply set free the coloured azo-sulphonic acid, but if this were so, it was difficult to see why a specific coloration should be produced by each mineral acid, unless, indeed, the azo-group came into play in forming with these acids additive compounds having distinctive shades of colour.

Mr. F. **Napier Sutton** said he had had an opportunity of testing papers dyed with tropeoline, metanil yellow, and another dye. Both tropæolin and metanil were very sensitive to traces of mineral acids. Gases from a sulphuric acid chamber instantly caused the papers to turn colour, even when the acidity was exceedingly low. The presence of oxides of nitrogen appeared to have no effect on this dye; for instance, the exit gases from a sulphuric acid chamber instantly gave the characteristic heliotrope colour; on agitating the gases with hydrogen peroxide for the absorption of the sulphur gases a further slight coloration might result if the washed gases were again impinged upon the paper, thus showing traces of unabsorbed sulphuric acid, but with further agitation, although the presence of oxides of nitrogen could still be detected by smell, there was no indication of colour. Again, hydrochloric acid gave an exceedingly intense colour effect. If the paper were held in an atmosphere in which the nose could faintly detect the presence of acid, as in a salt cake house fairly free from gas, it would be distinctly tinted in a few minutes, but, held in the gas itself, a beautiful violet colour instantly developed. This effect of a dry indicator was very interesting, and certainly had its practical uses.

Mr. **Linder**, in reply, said that the colour changes observed when metanil yellow (sodium salt) reacted with mineral acids in aqueous solution were consistent with the hypothesis that the colour acid (aminosulphonic acid) itself was yellow, and that the violet products were compounds of the colour acid with mineral acid, the products being more or less dissociated according to the concentration of the mineral acid present—the full depth of violet being obtained only in absence of water. He instanced the fact that the violet compounds obtained on dry test paper became yellow on moistening with water. Such treatment could not reproduce the sodium salt, as the mineral acid undoubtedly set free the colour acid as a first product. Doubtless the colour acid was basic in properties in respect of the amino group contained therein.

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MR. E. G. HOOPER IN THE CHAIR.

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THE CONVERSION OF OLEIC ACID INTO CANDLE MATERIAL. II.

BY DR. J. LEWKOWITSCH.

Exactly eleven years ago I read a paper before this Section in which early attempts to convert oleic acid into candle material were reviewed and my own endeavours to effect, by means of the sulphuric acid process, a more complete conversion than was obtained on a large scale were described. In the following years several patents were taken out, claiming protection for processes on the same lines. Thus Hausamann (Fr. Pat. 335,768, 1903) acidifies the mixed fatty acids obtained in an autoclave in the usual manner at an elevated temperature with concentrated sulphuric acid, whereupon the mass is distilled. The distillate is cooled till the mass has solidified completely and is then treated once more with sulphuric acid in the cold. The example which the inventor gives is not very encouraging, as the second treatment only raises the titer test of the once acidified fatty acids from 40° C. to 43·5—44° C. Moreover, he himself declares that it is impossible to convert the total quantity of the oleic acid into solid material. This is, of course, owing to the formation of anhydrides. K. Hartl, jr. (Ger. Pat. 148,062, 1903), endeavoured to avoid the drawback inherent to the process of distilling the acidified mass (see below) by purifying oleic acid (or the mixed fatty acids) by distillation and by subsequently treating the distillates with concentrated sulphuric acid. It is difficult to see either the novelty or the advantage of this method, as I have pointed out elsewhere (Jahrbuch der Chemie, XIII., 414). This patent was withdrawn shortly afterwards. A. A. Shukoff (Fr. Pat. 328,604, 1903; Ger. Pat. 150,798) avoids temperatures exceeding 100° C. in the acidifying process and aims at the direct production of stearolactone, by acidifying with the theoretical amount of concentrated sulphuric acid of 64° Bé. at temperatures lying between 70° and 80° C. The reaction requires from seven to twelve hours for completion. The final product which I had occasion to examine was perfectly white and hard; it was practically pure stearolactone, for its acid value was *nil*; its saponification value was 199·3, and its iodine value 1·1. An intermediate product, requiring further purification had the following characteristics:—

Titer test	26·7° C.
Acid value	153·9
Saponification value	194·3
Iodine value	55·17

Of course, the conversion of oleic acid into the solid product is not complete. The inventor states that the yield of candle material is satisfactory. As far as I am aware this process has not been taken up by other manufacturers. It is noteworthy that mixtures of the lactone with paraffin wax have as melting points the arithmetical means of the two components.

The patent specification of Dreymann (Eng. Pat. 19,988, 1905; Fr. Pat. 358,212) need only be mentioned in passing, as it offers no novelty as regards the present subject. The same stricture would apply to the Ger. Pat. 116,695 (1895) taken by P. Wunder.

In my former paper (this J., 1897, 393) I suggested, as a practical working method, to remove from the acidified mass, after treatment with water, the hydroxystearic acid formed thereby, since during distillation of the acidified mass hydroxystearic acid is broken down to a mixture of oleic and iso-oleic acids. I stated that this was to be tried on a large scale but I was unable to continue the large scale experiments for a sufficient length of time to arrive at definite results. This work was taken up—independently—by Dr. Gray, chief chemist to the Standard Oil Company at Whiting, near Chicago, and at the visit of the Society of Chemical Industry to the United States I was allowed to see the experimental plant in which hydroxystearic acid was made from oleic acid. This process is protected by the U.S. Pat. 772,129 (W. M. Burton, Assignor to the Standard Oil Co., 11th Oct., 1904). Eng. Pat. 20,474, 1904, Fr. Pat. 348,089. The *modus operandi* is as follows:—Oleic acid is dissolved in light petroleum ether (1 volume of acid and 2 volumes of oil) and then treated with sulphuric acid. The process is carried out at the low temperature of 40° F., hence the chemical reaction is easily controlled and the injurious influence of a rise of temperature is more easily prevented than when oleic acid itself is employed. The acidified mass is treated with steam so as to obtain hydroxystearic acid. Thus 50 per cent. of the oleic acid are stated to become converted into hydroxystearic acid. On cooling the solution, the hydroxystearic acid separates in the crystalline form; the crystals are filtered and dried in a centrifugal machine and are then ready for use. From the filtrate unattacked oleic acid and stearolactone are recovered by driving off the solvent; they are then purified by distillation and again subjected to the same treatment with sulphuric acid. The yield of hydroxystearic acid is stated to be 85—90 per cent. The melting point of the hydroxystearic acid is higher than that of stearic acid, but this property alone does not yet prove that it is suitable for candle making purposes. This is borne out by a statement made in a later specification (U.S. Pat. 802,100, G. R. Gray, Assignor to the Standard Oil Co.; Eng. Pat. 17,945, 1905; Fr. Pat. 357,507; Ger. Pat. 174,471) that hydroxystearic acid when mixed even in the proportion of 15—25 per cent. with paraffin wax does not furnish saleable candles, inasmuch as it causes "stratification" in the moulded candle and tends to accumulate at its extremities. (The seriousness of this drawback will be better understood if one remembers that in the manufacture of composite candles stearic acid can be admixed with paraffin wax in any proportion from 5 per cent. upwards.) Therefore a mixture of 3 parts of hydroxystearic acid with 1 part of commercial stearic acid is recommended as a stock mixture, for "stiffening" paraffin wax candles.

Provided the results claimed by the specifications are obtained regularly on a large scale, this method would represent the most advantageous form of the sulphuric acid process.

A claim made by Tissier in the Russian Privilegium 1499, of January, 1897, to have effected a (partial) conversion of oleic acid into stearic acid by means of hydrogen, evolved whilst saponifying fats in an autoclave with zinc and zinc dust by the action of the latter on water, was too absurd to require any refutation. Still, Freundlich and Rosauer have shown (Chem. Zeit., 1900, 566) by experimenting with oleic acid and bone fat in an autoclave, that no oleic acid was reduced to stearic acid. Possibly Tissier's error is best explained by the formation of zinc soaps which naturally raise the melting point of the oleic acid in which they are dissolved. It may be recalled here that I have not been able (this J., 1897, 390) to effect a reduction of oleic acid by hydrogen in *statu nascendi*.

A kind of connecting link between the sulphuric acid processes and the processes invoking the aid of electricity (see below) is exemplified by the patents of Magnier, Bragnier and Tissier (Eng. Pat. 3363, 1900; Fr. Pat. 291,839; Ger. Pat. 126,446; Additional Ger. Pat. 132,223). The acidification is carried out in the usual manner, whereupon the acidified mass is mixed with 5 to 6 times its weight of water and is then subjected to the action of an electric current (under a pressure of 5 atmospheres). The latter procedure has been discussed already by me in my first paper (this J., 1897, 390). It appears extremely doubtful whether any larger yield of candle material is obtained than by sulphuric acid alone, *i.e.*, without the electric current, and I find good ground for this opinion in the fact that the process has not found its way into practice.

A process attempting to effect the conversion of oleic acid into stearic acid by electrical discharges in an atmosphere of hydrogen has been patented by A. de Hemptinne (Eng. Pat. 1572. 1905; Fr. Pat. 349,942; Ger. Pat. 167,107; U.S. Pat. 797,112). The electrical discharges are produced between a number of metal plates, separated by glass plates so as to prevent short-circuiting between the metal plates, which are alternately connected with the poles of a generator of electrical energy. Oleic acid is allowed to trickle in a fine stream (by a sprinkling arrangement) on to the plates enclosed in a vessel through which hydrogen passes (the apparatus is illustrated in Eng. Pat. 7101, 1905) at a pressure below that of the atmosphere. By rotating the apparatus slowly the oleic acid is kept as a moving film, thus continually exposing a fresh surface to the hydrogen. A. de Hemptinne states (Bulletin de l'Acad. royale de Belgique, 5 (1904), 550) that 50 per cent. of oleic acid are converted into stearic acid. According to the English specification the process is interrupted when about 20 to 30 per cent. of stearic acid are formed. The mass is then withdrawn, cooled, and the filtrate again treated as before, until the accumulation of by-products puts an end to the formation of stearic acid. This process deserves the attention of the candle maker and would recommend itself on account of its simplicity, provided a much higher yield of stearic acid could be reached through preventing the formation of condensation products and of resinous substances.

J. Petersen (Zeit. f. Elektrochemie, 1905, p. 549) also endeavoured to reduce oleic acid to stearic acid by allowing an electric current to act on an alcoholic oleic acid solution, slightly acidulated with sulphuric acid or preferably with hydrochloric acid, between nickel electrodes. But the yield of stearic acid was small, even under the most favourable conditions, and did not exceed 15 to 20 per cent. When platinum electrodes were employed, no reduction at all took place. Hence, so far this process cannot claim the attention of the candle manufacturer.

C. F. Böhringer and Söhne (Ger. Pats. 187,788; 189,332, 1906), obtained by the same method much better results when using metallic electrodes as cathodes, which were covered with a spongy layer of the same metal. They recommend as cathodes platinised platinum, as also palladium electrodes covered with a spongy layer of palladium-black. Nickel electrodes covered with spongy nickel may also be used, but in this case with a current density of 100 ampères per square meter only a "considerable reduction" is stated to have taken place. If copper be substituted for nickel and the current density be reduced to 10 ampères per square meter slight reduction only was noticed. The following details are given by the patentees:—25 volumes of oleic acid or erucic acid (or their methylesters) were dissolved in 250 volumes of strong alcohol and 5 to 10 volumes of a 30 per cent. sulphuric acid or of a 20 per cent. hydrochloric acid were added. When employing a platinised platinum cathode and electrolysing with a current density of about 1 ampère per square meter at a voltage of 4 to 6, the temperature being kept between 20 and 50° C., the "whole of the oleic acid" was stated to be reduced to stearic acid after 7 ampère-hours per kilo of oleic acid had been used. In the case of a palladium electrode covered with palladium-black at a current density of 100—500 ampères per square meter, "the" (whole ?) oleic acid is reduced after 300 ampère-hours per kilo of material had been consumed, whilst stearic acid and ethyl stearate separate. Finally, in the case of a nickel cathode covered with a spongy layer of nickel and at the same current density, about one-third of oleic acid was converted into stearic acid after 300 ampère-hours per kilo of acid had been consumed.

In a survey of the modern work on the electrolytic reduction of unsaturated acids, Fokin (Zeitschr. f. Elektrochem., 1906, 12, 749) states that reduction of oleic acid can only be effected with the aid of cathodes of palladium, platinum, rhodium, iridium, osmium, nickel, cobalt, and copper. The best results were obtained by electrolytic reduction; next as regards efficiency came reduction in the gaseous state in the presence of these metals, they acting as catalysts. Less favourable still were the yields with galvanic couples, and the lowest yields were obtained with metal hydrides. In all cases the reduction is explained as being due to the activity of occluded hydrogen.

The above given practical data as to yields of stearic acid by A. de Hemptinne, Petersen, and Böhringer, taken in conjunction with the statements to be made below, do not bear out the correctness of Fokin's opinion that electrolytic reduction processes furnish the highest yields. Fokin's error may be caused through his taking the rise of the melting point alone as a proof of the presence of stearic acid. Experiments which I have carried out several years ago on the reduction of oleic acid by means of hydrogen in the presence of catalysts (Jahrbuch der Chemie XVI., 1906, 400) showed that even by small quantities of metal soaps—the last traces of which can only be removed with great difficulty—the melting point is affected considerably. Although Fokin distinctly states that the presence of nickel soap caused him great difficulties, so that he must have been well acquainted with this source of error, I would still consider that his statements must be accepted with reserve, until in each case stearic acid free from metal has been isolated.

The classical work of Sabatier and Senderens on reduction of organic substances in the presence of finely divided metals, especially of finely divided nickel, which has proved to be one of the most fruitful methods of organic synthesis discovered during the last decade, was destined to create a new epoch also in the solution of our present problem. Those who were practically interested in this subject saw at once that here there had been brought into light an entirely new principle, an entirely new method for reaching the desired end. Very shortly after the publication of Sabatier and Senderens' earlier work, and based upon it, a patent was taken out by the Herforder Maschinenfett & Oelfabrik, Leprince and Sievecke, for the conversion of unsaturated fatty acids or their glycerides into saturated compounds (Ger. Pat. 141,029).

I myself had already undertaken laboratory experiments, on the lines of Sabatier and Senderens' work, but I could not find that conversion of oleic acid into stearic acid had taken place to any notable extent. In the light of my present experience I can only account for my failure at that time by assuming that the conditions under which I worked precluded the formation of stearic acid, or in more modern parlance that the contact-mass had been "poisoned."

The Herford Works took out a patent also in this country (Eng. Pat. 1515, 1903, in the name of W. Normann), under the same title, but as far as I am aware no stearic acid has been made by this process on a commercial scale.

The succession of those wonderful papers which Sabatier continued to publish with his collaborators could not fail to rivet the attention of workers in this field and induce them to renew again and again their attack on this problem by his method. As mentioned already Fokin only partially succeeded in converting unsaturated fatty acids in their gaseous state into saturated compounds. Bedford (Inaugural Dissertation "On the unsaturated acids of linseed oil and their quantitative reduction to stearic acid," Halle, a. S, November, 1906) successfully applied Sabatier and Senderens' method to the reduction of oleic acid to stearic acid, of ethyl crotonate to ethyl butyrate, and of ethyl linolenate to ethyl stearate. By measuring accurately the amount of hydrogen absorbed, he showed that the reduction takes place quantitatively. In the case of oleic and crotonic acids the "hydrogen value," as Bedford proposes to term it, came very near the theoretical number.

A patent by Crosfield and Sons and K. E. Markel (Eng. Pat. 13,042, 1907; Fr. Pat. 378,528) claims the application of Sabatier and Senderens' method to the hardening of soap.

During the last month there appeared in print the Pat. Specif. of No. 2520, 1907, of Bedford and Williams:—"Improvements in and relating to the reduction of organic substances," in which is described amongst other examples the reduction of linseed oil to a solid substance, and of oleic acid to stearic acid by using nickel as a contact substance. Finally, a German patent has been applied for by P. Schwoerer under the title "Apparatus for the conversion of oleic acid into stearic acid by the contact process."

I myself had meanwhile resumed my earlier work on the conversion of oleic acid and by a systematic study of Sabatier's reaction (in which I was assisted by Dr. H. Pick). I succeeded in converting oleic acid into stearic acid, with a practically theoretical yield. As this result is of technical importance, it will be understood why I must exercise reserve with regard to publishing details of my method, and I will frankly acknowledge that, but for the appearance of the afore-mentioned patents, the fact that my endeavours have been successful would not yet have been communicated. I must therefore content myself with showing samples of the *crude* stearic acid I obtain. I should mention that I have made a short communication early in February in the manuscript of my Annual Report for the Jahrbuch der Chemie. This will, however, not appear in print before June or July.

The near future must show whether the different attempts I have enumerated will survive the refining fire of technical application, and whether we shall be able to say that this most fascinating technical problem in the fat industry—as I ventured to term it eleven years ago—has been solved. But may the outcome of commercial operations be success or failure, the fact that oleic acid and even less saturated acids can be converted quantitatively into saturated acids will stand out for ever as no mean monument to the work of Sabatier and Senderens.

FORTHCOMING MEETING.

The following papers will be read at the next meeting of the London Section, on Monday, June 1st :—

(1) The "Autolysator," an apparatus for the direct estimation of carbon dioxide. By C. A. Keane, M.Sc., Ph.D., and H. Burrows, A.R.C.S., Ph.D.

(2) Explosives and the building of explosive factories. By O. Guttmann.

(3) Some modern chemical plant. By O. Guttmann.

Manchester Section.

Meeting held at Manchester on Friday, April 3, 1908.

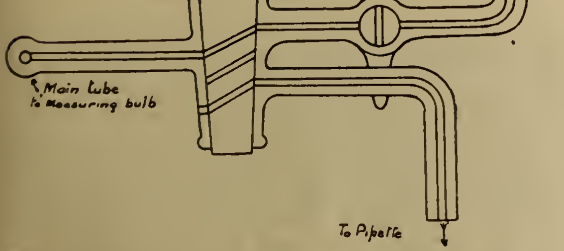
MR. R. H. CLAYTON IN THE CHAIR.

NEW GAS ANALYSIS APPARATUS.

BY RAYMOND ROSS, F.I.C., AND J. P. LEATHER.

In this communication the authors describe an apparatus for accurate gas analysis, which they have designed, and which has been in use for about a year. The apparatus consists of a measuring bulb surrounded by a water jacket. This is provided with a three-way stopcock and connected by flexible tubing to a mercury reservoir and also to an 800 mm. graduated tube.

The measuring bulb communicates with eight absorption pipettes by means of a capillary tube provided with specially designed stopcocks. The construction of these will be understood by reference to the diagram.



The method of working is as follows :—By raising the mercury reservoir, the measuring bulb and the whole of the connections are filled with mercury, which is allowed to flow through each stopcock in turn till the small glass cups are about half filled. The reservoir is then lowered till the mercury falls to the mark on the measuring bulb. The barometric pressure is now read off in millimetres, including the tension of aqueous vapour, sufficient water for this purpose being introduced with the mercury. The barometer tube is then shut off and the measuring bulb refilled with mercury, and the gas to be analysed introduced into the bulb and brought exactly to the mark at atmospheric pressure. To introduce the gas into the required absorption pipette, the mercury reservoir is raised, and the mercury in the capillary connection tubes driven forward by the gas into the cups till the gas just reaches the three-bored stopcock. The small stopcock is then closed. The absorbent is driven up by means of the short rubber tube, till it fills the bore of the tap. The stopcock is then reversed allowing the gas to enter the pipette. When the absorption is complete the process is reversed, and the gas finally swept through the capillary tube into the measuring bulb by means of the mercury from the cup. The mercury is again brought to the mark in the measuring bulb, connection with the millimetre tube having been re-established. The reading, multiplied by 100 and divided by the first ("barometric") reading, gives the percentage absorption. The pipettes are all filled with glass beads, and hold about 250 c.c. of absorbent. The usual absorbents are employed, and the ammoniacal cuprous chloride solution is protected from oxidation by bulbs containing water. Explosions are carried out in the measuring bulb, the portion of the gas not required for explosion being passed into one of the absorption pipettes. The whole apparatus is about 50 inches high, and for convenience of working is mounted on a stage about 15 inches high. In the authors' hands the apparatus has been found to be easy of manipulation and to give very accurate results.

DISCUSSION.

Dr. G. H. **Bailey** considered the apparatus better than any other of the Orsat or Hempel type. What length of time was occupied in completely expelling air from the bulbs and capillary tubes as described? He hoped the authors would say how they had fared with vaseline and mercury in the absorption tubes containig caustic potash.

Dr. G. J. **Fowler** asked if, with a maximum volume of 150 c.c., the apparatus would not come under the same criticism as a similar apparatus he had described some time ago for analysing gases from sewage, which was arranged to permit of explosions being made over mercury in the measuring pipette, but which was not capable of the same degree of fineness as the author's apparatus with regard to adjusting the mercury. Had any difficulty been found in obtaining complete explosions with small percentages of methane; or, on the other hand, with a gas containing a large percentage of combustible constituents, could the volume be reduced considerably? Could the apparatus described be conveniently used for gases boiled off from fermenting solutions? He could not see how the apparatus would lend itself to this particular kind of work.

Mr. **Ross**, in reply to Dr. Fowler, said that the apparatus was very suitable for boiled out gases. Whatever amount was taken, it was brought to constant volume. If desired to explode it, air or oxygen could be used, constant volume re-established, and the amount taken read off. The experimental error was slightly over 0·1 per cent. The use of fresh solutions, as recommended by Professor Bone, was a decided disadvantage: all gases were somewhat soluble in any solution, and accurate results could only be obtained after several analyses had been made with the same solvents. In reply to Dr. Bailey, a complete analysis could be carried out in about an hour. The taps were greased with an emulsion of vaseline and mercury which acted very well.

New England Section.

Meeting held at Boston, Mass., on Friday, April 3rd, 1908.

MR. F. E. ATTEAUX IN THE CHAIR.

Dr. M. J. **Langdon** gave a lecture on "Old Style Calico Printing."

Journal and Patent Literature.

Patent Specifications may be obtained by post by remitting as follows :—
English.—8*d.* each, to the Comptroller of the Patent Office, C. N. Dalton, Esq., Southampton Buildings, Chancery Lane, London, W.C.
United States.—1*s.* each, to the Secretary of the Society.
French.—1 fr. 25 c. each, to Berlin et Cie., 56, Rue des Francs-Bourgeois, Paris (3e.).

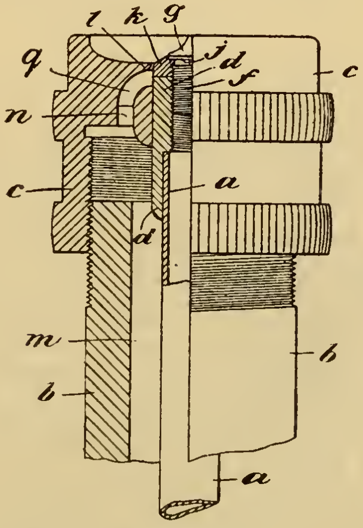
I.—PLANT, APPARATUS, AND MACHINERY.

Patents.

Towers and other apparatus used for the absorption, elimination, or condensation of chemical vapours. The Mayor, Aldermen and Citizens of Bradford, W. Wyld, Frizinghall, and S. W. Shepherd, Shipley. Eng. Pat. 8317, April 10, 1907.

The claim is for the use of bricks or blocks of different widths to form the lining of the tower, so as to leave ledges on which rest the ends of the strips of glass or other substance which form the packing material. The layers of strips are arranged alternately at right angles and are spaced apart by "distance-pieces."—W. H. C.

Atomising apparatus. J. Mecredy and D. M. A. G. Hawes, London. Eng. Pat. 8862, April 16, 1907.

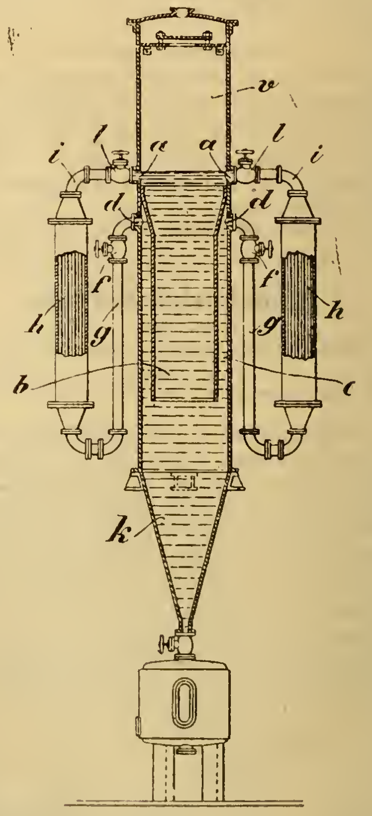


The oil is supplied under pressure to the central tube, *a*, which is surrounded by the air-tube or chamber, *b*. The end of the tube, *a*, is provided with an adjustable screw-cap, *d*, a perforated plug, *f*, a nipple, *g*, and a removable disc, *k*. The outer air-tube, *b*, has an adjustable screwed cap, *c*, fitted upon the end. The liquid to be atomised passes along the tube, *a*, through the plug, *f*, which is either perforated, or has the thread scored with cross cuts for that purpose, to the passages, *j*, and issues as a fine stream from the narrow annular opening between the nipple, *g*, and the disc, *k*. The air, also under pressure passes from *m*, through the passages, *n*, *q*, and issues through the narrow annular opening, *l*.—W. H. C.

Mixture of substances of different nature and dimensions and in any number ; Process and apparatus allowing of obtaining an intimate ——. E. Dor-Delattre, Dorplein, Holland. Eng. Pat. 24,958, Nov. 11, 1907. Under Int. Conv., Nov. 19, 1906.

The substances to be mixed are introduced by a screw-conveyor into the upper ends of a number of vertical compartments which form one section of the apparatus. When filled, horizontal layers are taken from the lower ends of the vertical compartments and delivered to a screw-conveyor, which delivers them to an elevator, that lifts and delivers them to a second screw-conveyor placed above a second set of similar vertical compartments. When the whole has been transferred to the second section of the apparatus, horizontal layers are again taken from the bottom and returned in a similar manner to the first section. The operations are repeated until the desired degree of admixture is attained.—W. H. C.

Vaporisers [evaporators] for mineral-containing liquids. H. Fairbrother, London. From G. Sauerbrey, Maschinenfabr. Akt.-ges. Stassfurt, Germany. Eng. Pat. 501, Jan. 8, 1908.



The liquid-containing portion of the vaporiser, *v*, is divided, by the partition, *b*, which may be of any suitable shape, into two parts which communicate below only. The tubular heaters, *h*, *h*, are outside the vessel, *v*, and communicate with it by the pipes and taps, *i*, *l*, *a*, *g*, *f*, *d*. The heated liquor enters the vaporiser, *v*, from the heaters, *h*, by the pipes, *a*, gives off vapour and sinks slowly in the inner space, *b*, depositing the solids, which collect in the cone, *k*, from which they are from time to time removed. The liquor freed from solids, returns by the annular space, *c*, and the tubes, *d*, to the heaters, *h*. The deposited solids are not carried into the heaters, which are consequently less quickly encrusted, and any one of the heaters, of which there may be several, can be isolated by closing the taps, *l*, *f*, and cleaned, without interrupting the working of the apparatus.—W. H. C.

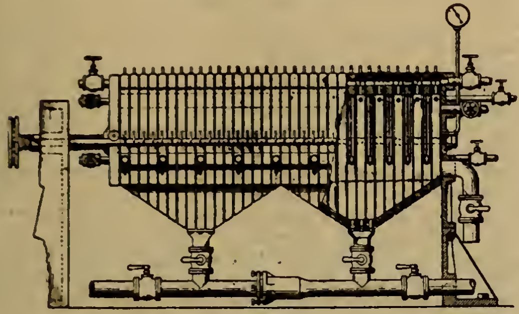
Vacuum evaporating apparatus. F. H. Fouché. Fr. Pat. 384,966, Dec. 5, 1907.

The apparatus consists of a casing surmounted by an upper chamber which may be jacketted. The heating equipment may be bodily withdrawn horizontally from the casing to facilitate cleaning.—J. W. H.

Filtering, and apparatus for the same. B. M. Jäger, Birkenhead. Eng. Pat. 2165, Jan. 30, 1908. Addition to Eng. Pat. 20,677, Sept. 17, 1907 (this J., 1908, 437).

The claim is for a method of improving the working of the filter by maintaining the liquid above the filter-bed at such a constant level that the pressure of the liquid upon the surface of the filter-bed is less than the pressure due to the height of the surface of the liquid above the bottom of the filter. This is effected either by throttling the exit, or by raising the end of the exit pipe.—W. H. C.

Filter. E. J. Sweetland, Goldfield, Nev. U.S. Pat. 885,398, April 21, 1908.



The filter is similar to an ordinary filter-press, with the exception that the lower portions of the frames are of different lengths, so that when they are assembled, one or more hopper-shaped compartments are formed as shown in the figure.—W. H. C.

Filter with filtering medium of progressively decreasing porosity. C. Cuau. Addition, dated Nov. 28, 1907, to Fr. Pat. 372,281, Dec. 5, 1906 (this J., 1907, 599).

The filtering mass is disposed in a column of two parts, the upper being finely divided, and acting as a preliminary filter. The liquid to be filtered is received by a vessel above, to ensure a constant head.—J. W. H.

Filtration; Treatment of wood fibre for use in ——. H. Ruthenberg. Fr. Pat. 385,035, Dec. 14, 1907.

Wood fibre (wool) to be used for filtration purposes is previously treated with a (preferably hot) solution of potassium permanganate, with or without the addition of an acid.—J. W. H.

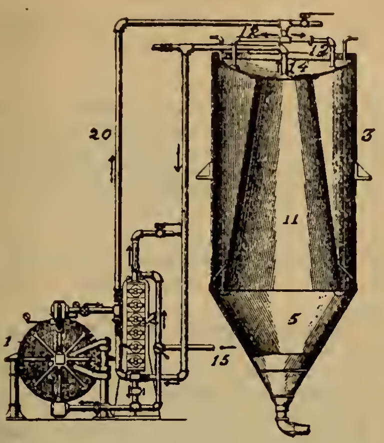
Purifying vapours and gases. J. A. Serrell, Bayonne, N.J., Assignor to Warren Webster and Co., New Jersey. U.S. Pat. 885,185, April 21, 1908.

The gases are passed through a chamber or casing where they are first washed by a shower or spray of liquid. They then pass on to the second portion of the chamber, where they are compelled to pass over a number of inclined baffles, in order to eliminate the liquid, which collects in a well in the bottom of the chamber and escapes through a trap.—W. H. C.

Drying apparatus. L. Mourgeon, Assignor to A. Huillard, Suresnes, France. U.S. Pat. 885,360, April 21, 1908.

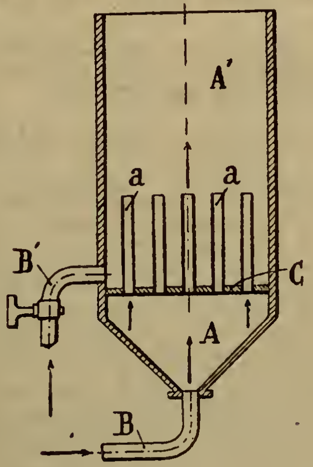
See Addition of Aug. 10, 1906, to Fr. Pat. 318,562 of 1902; this J., 1907, 81.—T. F. B.

Separating solids from liquids; Apparatus for and process of ——. E. W. Deming, New York. U.S. Pats. 885,450 and 885,451, April 21, 1908.



The liquid, holding the solid matter in suspension, enters the apparatus by the pipe, 15, and passes through the heat-interchanger, into the boiler, 1, where it is agitated and heated to the requisite temperature. From 1, the mixture passes by the pipes, 20, 12, to the outer space of the closed settler, 3. The mixture sinks slowly down through the space between the cone, 11, and the shell of the vessel, 3, and up within the cone, 11, depositing the solids, which collect in the lower cone, 5. The hot, clear liquid leaves the settler by the pipe, 14, and returns to the heat- interchanger, where it parts with its heat to the inflowing mixture.—W. H. C.

Vacuum; Arrangement for producing a ——. A. Tassel. Fr. Pat. 384,531, Feb. 6, 1907.



Steam, or compressed air or gas, is admitted into the chamber, A, by the pipe, B, and issues into the chamber, A^1, from the tubes, *a*, fixed in the plate, C, with their upper ends considerably below the open top of A^1. The issuing steam or gas produces a rarefaction in the lower part of A^1, and induces a current of air through the tube, B^1, which is connected to the vessel within which it is desired to produce a vacuum.—W. H. C.

Distillation and rectification; "Toothed" columns for ——. F. Pampe. Fr. Pat. 384,775, Nov. 29, 1907.

In order to improve the rectification and distillation, the exterior annular portions of the concave or convex plates are perforated, so that the spray of liquid may be traversed both horizontally and vertically by the ascending vapour.—W. H. C.

Column apparatus for distillation and absorption. K. Kubierschky. Fr. Pat. 384,982, Dec. 12, 1907. Under Int. Conv., Dec. 12, 1906.

The column is divided into a number of bell-sealed compartments, each being provided with a number of perforated plates. The lower part of each compartment communicates by a pipe with the upper part of the compartment immediately over it.—J. W. H.

Non-aqueous mixtures; Preparation of ——. E. G. Acheson. Fr. Pat. 384,698, Dec. 5, 1907.

A mixture of a non-aqueous liquid and an amorphous solid may be made by first " de-flocculating " the amorphous substance by a de-flocculating agent in aqueous solution and afterwards displacing the water by mixture with the non-aqueous liquid. In the case of graphite, a paste is made by mixing it with a de-flocculating agent (such as tannin or gallotannic acid in water), which is afterwards triturated with oil. An oil is thus obtained carrying graphite in permanent suspension.—J. W. H.

Concentration of solutions and recovery of volatile solvents. D. Dubois. Fr. Pat. 384,907, Dec. 11, 1907.

The claim is for the application of the multiple-effect system to the distillation and evaporation of volatile solvents such as carbon bisulphide, benzene, ether, etc., employed in the extraction of sulphur, fats, oils, and other bodies soluble in such solvents.—W. H. C.

II.—FUEL, GAS, AND LIGHT.

Gases; Combustion of ——, by incandescence, in presence of oxidisable and of incombustible substances. J. Meunier. Compt. rend., 1908, **146**, 757—758.

Incandescent substances localise combustion on their surfaces: to this property is due their behaviour in explosive gases, and the phenomenon of combustion without flame. The phenomena exhibited are different, according as the incandescent substance is combustible or not. At the ordinary temperature, no attraction occurs between the molecules of the two substances which at a higher temperature would be concerned in a combustion, but at the temperature of ignition, such attraction does exist. This chemical attraction is, however, accompanied by a physical attraction or attraction at a distance, for only in this way can the combustion of a solid substance in a gas be explained. A steel wire, for example, can be burnt at a red heat in an explosive mixture of methane and air without exploding the mixture; half of the oxygen can be thus removed in a few seconds, during which time it cannot be supposed that the operation of diffusion and convection currents would have brought the whole of this oxygen into contact with the wire. As a rule, metals in the form of gauze or perforated discs, heated and then exposed to an inflammable gaseous mixture, will not remain incandescent, though platinum possesses this property; but many metallic oxides possess the property in a high degree. The most simple experiment in this line, is to bring the skeleton of the ash of a partly burnt match near a candle-flame. It becomes visibly incandescent at 4 mm. distance, and at 1 or 2 mm. its incandescence is so bright as to cause the flame to appear pale by comparison. The intensity of the incandescence depends not only on the nature of the incandescent substance, but also on the composition of the inflammable gaseous mixture.—J. T. D.

Combustion without flame and its application to lighting by the incandescent mantle. J. Meunier. Compt. rend., 1908, **146**, 864—866.

In order to explain the fact that an incandescent body, such as a gas mantle, is at a higher temperature than the surrounding flame, the author supposes that oxygen is energetically attracted to the body, which, therefore, becomes the seat of local combustion in almost pure oxygen. Each particle of carbon, for instance, in an ordinary luminous gas flame may be looked upon as becoming a centre of combustion, by surrounding itself with an atmosphere of oxygen. Combustion by incandescence lowers considerably the inferior limit of inflammability of a gas, for it is found that when a feebly incandescent Auer mantle is exposed to a jet of air, containing only 5 per cent. of coal gas (10 per cent. is the inferior limit of inflammability), there is a marked increase of incandescence, although a jet of pure air produces, on the contrary, a dark band on the part of the mantle affected by it.—F. Sodn.

Coal exported in 1907. J. Gas Lighting, 1908, May 12, 369. [T.R.]

The following are particulars as to the total quantity of coal exported from the United Kingdom in 1907, including the estimated coal equivalent of coke and patent fuel :—Coal, 63,600,947 tons; coke, 981,418 tons; coal equivalent of coke, 1,635,697 tons; patent fuel, 1,480,893 tons; coal contained in patent fuel, 1,332,804 tons; coal shipped for the bunkers of steamers engaged in foreign trade, 18,618,828 tons; total coal shipped (Nos. 1, 3, 5, and 6), 85,188,276 tons. The figures for coal equivalent of coke have been computed on the assumption that for every 60 tons of coke exported, 100 tons of coal were consumed in its manufacture. In the case of coal in patent fuel, the patent fuel exported had been assumed to contain 90 per cent. of coal; the remaining 10 per cent. consisting mainly of pitch. The estimates as to the coal equivalent of the coke exported and the coal contained in patent fuel had been made on the basis adopted by the Royal Commission on Coal Supplies in their final report.

Calcium carbide manufacture in France. Times Eng. Suppl., 13 May, 1908. [T.R.]

Numerous factories in France are engaged in the production of calcium carbide by hydro-electric agency. The Bullier patents for the manufacture of this substance have been legally pronounced to be the only ones valid. These patents will expire, however, on February 9, 1909, and thenceforth the French electro-chemical preparations will be no longer protected against foreign products, which can be manufactured at a much lower rate in countries where hydro-electric energy is relatively cheap. The French industry is thus exposed to serious menace, and Mr. Guillain, the president of the Union of Electrical Syndicates, recently called the attention of M. Cruppi, the Minister of Commerce, to the matter. The Minister replied that a good case had been made out for affording protection to the native manufacture of calcium carbide by the imposition of a suitable duty on imports.

Patents.

Liquid fuel; Manufacture of ——. R. Hense. Fr. Pat. 384,946, Oct. 26, 1907.

A liquid fuel suitable for internal combustion motors is obtained by distilling a mixture of hydrocarbons of different volatility, an oxidizing agent, a resin or gum, an alkali, and an aqueous solution of a convenient salt. An example of the method is given :—Kerosene 100 parts, benzene 20 parts, and caustic potash ½ part, are mixed in one vessel; 5 parts of resin dissolved in 5 parts of benzol, 1 part of picric acid dissolved in 1 part of benzol, and 1 part of sulphuric acid, are mixed in a second vessel and added to the first; the whole is stirred up with a solution of ½ part of magnesium sulphate in 80 parts of water, amyl acetate being also added if desired. After the separation of the water, the mixture is distilled, the portion coming over below 200° C. being the liquid fuel claimed.—J. W. H.

Combustible mixtures; Process for facilitating the ignition of ——. G. F. Jaubert, Paris. Eng. Pat. 21,105, Sept. 23, 1907. Under Int. Conv., Sept. 24, 1906.

The method consists in dividing the charge of combustible substance into fractions, insulated from each other if desired, and in kindling each of them simultaneously by appropriate means, with the object of reducing the time required for igniting the total charge by rapidly raising the entire mass to a high temperature. By this means, products or powders, the combustion of which proceeds slowly can be used, and thereby the danger of explosion is reduced. In carrying out the process, each of the partial charges is formed by a cartridge comprising a metallic or refractory casing, solid or perforated, containing the combustible charge in the form of powder or of compressed cakes of any convenient shape. The invention is also applicable for heating air or gases supplied to engines. Reference is directed to Eng. Pats. 20,894 and 20,895 of 1896 (this J, 1897, 720).—R. L.

Filtering smoke gases or products of combustion; Method of ——. W. F. L. Beth, Lubeck, Germany. Eng. Pat. 25,644, Nov. 19, 1907. Under Int. Conv., Nov. 20, 1906.

See Fr. Pat. 384,120 of 1907; this J., 1908, 396.—T. F. B.

Coke ovens; Horizontal —— *with vertical flues.* G. Wolters. Fr. Pat. 384,841, Dec. 9, 1907.

In regenerative horizontal coking ovens with vertical flues, the latter are arranged in the walls in groups. —J. W. H.

Producer-gas generators. G. F. Chutter, Kettering. Eng. Pat. 8512, April 12, 1907.

The generator, which is suitable for producing "clean" gas from bituminous coal, comprises a vertical brick-lined casing having a complete ring of inlets for air and steam at about the middle of its height. The function of the upper part of the producer is to convert the fuel into coke; the air and steam are drawn downwards through the coke in the lower part of the producer by the suction of an engine or otherwise, the gas leaving the producer through an outlet arranged below a horizontal grate on which the fuel column rests. The gas, soot, tar, etc., formed in the upper part of the producer is allowed to escape, or may be used for heating purposes.—A. T. L.

Fuel and gas-manufacture; Treatment of coal for ——. J. Jowett, Bolton-le-Sands. Eng. Pat. 14,893, June 29, 1907.

Small quantities of potassium chlorate, saltpetre, and potassium permanganate are mixed with the charge of coal in a gas-making retort, in order to improve the quality of the coke. The proportions used per ton of coal, are:—Potassium chlorate, 14—24 oz., saltpetre, 6—12 oz., and potassium permanganate, ¼—¾ oz. —A. T. L.

Lighting gas; Process and apparatus for the production of ——. E. U. G. Ernst, Copenhagen. Eng. Pat. 17,991, Aug. 7, 1907. Under Int. Conv., Aug. 8, 1906.

See Fr. Pat. 380,597 of 1907; this J., 1908, 15.—T. F. B.

Water-gas apparatus. J. M. Rusby, Philadelphia. Eng. Pat. 28,181, Dec. 21, 1907. Under Int. Conv., Jan. 31, 1907.

The air supply during the "blow" to a water-gas generator, is so controlled by suitable connections and pressure gauges of the "Venturi" type, that it is possible to introduce a definite volume of air during one period of blowing up, regardless of the state of the fire or other conditions. By this means the quantity and quality of the gas is said to be kept uniform.—R. L.

Gas; Process of making ——. A. M. Gow, Edgewood Park, Pa., Assignor to The Westinghouse Machine Co. U.S. Pat. 884,655, April 14, 1908.

A body of fuel is maintained at a higher temperature in its exterior portion than in its interior portion, by delivering to the exterior portion, from a number of points located around it, a blast of air, thus raising the outer body of fuel to incandescence. The hot products of combustion are utilised by absorbing the sensible heat in a regenerative chamber, for the production of steam. Fresh fuel is forced into the interior portion of the fuel, the heat of the surrounding incandescent material bringing about the destructive distillation of the fresh fuel. Superheated steam is introduced into the central portion of the fresh fuel, and caused to pass, first through the latter and then through the heated external portion of the fuel bed.—B. N.

Gas from alcohol; Producing ——, *and compound to be used in the manufacture of the same.* W. T. Solomon, Assignor to R. C. Hall, Pittsburg, Pa. U.S. Pats. 885,095 and 885,096, April 21, 1908.

(1). A mixture of air and alcohol vapour is passed over, or through an oxidising agent composed of a mixture of nitric and sulphuric acids with benzene and alcohol, in order to produce a "fixed gas." (2). The claim is for the oxidising mixture described in U.S. Pat. 885,095.—W. H. C.

Gas; Apparatus for the manufacture of ——. H. W. Woodall, Wimborne, and A. M. Duckham, Parkstone. Assignors to Isbell-Porter Co., New York. U.S. Pat. 885,308, April 21, 1908.

See Eng. Pat. 16,497 of 1903; this J., 1904, 744.—T. F. B.

Producer gas; Process of making ——. F. Jahns, Von der Heydt, Germany. U.S. Pat. 885,480, April 21, 1908.

See Addition of March 9, 1905, to Fr. Pat. 327,214 of 1902; this J., 1905, 961.—T. F. B.

Gas; Manufacture of lighting ——. H. Ries. Fr. Pat. 384,578, Dec. 2, 1907. Under Int. Conv., Feb. 11, 1907.

In the manufacture of coal gas, the product first given off is rich in light hydrocarbons which may be partly decomposed through contact with the hot retort. The poor gas given off by a retort in the later stages of the distillation are made to pass through a retort in the early stages. In this way, the rich gas is diluted and removed from the retort as rapidly as possible, and the average quality of the gas improved.—J. W. H.

Ammonia; Washing out —— *from coal gases and the like.* W. Feld, Zehlendorf, Germany. Eng. Pat. 27,567, Dec. 13, 1907. Under Int. Conv., May 29, 1907.

In extracting the ammonia from coal gas by means of acids or salt solutions, it is important to prevent the excessive dilution of the washing fluid by the steam contained in the hot gases. This is effected by mixing with the gases to be treated, a quantity of gas from which the moisture has already been removed in order to lower the "dew point," *i.e.*, the temperature at which water vapour—or tar vapour, as the case may be—is condensed. The gas of lower dew point may be mixed with the crude gases in such proportion that is possible to extract the ammonia before condensing tar and water vapour. Or, the gases may be diluted after separation of the vapours which condense above the dew point of the gases as regards water. As diluent gases those already purified and deprived by cooling of the greater part of water and tarry matter are used. After the washing out of the ammonia, the gases are cooled for the purpose of separating water and tar products. The latter may be separated into fractions by effecting the cooling in consecutive stages.—R. L.

Metallic incandescence bodies adapted for electric incandescence lamps; Manufacture of ——. Deutsch. Gasglühlicht A.-G., Berlin. Eng. Pat. 8563, April 12, 1907. Under Int. Conv., Aug. 30, 1906.

See Fr. Pat. 375,133 of 1907; this J., 1907, 863.—T. F. B.

Plastic mass from tungsten compounds [*for incandescence filaments*]; *Manufacture of a* ——. Siemens und Halske A.-G., Berlin. Eng. Pat. 16,489, July 18, 1907. Under Int. Conv., July 21, 1906.

See Fr. Pat. 378,743 of 1907; this J., 1907, 1192.—T. F. B.

Refractory metallic electrical conductors for incandescent electric lamps. The British Thomson-Houston Co., Ltd., London. From General Electric Co., Shenectady, U.S.A. Eng. Pat. 16,530, July 18, 1907.

The invention consists in the manipulation of conductors of tungsten or molybdenum in the open air at a temperature below visible redness, and below the temperature at which the metal oxidises in air, the metal becoming ductile under these conditions and capable of receiving a permanent "set." The metal must first be obtained in a coherent condition, a suitable method being to dissolve powdered tungsten in a mercury-cadmium amalgam, form the plastic mass into wire and drive off the mercury and cadmium by heat. Several applications of the invention are described. A spiral filament may be formed by winding a tungsten wire on a heated mandrel; a filament may be shaped by pressing the wire between heated metal blocks; a tungsten rod may be rolled into wire by means of hot grooved steel rolls, and the wire may be drawn through heated diamond dies, all these operations being carried on in contact with the atmosphere. The joints between the leading-in wires and the filament may be formed by pressing the parts together with heated pincers. —A. T. L.

[*Incandescent electric lamps, etc.*] *Electric conductors; Melting or fusing glass or like vitreous material around and on to* ——. C. O. Bastian, G. Calvert, and J. H. Sanders, London. Eng. Pat. 16,736, July 22, 1907.

The invention constitutes an improvement on Eng. Pats. 22,911 and 22,911a of 1906. Its object is to enable common metals, *e.g.*, copper, to be sealed through glass, and used as electric conductors. For this purpose the metal should have a surface as great as possible for a given cross-section, *i.e.*, it should be used in the form of ribbon or of flattened wire. At the point where it is to be sealed through the glass, the metal is surrounded by an envelope of a suitable flux fitting as closely as possible. This envelope is fused on to the metal by drawing the latter through two converging blow-pipe flames at the point where the flames meet. During this process, the envelope is pressed by pincers on to the metal at the end remote from the flame, the pincers being slipped away as this end approaches the flame. The coated metal is afterwards sealed into the glass as usual.—A. G. L.

Sulphates of iron and zinc, and by-products [*hydrogen, etc.*]. Fr. Pat. 384,904. *See* VII.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

Patents.

Gray acetate of lime and wood-alcohol; Process for the manufacture of ——. H. B. Schmidt, Assignor to Joslin, Schmidt and Co., Cincinnati, Ohio. U.S. Pat. 885,183, April 21, 1908.

Crude pyroligneous liquor is distilled and the vapours are passed first through a solution of lime which absorbs the acetic acid and forms calcium acetate. The mixture of alcohol vapour and steam escaping from the lime solution is then passed through weak alcohol solutions to drive off the alcohol without the use of additional steam. The alcohol is finally condensed.—W. H. C.

Ammonia; Process for the manufacture and recovery of ——, *other by-products, and of a better quality of tar from the gases of furnaces.* W. J. Dunnachie. Fr. Pat. 385,006, Dec. 13, 1907.

In furnaces, gas generators, coke-ovens, etc., the gases are withdrawn from the hottest zones where cyanogen and cyanides occur. These compounds are directly converted into ammonia by means of steam, atomised water, or both, with if necessary a small quantity of air. Slack or dirty coal, lignite, or peat may be used as fuel. The by-products and ammonia are recovered from these gases in an external apparatus, by which they are progressively concentrated and the residual gases returned to the furnace.—J. W. H.

Ammonium sulphate; Saturator for the manufacture of ——. B. Thiel. Ger. Pat. 193,218, Jan. 29, 1907.

The essential feature of the invention consists of a double bell, the outer wall of which dips to a greater depth in the acid than the inner one, and is provided with two rows of openings at different levels, so that by reason of the difference in temperature between the inner and outer walls, a continuous circulation of the acid below and outside the bell is produced.—A. S.

Benzines and mineral essential oils; Process for the treatment of —— *and products obtained thereby.* A. Fama, Saxon, Switzerland. Eng. Pat. 8486, April 11, 1907. Under Int. Conv., April 12, 1906.

See Fr. Pat. 376,601 of 1907; this J., 1907, 1002.—T. F. B.

IV.—COLOURING MATTERS AND DYESTUFFS.

Triphenylmethane [*Tritane*] *series; Studies in the* ——. H. von Liebig. Annalen, 1908, **360**, 128—264.

This subject is treated under the following heads:—I, Fluorescence and colour of organic substances. II, Derivatives of *m*-tetra-2,4-dihydroxytritanol. III, The union of benzil with phenol. IV, On the sulphonation of tritanols. V, On the influence of constitution on the capacity for sulphonation. IV, Reactions of sulphonic acids with separation of the sulphonic group. (See also this J., 1906, 1213.)

Triphenylmethane; Absorption spectrum of ——. A. G. G. Leonard. Chem. Soc. Proc., 1908, **24**, 93.

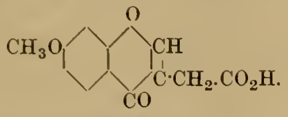
In order to ascertain the cause of the difference between the absorption curve plotted by Hartley, in 1887 (this J., 1887, 215), and that plotted by Baker, in 1907, the absorption spectrum of triphenylmethane was thoroughly re-examined. All the specimens examined gave at first curves similar to that obtained in 1887, but, on purifying the samples by repeated recrystallisation from alcohol, the absorption curve became identical with that found by Baker. This curve is therefore the true absorption curve of triphenylmethane. The difference is clearly shown to be caused by the presence of an impurity in the sample originally examined, and this impurity is always present when the triphenylmethane is prepared from benzene and chloroform by Friedel and Crafts' reaction (see following abstract).

Triphenylmethane; Nature of the impurity found in preparations of ——. W. N. Hartley. Chem. Soc. Proc., 1908, **24**, 94.

The experiments of Leonard (see preceding abstract) have shown conclusively that in the preparation of triphenylmethane there are always two substances obtained, even when the materials are of the greatest purity and free from moisture. The second substance must be a hydrocarbon; it is yellow, and apparently it undergoes oxidation, becoming still brighter in colour. From these and other considerations, it appears to be identical with Gomberg's triphenylmethyl, and the final product, with triphenylmethyl peroxide.

Brazilinic acid, the lactones of dihydrobrazilinic and dihydrohæmatoxylinic acids, anhydrobrazilic acid, &c. The constitution of brazilin, hæmatoxylin, and their derivatives. W. H. Perkin and R. Robinson. Chem. Soc. Proc., 1908, **24**, 54. (See also this J., 1908, 17.)

Further confirmation of the constitution of the members of this group is afforded by the synthesis of *anhydrobrazilic acid*, which has been proved to possess the formula :



Patents.

Sulphurised dyestuffs for printing ; Manufacture of ——. O. Imray, London. From Farbw. vorm. Meister, Lucius und Brüning, Hoechst-on-the-Maine, Germany. Eng. Pat. 10,527, May 6, 1907.

Sulphide dyestuffs have not hitherto been much used for printing as they blacken the copper rollers. In Eng. Pat. 16,897 of 1902 (this J., 1903, 862) it was shown that sulphur does not affect the rollers when present as thiosulphate and it was therefore proposed in that patent to convert the free sulphur in the dyestuff into thiosulphate by treatment with sodium sulphite. It has now been found, however, that by the simultaneous presence of the thiosulphate thus formed and of a hydrosulphite or formaldehyde-sulphoxylate, the roller is blackened, just as it is by free sulphur. According to the present patent, dyestuffs which do not attack the rollers when printing with formaldehyde-sulphoxylates or hydrosulphites, particularly in presence of alkalis, are obtained from sulphide dyestuffs precipitated with air, acids, or the like, by treating them, at a raised temperature, when dry or as pastes, with a sulphite, and eliminating the thiosulphate which is formed, by washing. If the dyestuff is soluble in sulphites, sufficient common salt or other salt is added to prevent solution. For example, 100 kilos. of finely pulverised and levigated concentrated Thiogene-cyanine G are boiled in a reflux apparatus for some hours with a solution of 200 kilos. of crystallised sodium sulphite in 250 litres of water. The mass is filtered, washed, and dried. Or, again, 100 kilos. of Thiogene Brown S. conc. are boiled for some hours in a solution of 75 kilos. of crystallised sodium sulphite and 100 kilos. of common salt in about 500 litres of water. The mass is filtered and washed with a solution of common salt.—E. F.

p-Amino-p¹-[hydr]oxydiphenylamine ; Manufacture of ——. A. G. Bloxam, London. From Act.-Ges. f. Anilinfabr., Berlin. Eng. Pat. 10,978, May 10, 1907.

See Fr. Pat. 377,866 of 1907 ; this J., 1907, 1082.—T. F. B.

p-Nitro- and p-aminodiphenylamine and derivatives thereof; Manufacture of ——. A. G. Bloxam, London. From Act.-Ges. f. Anilinfabr., Berlin. Eng. Pat. 14,167, June 19, 1907.

See Fr. Pat. 379,949 of 1907 ; this J., 1907, 1273.—T. F. B.

Gallocyanine series ; Leuco derivatives of the ——. W. Lommel, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 884,745, Apr. 14, 1908.

By heating dyestuffs of the gallocyanine series with diluents such as glycerin at a temperature higher than 100° C., new leuco compounds are formed which produce in dyeing or printing, considerably bluer or greener shades than are produced from the known leuco compounds of the dyestuffs from which they are prepared.—P. F. C.

Alizarin ; Process of making ——. H. Boner, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 885,577, April 21, 1908.

See Fr. Pat. 344,680 of 1904 ; this J., 1904, 1210.—T. F. B.

Thiosalicylic acid ; Production of derivatives of ——, *and sulphur dyestuffs therefrom.* Badische Anilin und Soda Fabrik. Fr. Pat. 385,044, Dec. 14, 1907. Under Int. Conv., Oct. 2, 12, 26, and 30, 1907.

When dichloro- or dibromo-ethylene acts on the salts of thiosalicylic acid or its derivatives, the reaction proceeds according to the equation :

$$2CO_2R^1.R.S.M + C_2H_2Cl_2 =$$
$$CO_2R^1.R.S.CH : CH.S.R.CO_2R^1 + 2MCl$$

(R being a benzene or naphthalene radical, and R^1 a metal or an alkyl or aryl group), with formation of acetylenebisthiosalicylic (bismethinethiosalicylic) acids. Further, trichloro- or tribromoethylene reacts with the salts of thiosalicylic acid or its derivatives, to form ω-dihalogenated vinylthiosalicylic acids, thus :

$$CO_2R^1.R.S.M + C_2HCl_3 = CO_2R^1.R.S.CH : CCl_2 + MCl$$

Instead of the thiosalicylic acids, dithiosalicylic acids of the type, $CO_2R^1.R.S_2.R.CO_2R^1$, or the corresponding thiocyanobenzoic or xanthobenzoic acids may be used. When these new products are condensed by means of sulphuric or chlorosulphonic acids or phosphoric oxide, thioindigo dyestuffs are obtained, and if alkaline condensing agents are used, the leuco-derivatives result. For example, ω-dichlorovinylthiosalicylic acid furnishes 3-oxy-(1)-thionaphthene-2-carboxylic acid or a mixture of this with 3-oxy-(1)-thionaphthene.—J. C. C.

Sulphide dyestuff ; Process for preparing a yellowish-green ——. L. Cassella und Co. First Addition, dated Feb. 14, 1907, to Fr. Pat. 384,344, Jan. 31, 1907.

See Eng. Pat. 3279 of 1907 ; this J., 1907, 1082.—T. F. B.

Triphenylmethane dyestuffs ; Blue, chrome ——. Fabr de Couleurs d'Aniline et d'Extraits ci-dev. J. R. Geigy, Fr. Pat. 384,979, Feb. 21, 1907.

Triphenylmethane dyestuffs dyeing on a chrome mordant are obtained by oxidising the leuco-compounds resulting from the condensation of *o*-sulpho- and *o*-chlorobenzaldehyde, or their derivatives, with *o*-hydroxybenzoic acids, such as salicylic or *o*-cresotic acid. These dyestuffs furnish shades on wool varying from violet-blue to greenish-blue when the material is first dyed in an acid bath and then chromed. They may also be used for printing cotton, by employing a chrome mordant. The shades obtained by the use of *o*-cresotic acid are brighter and bluer than those derived from salicylic acid. The condensation may be effected by means of either 30–40 per cent. sulphuric acid or concentrated sulphuric acid, and the oxidation is carried out in concentrated sulphuric acid. The two operations can be carried out in one step in presence of concentrated sulphuric acid. The best oxidising agent is nitrosulphonic acid.—J. C. C.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

Egyptian cotton ; Nitrogen contents of ——. A. Schindler. J. Soc. Dyers and Col., 1908, 24, 106—107.

Haller (this J., 1907, 523) has shown that cotton, at any stage of its manufacture, is dyed slightly by an acidulated solution of Safranine. The shades obtained are fast to washing, and he considers this dyeing effect to be due to the albuminoid substances present in the cotton. Bleached cotton is less deeply tinted than unbleached, and the author confirms Haller's view by a determination of the nitrogen contents of Egyptian cotton in the raw and partially bleached states. The cotton used, was in the form of sliver, and the nitrogen was estimated by Kjeldahl's process. Two determinations on the raw material gave 2·56 and 2·50 per cent. of nitrogen. Two determinations on material which had been boiled for 8 hours in caustic soda of 2° T., gave 0·066 and 0·064 per cent. respectively. Another sample, boiled for 8 hours with caustic soda of 10° T. contained only 0·028 per cent. of nitrogen. It was found that on boiling in strong caustic soda of 77° T., ammonia, corresponding to 0·06 per cent. of nitrogen in the cotton taken, was evolved, and two determinations of the nitrogen remaining in the cotton after this treatment, gave 0·019 and 0·016 per cent. Thus, upon boiling with caustic soda, the bulk of the nitrogenous matter present in the cotton goes into solution in the caustic liquor.—F. M.

Mordants ; Dehydration of aluminium, iron and chromium ——. F. Binder. Bull. Soc. Ind. Mulhouse, 1908, 78, 30—31.

In 1883, Scheurer expressed the opinion that the "brightening" of Turkey Red dyeings was a result of a dehydration of the lake produced by the union of dyestuff, mordant and fatty body, and showed that the temperature (120° C.) at which steam exerted the maximum brightening effect was that at which the mordant on a similarly prepared, but undyed pattern, was completely dehydrated. The dehydrated mordants have but little affinity for dyestuffs and are not readily attacked by acids ; this latter property is of value in the dyeing of khaki, where a mixture of the oxides of iron and chromium is precipitated upon the fibre. The author submitted patterns, dyed in 1886, of material which had been mordanted with alumina and dyed with alizarin. One, showing a normal red, had been dyed before steaming ; another, showing a much poorer red, had been steamed for 4 hours without pressure, before dyeing ; a third, having a very poor colour, had been steamed under 5 atm. pressure for one hour before dyeing. A piece of material mordanted with iron and heated for 15 minutes with water under 5 atm. pressure, was hardly dyed by dinitroresorcinol, and a chrome-mordanted piece, similarly treated, was not dyed by Persian berries. The loss of affinity for dyestuffs is more pronounced with iron and chromium than it is with aluminium mordants.—F. M.

Reserves and coloured effects under diazo colours. M. W. Pluzanski. Sealed Note 919, Oct. 19, 1896. Bull. Soc. Ind. Mulhouse, 1908, 78, 50.

Upon a preparation of β-naphthol with sodium nitrite (15 grms. per litre), the author prints with a tin salt and then applies as a ground, a colour containing dianisidine sulphate (dissolved in acetic acid), oxalic acid (30 grms. per litre), and a basic dyestuff such as Thioflavine T, Methylene Blue, etc. He thereupon treats with a solution of a diazo compound, for example diazotised α-naphthylamine. The same effect is obtained by printing with a tin salt upon a piece prepared with sodium naphtholate, and "grounding" then with diazotised dianisidine, to which basic dyestuffs (in acetic acid solution) have been added. With appropriate designs, shot effects are obtained.—F. M.

British cotton cultivation. "Times," May 15, 1908. [T.R.]

A report on British Cotton Cultivation by Professor Wyndham Dunstan has been issued as a Parliamentary Paper [Cd. 3997] by the Colonial Office. The document is supplementary to the report on the same subject issued in 1904 [Cd. 2020] and to the "Handbook to the Cotton Exhibition" held at the Imperial Institute in 1905. It shows that considerable progress has been made in the movement, started in 1902, for developing the cultivation of cotton in British dominions. Abstracts are given of reports relating to British cotton-growing areas all over the world, with details of the quality and quantity of cotton grown, the experiments carried on, and the difficulties encountered. The principal facts are summarised below :—

Europe : Cyprus.—A short-stapled native variety is grown on non-irrigated lands ; American seed introduced and found to give good results under irrigation. Samples of native cottons valued at 6¼d. and 6⅞d. per lb. ; samples of American cotton were of good quality and equal in value to "middling" American. In 1903–4, estimated production 148 tons, export 105 tons, valued at £4,151 ; in 1906–7, production 717 tons, export 202 tons, value £9,552.

East Africa : Sudan.—Greatly increased area planted in 1906 in White Nile and Blue Nile provinces ; experiments in progress at Government experimental farm at Shendi. Samples from Zeidab, in Berber district, examined in 1907 included American Upland, Sea Island, Egyptian, and native varieties. American Upland, of very good quality, valued higher than "middling" American ; Sea Island somewhat inferior to standard American qualities, valued at 12½d. to 13½d. per lb. ; Egyptian of fair quality and readily saleable.

East Africa Protectorate.—Large increase of area under cultivation expected in the immediate future ; seed farm established at Malindi has given very favourable results. Samples of native, Egyptian, American Upland, and Sea Island examined ; Egyptian will probably give best results. Crop from Malindi sold at 5¼d. to 7½d. per lb. Exports increased from £285 in 1904–5 to £1,407 in 1906–7.

Uganda.—Large areas well suited to cotton growing ; seed distributed to natives who take readily to cultivation. The Uganda Company has established ginning centres and obtained very promising results, which indicate that cotton growing will probably become an important industry. Export increased from £6 in 1903–4 to £11,411 in 1906–7. Experiments made with Egyptian, American Upland, and "Black" Peruvian varieties ; it is considered that improved American Upland gives the best results ; sample of Egyptian "Abassi" examined and found to be of long staple and promising quality.

Nyasaland Protectorate.—Area planted increased from 380 acres in 1903 to 40,000 in 1908. Cultivation actively promoted by British Cotton-Growing Association and cotton being planted by several companies. Labour and transport are difficulties. Egyptian varieties yielded best results at low altitudes, but American promises to succeed well on high land. Samples examined found to be of excellent quality, realised 7d. to 9d. per lb. Export risen from £3 in 1903 to £15,345 in 1906–7.

South Africa : Rhodesia.—Cotton now grown on extensive scale in North-Eastern Rhodesia. Large number of samples examined; best results with Egyptian. Bales received in Liverpool in 1906 realised from 7½d. to 9d. per lb.

Transvaal.—Cotton can be grown on the low veld and parts of the middle veld ; best samples produced in Zoutpansberg district ; experiments being made to improve native cottons and test foreign varieties ; best results with improved American Upland, valued at ½d. to 1½d. above "middling" American cotton.

Orange River Colony.—Experiments made in 1905–6 with American and Egyptian seed sufficiently encouraging to warrant further trials. Sample received valued at 5¾d. to 6½d. per lb.

Natal.—Planting at present in experimental stage, being carried on by a syndicate of Natal farmers and by individuals. A variety of "kidney cotton" grown with good results ; experiments with American, Egyptian, and other varieties encouraging ; amount produced in 1906, 19,865 lb.

Cape Colony.—Experiments carried out in various parts with encouraging results.

West Africa.—Native cultivation carried on and plantations established in Sierra Leone, Gold Coast, Lagos, and Southern Nigeria by British Cotton-Growing Association. Soil and climate suitable and natives acquainted with cotton-growing ; experimental work required to improve native varieties ; labour and transport difficulties in some parts. Exports risen in value from £7,315 in 1903 to £29,000 in 1905. In *Southern Nigeria* natives taking to cotton-growing ; ginning factory and baling presses erected ; experimental and seed farm established ; native varieties of inferior quality ; American more satisfactory. *Northern Nigeria.*—Enormous possibilities of cotton-growing, and natives thoroughly acquainted with cultivation ; large quantities produced and used locally. British Cotton-Growing Association co-operating with Niger

Company on Niger and Benue rivers; ginning factories, &c., erected. Many samples of different varieties examined and found to be in most cases of fair quality; 356.200 lb. exported to United Kingdom in 1906.

Mauritius and Seychelles.—Experimental attempts being carried on.

Australasia.—Amount now produced very small, but attempts made to revive cultivation, formerly considerable.

West Indies.—Cotton-growing extending rapidly; exports risen from 328.530 lb. (value £9,676) in 1902 to 1,785.887 lb. (value £167,664) in half-year ended June, 1907. The industry now established on a commercial basis; ginning factories and oil mill (Barbados) erected. Several varieties tested and numerous samples received from many of the islands; most of them, especially Sea Island, of excellent quality, and sold from 1s. to 2s. per lb.

Patents.

Filaments of metamorphosed cellulose or similar material; Apparatus for forming —— in the manufacture of artificial silk or like substances. M. Waddell, New York. Eng. Pat. 5881, March 11, 1907.

See U.S. Pat. 849,870 of 1907; this J., 1907, 525.—T. F. B.

Bleaching flax, hemp, and like textile materials; Method of ——. L. C. P. Jardin, Paris. Eng. Pat. 9120, April 19, 1907.

See Fr. Pat. 374,580 of 1906; this J., 1907, 869.—T. F. B.

Bleaching animal and other products; Process for ——. H. Picard. Fr. Pat. 384,631, Dec. 3, 1907.

The material to be treated, and the bleaching solution, are introduced into a rotatable drum mounted upon a horizontal axis and divided into compartments by means of perforated partitions. The rotatory movement of the drum ensures the complete circulation of the bleaching liquor through the material.—P. F. C.

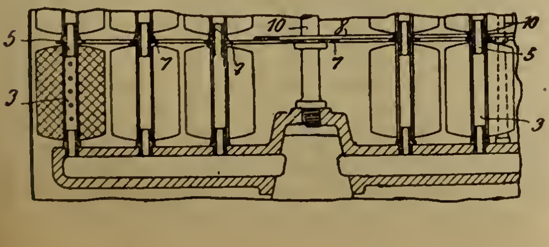
Two colour effects; Production of —— in union goods by dyeing. H. Levinstein and Levinstein, Limited, Manchester. Eng. Pat. 8111, Apr. 8, 1907.

Claim is made that mixtures of wool and cotton may be uniformly dyed, or the cotton alone may be fully dyed, the wool being left untouched, by using a dyebath made up with a sulphide dyestuff and sodium sulphide, together with hydrosulphite, hydrosulphite-formaldehyde, etc., and glue or other colloid. The order in which the ingredients are mixed is immaterial. For dyeing 100 lb. of cotton piece goods, with a white woollen stripe, the following bath is given:—Thionol Black O, 50 per cent. paste, 30 lb.; "sodium sulphide conc.," 3—6 lb.; hydrosulphite N.F. conc., 5—15 lb.; glue, 5—15 lb.; and caustic soda, 70° T., ⅓—2 lb., with water to make up to 16—20 gallons. The dyeing is carried out at the ordinary temperature when the wool is to be left white, and at a raised temperature when a uniform shade is desired. After dyeing, the goods are well rinsed in water.
—F. M.

Textile fibres; Method of and apparatus for treating [dyeing] ——. R. G. Campbell, Greensboro, N.C., U.S.A. Eng. Pat. 12,215, May 27, 1907.

See U.S. Pat. 856,029 of 1907; this J., 1907, 1005.—T.F.B.

Dyeing and bleaching bobbins of yarn with paper sleeves; Apparatus for ——. O. Rothemann, Mölndal, Sweden. Eng. Pat. 28,510, Dec. 27, 1907. Under Int. Conv., Dec. 27, 1906.



All prepared paper spools are softened by the boiling process in alkaline, and even in neutral, baths, and consequently, as they are generally used in columns of several spools supporting one another, the lower spools get crushed and bent by the weight of those above. To avoid this, according to the present patent, the nipples, 5, connecting each layer of spools, 3, with the layer immediately above, are mounted in concentric rings, 7, which are in turn supported in cross-pieces, 8, kept apart by distance-bolts, 10, screwed into the bottom of the machine. In this way each set of spools is supported by the set of rings immediately below, and completely relieved from the weight of the spools above.—E. F.

Dyeing machine. J. Hussong, Camden, N.J., Assignor to Hussong Dyeing Machine Co., Groveville, New Jersey. Re-issue 12,781, April 21, 1908, of U.S. Pat. 822,844, June 5, 1906.

The dyeing machine consists of a vat divided into two compartments, one of which is fitted with a frame carrying sticks to suspend the hanks of yarn to be dyed, whilst the second contains circulating mechanism by means of which the liquor may be directed over the partition into the other compartment or made to flow in the reverse direction.—J. C. C.

Dyeing of fibres and fabrics; Process for producing penetration and electrical oxidation of dyestuffs in the ——. Baudot et Cie. Fr. Pat. 384,866, Feb. 18, 1907.

By so arranging positive and negative electrodes inside a dye-vat that the material under treatment travels between them, and then passing an electric current through the dye-liquor, it is claimed that complete penetration and oxidation of the dyestuff are obtained, and shades of great brilliancy are produced.—P. F. C.

Dyeing machine with circulating bath. L. Mascelli. First Addition, dated Dec. 6, 1907, to Fr. Pat. 380,671, Aug. 10, 1907 (this J., 1908, 20).

In order to dye piece goods, the two horizontal perforated plates described in the chief patent, are replaced by a hollow perforated cylinder closed at one end, round which the piece is wrapped. The dye-liquor is delivered through the open end of the cylinder, and is forced through the perforations. The operation is repeated if necessary.
—J. C. C.

Dyeing of fibrous materials; Apparatus for ——. L. Mascelli. Fr. Pat. 384,798, Dec. 6, 1907.

The material to be dyed is arranged inside two vats, which can be put in communication with a steam supply, and are connected by pipes with one another and also with a reservoir containing the dyeing solution. The vats are then closed by air-tight covers, and steam is forced into them until the air they contain is all expelled through a discharge pipe. This pipe is then closed, the steam is shut off, and a sufficient quantity of the dye-liquor is allowed to flow into the vats from the reservoir. This dye-liquor is then alternately forced from one vat into the other by steam pressure, and in this way a complete circulation of the solution through the material to be dyed is ensured.—P. F. C.

Aldehyde sulphoxylates; Production of ——. F. Becker, Prague, and M. Bazlen, Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pats. 885,566 and 885,567, April 21, 1908.

See Addition to Fr. Pat. 350,607 of 1905; this J., 1905, 1300.—T. F. B.

Vegetable fibres and articles and materials made of same; Protecting —— from decomposition and putrefaction. G. Dillberg and A. Gadd, Ovedsgard, Sweden. Eng. Pat. 16,757, July 22, 1907. Under Int. Conv., Dec. 14, 1906.

The tanning process is considered the most effective yet employed for the protection of vegetable fibres from decomposition and putrefaction, but water soon dissolves out the tannic acid. To prevent solution of the tannic acid and at the same time to increase the resistance to fermentation, according to the present patent, the fibre, or materials made from the same, is first treated with tannic acid and creolin or kindred products and then with formalin. Both the process and the products after treatment by the same are claimed. Treatment of cotton fabrics, especially for personal wear, first with tannic acid and then with an acid formaldehyde solution has already been proposed, but the use of creolin or kindred products in addition to the other materials is essential to the present patent. For instance the twine, etc., is saturated with a solution of 30 to 60 grms. of best catechu and 30 to 60 grms. of pure creolin per litre. It is then wrung out and saturated in a bath containing 10 to 25 c.c. of formalin (40 per cent.), which coagulates the tannic acid in the fibre. It is then dried. The treatment may be also applied to canvas, sails, tents, ropes, cord, strings, threads, wood-work and all other materials made from vegetable fibres.—E. F.

Vegetable fibres and articles made therefrom; Process for protecting —— against decomposition and putrefaction. G. Dillberg and A. Gadd. Fr. Pat. 384,996, Dec. 13, 1907. Under Int. Conv., Dec. 14, 1906.

See Eng. Pat. 16,757 of 1907; preceding.—T. F. B.

Sodium perborate. Fr. Pat. 384,967. *See* VII.

VI.—COLOURING WOOD, PAPER, LEATHER, &c.

Leather dyeing; Acid in ——; its absorption and effect. M. C. and J. W. Lamb. Leather Trades' Rev., 1908, **41**, 345—346.

The authors' experiments lead to the conclusions that:— I. There is little liability to injury of leather if well tanned, by immersion in water under 60° C. II. The amount of acid absorbed by leather is practically the same, no matter what the concentration, providing that sufficient excess be present. III. Any excess of acid not absorbed, conduces to rapid disintegration of the leather at a much lower temperature than would be the case if no excess were present. IV. There is much less liability to damage of goods, when formic acid is used, than when any other of the acids (hydrochloric, sulphuric, or oxalic) usually employed, is used.

VII.—ACIDS, ALKALIS, AND SALTS, AND NON-METALLIC ELEMENTS.

Chromium oxides and copper-chromium oxides; Dissociation of ——. L. Wöhler and P. Wöhler. Z. physik. Chem., 1908, **62**, 440—453.

Experiments with chromic oxide, chromium trioxide, and the so-called chromium dioxide, CrO_2, obtained by the incomplete reduction of potassium bichromate with sodium thiosulphate, showed that below 1220° C., no perceptible oxidation of anhydrous chromic oxide takes place. With a mixture of chromic oxide with half its weight of finely powdered potassium sulphate, absorption of oxygen takes place at temperatures above 900° C. At 1009° C. the equilibrium pressure of the oxygen is 878 mm., and at 1029° C., 785 mm., indicating clearly the endothermic character of the oxidation process. The reaction is as follows:—

$$2K_2SO_4 + Cr_2O_3 + 3O \rightleftarrows 2K_2SO_4{,}2CrO_3,$$

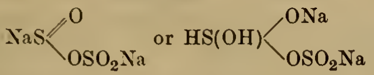
and is interesting as being the first example of an exothermic dissociation or endothermic formation of an oxide, which it has been found possible to measure thermodynamically. The formation of chromium trioxide from anhydrous chromic oxide and oxygen, will evidently only take place at still higher temperatures, and this fact explains why the decomposition of chromium trioxide at lower temperatures is an irreversible reaction. On heating commercial copper chromate in a current of oxygen at 650°—700° C., there is formed a mixture of cupric oxide and a basic chromite, $4Cr_2O_3{,}5CuO$, the latter being insoluble in nitric acid. If this mixture be then heated to above 900° C., oxygen is evolved, and cuprous chromite is formed: $4Cr_2O_3{,}5CuO + 3CuO = 4(Cr_2O_3{,}Cu_2O) + 2O_2$. Cuprous chromite is insoluble in strong nitric acid. When prepared in the manner described, it is contaminated with potassium sulphate and chromate, and is obtained in the form of steel-blue, triangular leaflets, which yield a greyish-green powder. On heating strongly, the powder is sintered and the product again becomes steel-blue. Cuprous chromite is, with difficulty, oxidised to chromic acid by a mixture of strong nitric acid and potassium chlorate. On heating in an atmosphere of oxygen below 870° C., it yields a mixture of cupric oxide and crystallised cupric chromite, but the absorption of oxygen is very slow towards the end: $Cr_2O_3{,}Cu_2O + O = Cr_2O_3{,}CuO + CuO$. Amorphous cupric chromite is readily obtained by precipitating a mixture of the hydroxides of chromium and copper from a solution of the sulphates, and heating the well-washed precipitate in a current of oxygen at 700° C. From the product, unchanged copper oxide is extracted by dilute acid, leaving the cupric chromite in the form of a black amorphous powder. Cuprous chromite itself is not acted upon by sulphur dioxide, and its action as a catalytic substance in the manufacture of sulphuric acid, can apparently be due only to its primary oxidation as described above, together with its subsequent reformation by the reduction of the mixture of cupric chromite and oxide produced. The reaction: $Cr_2O_3{,}CuO + CuO \rightleftarrows Cr_2O_3{,}Cu_2O + O$, is reversible. A study of the decomposition of copper chromate was undertaken, and the second stage of this decomposition, viz., the formation of cuprous chromite from the mixture of basic cupric chromite and cupric oxide ($4Cr_2O_3{,}5CuO + 3CuO$) produced at first, was found, by measurement of the oxygen pressure, to be identical with the reaction: $Cr_2O_3{,}CuO + CuO \rightleftarrows Cr_2O_3{,}Cu_2O + O$.—A. S.

Alkaline-earth salts; Colloidal and gelatinous ——. II. [Compounds of calcium, magnesium, and strontium]. C. Neuberg and B. Rewald. Biochem. Zeits., 1908, **9**, 537—550. (See also this J., 1906, 926.)

The solution which is finally obtained on passing a current of carbon dioxide through a methyl alcohol solution of barium oxide, possesses all the properties of a true colloidal solution. If the methyl alcohol be partially evaporated *in vacuo*, a jelly is obtained which can be re-dissolved in methyl alcohol, but if it be completely evaporated, a solid transparent mass, like celluloid, is obtained, which is no longer soluble in methyl alcohol. This is a peculiarity which is characteristic of colloids. The barium carbonate in the solution is non-diffusible, both towards methyl alcohol and towards water. Its electrical conductivity is practically *nil*, and when examined with the ultramicroscope, the solution is seen to contain rapidly moving bright points. Methyl alcohol solutions of strontium oxide and strontium hydroxide, when treated with aqueous acids, yield gelatinous precipitates of the corresponding strontium salts in a flocculent form. A methyl alcoholic solution of strontium hydroxide gives no precipitate when saturated with carbon dioxide, but a solution of strontium oxide does. The main part of the paper is devoted to a description of the colloidal solutions and gelatinous precipitates of calcium and magnesium salts, which have already been noticed in this Journal, 1908, 120. Calcium oxide is not very soluble in methyl alcohol, and its solution differs from the corresponding solution of barium oxide, in that it is colloidal and non-diffusible, whereas the barium oxide solution is not colloidal. Calcium carbonate is more soluble, and is best prepared in the colloidal condition by saturating a suspension of calcium oxide in methyl alcohol with carbon dioxide. The authors note that polyhydroxy compounds have an influence similar to that of methyl alcohol, and salts of the alkaline-earths precipitated in presence of these compounds tend to assume a gelatinous condition. This property has long been recognised in sugar refineries and in the manufacture of glycerol. The peculiar colloidal properties of the alkaline-earth salts have a bearing on physiological chemistry, since compounds of calcium and magnesium play an important part in living organisms.—J. F. B.

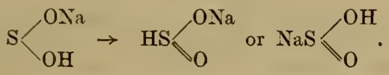
Sodium hydrosulphite and sodium formaldehyde-sulphoxylate; Constitution of ——. E. Orlow. J. Russ. Phys.-Chem. Ges., 1908, **39**, 1588—1617. Chem. Zentr., 1908, **1**, 1518—1519.

The author studied the behaviour of hydrosulphurous acid and its salts and of sodium formaldehyde-sulphoxylate towards $N/10$ solutions of iodine and sodium hydroxide and to neutral and alkaline solutions of potassium-mercuric iodide, $2KI,HgI_2$. He draws the following conclusions from his results. The formula, $Na_2S_2O_4$, proposed by Bernthsen for sodium hydrosulphite, does not correspond to the hydrosulphite itself, but to a condensation product, which would be more correctly named sodium bisulphite-hydrosulphite, corresponding to the formula,



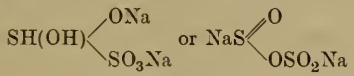
$$\mathrm{NaS}\Big\langle\begin{matrix}\mathrm{O}\\ \mathrm{OSO_2Na}\end{matrix} \quad \text{or} \quad \mathrm{HS(OH)}\Big\langle\begin{matrix}\mathrm{ONa}\\ \mathrm{OSO_2Na}\end{matrix}$$

Hydrosulphurous acid may be regarded as the hydroxide, $S(OH)_2$, of a hypothetical oxide of sulphur, SO. Since it is not dibasic, but monobasic, like hypophosphorous acid, it seems probable that in aqueous solution, its salts immediately undergo transformation:



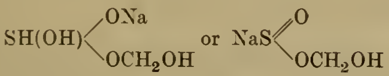
$$\mathrm{S}\Big\langle\begin{matrix}\mathrm{ONa}\\ \mathrm{OH}\end{matrix} \rightarrow \mathrm{HS}\Big\langle\begin{matrix}\mathrm{ONa}\\ \mathrm{O}\end{matrix} \quad \text{or} \quad \mathrm{NaS}\Big\langle\begin{matrix}\mathrm{OH}\\ \mathrm{O}\end{matrix}.$$

In the latter form, hydrosulphites would be capable of yielding condensation products similarly to aldehydes and ketones, *viz.*,



$$\mathrm{SH(OH)}\Big\langle\begin{matrix}\mathrm{ONa}\\ \mathrm{SO_3Na}\end{matrix} \quad \text{or} \quad \mathrm{NaS}\Big\langle\begin{matrix}\mathrm{O}\\ \mathrm{OSO_2Na}\end{matrix}$$

I.



$$\mathrm{SH(OH)}\Big\langle\begin{matrix}\mathrm{ONa}\\ \mathrm{OCH_2OH}\end{matrix} \quad \text{or} \quad \mathrm{NaS}\Big\langle\begin{matrix}\mathrm{O}\\ \mathrm{OCH_2OH}\end{matrix}$$

II.

Formulæ I represent Bernthsen's "sodium hyposulphite (hydrosulphite)," and formulæ II, sodium formaldehyde-sulphoxylate. In aqueous solutions these condensation products may exist in two modifications, easily convertible one into the other. The author discusses in detail his theory of the alterable configuration of the oxygen-hydrogen compounds of sulphur.—A. S.

Ferropyrophosphates; Reducing power of ——. P. Pascal. Compt. rend., 1908, **146**, 862—864.

Solutions of the alkali ferropyrophosphates are energetic reducing agents, tending, in the cases observed, to the production of stable and intensely coloured colloidal solutions. Thus, a solution of sodium ferropyrophosphate, $Na_8Fe_2(P_2O_7)_3$, formed by dissolving ferrous pyrophosphate in a slight excess of sodium pyrophosphate solution, instantly reduces the salts of gold or silver, though it has no action on those of platinum, even at the boilig poinnt. With dilute solutions and small quantities of gold or silver, the metal liberated forms blue or violet colloidal solutions in the case of gold, or a red solution of silver, and the intensity of the colour renders easy the detection of 0·01 mgrm. of the metal in 1 c.c. of solution. The alkali ferropyrophosphates also reduce mercuric chloride solution, giving mercurous chloride and then mercury, being themselves oxidised to ferripyrophosphates (*e.g.*, $Na_6Fe_2(P_2O_7)_3$). With small quantities of mercuric chloride and a weak solution of the reducing agent, a colloidal solution of mercury is obtained, brown by transmitted, and grey by reflected light. In the presence of alkali bromides or iodides, the alkali ferropyrophosphates precipitate copper salts as cuprous bromide or iodide. They also reduce Fehling's solution and solutions of the double carbonate of copper and sodium, and even neutral or faintly acid solutions of copper salts are reduced, giving yellow colloidal solutions of cuprous hydroxide, green by reflected light. This furnishes a test for copper far more delicate than that depending on the production of the well-known blue colour with ammonia.—F. Sodn.

Nitrites; Complex —— *containing potassium and lead.* A. N. Meldrum. Chem. Soc. Proc., 1908, **24**, 97.

The reaction between potassium nitrite and a lead salt (which may be the acetate, nitrate, chloride, bromide, or iodide) results in the production of complex compounds, which, in addition to potassium, lead, nitrosyl, and water, may contain one or more equivalents of the negative ion with which the lead was originally associated. The products vary in colour from bright yellow to orange, and they contain potassium and lead, as a rule, in the atomic ratio of 3 : 2. In attempting to prepare the compound, $K_2Pb(NO_2)_2(NO_3)_2,H_2O,(KO,NO_3,PbO,NO_5+HO$, Hayes, Quart. Journ. Chem. Soc., 1860, **13**, 335), the author finds that the product has always the composition, approximately, if not exactly, $K_2Pb(NO_2)_3NO_3,H_2O$. Metallic lead is more easily attacked by solution of lead nitrate to which potassium nitrate has been added, than by lead nitrate solution alone.

Acetic acid, acetate of lime and acetone; Forthcoming increase of duties on —— *in Japan.* Bd. of Trade J., April 30, 1908. [T.R.]

A law has recently been passed providing for the modification of the rates of customs duty levied on acetic acid, acetate of lime, and acetone imported into Japan, as shown in the subjoined statement. The new duties are to be enforced from the 1st October next:—

Tariff No.	Articles.	Rate of duty.	
		Present.	From 1st October, 1908
		Yen.	Yen.
112	Acetic acid.........	100 kins 5·60	100 kins 8·00
134 (2)	Acetate of lime...	Not specially mentioned.*	,, 0·41
134 (3)	Acetone..........		,, 15·13

* Apparently dutiable at the rate of 20 per cent. *ad valorem* under the head of "chemicals not specially enumerated."

Patents.

Nitric acid and nitrites; Manufacture of ——. Aktieselskabet det Norske Kvaelstofkompagni, Christiania. Eng. Pat. 6265, Mar. 20, 1908. Under Int. Conv., Mar. 22, 1907.

Nitrous gases, such as are obtained by the electrical oxidation of nitrogen, are absorbed in two stages; first by water or dilute nitric acid, with the formation of practically pure nitric acid; and secondly by a caustic alkali, with the formation of a practically pure nitrite.
—O. R.

Nitrogen oxides; Process and apparatus for making —— *from air.* A. Grau and F. Russ. U.S. Pats. 884,919 and 884,920, April 14, 1908.

Air is passed into an electric arc flame, and the gases are withdrawn directly from the central zone of the flame and immediately cooled. This is effected by providing an exit tube for the gases, of about the same

diameter as the inner zone of the flame, and projecting into this zone, the tube being cooled during working. Or, a cooled tubular electrode may serve as the exit tube.
—F. Sodn.

Hydrochloric acid gas; Preparation of dry ——. T. Meyer. Fr. Pat. 384,727, Oct. 12, 1907. Under Int. Conv., Oct. 13, 1906.

Hydrochloric acid is prepared from sulphuric acid and rock salt in a medium of molten sodium bisulphate. The bisulphate, at about 300° C., is contained in a cast-iron vessel, and sulphuric acid (containing about 93 per cent. of H_2SO_4) is allowed to flow, continuously or periodically, through an iron pipe dipping below the surface of the liquid, thus maintaining a constant circulation, the powdered salt being regularly introduced in equivalent quantity from above. The denser bisulphate escapes from a point near the bottom of the vessel, at a rate corresponding to that of its formation, and its heat is utilised to raise the temperature of the entering acid. The advantages of the method are: (1), iron vessels may replace those of stoneware, on account of the strength of the acid used; (2), no stirring is necessary, since no solid lumps are formed, and the introduction of air is therefore avoided; (3), the gas obtained is dry.—F. Sodn.

Hydrochloric acid and calcium fluoride; Process for the manufacture of —— *from calcium chloride.* C. Schollmeyer. Ger. Pat. 191,830, April 4, 1907.

Calcium chloride is decomposed with hydrofluosilicic acid, with the aid of moderate heat, whereby hydrochloric acid is evolved. The solution is evaporated to dryness, and the residual calcium silicofluoride is converted into fluoride by heating until silicon fluoride is no longer evolved. The silicon fluoride is converted into hydrofluosilicic acid, for use over again in the process, by interaction with water in the usual manner.—A. S.

Sulphuric anhydride; Process for the preparation of —— *by means of contact substances in a cylindrical apparatus.* M. Neumann. Ger. Pat. 187,077, July 1, 1904.

In order to ensure uniform distribution of the current of gases over the whole cross-section of the cylinder, the contact material is disposed in the chamber according to its state of division, the finest material at the axis, and then successive annular bands of material of increasingly coarser state of division towards the wall of the vessel. A series of concentric cylinders is disposed on the supports for the contact material, so as to form annular spaces for the contact substance. A tube, provided with a cock, and through which a cooling agent can be led, enters the cylinder just above the first horizontal layer of contact material, and passes upwards through the axis of the vessel, leaving the vessel above the uppermost layer of contact substance.—A. S.

Platinised contact masses; Process for the preparation of ——. M. Neumann. Ger. Pat. 188,503, Jan. 3, 1906.

The supports for the contact substance are formed of a material as dense as possible, but possessing sufficient absorptiveness. They are first impregnated with a solution of a reducing agent or of an alkali, and are then treated at a suitable temperature with an alkaline solution of platinum chloride, or with a solution of platinum chloride to which alkali has been added. In this way an extremely thin layer of platinum is produced on the support.—A. S.

Sulphuric acid manufacture; Tangential chamber for——. T. Meyer. Ger. Pat. 186,164, Feb. 3, 1906.

The chamber is provided with two or more tangential inlet tubes, at suitable distances apart, and at different levels. The cross-section of the tubes is reduced to correspond with the smaller quantity of gas passing through. The velocity of the inflowing gases is 2—4 m. per second.—A S.

Sulphur trioxide; Process for the preparation of ——. R. Frank. Ger. Pat. 194,879, June 28, 1906.

See this J., 1908, 404.—A. S.

Sulphuric acid evaporating apparatus; Condenser for ——. S. Littman. Ger. Pat. 187,253, Feb. 23, 1906.

The dome of the evaporator carries a short pipe which projects upwards into the condenser. This pipe is closed at the top, but has side openings. The condenser is in the form of a flask with a flat bottom, and the neck is widened out at the top. The lower outer edge of the wide portion is connected with a pipe, which passes out through the cooling medium (water) surrounding the condenser, and leads to a receptacle. A discharge pipe for condensed acid is also provided at the bottom of the condenser. The receptacle mentioned has a draw-off pipe at the bottom for condensed acid, whilst from its upper portion a pipe leads upwards, and at some distance above, is bent twice at right angles, and then opens into the pipe through which the cooling water flows away from the vessel surrounding the condenser. The action of the water flowing past the open end of the pipe produces a certain degree of suction in the receptacle and condenser.—A. S.

Sulphur; Process for converting —— *into sulphurous acid by combustion, or into flowers of sulphur by condensation.* O. N. Witt. Ger. Pat. 186,332, July 18, 1905.

Molten sulphur is atomised by means of steam under pressure or compressed air, and the cloud of finely-divided sulphur is either burnt to sulphur dioxide, or led into cooling chambers for the production of flowers of sulphur.
—A. S.

Sulphurous acid; Process and furnace for the preparation of —— *by burning sulphur.* Chem. Fabr. auf. Actien, vorm. Schering. Ger. Pat. 191,596, March 13, 1907.

The process consists in introducing finely-divided sulphur continuously into a current of air or oxygen (produced either by pressure or by suction), in such a manner that the sulphur is ignited just as it comes into contact with the air or oxygen, and is immediately burnt to sulphur dioxide. In the furnace for carrying out the process, the sulphur is fed from a screw conveyor on to a movable sieve or other distributing device, through which it falls into the combustion chamber below.—A. S.

Lime crushing, slaking, drying, and sifting machines. W. Wyssling, Paris. Eng. Pat. 20,827, Sept. 19, 1907.

This machine is a combination of a crusher and a digester. The latter is composed of two compartments, in one of which the crushed lime is slaked by means of steam, the other one, provided with a double bottom adapted to be heated, serving for drying the slaked lime. A sifting drum is mounted upon the end of a paddle shaft outside the digester, and brushes, fixed to the outer surface of the end plate of the digester, project into the drum and accelerate the sifting process. Suitable means are provided for operating the various parts from one common driving shaft.—O. R.

Quicklime; Process of obtaining lumps of ——. A. T. Schloesing. Fr. Pat. 384,551, Nov. 30, 1907.

Quicklime is slaked with a small quantity of water. The slaked lime obtained is sifted, and, after adding more water, is moulded under pressure into balls or bricks, which are then burnt at about 600° C. Agglomerating materials may be added to the lime The balls or bricks of quicklime obtained are especially suitable for the absorption of nitrous fumes and other gases —A. G. L.

Slaked lime in the form of a fine powder; Process for the preparation of ——. H. Wiegand, Export und Import von Maschinen. Ger. Pat. 193,825, Dec. 22, 1906.

Quicklime is treated in a slaking chamber with moist air, and then a current of heated dry air is passed over the product and into a settling chamber, where slaked lime in the form of a very fine powder is deposited. These operations are repeated as often as is necessary.—A. S.

Barium oxide ; Process for the preparation of —— from barium carbonate. M. Herzberg. Ger. Pat. 195,287, Jan. 23, 1907.

Barium oxide is obtained by strongly heating a mixture of barium carbonate and barium peroxide. The gas evolved, when freed from carbon dioxide, can be utilised for the preparation of a further quantity of barium peroxide.—A. S.

Sodium perborate ; Preparation of —— containing borax. Stolle und Kopke. Fr. Pat. 384,967, Dec. 5, 1907.

By the interaction of 1 molecular proportion of sodium peroxide with 3 molecular proportions of boric acid, a mixture of sodium perborate, $NaBO_3$, and borax is obtained, containing 4·6 per cent. of active oxygen (compare this J., 1904, 323, 823, and 1145). For its preparation, 25 kilos. of boric acid are suspended in 120 kilos. of water at 0° C., and 10 kilos. of sodium peroxide (92 per cent. Na_2O_2) are added in small quantities, the temperature being kept below 30° C. After a time crystals appear, which are dried at 30° C., the yield being 43 kilos. The mother liquor is used again. Since the borax formed by its decomposition is harmless, the product is well adapted to the requirements of the textile industry.—F. Sodn.

Sulphates of iron and zinc and their derivatives [oxides] ; Process for the manufacture of —— and the recovery of by-products [hydrogen and sulphuric acid]. F. A. E. van Berckelaer, E. J. E. van Gorp, and P. E. G. Gros. Fr. Pat. 384,904, Dec. 11, 1907. Under Int. Conv., Nov. 22, 1907.

Iron or zinc is introduced into a perforated copper tube, fitting gas-tight into a cylindrical metal generator, lined with lead or copper, into which dilute acid may be admitted. The hydrogen is conducted from this vessel to the bottom of a column filled with water, through which it forces its way, a series of horizontal partitions of wire gauze serving to break up the gas into small bubbles. Thus cooled and freed from acid, it passes to a similar column filled with benzine or other hydrocarbon, for carburetting the gas, and thence to a gasometer. The gas is free from all the objectionable impurities of coal gas, and is suitable for lighting and heating purposes, or for generating power. The sulphate liquor, run out from the bottom of the generator, is filtered and crystallised, the solution being first subjected to electrolysis, in the case of zinc sulphate, in order to free it from cadmium. By calcining the sulphates, oxides of iron and zinc are obtained, and also fuming sulphuric acid.—F. Sodn.

Acid sodium percarbonate ; Process for the manufacture of ——. E. Merck. Ger. Pat. 188,569, Feb. 3, 1905.

Acid sodium percarbonate, $4Na_2CO_4 + H_2CO_3$, is obtained by the interaction of 1 molecular proportion of sodium peroxide hydrate and more than 1 molecular proportion of carbonic acid at a low temperature. The product is suitable for use as a disinfectant and for the preparation of hydrogen peroxide.—A. S.

Potash salts [potassium chloride] ; Vessel for the refining [" Decken "] of ——. Gebr. Burgdorf. Ger. Pat. 189,866, May 19, 1906.

In the preparation of refined potassium chloride, the crude salt is placed in a tall vessel, provided with several horizontal perforated partitions, and is treated with water, which displaces the mother liquor retained by the crude salt. According to the present patent the vessel is provided with manholes at different heights, so that the refined products of varying degrees of purity can be withdrawn separately.—A. S.

Thorium sulphide ; Process for the preparation of ——. Siemens und Halske A.-G. Ger. Pat. 187,546, July 22, 1906.

Thorium sulphide, free from carbon, is obtained by leading carbon bisulphide vapour, alone or mixed with hydrogen sulphide, over heated thorium oxide.—A. S.

Sodium silicofluoride and fertilisers ; Process for the manufacture of ——. Rütgerswerke A.-G. Ger. Pat. 188,651, Oct. 2, 1906.

Substances containing fluorine and silicon, as for example, felspar (orthoclase), are added, in definite quantities, to the charge of raw materials for the manufacture of superphosphates. The vapours evolved in the subsequent working-up of the charge, are converted into sodium silicofluoride in the usual manner. The superphosphate obtained is specially valuable owing to its content of potassium.—A. S.

Boron ; Manufacture of ——. Cie. Franç. pour l'Exploitation des Proc. Thomson-Houston. Second Addition, dated Nov. 22, 1907, to Fr. Pat. 377,683, May 8, 1907.

See Eng. Pat. 1197 of 1907 ; this J., 1908, 226.—T. F. B.

Sulphur ; Process for preparing finely-divided ——. H. Köhler. Ger. Pat. 192,815, May 29, 1906.

Sulphur and naphthalene, preferably in equal quantities, are fused together, and from the solidified product, the naphthalene is removed by heating moderately in a current of an inert gas, or by extraction with a suitable solvent.—A. S.

Oxygen and nitrogen ; Process for the separation of —— from air. G. Weilnböck. Ger. Pat. 193,410, Oct. 23, 1906.

Air is treated in closed vessels with the barks of trees and shrubs moistened with water, whereby, it is stated, the oxygen is absorbed. After removing the residual nitrogen from the vessel, the oxygen is withdrawn from the bark by means of suction.—A S.

Chlorates ; Preparation of —— by electrolysis. Ger. Pat. 190,626. *See* XIA.

Alkali metals, alkaline-earths, rare-earths, etc. Fr. Pat. 384,604. *See* XIA.

VIII.—GLASS, POTTERY, AND ENAMELS.

Clay slip ; Studies on ——. I.—J. W. Mellor, S. A. Green, and T. Baugh. Trans. Engl. Ceramic Soc., 1906—7, 6, 161—170.

The effect of the addition of small quantities of salts and other substances on the fluidity of clay slips was studied. Ordinary earthenware casting slip contains 55 to 60 per cent. of water, whilst similar slip to which 0·25 per cent. (on the dry clay) of sodium or potassium carbonate has been added, is equally fluid with about 30 per cent. of water. The increased fluidity thus obtained renders it possible to cast in one mould pieces such as teapots, which formerly required three separate moulds, and also to use moulds 10 or 12 times, instead of only three times, before drying. On the other hand, a soluble salt may accumulate in, and disintegrate, the mould, and it may also cause scumming (milkiness) in the piece In order to determine the maximum fluidity obtainable by the addition of different substances to slips, the viscosities of a number of mixtures were determined in an apparatus consisting of a vertical wide glass tube, closed at each end by a rubber stopper. The lower stopper carried a short piece of glass tubing of 2—3 mm. bore, whilst through the upper stopper was inserted a long piece of glass tubing terminating about 3 cm. above the lower stopper, and placed somewhat on one side. The time necessary for 200 c.c. of the slip to run from this apparatus was determined, the air which entered as the slip ran out serving to agitate the slip. The maximum fluidity was obtained with 0·4 grm. of sodium carbonate per 68 grms. of dry body and 110 c.c. of water. The substances tried could be divided into classes as follows: Sodium and potassium carbonates, fusion mixture, potassium sulphate, bisulphate, hydroxide, and nitrate, sodium sulphide, tannin, and gallic acid, increase the fluidity at first, whilst larger additions stiffen the slips. The reverse is the case with copper sulphate, ammonia solution, and potassium-aluminium sulphate. Magnesium sulphate, mercury sulphate, sodium sulphate, sulphite, acetate, chloride, and phosphate, ammonium gallate, hydrochloric acid, and water-glass render the slip thinner. Grape sugar, humic acid, borax, ammonium chloride, calcium chloride, calcium sulphate, ammonium urate, aniline, ethylamine, and methylamine render the slip stiffer. Alcohol has no appreciable effect. Simoni's experiments are referred to. He measured the viscosity of a clay slip by the weight required to remove a glass plate from the surface of the slip, and also by means of the Vicat needle.—A. G. L.

Centrifugal extractors versus filter-presses [*for potteries*]. J. W. Mellor. Trans. Engl. Ceramic Soc., 1906—7, 6, 171.

Clay slips cannot be dried by means of centrifugal extractors because the slip forms a hard crust covering the perforations in the drum, thus rendering them impermeable to water. For a similar reason, filter-presses with deep trays cannot be used. But when the clay slip is run through a long, rapidly rotating cylinder with solid walls, the clay collects on the walls, and water flows from the end of the cylinder. The cylinder is emptied as soon as the issuing water appears turbid. —A. G. L.

Saggar marls ; Some notes on ——. S. T. Wilson. Trans. Engl. Ceramic Soc., 1906—7, 6, 121—122.

Saggars made by mixing marl and coarse grog will stand repeated firing without cracking, but will not stand any weight. When fine grog is used, the saggars crack readily, but bear the weight well. The best results are obtained when both coarse and fine grog are mixed with the marl. If much iron is present in the marl, the saggars fuse on repeated firing, unless care be taken to maintain an oxidising atmosphere within them. With gas-firing, marls containing but little iron must be employed, as otherwise the saggars fuse owing to reduction of the iron to the ferrous state.—A. G. L.

Cobalt blue colours [*for pottery*]. J. W. Mellor. Trans. Engl. Ceramic Soc., 1906—7, 6, 88—96.

Vessels on which a blue band has been formed with "mazarine blue" sometimes show white patches, known as "scumming" or "milkiness," after firing. The defect is usually due to the presence of undissolved particles ("pitchers"), or to the devitrification of the glaze or enamel, and rarely to the formation of "glass-galls." The first defect may be cured by better fritting of the stain, with the addition of more flux, if necessary. The second defect may be prevented by diminishing the proportion of lime in the frit, or by the addition of alumina (5 to 15 per cent.). "Floating" or displacement of the pattern may be due to traces of moisture or grease on the ware, below the stain, suddenly becoming vaporised, and also to the film of moisture or, in the case of sulphurous coal being used for firing, dilute sulphuric acid, deposited on the ware during the first stage of firing and attacking the stain before volatilising. "Ironing," or the formation of reddish or grey patches on the colour, is due to reduction of the cobalt oxide, or to separation of a cobalt compound owing to an excess of cobalt oxide in the stain. Addition of alumina or titanium oxide prevents this defect; coating with red-lead and refiring will frequently cure it. "Blistering" is said to be due to the evolution of oxygen from cobaltic oxide, and the addition of phosphates is advocated as a cure.—A. G. L.

Cobalt salts ; Action of —— *on clay.* A. D. Holdcroft and J. W. Mellor. Trans. Engl. Ceramic Soc., 1906—7, 6, 153—160.

Experiments made to compare staining by means of soluble cobalt salts (chloride or nitrate) and insoluble cobalt compounds (oxides and silicates), showed that when soluble salts are used, an appreciable proportion (15 per cent.) of the cobalt is found in the water from the filter-press. If this water is used over and over again, there is practically no loss of cobalt. Specking of the ware does not occur when soluble salts are used. In discussing the paper, W. Edwards stated that, tested with ferricyanide, the water from the filter-press was free from cobalt when soluble salts were used. He, however, used the water over again. The price of cobalt chloride worked out at a little more than that of unground cobalt smalt, but the results were better. A. Fielding stated that the chief advantage lay in the more intimate mixing attainable by the use of soluble salts. B. Moore pointed out that finely-ground smalt also passes into the water from the filter-press.—A. G. L.

Clay, bricks, tiles, and terra-cotta ; Drying of ——. R. Casson. *See* IX.

Lead in the manufacture of china. [T.R.]

The Home Secretary has appointed the following committee on the use of lead in the manufacture of earthenware and china :—

Mr. E. F. G. Hatch, chairman ; Mr. W. Burton, Mr. Noel Buxton, Mr. Bernard Moore, Mr. Noah Parkes, Dr. George Reid, Miss Tuckwell, Mr. A. Vernon-Harcourt, F.R.S., and Mr. John Ward, M.P.

The terms of the committee's reference are :—

To consider the dangers attendant on the use of lead in the various branches of the manufacture of china and earthenware, and in the processes incidental thereto, including the making of transfers, and to report how far these can be obviated or lessened by improved appliances and methods in the lead processes, or by conducting any of those processes in separate rooms, or by limitation of the use of lead, or by substitution of harmless lead compounds for raw lead, or by substitution of other materials for lead, or by controlling the employment of susceptible persons in lead processes, or by precautions for detection of lead poisoning in the earlier stages, or otherwise, and how far such precautionary measures are reasonably practicable generally and with regard to the several branches of the said manufacture.

To consider whether the danger or injury to health arising from dust or other causes in the said manufactures can be further obviated or lessened, and by what means, and how far such means are reasonably practicable generally and with regard to the several branches of the said manufacture.

To consider the existing special rules for the manufacture and decoration of earthenware and china, and the making of transfers, and to report what amendments, if any, are desirable for the better protection of the workers from lead poisoning and other diseases.

And to consider and report what modifications, if any, are desirable in the application of the said special rules, so amended, to particular branches of the manufactures named above, in the form of regulations under Section 72 of the Factory and Workshop Act, 1901.

Correspondence may be addressed to the secretary, Mr. E. A. R. Werner, Factory Department, Home Office.

Patents.

Glass or vitreous substances [*for Röntgen tubes*] *and the production and use thereof.* F. A. and C. L. Lindemann, Sidmouth, Devon. Eng. Pat. 8704, Apr. 15, 1907.

A glass which is claimed not to absorb rays of short wave-length is composed of oxides of elements having atomic weights less than that of silicon. A suitable composition is: Lithium borate ($Li_2B_4O_7$), 83·5 per cent. ; boric anhydride, 14 ; beryllium oxide, 2·5.

Fluorides of aluminium, magnesium, lithium, and beryllium may also be added. If necessary, the glass may be coated with a photographic varnish to protect it from moisture.—A. G. L.

Enamelling ; Method of ——. C. R. Schmidt, Baltimore, U.S.A. Eng. Pat. 19,429, Aug. 29, 1907.

See U.S. Pat. 862,285 of 1907 ; this J., 1907, 1009.—T.F.B.

Electric conductors ; Fusing glass on to ——. Eng. Pat. 16,736. *See* II.

Quartz ; Electrically fusing, refining and moulding ——. Eng. Pat. 5764. *See* XIA.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Clay, bricks, tiles, and terra-cotta ; Artificial drying of——. R. Casson. Trans. Engl. Ceramic Soc., 1906—7, **6**, 97—120.

To obtain slow drying of goods during the early stages of drying, it is generally better to use hot air previously nearly saturated with moisture than to use colder and drier air, as the former leaves the goods at a temperature at which the final drying can readily be forced. The author's firm have compiled a moisture table for use with wet and dry bulb thermometers up to 210° F., which they will communicate to other clay-workers on application. The older methods of drying on shed floors, whether by exhaust steam by day, and live steam by night, by coal-firing, or even by waste gases drawn from kilns by a fan, are not to be recommended, the cost being seldom below 3 cwt. of fuel per 1,000 bricks. The cost of exhaust steam may be considerable on the basis of the steam-raising value of an equal amount of fuel used in a compound condensing engine. Drying in continuous kilns is also uneconomical, both labour and fuel costs being considerable. The best types of dryers are the various modern tunnel dryers, of which the periodical or intermittingly working tunnels have the lowest first cost, but are the least convenient to work. The best type is a progressive dryer using air heated by steam outside the tunnel, about $1\frac{1}{4}$ cwt. of fuel per 1,000 bricks being necessary. It is suited to the most delicate kinds of goods. Terra-cotta may also be dried in chambers into which steam and air are injected, the proportions being controlled according to the indications of wet and dry bulb thermometers placed in the chambers. Clay in bulk is best dried by preliminary treatment in a filter-press, followed by drying in chambers fitted with racks, or in rotating cylinders heated by steam.—A. G. L.

U.S. fire tests on building material, by the National Board of Fire Underwriters. Times Eng. Suppl., May 13, 1908. [T.R.]

Thirty panels of various building materials, including concrete building blocks, common, hydraulic-pressed, and sand-lime bricks ; concrete of gravel, cinder, limestone, and granite ; glazed and partition terra-cotta tile ; sandstone, granite, and marble building stone were tested. These were placed in a sliding panel, which formed one side of the furnace. Gas flames were forced against them by blasts of air in such a way as to obtain a *maximum* temperature of 1,700° F. within half-an-hour of the beginning of the tests. After two hours the panel was extracted and subjected to a jet of water with a pressure of 50 lb. to the square inch. In the opinion of the engineers this was a more severe test than could be reached in an ordinary fire, though not, perhaps, in a wind-fanned conflagration. None of the materials passed the ordeal unharmed. For comparative purposes the test was a good one, and without being conclusive, it has afforded a number of important *data* for future investigations.

The brick panels appear to have withstood the tests better than any other material. Two kinds were tested, one made of a new brick and the other of a brick that had been in an engine foundation for some years. The latter best resisted the heat. Fifty per cent. of the new bricks were split, while 60 to 70 per cent. of the old ones were not damaged. Those at the back of the panel were entirely unaffected.

Hydraulic pressed bricks stood the test better than any other material. No damage was apparent after the firing and before the water was applied, and 70 per cent. of the bricks were found to be intact after the quenching of the flames. There was apparently little difference in the strength of the bricks before and after firing.

Natural building stones showed the worst behaviour of all the materials tested. They were almost completely destroyed. A sandstone panel entirely collapsed soon after the heat was applied.

Difficulty was found in determining whether the concrete made from limestone, granite, gravel, or cinders sustained the least damage. The surfaces were all rather badly pitted by the fire and washed away by the stream of water. The test was unfair to cinder concrete, as the sample of cinder was poor, containing a large percentage of unburned coal, which ignited and left the surface of the concrete much pitted. The granite concrete was perhaps the best. The damage in no case extended far into the concrete, probably not more than one and a half inches, and the evidence shows that even at this depth the temperature was comparatively low.

Linen tags which were placed in the hollow concrete blocks when they were moulded, emerged from the furnace undamaged. Sometimes, however, these blocks split after being subjected to the fire and water test.

Further experiment will be necessary, however, before anything approaching a satisfactory material can be obtained. As far as the experiments go they appear to prove the contention of Government experts to the effect that a really fire-proof building material has yet to be found.

Portland cement production in the United States in 1907. Eng. and Min. J., Apr. 25, 1908. [T.R.]

The following statement, issued by the United States Geological Survey, shows the total production of Portland natural-rock and puzzuolana cements in the United States for the calendar year 1907.

The total production of all kinds of hydraulic cement in 1907 was 52,230,342 barrels, valued at $55,903,851. Of the above total quantity of cement manufactured in 1907 in the United States, 48,785,390 barrels were Portland cement, with a value of $53,992,551 ; 2,887,700 barrels were natural-rock cement, with a value of $1,467,302 ; and 557,252 were puzzuolana cement, with a value of $443,008. The total production of hydraulic cement in 1906 was 51,000,445 barrels, valued at $55,302,277. Comparison of these totals with those above given shows an increase in quantity in 1907 over 1906 of 1,229,897 barrels, and in value of $601,574.

Corundum discoveries in India. Bd. of Tr. J., May 5, 1908. [T.R.]

Corundum is found exposed, and has been seen at three places, *viz.* : (1) Patarknang—a village jointly belonging to Mariaw and Rambrai States, lying a few miles west of the Raciang (Riwiang) river ; (2) at Nongmaweit village ; (3) on the Raindu river, a tributary of the Someshveri river. This mineral is said, however, to extend over a very large area near (2) and (3). The stone at (1) is coarse and is regarded by the people as of small value ; (2) and (3) are close together and are situated a few miles west of the U Blay river, near its source : they are in the Nongstein State and produce a superior stone. Corundum is quarried chiefly at (2) because it occurs there in small lumps which can be handled easily. At (3) corundum occurs close to and in the river bed in much larger blocks, weighing probably several tons. It is here that the best quality stone is found. It is close grained and highly crystalline. It is, however, not worked to any considerable extent owing to the difficulty in cutting.

Patents.

Aluminium ; Process for treating minerals containing —— [*for the production of corundum*]. H. Herrenschmidt. Fr. Pat. 384,493, Feb. 5, 1907.

Minerals, containing aluminium, may be converted into refractory and abrasive materials by fusion in an electric furnace. The present invention consists in mixing such minerals, before fusion, with a suitable oxidising agent, such as manganese dioxide, zinc sulphate, or potassium nitrate, to prevent the formation of carbides and the reduction of metallic oxides during the process, and also in adding magnesia, or other basic substance, to neutralise some of the silica present, or in adding more silica, so that the mixture approximates to the formula, $112Al_2O_3+60{\cdot}4SiO_2$. For example, to 100 parts by weight of dried bauxite containing, besides alumina, 12 per cent. of silica and 6 per cent. of iron oxide, might be added : (*a*), 15 parts of zinc sulphate ; or (*b*), 12 parts of magnesia and 15 parts of zinc sulphate ; or (*c*), 25 parts of silica and 15 parts of zinc sulphate. The resulting mixtures, fused in the electric furnace, give a product practically equal to pure corundum in quality.—F. Sodn.

Aluminium ; Process for treating minerals containing —— [*for the manufacture of refractory products*]. H. Herrenschmidt. First Addition, dated Feb. 19, 1907, to Fr. Pat. 384,493, Feb. 5, 1907 (see preceding abstract).

For the manufacture of refractory and ceramic products, such as firebricks, it is proposed to employ the artificial corundum, made as described in the principal patent. The colour and properties of the product may be varied by the addition of appropriate oxides in preparing the corundum. The process consists in mixing the corundum (100 parts), preferably reduced to grains of three different sizes, with an appropriate agglomerant, such as clay (about 25 parts), the mixture being worked up into a homogeneous paste with water, and then moulded under pressure. After drying, it is burnt in a pottery kiln, at the temperature of the porcelain kiln. The ingredients may be mixed in proportions other than those specified. —F. Sodn.

Materials capable of withstanding heat, acids and alkalis, and the manufacture of the same and apparatus for use therein. A. A. de Karyscheff, Paris. Eng. Pat 2994, Feb. 6, 1907.

See Fr. Pat. 350,016 of 1904 ; this J., 1905, 971.—A. G. L.

Metals and metalloids ; Process of extraction of —— from minerals, earths, or compounds containing them. H. Herrenschmidt. Third, fourth, and fifth Additions, Feb. 19, 1907, to Fr. Pat. 369,878, Sept. 18, 1906 (this J., 1907, 208 and 419).

The crude bauxite is dried by waste heat from the electric furnace in which the iron boride and corundum are produced. If aluminium is to be made from the corundum, the latter is not allowed to cool, but is at once transferred to another furnace, or to another part of the same furnace, in which the reduction is carried out. Coloured corundum is produced by mixing with the corundum, after removal of the iron boride, a coloured oxide (chromium oxide or manganese oxide) and an oxygen carrier (manganese dioxide, nitre or zinc sulphate), and reheating. Suitable proportions are : Bauxite, 100 parts ; borax, 30 ; carbon, 30 ; to which are afterwards added : Chromium oxide, 20 parts ; zinc sulphate, 40. Refractory products (bricks, crucibles, etc.) are obtained by adding clay to the corundum, powdering the mixture, moulding under pressure after adding water, drying, and burning at the temperature of the porcelain furnace. The most refractory products are obtained when the composition of the mixture approximates to the formula, $112Al_2O_3+62{\cdot}4SiO_2$. —A. G. L.

Magnesium silicates ; Manufacture of ——. H. Herrenschmidt. First and Second Additions, dated Feb. 19, 1907, to Fr. Pat. 369,987, Sept. 24, 1906 (this J., 1907, 203).

(1). For carrying out the fusion described in the principal patent, it is proposed to use materials, which are as nearly as possible at the temperature they have attained during desiccation or other preliminary heating process. This is secured by conducting such preliminary treatment in an apparatus contiguous to or closely adjoining the electric furnace. (2). The various acid and basic magnesium silicates, which may be thus obtained, are specially suitable for the manufacture of refractory and ceramic products, such, for example, as firebricks, in which acid or basic properties are desired. These are manufactured by mixing the silicate, preferably reduced to grains of three different sizes, with an agglomerant, such as clay (as a rule, in the proportion, 25 of clay to 100 of silicate), and working the mixture with water into a paste, which is then moulded under pressure, and, after drying, burnt in a pottery kiln, at the temperature of the porcelain kiln.—F. Sodn.

Artificial marble coloured with different shades throughout the mass and possessing the appearance and qualities of natural marble ; Transformation of calcareous stones into ——. J. P. Veillard, G. Briais, H. Marquis, E. Herreman, and H. Cartier. Fr. Pat. 384,942, Mar. 22, 1907.

The calcareous stone is successively treated with solutions of salts which are so chosen that they react either with one another or with the material of the stone itself, to produce compounds which impart the desired colouring for imitation marble. By reserving parts of the surface, multi-colour effects can be obtained.—P. F. C.

Stone, artificial ; Manufacture of —— from foundry residues. E. Reinecke. Fr. Pat. 384,725, Oct. 3, 1907.

Sifted foundry sand (50 per cent. by volume), granulated slag from a cupola furnace (40 per cent.), containing about 60 per cent. of silica, and lime or cement (10 per cent.) are mixed together, ground finely, and moulded under pressure after adding water to the mixture.—A. G. L.

Puzzuolana and other volcanic materials ; Process for working —— in order to facilitate mixing and combining with lime or cement and to yield highly resistant products. E. Bougleux. Fr. Pat. 384,930, Dec. 12, 1907. Under Int. Conv., Dec. 15, 1906.

Puzzuolana, trass or other volcanic rock is broken up into pieces, exposed to the sun and then to rain, and allowed to dry, if possible in a current of air or other oxidising gases. The material is then further dried and oxidised in cylindrical kilns or towers traversed by hot flue-gases containing oxygen, after which it is powdered and mixed with lime, or cement, and water in special mixing machines. Crystalline minerals (leucite) should be separated, powdered separately, and then mixed with the bulk of the material.—A. G. L.

Anhydrite or dead-burnt plaster ; Process for the hydration of ——. G. Linck. Ger. Pat. 194,316, Feb. 12, 1907.

The anhydrite or dead-burnt plaster is ground, moistened with a sufficient quantity of water to form gypsum, or plaster of Paris ($CaSO_4,\frac{1}{2}H_2O$), or a mixture of the two, and subjected to strong pressure in suitable moulds. Particles of gypsum or plaster of Paris may be added to the material before or after moistening with water, and a catalyser, such as sodium chloride may also be added. It is stated that at the ordinary temperature, a pressure of 1500 kilos. per sq. cm. will effect the conversion into gypsum in, at the most, 12 hours, whilst for the conversion into a mixture of gypsum and plaster of Paris, a pressure of 300—400 kilos. is sufficient.—A. S.

X.—METALS AND METALLURGY.

Steel production in the United States in 1907. Eng. and Min. J., April 18, 1908. [T.R.]

The American Iron and Steel Association has completed the collection of statistics of open-hearth steel production in the United States for 1907. The figures show 10,803,211 long tons of ingots and 745,877 tons of direct castings; a total of 11,549,088 tons, being an increase over the preceding year of 568,675 tons, or 5·1 per cent. The division of this steel by the process used was as follows:—

	1906.	1907.
	Tons.	Tons.
Acid	1,321,653	1,269,773
Basic	9,658,760	10,279,315
Total	10,980,413	11,549,088

The total production of steel in the United States for two years past is as follows, in long tons:—

	1906.	1907.
	Tons.	Tons.
Bessemer	12,275,830	11,667,549
Open-hearth	10,980,413	11,549,088
Crucible, etc.	141,893	143,000
Total	23,398,136	23,359,637

The total production of steel for 10 years past has been as follows, in long tons:—

1898	8,932,857	1903	14,534,978
1899	10,639,857	1904	13,859,887
1900	10,188,329	1905	20,023,947
1901	13,473,595	1906	23,398,136
1902	14,947,250	1907	23,359,637

Copper production of the World. H. R. Merton and Co. April, 1908. [T.R.]

The following are figures showing the copper production of the world, in long tons:—

	1906.	1907.
North America—		
United States	409,650	395,090
Canada	25,460	25,615
Mexico	60,625	56,565
Newfoundland	2,295	1,730
	498,030	479,000
South America—		
Chile	25,745	26,685
Peru	8,505	10,575
Bolivia	2,500	2,500
Argentina	105	220
	36,855	39,980
Europe—		
Spain and Portugal	49,320	49,675
Germany	20,340	20,490
Russia	10,490	15,000
Sweden	1,500	2,000
Norway	6,120	7,010
Italy	2,865	3,300
England	750	700
Austria	1,225	920
Hungary	210	125
Turkey	425	1,250
	93,245	100,470
Africa—		
Algeria	440	70
Cape of Good Hope	6,540	6,730
	6,980	6,800
Japan	42,740	48,935
Australasia	36,250	41,250
Total	714,100	716,435

Mineral production of Queensland in 1907. Bd. of Trade J., April 30, 1908. [T.R.]

The "Queensland Government Mining Journal" publishes the following statistics of the mineral output of Queensland for the year 1907, with the corresponding figures for the preceding year:—

	1906.		1907.	
	Quantity.	Value.	Quantity.	Value.
		£		£
Antimony ....tons	530	6,917	521	7,863
Coal ,,	606,772	173,282	683,272	222,135
Copper ,,	10,077	916,546	12,756	1,028,179
Gems	—	18,110	—	40,500
Gold ....fine oz.	544,636	2,313,464	466,476	1,981,461
Ironstone .....tons	31,401	14,114	35,856	24,327
Lead ,,	2,809	49,884	5,157	75,330
Limestone ,,	61,856	23,364	89,978	35,808
Molybdenite ,,	106	15,275	67	8,442
Silver oz.	783,087	101,693	921,497	112,540
Tin............tons.	4,823	490,283	5,140	496,766
Wolfram ,,	768	64,136	615	89,767
Other	—	11,579	—	11,569
Total value	—	4,198,647	—	4,134,687

Iron ore from Natal. Bull. Imp. Inst., 1908, **6**, 27—28.

The sample of ore, taken from a surface outcrop at Sweetwaters, Natal, consisted of fragments of a brownish limonitic mineral. It contained: ferric oxide, 71·31 per cent. (=metallic iron, 49·91); ferrous oxide, *nil*; manganese oxide, 2·36 (=metallic manganese, 1·82); silica, 6·08; phosphoric anhydride, 0·70 (=phosphorus, 0·30) per cent.; sulphur, *nil*.—A.S.

Blast-furnace; Re-starting a —— after damping for fourteen months. S. Surzycki and W. Jacobson. Stahl u. Eisen, 1908, **28**, 623—624.

Particulars are given of the re-starting of a furnace at Czenstochau, Russia, which had been damped for 14 months, as, owing to the extreme thinness (3 cm.) of the walls in places, it would have been fatal to have allowed it to burn out entirely. The furnace had a daily output of 140—150 tons of pig-iron. When damped, it had been in use for 5½ years, during which period it had been stopped once for repairs, and had been damped once for 28 days. The furnace was nearly filled with charges containing a total excess of coke amounting to 15 tons, the excess being placed at bottom and top; this was covered by a charge of argillaceous ore, on top of which a layer of clay was placed and stamped down. The tuyères were removed, all openings bricked up, and the whole outside coated with tar. After being in this condition for 14 months, the furnace was re-started after repairing the walls to some extent and placing iron pipes in the tuyère openings. The first iron was obtained in 36 hours, and the furnace was in full working order in a few days more. It is expected to last for several years.
—A. G. L.

Flame spectra of iron. G. A. Hemsalech and C. de Watteville. Compt. rend., 1908, **146**, 859—862.

The authors' new method of studying flame spectra (this J., 1907, 830), applied to iron, gives different results according to the gaseous mixture employed. When iron is introduced into a flame of air and coal gas, either by use of the arc or spark between iron terminals, or as ferric chloride, a spectrum is observed containing about 750 lines between λ2250 and λ5000; but by substituting oxygen for air, only about 250 lines occur in the same interval, and using a mixture of oxygen and hydrogen, about 210 lines. These differences appear to be independent of the manner in which the iron is introduced into the flame, and are not accounted for by the individual effect of the atmospheric nitrogen or the carbon in the coal gas. All the lines of iron appearing in the oxy-hydrogen flame-spectrum occur also in that obtained with coal gas and air. About 80 lines are common to all the flame spectra and may probably be regarded as the fundamental lines of iron. They are identical with the lines recognised in stellar spectra.—F. SODY.

Phosphor-bronze. E. S. Sperry. Mech. Eng., 1908, 54—55.

THE phosphorus acts as a deoxidising agent in phosphor-bronzes and not as a constituent of the alloy. The preferable means for introducing phosphorus, is by addition of phosphor-tin, which generally contains about 5 per cent. of phosphorus. Phosphor-bronze which is to be rolled, should be made from a mixture of tin (3 to 5; max. 8 per cent.), and phosphorus (0·02 to 0·03; max. 0·05 per cent.). Zinc is injurious in phosphor-bronzes, "tin-spots" being produced in a marked degree.

Alloys of lead and tin; Hardness of ——. A. Saposhnikow. J. Russ. Phys.-Chem. Ges., 1908, **40**, 92—95. Chem. Zentr., 1908, **1**, 1450.

ALLOYS of lead and tin, the cooling curve of which, according to Roberts-Austen, consists of two branches intersecting at the eutectic point (at 33 per cent. of lead), were examined with respect to hardness by Brinell's method (this J., 1908, 126), in which a weighted steel cone is forced into the metal. The results were as follows, the degree of hardness being expressed in kilos. per sq. mm. :—

Tin, per cent.	0	10	20	30	40	50	60
Solidification temp. ...	316°	295°	272°	253°	235°	213°	183°
Degree of hardness .	3·90	10·10	12·16	14·46	15·76	14·90	14·58

Tin, per cent.	66	67	68	70	80	90	100
Solidification temp ...	180°	180°	178°	180°	198°	215°	222°
Degree of hardness	16·66	15·4	14·58	15·84	15·20	13·25	4·14

The results indicate that the maximum degree of hardness is found in the case of the eutectic alloy.—A. S.

Alloys of aluminium and zinc; Hardness of ——. A. Saposhnikow. J. Russ. Phys.-Chem. Ges., 1908, **40**, 95—100. Chem. Zentr., 1908, **1**, 1450—1451.

ACCORDING to Heycock and Neville, the cooling curve of the alloys of aluminium and zinc consists of two branches intersecting at the eutectic point (4·9 per cent. of aluminium). Shepherd states that in addition to the eutectic, there are also formed two series of mixed crystals containing up to 50 per cent. of zinc and up to 2 per cent. of aluminium respectively. The author determined the hardness (kilos. per sq. mm., see preceding abstract) and elasticity (kilos. per sq. cm.) of these alloys with the following results :—

Zinc, per cent.	0	10	15	20	30	40	60
Hardness ..	25·4	47·8	66·0	89·0	107·0	85·0	67·0
Elasticity ..	402	985	—	1840	2530	1900	2140

Zinc, per cent.	70	80	90	94	95	96	98	100
Hardness	64·3	57·0	73·3	74·0	77·9	73·0	72	36·7
Elasticity	2230	1670	1670	1425	1290	1185	1210	570

The eutectic alloy thus shows a relative maximum degree of hardness, whilst the alloy containing 70 per cent. of aluminium shows an absolute maximum degree of hardness and of elasticity, which the author attributes to the formation of mixed crystals.—A. S.

Analysis of alloys; The planimetric ——, *and the structure of phosphor-copper.* A. K. Huntington and C. H. Desch. Faraday Soc. [Advance proof], April 28, 1908.

IN the microscopic examination of metallic alloys, a smooth polished surface is chemically treated in such a manner that the constituents can be visibly differentiated. (See Stead, this J., 1897, 200 and 506; 1898, 1111.) If the specimen appears to be homogeneous, it may be either a pure metal, a definite intermetallic compound, or a homogeneous solid solution. Where two solid constituents are visible in the same section and the composition of each phase is known, such as in the copper-zinc alloy containing from 36·5 to 46·5 per cent. of zinc, where the two micrographic constituents are the so-called α- and β- solutions, the proportion of each constituent may be calculated from the relative areas occupied. Where crystals of a solid constituent are surrounded by the eutectic, measurements of their relative areas can be made and, as the composition of the eutectic is constant, the composition of the alloy can be calculated. It is essential, for quantitative microscopic measurements, that the alloys should be cooled sufficiently slowly to permit of a state of equilibrium being established between the solid phases, or if quenched, that the condition of equilibrium at the temperature of quenching be known. The method is therefore only applicable to alloys the freezing points and transformation curves of which have been accurately determined. As the ordinary photo-micrograph is too small to allow of accurate measurement, the image should be projected upon paper fastened to a drawing board, and the outlines traced with a pencil. If the illumination be poor, tracing paper laid on clear glass can be substituted for the drawing board. To facilitate measurement, one of the constituents in the drawing is shaded, and the area measured with a planimeter. If the pattern be complicated or the crystals small, the error of planimetric measurement becomes excessive and a better method is to divide the drawing into 1 cm. squares and estimate the proportion of shaded to white areas. The proportions of the component metals corresponding to the areas exposed, may be calculated from a knowledge of the densities of the constituents, but these calculations may be avoided by using a graphic calculator having the percentage of the component metals as abscissæ and the percentage area occupied by any micrographic constituent as ordinates. The diagonals are obtained by joining up points corresponding with the composition of each micrographic constituent. An important feature affecting this method of assay is that in some alloys and particularly in some phosphor-copper alloys, segregation takes place. In an etched section, dark copper crystals may be seen, separated from the eutectic by a belt of white copper phosphide. The area of the copper crystals is greater than that corresponding to equilibrium, owing to the copper which they have abstracted from the surrounding eutectic. The author shows that by taking the area of the copper phosphide belts, a correction for the segregation can be made. A table giving a number of assays made by measurements, and checked by analysis, is included in the paper.—F. R.

PATENTS.

Metalliferous [tin-bearing] slime and the like; Treatment of ——. J. H. and J. M. Holman, Camborne, Cornwall. Eng. Pat. 6237, Mar. 14, 1907.

THE metalliferous (tin-bearing) slime is treated on a revolving table formed of two concentric rings the surfaces of which are inclined towards each other, the two rings thus forming a trough of flat conical shape. A space is left between the two adjacent edges of the rings to allow of the escape of the slime into a launder placed below. This launder is divided by a central partition into two concentric annular launders, which are further sub-divided into compartments by radial partitions, so that material from any part of one ring can be again treated on the other ring. Launders are provided for delivering crushed ore and water to the upper rims of both rings, as well as pipes and receptacles for raising the slime from the central launder, and pipes for supplying water to different parts of the table.
—A. G. L.

[*Flotation process for zinc-retort residues.*] *Non-metallic from other mineral substances; Separation of certain* ——. A. J. Boult, London. From G. A. Chapman, Broken Hill, New South Wales. Eng. Pat. 8567, Apr. 12, 1907.

ZINC-RETORT residues, which contain a large quantity of carbonaceous material, together with lead, iron, silver, zinc, zinc oxide, gangue, etc., are made into a pulp with acidified water, and the mixture is briskly agitated, *e.g.*, in a gabbet plant, with a small proportion of oil (0·5 to 2·0 per cent. reckoned on the residues), at a temperature of 50° C. or over. On stopping the agitation, the carbonaceous material is floated to the top by the oil and evolved gas, and is removed. The metallic minerals and gangue left may then be separated in any usual way.—A. G. L.

Flue-dust [from copper and nickel ores]; Process of utilising ——. E. F. Wood, New York, Assignor to Internat. Nickel Co., New Jersey. U.S. Pat. 884,970, April 14, 1908.

Fine flue-dust from copper and nickel sulphide ores is mixed with ore containing more sulphur than the flue-dust. The whole is ignited, and air is blown through the mass so as to cause it to sinter.—A. G. L.

Copper; Process for obtaining pure ——. L. Jumau, Paris. U.S. Pat. 885,622, April 21, 1908.

See Fr. Pat. 364,430 of 1906; this J., 1906, 892.—T. F. B.

Minerals [copper sulphide ores]; Apparatus for roasting and sintering ——. F. Bennitt. Fr. Pat. 384,539, Nov. 30, 1907.

The apparatus is designed for the roasting and sintering of fine copper sulphide ores, and consists essentially of an endless chain conveyor carrying a number of metallic receptacles with perforated bottoms, or else of a rotating drum, the outer surface of which carries a number of similar compartments. In the interior of the apparatus is placed a chamber heated by the burning ore, from which the air necessary for the roasting is drawn through the material in the compartments into an outer chamber leading to the chimney. Each compartment first receives from a hopper a charge of refractory material, *e.g.*, calcareous rock, designed to protect the metal from injury, and then passes under a second hopper which supplies it with its charge of ore. Each compartment next passes in front of a burner from which a flame issues, and over a flue in which is a fan or other suction device, air being drawn through the charge of ore. After passing the flue, the compartments are eventually emptied into a truck. (See also Fr. Pats. 380,343 and 380,344 of 1907; this J., 1908, 26.)—A. G. L.

Ores containing arsenic; Process for treating ——. T. B. McGhie, Assignor to T. Barton, London. U.S. Pat. 885,071, April 21, 1908.

See Eng. Pat. 7034 of 1907; this J., 1908, 448.—T. F. B.

Metalloids in crude iron; Process of utilising the —— *for reducing metallic iron.* H. D. Hibbard, Plainfield, N.J. U.S. Pat. 885,248, April 21, 1908.

A previously heated vessel is charged with molten crude iron, to which is then gradually added iron oxide in such proportion, that, on mechanically agitating the mixture, and repeatedly pouring the molten iron through the mass of iron oxide, the charge is maintained in the molten condition, owing to the oxidation of the metalloids other than carbon, in the crude iron, the carbon content, however, remaining substantially unaffected.—A. G. L.

Titaniferous iron ores; Process for treating ——. A. Sinding-Larsen and A. N. Willûmson. Fr. Pat. 384,882, Dec. 10, 1907. Under Int. Conv., Dec. 13, 1906.

The ore may be reduced in an electric furnace so as to give a ferro-titanium alloy, which is then treated in a converter with nitrogen, titanium nitride and iron being obtained; the iron is further purified, after removing the titanium nitride, by blowing superheated steam through it. Or else, iron only is first reduced in an electric furnace containing a basic slag, the resulting titanates then being separately reduced, and converted into titanium nitride by subsequent treatment with nitrogen. The titanium nitride may be used as fertiliser, or it may be made to yield oxides of nitrogen by heating it with easily reducible metallic oxides, preferably such that the metal, *e.g.*, lead, can be readily removed by distillation from the titanium alloy formed.—A. G. L.

Metal [iron]; Treatment of —— *to obtain castings by the Bessemer process.* W. Galbraith. Fr. Pat. 385,030, Dec. 14, 1907.

See Eng. Pat. 8543 of 1907; this J., 1908, 338.—T. F. B.

Iron or steel; Method of uniting —— *with each other and with other metals.* E. L. Davies and W. G. Clark, Wessels Nek, Natal, U.S. Pat. 885,668, April 21, 1908.

See Eng. Pat. 13,811 of 1905; this J., 1906, 699.—T. F. B.

[Sulphide] Ores; Process of oxidising ——. B. E. Eldred, Bronxville, N.Y., Assignor to Combustion Utilities Co., New York. U.S. Pat. 885,328, Apr. 21, 1908.

Sulphide ore is oxidised by blowing through an ignited mass of the ore, a current of air diluted with a determined proportion of products of combustion, *i.e.*, carbon dioxide and water vapour.—A. G. L.

Gold; Process for the separation of —— *from dilute solutions.* L. Darapsky. Ger. Pat. 181,408, April 23, 1905.

Dilute solutions from which gold cannot be separated by the usual precipitants (ferrous sulphate, stannous chloride, etc.), are treated first with one of such precipitants and then with air or oxygen, whereby the precipitant is oxidised and precipitated, carrying down with it the gold contained in the solution. The liquid and precipitate are then forced through a filter formed of fine impervious particles, on the surface of which the metallic gold and the oxidised precipitant are deposited.—A. S.

Stone; Artificial —— *from foundry residues.* Fr. Pat. 384,725. *See* IX.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(A.)—ELECTRO-CHEMISTRY.

The electrolytic copper industry. Times Eng. Suppl., May 13, 1908. [T.R.]

Beginning in a small way in 1882, the growth of the electrolytic copper industry in America has been phenomenal, and the 11 refineries now operating in the United States and Canada, according to Ulke, produce 86·5 per cent. of the total output, or 346,000 tons of refined copper per annum; while the six English refineries contribute only 8·8 per cent. of the total output, which is now estimated at 400,000 tons per annum.

The opening up of new copper mining districts in Australasia and in Russia has led to a demand for the erection of central electrolytic refineries, to which it is proposed to send the raw copper from the various mining centres in those two countries. Schemes are now under discussion in Sydney, N.S.W., and in Moscow for meeting this demand in a practical manner.

Patents.

Quartz; Process and apparatus for electrically fusing, refining, and moulding refractory substances such as ——. J. W. Mackenzie, London. From L. Bolle und Co., G.m.b.H., Berlin. Eng. Pat. 5764, Mar. 9, 1907.

Silica is fused and refined by electrically heating it in a vertical or horizontal carbon tube forming one electrode.

The carbon tube is surrounded by powdered carbon or other resistance material, which is contained in a wide carbon tube forming the second electrode. The whole is encased in bricks of refractory material. The bottom, or one end of the inner carbon tube, is closed by a movable carbon plug. The other end of the tube is closed by a plunger, which is lowered into the melted material. According to the shape given to this plunger. the fused silica is compressed into the form of a solid block, or it is pressed against the walls of the carbon tube to form a cylinder, etc. The plunger may be made hollow, and compressed air or steam may be delivered through it into the carbon tube. After removing the plug at the other end of the tube, the plunger may be made to eject the silica from the tube.—A. G. L.

Electrolytes for alkaline storage batteries. T. A. Edison, Orange, N.J., U.S.A. Eng. Pat. 401, Jan. 7, 1908. Under Int. Conv., May 10, 1907.

See U.S. Pat. 876,445 of 1908; this J., 1908, 167.—T. F. B.

Cell; Electrolytic ——. G. A. Gabriel, Assignor to Bleach and Caustic Process Co., New York. U.S. Pat. 884,653, April 14, 1908.

The ends and bottom of the anode chamber are formed from a U-shaped body, and the sides of the cell and the cathode chamber consist of metallic plates, comprising rectangular marginal portions, "and off-set or outwardly-extending central portions forming closed cathode chambers, the cathode and diaphragm of the cell being held by the rectangular portions over the recesses formed by the off-set portions." The walls have inner faces of non-conducting material, inert to the electrolyte, these forming an upward extension of the sides of the anode chamber, above the metallic plates, for increasing the hydrostatic pressure of the anode electrolyte, and this upward extension is provided with ties or braces.—B. N.

Depolariser for galvanic batteries. E. W. Jungner, Knieppbaden, Sweden. U.S. Pat. 884,664, April 14, 1908.

"Two carbon electrodes of different forms of carbon" are employed. One electrode is covered with the depolariser, which consists of nitrosyl-sulphuric acid dissolved in concentrated sulphuric acid, and air is supplied to the other electrode.—B. N.

Alkali metals, alkaline-earths, rare earths, and aluminous earths; Process of separating non-metals from compounds which they form with —— by the triple action of the electric furnace, oxygen and boric acid. H. Herrenschmidt. Fr. Pat. 384,604, Feb. 7, 1907.

Oxides, free from carbon, are obtained by treating compounds, such as aluminium sulphate or sodium carbonate, by fusion in an electric furnace in the presence of oxygen, or preferably an oxidising body such as saltpetre, together with boric acid. Pure alumina (corundum) or caustic soda may be thus obtained.—B. N.

Ozone; Process for the preparation of —— by electrolysis of aqueous liquids. F. Fischer. Ger. Pat. 187,493, Sept. 14, 1905.

The claim is for the use of anodes which are partly covered with, or enclosed by, non-conducting material, and which are cooled, in order to obtain high current-yields. Tubular platinum anodes, cooled internally with water, yield about 3 per cent., and uncooled anodes partly covered with insulating material, about 7 per cent. of ozone. With anodes which are both cooled with water and partly covered with insulating material, a yield of 23 per cent. of ozone can be obtained, whilst a yield of 30 per cent. is attainable by using salt solution as cooling agent. (See also this J., 1907, 156, 208.)—A. S.

Chlorates; Process for the preparation of —— by electrolysis of acid solutions of alkali or alkaline-earth chlorides. F. Ratiz. Ger. Pat. 190,626, Feb. 24, 1906.

Claim is made for the addition to the electrolyte of hydrobromic acid or a substance capable of producing it, and also a compound which will prevent reduction of the chlorate. It is stated that higher yields of chlorate are obtained with a lower E.M.F. than when hydrochloric acid is used instead of hydrobromic acid.—A. S.

Refractory metallic electrical conductors. Eng. Pat. 16,530. *See* II.

Electric conductors; Fusing glass on to ——. Eng. Pat. 16,736. *See* II.

Nitrogen oxides from air. U.S. Pats. 884,919 and 884,820. *See* VII.

(*B.*)—ELECTRO-METALLURGY.

The Laszczynski copper process. Times Eng. Suppl. May 10, 1908. [T.R.]

This process has been described by K. I. Grivnaka in a Russian technical journal, and also by Professor Piltschikoff in a paper read before the Faraday Society on April 28, 1908, and the following details are drawn from those two sources combined.

The Laszczynski process is based upon lixiviation of the roasted copper ore with a dilute solution of sulphuric acid, and electrolysis of the resultant solution, containing copper and iron sulphates and free acid, in special vats, using lead anodes and copper cathodes. The principle of the process is not new, having been tried experimentally both in Germany and America; but Laszczynski has introduced some novel features, which are claimed to convert a process that has hitherto failed, into a practical and economical success. The ore is delivered from the mine in three grades—testing respectively 4·5 per cent., 2·8 per cent., and 1·5 per cent. of copper. This ore is carefully sorted to free it from gangue, etc., and is mixed and ground to pass through a one-millimetre mesh sieve. The finely ground ore is then mixed with clay and formed into briquettes, which are roasted. This briquetting and roasting is one of the important features of the Laszczynski process, since by this treatment the iron is converted into an oxide that does not dissolve in the leaching liquor, and one of the difficulties met with in working other processes of this character is thereby avoided. The copper after the roasting operation is present in the roasted ore partly as sulphate and partly as oxide. The roasted ore is now leached with a 5 per cent. solution of sulphuric acid in lead-lined vats, worked upon the same principle as black-ash lixiviating vats, the saturated copper solution meeting the fresh ore, and the exhausted ore being leached with fresh acid solution. The liquor obtained by this leaching operation contains 5 per cent. of copper and 1 per cent. of free acid, and is filtered before passing into the electrolytic vats.

These are square wooden boxes lined with sheet lead and measuring 1 mètre in each direction. Each vat when fully charged contains 9 anodes and 8 cathodes, the former of sheet lead, 3 mm. thick, and the latter of thin copper sheet. The anodes are encased in cotton cloth. The electrolyte is constantly agitated during the passage of the current, by aid of wooden frames placed between each anode and cathode, and operated by mechanical means. The current strength is 900 ampères per vat, and the e.m.f. required varies from 2 to 5 volts, while the yield is 25 kilos. per 24 hours. In the course of one month the cathode sheets attain a thickness of 20 to 30 mm. and increase in weight to 55 lb. The exhausted electrolyte contains 1 to 1½ per cent. of copper and 5 per cent. of sulphuric acid and is used again, with the addition of fresh acid, for leaching purposes. The presence of carbonate of lime in the ore leads to some loss of acid, due to the formation of calcium sulphate, which is removed during filtration; but this loss is partly compensated by the presence of sulphur in the raw ore and by the formation of copper sulphate during the roasting operation.

The copper deposited at the cathodes has the colour and appearance of fine electrolytic copper, and is slightly crystalline in structure.

The re-solution of copper at the cathodes which usually occurs when a mixed solution of iron and copper sulphate is electrolyzed is avoided in this process by the use of the covered lead anodes. The use of linen covers for these, in some unexplained manner, prevents the formation of ferric sulphate by oxidation of the ferrous sulphate present in small amounts in the solution, and the full theoretical yield of 1·15 grm. of copper per ampère-hour is therefore obtained at the cathode. The cotton covering of the anodes is stated to last about four months without renewal.

The success of this extraction process at Boleslav has led to the erection of a larger works for operating it on the River Nid. not far from the original experimental installation of plant. The cost of a plant capable of producing 1,000 kilos. of copper per day is 27,000 roubles (equal to £4,300), and the process is stated to be equally efficient when worked on a small or large scale.

(*B.*)—ELECTRO-METALLURGY.

Electrolysis on inclined planes. R. Goldschmidt. Bull. Soc. Chim. Belg., 1908, **22**, 138—145.

In depositing zinc electrolytically, the author uses a plate of zinc as anode and a metallic cathode bent around the anode so as to form (with narrow glass slips at the sides) a shallow U-shaped trough, which is kept at an angle of 10—15 degrees from the horizontal. The electrolyte (zinc silicofluoride) is run in from a reservoir at the upper end of the upper limb of the U, and escapes at the upper end of the lower limb. It is kept in continual circulation by means of a pump, and fine sand is suspended in it. In this way coherent and homogeneous deposits of pure zinc are obtained. The quantity is always somewhat below that calculated from the current, no doubt because of the small amounts worn off by the polishing action of the sand.—J. T. D.

Patents.

Electric furnace. E. Viel, Paris. Eng. Pat. 24,807, Nov. 8, 1907.

See Fr. Pat. 380,610 of 1907 ; this J., 1908, 28.—T. F. B.

Zinc ; Electric furnace for the continuous extraction of —— from its ores. E. F. Côte and P. R Pierron. Fr. Pat. 385,018, Feb. 22, 1907.

See Eng. Pat. 5100 of 1907 ; this J., 1908, 342.—T. F. B.

Metallic compounds ; Electrolytic reduction of ——. H. Rodman, Assignor to The Electric Storage Battery Co., Philadelphia, Pa. U.S. Pat. 884,763, April 14, 1908.

Iron oxide is reduced, by employing it as a cathode in an electrolyte containing an alkali and a soluble sulphide. —B. N.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

Mimusops djave ; Fat from seeds of ——. J. Freundlich. Chem. Rev. Fett- u. Harz-Ind., 1908, **15**, 78—79, 106—108.

The seeds examined were obtained in the Cameroon district of West Africa, the results being in fair agreement with those already reported by Wedemeyer (this J., 1907, 262). The author is of the opinion that, though the fat is of doubtful utility as a foodstuff on account of the somewhat high percentage of unsaponifiable matter which it contains, it can be used both in the soap and stearine industries. The seeds weighed about 10 grms. each and consisted of 65 per cent. of kernel and 35 per cent. of shell. The rasped kernels lost 4·54 per cent. of their weight at 100° C., and after drying, yielded 67·48 per cent. of a light brown fat which was clear at 32° C. but began to solidify below this temperature to a lard-like mass. The following results were obtained on analysis :—Sp. gr. at 36·5° C., 0·9022 ; solidifying point, about 28° C. ; unsaponifiable matter, 2·2 per cent. ; acid value, 13·8 ; saponification value, 182·45 ; iodine value, 56·0 ; Reichert-Meissl value, 0·7 ; acetyl value by distillation method, 15·68, and by filtration method, 7·07 ; melting point of fatty acids, 51° C. ; solidification point of fatty acids, 46° C. ; neutralisation value of fatty acids, 190·52 ; saponification value of fatty acids, 197·15. The difference between the neutralisation value and the saponification value of the fatty acids may be due to the presence of lactones or anhydrides, or possibly, as suggested by Lewkowitsch, to polymerisation products.—J. A.

Castor oil [and sesamé oil] containing zinc. W. Van Rijn. Pharm. Weekblad, 1908, **45**, 346—347. Chem. Zentr., 1908, **1**, 1732.

The author has previously shown that sesamé oil has a considerable solvent action on zinc, and he now finds that the same is the case with castor oil.—A. S.

Olive oil ; Action of some finely-divided metals on —— W. Van Rijn. Pharm. Weekblad, 1908, **45**, 347—348. Chem. Zentr., 1908, **1**, 1732—1733.

Twenty-five grms. of the oil were heated on the water-bath for 6 hours with 5 grms. of the metal powder, and the filtered oil was examined, its acid value being determined, and the ash left after burning tested for metal. Aluminium, nickel, and tin were not dissolved by olive oil under these conditions, but in the case of the other metals used, the acid value (3·24) of the oil fell to the following values :—Magnesium, 0·8 ; zinc, 0·9 ; manganese, 3·0 ; iron, 2·3 ; copper, 1·8 ; and lead, 2·1.—A. S.

Cholesterol ; Origin and formation of ——. J. Lifschütz. *See* XXIV.

Patents.

Fatty substances ; Preparing ——. E. Schou, Ealing, and H. H. Schou, Copenhagen. Eng. Pat. 16,886, July 23, 1907.

In the preparation of fatty substances suitable for culinary purposes, it has been proposed to scrape the solidified fat off a cooled roller or plate, which works in contact with the molten fatty matter contained in a receptacle. By the present invention, the cooled fat is stated to be obtained in a very thin layer, of uniform composition, by spreading the liquid mixture upon the surfaces of two rollers, set at a definite distance apart and revolving in opposite directions, as described in Eng. Pat. 12,561 of 1907.—F. M.

Fats ; Purification and deodorisation of ——. L. de Casamajor. Fr. Pat. 384,492, Feb. 5, 1907.

The finely divided oil is directed against an incoming current of air, and the resulting emulsion carried along a horizontal chamber until it strikes against a vertical wall, where the emulsion is broken by the shock, the oil falling into a tank, whilst the air, carrying with it the oxidised malodorous constituents, escapes by a vertical column.—C. A. M.

Fatty matters ; Saponification and further treatment of ——. P. A. Barbé, F. Garelli, and G. de Paoli, Ferrara, Italy. Eng. Pat. 12,210, May 27, 1907.

See Fr. Pat. 372,341 of 1906 ; this J., 1907, 537.—T. F. B.

Glycerin ; Method of distilling ——. Raison sociale, Marx and Rawolle. Fr. Pat. 384,944, Oct. 25, 1907.

See U.S. Pat. 881,525 of 1908 ; this J., 1908, 345. The mixture of glycerin and steam should be superheated in a vacuum corresponding to about 710 mm. of mercury, whilst the vacuum in the condensation vessel should correspond to about 405 mm. of mercury.—C. A. M.

XIII.—PIGMENTS, PAINTS ; RESINS, VARNISHES ; INDIA-RUBBER, &c.

(*A.*)—PIGMENTS, PAINTS.

Patents

Water-colour or distemper ; Dry ——. A. C. Anderson, Copenhagen. Eng. Pat. 25,181, Nov. 13, 1907. Under Int. Conv., Mar. 14, 1907.

One part by weight of carrageen (so-called "Irish moss") is boiled for 1½ hours with about 22 parts of water, forming a jelly which is strained from moss-fibres and other impurities. While still hot, ½ part of boric acid and about 40 parts of chalk are added to it, and after thorough incorporation, the mixture is rapidly dried and ground, when it is ready for use. The further addition of a small quantity of molasses or syrup increases the binding power and durability of the product.—O. R.

Paint; Mixed —— and method of making same. W. F. Doerflinger, Niagara Falls, N.Y. U.S. Pat. 884,475, April 14, 1908.

Claim is made for a ready-mixed paint consisting of a pigment containing metallic gold bronze powder, and a solution of an organic acid colloid ester, such as cellulose acetate, in a volatile solvent, such as acetone, so that on evaporation of the solvent, a solid cohesive film is left.—C. A. M.

Zinc sulphide pigment, and process of producing the same, H. W. de Stucklé, Dieuze, Germany. U.S. Pat. 884,874. April 14, 1908.

Claim is made for a light-proof and weather-proof pigment obtained by precipitating zinc as a hydrated sulphide from an alkaline solution, and dehydrating the precipitate (*e.g.*, by heating it at about 300° C.), until the ratio of zinc sulphide to water is not less than 5 to 1.—C. A. M.

(*B.*)—RESINS, VARNISHES.

Varnish; Use of copal without previous fusion, in the manufacture of ——. A. Livache. Compt. rend., 1908, **146**, 898—900.

Although the statement of Vogel, that copal resins dissolve completely in amyl alcohol, is true for certain copals, the hardest resins do not dissolve completely even after one year's treatment. Amyl alcohol containing a few parts per thousand of nitric acid will dissolve the hardest copals in less than twenty days. On addition of turpentine no precipitation takes place and the amyl alcohol may be distilled off, leaving a turpentine solution of copal. The slight efflorescence which appears on standing for some days, and due to an acid body, may be removed by adding a trace of potash in amyl alcohol. Precipitation takes place if linseed oil be added, but since the fatty acids of linseed oil dissolve both the oil and the turpentine solution of copal, an oil varnish may be produced; *e.g.*, copal (1 part) dissolved in turpentine (2 parts) is mixed with 2/5 part of linseed oil and 3/5 part of the fatty acids of linseed oil (in place of the usual 1 part of linseed oil). The slower drying properties of the above varnish are improved by heating to 130—140° C. for some hours, having added a small quantity of manganese resinate. The varnish obtained is remarkably transparent and elastic.—J. W. H.

XIV.—TANNING, LEATHER, GLUE, SIZE.

"*Tannins*"; *Study of ——.* L. E. Cavazza. Chem. Zentr., 1908, 1, 1648—1649.

For the extraction of "tannins" the author recommends the use of distilled water in a vessel from which oxygen is excluded, *e.g.*, by the use of a vacuum or of inert gases, such as nitrogen, carbon dioxide, etc. In this way, and employing water free from oxygen and ammonia, it is possible to obtain, for example, *ampelotannic acid* as fine, micaceous leaflets. On evaporating the solution, the oxidation product of ampelotannic acid, formed by the action of the air, is obtained in the form of ruby-red lamellæ. The author prepared tannates of thallium, cæsium, rubidium, strontium, vanadium, thorium, cobalt, nickel, uranium, and arsenic, and also double tannates of selenium and potassium and of cobalt and potassium. The "tannin" may be purified by repeated evaporation of its solution in an atmosphere of an inert gas, the crystals forming at the edges and in the middle being removed. Thallium carbonate and uranyl nitrate are suitable reagents for the micro-chemical detection of tannins. With the former, chestnut-tannin gives a straw-yellow coloration, and with the latter, a rusty brown colour. Caffeetannic acid gives an emerald-green coloration or brown precipitate respectively; geranium-tannin, a hyaline or a yellowish-red precipitate; oak-tannin, a cheese-like precipitate or a yellowish-brown solution with a small quantity of a red precipitate; gallotannic acid, a dark yellow solution with a small quantity of a red precipitate, or a "colourless precipitate"; ampelotannic acid, a brown precipitate or a brick-red coloration. As specially suitable for the detection of "tannins" in plants, the author mentions vanadium chloride, which yields a vanadium tannate having an intense indigo-blue colour.—A. S.

Hides and skins; Sampling ——. P. Nicolardot. Bull. Soc. Chim., 1908, **3**, 513—518.

The article is a continuation of previous communications on the analysis of leather (see this J., 1908, 236). Difficulties are experienced in obtaining from a pack of hides an average sample for analysis, on account of the chemical and physical differences of the leather in different parts of the hide. After classifying the hides according to appearance, flexibility, substance, etc., one hide is chosen to represent its class, and may then be sampled in one of two ways. In one method, pieces are cut always from the same part of the skin; according to the other method, pieces are cut from butt, neck and flank and are well mixed. The first method does not give an average sample of the leather in the hide, but on the other hand permits a more reliable comparison between different hides. It is also better for making comparative mechanical tests (tensile strength, etc.). Results are given to shew that—contrary to the general opinion—hides are usually toughest in the flank, especially in the line perpendicular to the line of the back. Considerable variation in the amount of moisture is also found in the different parts of the hide.—H. G. B.

Disinfection of imported hides. U.S. Treasury Circular, Jan. 28th, 1908. B. of T. Jnl., Apr. 30, 1908. [T.R.]

Upon the recommendation of the Secretary of Agriculture, Department Circular No. 48 of 18th July, 1907 (this J., 1907, 978, 1190), relative to the disinfection of imported hides, is hereby revoked.

In accordance with the provisions of T. D. 23212 of 30th July, 1901, certificates of disinfection will be required upon the entry of all hides of neat cattle when not dry-salted or arsenic-cured from the countries of Europe, Africa, Asia, Australia, and South America.

Dry hides, which have been salted or arsenic-cured, will be considered as having been disinfected by the process of curing, and need not be submitted to any further treatment. Dry hides which have not been salted or arsenic-cured should be disinfected. Disinfection with sulphur dioxide may be accepted in case a room is provided which can be tightly closed, and also in case the bundles of hides are undone and each hide suspended separately from the ceiling in such manner that there may be free circulation of the sulphur fumes and that all parts of the surface may be acted upon. There should be at least 4 pounds of sulphur burned to each 1,000 cubic feet of air space, and the room should be kept closed and the hides subjected to the sulphur dioxide for six hours; or the dry hides may be immersed in a 4 per cent. solution of carbolic acid, or a 1 to 1,000 solution of bichloride of mercury until they are thoroughly wet with the disinfectant. Fresh or moist hides, whether salted or not, should be disinfected by immersion in a 5 per cent. solution of carbolic acid or a 1 to 1,000 solution of bichloride of mercury.

It is further directed that hides of neat cattle, other than dry-salted or arsenic-cured, the product of the countries above named, will require disinfection as above whenever they shall be shipped *via* the ports of any other country; and that hides, other than dry-salted or arsenic-cured, the product of any country not named above, if transhipped and actually landed at ports in any of the countries named, will require disinfection.

These regulations do not in any way modify or affect any regulations concerning disinfection issued under the quarantine laws of the United States.

Officers of the customs are directed to treat hides of neat cattle shipped to the United States without proper disinfection as prohibited importations and to refuse entry of such hides, including calfskins, hide cuttings or parings, and glue stock, the product of neat cattle, shipped from any of the countries named, except hides, parings, cuttings, and such glue stock, which have been dry-salted or arsenic-cured or lime-dried after soaking for forty days in a strong solution of lime (T. D. 15648 and T. D. 15753) and except abattoir hides the product of Sweden, Norway, and Great Britain (T. D. 20582)* and hides taken from American cattle killed in lairages in Great Britain, in all cases where the invoices are not accompanied by the proper certificates of disinfection issued by the American consular officer in the district from which such hides are imported, and the disinfection of such hides in this country, or storage of the same in general order warehouse will not be permitted, as the passage of diseased hides through the country or storage with other goods would tend to the dissemination of cattle disease in the United States.

Leather ; Japanese —— and its manufacture. W. Eitner. Gerber, 1907, **33**, 337—339.

Japanese leather is a similar product to alum leather, but has the advantage over the latter that when brought in contact with steel or iron, it does not cause rust. The hides, mainly Korean and Chinese ox- and cow-hides, are soaked in the Ischakawa, a mountain river, for about three weeks, after which time the hair can be removed with a blunt knife. The hides are then laid out on the ground, sprinkled with salt, left for 24—48 hours, and finally dried in the sun. After ten minutes' soaking in water, they are coated on both sides with rape oil, which is allowed to soak in. The damp skins are drained over a "horse," thoroughly worked to soften them, and again dried in the sun. The salt is now washed out in the stream, and the hides again dried in the sun. The whole process takes about 2—4 months. No tanning material is employed in the process, the production of the leather being ascribed to the influence of the water of the Ischakawa. Jacayimura on the Ischakawa, where 50,000—60,000 hides are said to be turned out annually, appears to be the only place where this leather can be manufactured, as attempts have been made above and below this town without success. The opinion is that under the river at this point is a bed of alum. A leather similar to this Japanese leather was produced by the author, by liming in "Calcin," unhairing, fleshing, and washing in the usual way. The skins were treated with formaldehyde for 6—8 days, washed, and fat-liquored in soft olive oil soap, with addition of olive oil, when very soft leather was required, then re-washed and dried, damped back and staked.—H. Br.

Patents.

Chrome alum destined for tannery and other like purposes ; Manufacture of ——. E. Meyzonnier fils, Annonay, France. Eng. Pat. 20,679, Sept. 17, 1907.

See Fr. Pat. 381,452 of 1907 ; this J., 1908, 122.—T. F. B.

Tanning materials ; Extractor for ——. S. Depigny and A. Larmet. Fr. Pat. 384,566, Dec. 2, 1907.

The apparatus consists of a vat with one or more transverse partitions above the bottom, or two vats one upon the other, the bottom of the upper vat being perforated. The upper part serves to contain the tanning material, and the lower part to contain the extracted liquor. The lower part is provided with a worm through which passes a current of steam for maintaining constant circulation.
—H. G. B.

Artificial leather and similar products ; Manufacture of ——. L. Gevaert-Naert, Bevere-Audenarde, Belgium. Eng. Pat. 8381, April 10, 1907.

See Fr. Pat. 378,807 of 1907 ; this J., 1907, 1207.—T. F. B.

XV.—MANURES, &c.

Alkali soils : their nature and reclamation. F. T. Shutt. Central Expt. Farm, Ottawa, Canada. Bull. No. 4 (Second series).

Alkali soils occur in the semi-arid districts of Canada—situated more particularly in parts of British Columbia and South-western Alberta. The compounds known collectively as "alkali" comprise chiefly sodium sulphate, carbonate and chloride, magnesium sulphate and occasionally the chlorides of calcium and magnesium. The total amount is extremely variable, and the "alkali" may be confined to the immediate surface or upper six inches of the soil, or it may be distributed through three or four feet. Besides the salts named, which are all injurious to crops, there are notable quantities of potassium compounds, phosphates, and other substances of manurial value. These give to the soil, when freed from "alkali," a high degree of fertility. Two classes of "alkali" are generally recognised, *viz.*, "white" and "black." "White alkali" consists chiefly of the sulphate and chloride of sodium but may also contain chloride and sulphate of magnesium. "Black alkali" is characterised by the presence of sodium carbonate which acts upon and dissolves the decayed vegetable matter (humus) of the soil. It is more pronounced in its action than "white alkali" for sodium carbonate is directly "corrosive." Alkali soils may be reclaimed by leaching and under-draining so as to wash away the "alkali." A soil impregnated with "black alkali" is best treated with a dressing of land plaster (calcium sulphate) whereby the carbonate is converted into sodium sulphate. It is necessary to wash out the resulting sulphate before the soil is fit for bearing crops. Drainage, which is usually exceedingly difficult on "black alkali" soils, is by the use of gypsum made practicable. Heavy and repeated applications of manure—more especially horse manure—have been found of great value for "alkali" spots. Sugar beets are remarkably tolerant of "alkali"; their growth removes large quantities of the mineral salts, so that this crop may so far improve the soil as to make it agreeable to grain. At first such beets may be too bitter for stock. Mangels, though inferior to beets, have also proved fairly satisfactory in removing deleterious salts. Barley, among the cereals, is considered the most successful crop for affected land. The legumes, with the exception of alfalfa and sweet clover, are particularly sensitive to "alkali." Very few vegetables can be successfully grown on "alkali soil."—E. F. A.

Phosphoric acid salts ; Comparison of various —— contained in superphosphates. R. Guillin. Biedermann's Zentr. f. Agrikult. Chem., 1908, **37**, 277—278.

The composition of three commercial preparations and an artificially prepared tribasic magnesium phosphate was as follows :—

	Mono-calcium phosphate.	Dicalcium phosphate.	Aluminium phosphate.	Magnesium phosphate.
Water-soluble phosphoric acid	43·26	1·90	—	—
Citrate-soluble phosphoric acid	45·50	41·26	43·52	—
Total phosphoric acid	46·00	42·10	44·16	40·00
Sulphuric acid .	3·10	0·8	0·11	—
Chlorine	—	2·3	—	—
Aluminium oxide	2·00	traces	26·64	—
Iron oxide			9·68	—
Calcium oxide ..	16·00	39·00	1·04	6·3
Magnesium oxide	—	—	—	31·7
Silica	—	—	8·16	—
Water at 100° C.	13·00	8·00	6·34	22·00

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* T.D. 20582 provides that so far as the countries of Norway, Sweden, and Great Britain are concerned, entry may be allowed of moist hides imported direct therefrom without disinfection, provided the invoice shall contain the declaration of the shipper that the hides are the product of such countries and were stripped from cattle in those countries, and that a certificate shall also be produced from the official veterinarian to the effect that the hides were taken from perfectly healthy cattle.

Comparative manurial trials were made in pot cultures with wheat and buckwheat, with the following results :—

Manure.	Wheat. Dry weight of yield.	Buckwheat. Dry weight of yield.
No phosphate manure	103·3	63·0
Monocalcium phosphate.......	145·0	85·2
Dicalcium phosphate	148·2	87·0
Aluminium phosphate	—	85·4
Aluminium phosphate	146·0	83·5
Magnesium phosphate	141·1	—
Magnesium phosphate	138·7	80·7

It would appear that the dicalcium phosphate is as easily assimilated as the monocalcium phosphate ; that the commercial aluminium phosphate is as good a manure as superphosphate, and lastly that the tribasic magnesium phosphate is likewise easily made use of by plants.
—E. F. A.

Patents.

Drying blood ; Apparatus for ——. E. G. Scott, London. Eng. Pat. 9949, April 29, 1907.

The invention relates to apparatus for drying blood in preparing it for use as a fertiliser. The blood is dried in a closed steam-jacketed pan in which a series of vertical blades is rotated and which is also provided with fixed blades spaced between the rotating blades. The outermost rotating blade is of such a shape that it scrapes the interior of the vessel and prevents accumulation of deposits. The vessel is exhausted and provided with a baffle chamber through which the vapours pass on their way to the vacuum pump. The vapours are first treated with a spray of water and are then delivered beneath the bars of a furnace, where they are burned to prevent nuisance.
—W. H. C.

Manure products containing phosphorus ; Manufacture of ——. C. N. Riiber, Christiania. Eng. Pat. 24,891, Nov. 9, 1907.

See Fr. Pat. 383,779 of 1907 ; this J., 1908, 414.—T. F. B.

Sodium silicofluoride and fertilisers. Ger. Pat. 188,651. *See* VII.

XVI.—SUGAR, STARCH, GUM, &c.

Patents.

Grape sugar (glucose) and ethyl alcohol ; Process for making —— *from materials containing cellulose.* G. Ekström, Limham, Sweden. Eng. Pat. 18,341, Aug. 13, 1907.

See Fr. Pat. 380,358 of 1907 ; this J., 1908, 32.—T. F. B.

Starch ; Apparatus for the recovery of ——. H. Benoist and L. Graillot. First Addition, dated Dec. 7, 1907, to Fr. Pat. 373,174, Dec. 21, 1906 (this J., 1907, 704).

In the original arrangement the machine had to be stopped in order to withdraw the concentrated charge. This addition relates to a device for discharging the concentrated pulp whilst the centrifugal machine is in motion. The device consists of a tube which enters the machine from above and terminates in a kind of scoop. The tube is supported with slight friction in another tube, the latter being cast in the frame of the machine. When the charge is sufficiently concentrated, the supply is stopped, and the inner discharge tube is turned round, by means of a hand-wheel, so that the scoop comes into play and the pulp is forced up the pipe whilst the machine is still running.—J. F. B.

XVII.—BREWING, WINES, SPIRITS, &c.

Barley ; Determination of the extract of —— *by the formaldehyde method.* A. Reichard and G. Purucker. Z. ges. Brauw., 1908, **31**, 185—186. (See also this J., 1908, 461.)

The following method for determining the extract yielded by barley, avoids the 15 hours' stand of the mash necessary when no formaldehyde is employed. The malt extract used, of which 100 c.c. are required for each estimation, may be prepared by any of the ordinary methods, that used in the authors' experiments being made by digesting 1 part of pale malt with 4 parts of water for several hours, and filtering. 25 grms. of the fine barley grist, weighed out from a larger quantity, are mixed with 30 c.c. of the malt extract taken from a weighed quantity of 100 grms., 100 c.c. of water, part of which is used to wash out the pipette used for the malt extract, and 1·5 c.c. of 36—37 per cent. formaldehyde solution. The mixture is placed in a mashing bath at 50° C. and stirred for half an hour, after which its temperature is raised in 20 minutes from 50° to 70° C. ; it is then boiled vigorously and stirred for two minutes, and next cooled to 50° C., at which temperature the remainder of the malt extract is added, the whole being then heated from 50° to 70°, maintained at 70° for 15 minutes, cooled, and made up to 250 grms. with water. After filtration the specific gravity of the wort is determined and the extract yielded by the barley calculated in the usual way. When this method is employed, it is unnecessary to boil the residual grains to ascertain if they contain unsaccharified starch. The method is found to give satisfactory results.—T. H. P.

Malt analysis ; Notes on ——. F. Bower. J. Inst. Brewing, 1908, **14**, 154—159.

The author describes some rapid methods of malt analysis. Previous to grinding, a device is employed for measuring the malt, consisting of a block of wood bored along its length with several holes which are closed by wooden plugs fixed to a thin piece of wood. Thus plugged, the holes contain when filled and struck with a sliding cover, an amount of English malt corresponding approximately with the weights required for the different determinations. The grinding is performed in an ordinary coffee mill with horizontal axle. For the determination of extract, 20 grms. of the malt are mashed in a flask graduated to hold 206 c.c., first for 55 minutes at a temperature of 150° F., and then for 5 minutes at 158° F. 150 c.c. of filtered wort are obtainable, and this, placed in a specially shaped jar, is sufficient to float a gravimeter having a fine stem giving 1° sp. gr. for a length of 1¾ in. To determine moisture, 10 grms. of malt in a small shallow dish are placed in a drying oven over night. A low result is obtained if the heating be continued for 24 hours. The Lintner tube method is followed in determining diastatic power. The colour determination is carried out on the same cold water extract.—E. F. A.

Malts ; Use of copper or brass beakers in the determination of "extracts" in ——. A. R. Ling and G. McLaren. J. Inst. Brewing, 1908, **14**, 160—166.

Brass beakers, the internal surface of which have become "bronzed," give low extract results when used for mashing, the error amounting to more than 1 lb. for pale malts and 2 lb. for brown malts. The activity of copper as a poison for diastase is shown by the fact that the largest amount of copper found in the wort made in "bronzed" beakers was equal only to one part in 700,000. Malt extract is very liable to dissolve copper, probably on account of the presence of amino-acids.
—E. F. A.

Yeast ; Carbohydrates of ——. W. Meigen and A. Spreng. Z. physiol. Chem., 1908, **55**, 48—73.

1. *Yeast-gum.* This was prepared, in the first place, by the method of Nägeli and Loew (Annalen, 1878, **193**, 322). It dissolved easily in water, alkalis, and acids to a yellowish, slightly opalescent liquid, and was precipitated

by alcohol, alkaline lead acetate solution, baryta water, and Fehling's solution, but had no reducing action on the last-named. The optical rotation in neutral aqueous solution, of the ash-free substance dried at 110° C., was $[\alpha]_D = +58{\cdot}5°$; and was not affected by addition of alkali or by prolonged boiling of the alkaline solution. The gum was hydrolysed by means of 3 per cent. sulphuric acid. From the reaction product, mannose and dextrose were isolated; mannose was present in larger quantity than dextrose. Yeast-gum prepared by Hessenland's method (Z. Ver. Deutsch. Zuckerind., **42**, 671) had the rotatory power, $[\alpha]_D = +47{\cdot}7°$. The gum was also prepared by Salkowski's method (this J., 1894, 411, 1213), and had the rotatory power, $[\alpha]_D = +89{\cdot}6°$. It had the composition, $C_{12}H_{22}O_{11}$, and contained twice as many mannan groups as dextran groups. Salkowski's yeast-gum must be regarded as an individual substance, a dextromannan; it was not affected by boiling for several hours with milk of lime. The "gums" obtained by the methods of Nägeli and Loew and of Hessenland on the other hand, yielded a product identical with Salkowski's yeast-gum when further purified.

2. *Yeast-cellulose.* The yeast was freed from gum by treating 1200 grms. of the fresh material with 12 litres of a cold 0·25 per cent. solution of potassium hydroxide, the alkali solution being frequently renewed during a period of six months. The residue was well washed with water by repeated decantation and centrifuging, then purified by means of alcohol, triturated with ether, and dried with the aid of the pump. In this way 150 grms. of a fine greyish-white powder were obtained, which was coloured brown by iodine and sulphuric acid and by a solution of iodine in potassium iodide, the brown colour being again destroyed on washing with water. The product was not coloured blue by the zinc chloride-iodine reagent, and was insoluble in cuprammonium solution. 20 grms. of it were heated on the water-bath for 10 hours with 3 per cent. sulphuric acid: 8·6 grms. of insoluble matter were left. The solution was boiled for a further half-hour, and then tested for sugars: dextrose was present, but no mannose, galactose, pentoses, or methylpentoses. The insoluble residue on further hydrolysis also yielded only dextrose. The carbohydrate yielded by the yeast cell-wall is thus a hemicellulose (dextran). In order to obtain the yeast-dextran in a pure condition, the yeast, after removal of the gum, was boiled for 4 hours with a 15 per cent. solution of sodium hydroxide, the solution concentrated and treated with an equal quantity of alcohol, and the white flocculent precipitate washed with alcohol, and freed from moisture by treatment with alcohol and ether. It was then dissolved in water, and the solution exactly neutralised with hydrochloric acid, purified by dialysis until free from chlorine, evaporated, and precipitated with alcohol. The dextran thus obtained was soluble in water, and was precipitated from its solution by lead acetate and baryta, but not by Fehling's solution. The aqueous solution was opalescent. The rotatory power of the dextran in neutral aqueous solution was $[\alpha]_D = +113°$. Yeast-dextran is identical with Salkowski's "erythrocellulose" (this J., 1895, 376). The portion of the yeast remaining insoluble after boiling with dilute sulphuric acid was a brownish powder, containing no nitrogen, and which gave no permanent coloration with iodine and sulphuric acid. The authors name this product, "yeast-cellulose"; it is identical with Salkowski's "achroocellulose." "Yeast-cellulose" is not a true cellulose. It has the composition, $C_6H_{10}O_5$, and yields equal proportions of dextrose and mannose on hydrolysis; it is therefore a mannodextran. In the authors' opinion the "yeast-dextran" and "yeast cellulose" are transformation products of hemicelluloses present in the original yeast.—A. S.

Yeast cell-juice; Properties of —— and production of zymase in yeast. E. Buchner and F. Klatte. Biochem. Zeits., 1908, **9**, 415—435.

The authors have studied the optical rotation of expressed yeast cell-juice under various conditions. Fresh cell-juice from Berlin yeast was found to possess a slight dextro-rotation, ranging from +1·68° to +2·48° in a 100 mm. tube. Juice similarly prepared from Munich yeast was practically inactive, showing rotations ranging from +0·12° to −0·28°. The difference between the two kinds of yeast is due to the fact that the Berlin yeast was obtained fresh from the brewery and was therefore rich in glycogen, whereas the Munich yeast, having undergone a long journey, had lost most of its glycogen. The other optically-active constituents of the juice therefore compensate each other. If the coagulable proteins be precipitated by heat and removed, the dextro-rotation of the filtrate is increased by 0·70°—1·28°; these proteins are therefore lævo-rotatory. If cell-juice from Berlin yeast be kept for one day, its rotatory power decreases owing to the disappearance of the glycogen; from then up to 4 days the optical rotation remains stationary at practically *nil*, until autolysis is far advanced. When cell-juice was mixed with dextrose and allowed to ferment, the decrease in rotation was always considerably smaller than the decrease calculated for the dextrose fermented, as measured by the carbon dioxide evolved. This would point to the formation of a dextro-rotatory polysaccharide at the expense of the dextrose (see Harden and Young, this J., 1904, 450). In some cases the decrease in rotation could be made to correspond fairly closely with that calculated from the dextrose fermented, by the addition of secondary sodium phosphate. If yeast cell-juice be concentrated *in vacuo* at 25°—30° C., a syrup is obtained; this syrup rapidly loses its fermentative activity, but the proteolytic activity of the endotryptase is preserved unchanged for several months. The authors have studied the effect of revivifying the yeast, before pressing out the juice, on the fermentative activity of the latter. By aëration in a saccharine medium, poor in nitrogen, for 4—8 hours, or by growing the yeast in presence of asparagine and primary potassium phosphate, according to Lange's method of regeneration (this J., 1907, 1104), the activity of the juice may be considerably increased, in some cases up to 7—8 times. But the experiments showed that this increase in activity only represented the replacement of the zymase previously lost by the yeast, and in no case did the activity of the juice from the regenerated yeast exceed the normal for fresh yeast in good condition. Secondary potassium phosphate has no such regenerative effect.—J. F. B.

Water [in malting and brewing]. H. Seyffert. Z. ges. Brauw., 1908, **31**, 169—171, 186–188.

Calcium carbonate can exist in a water together with calcium sulphate, provided that sufficient carbon dioxide is present to keep the sodium carbonate in solution as sodium bicarbonate. In such a water, the sodium carbonate and calcium sulphate can only react after the free and the loosely-bound carbon dioxide have been expelled. Such expulsion requires, however, protracted heating, several hours being necessary at ordinary mashing and sparging temperatures. It is therefore possible for the sodium carbonate in a water to act as such in spite of the presence of calcium sulphate. The appearance of a red coloration when a water is boiled with hops, is a sure sign of the presence of sodium carbonate in the water. This coloration does not appear when the water contains a sufficient amount of calcium sulphate. Calcium carbonate in a water causes a reddish-brown coloration on boiling with hops, but this coloration does not appear if calcium sulphate is present in the proportion of 1 part per 2·5 parts of the carbonate. An increase in the amount of calcium carbonate in the water endows the hop decoction with improved head-retaining properties. The unpleasant bitter flavour of the beer obtained in certain breweries when the normal proportion of hops is employed, is traced by the author to the action of small quantities of sodium carbonate in the water. For the analysis of brewing waters, the author recommends the following method, by means of which these small proportions of alkali carbonates may be estimated. The lime, magnesia, ferric oxide, alumina, silica, nitric acid, etc., are determined by the ordinary methods. 500 c.c. of the water, or a larger quantity with very soft water, are mixed with 10 c.c. of $N/_1$- sulphuric acid and evaporated in a basin on the water-bath to 250 c.c., after which it is titrated with standard baryta or sodium carbonate solution. In this way the amount of sulphur trioxide required to convert the carbonates into sulphate, and the amount of combined carbonic acid, are obtained. The quantities of sulphur trioxide equivalent to the chlorine, silica, nitric acid, etc. are calculated and are added to the amount of sulphur trioxide originally present in the water and the amount of sulphur trioxide found necessary to expel the carbonic acid. The sum represents the amount of sulphur trioxide required to convert all the bases present into the corresponding sulphates. From this sum are subtracted the various amounts of sulphur trioxide equivalent to all the bases present. Any remainder indicates the presence of alkalis in the water and is calculated as sodium oxide existing as alkali. In Great Britain this alkali may be converted into sodium chloride by the addition of the calculated amount of hydrochloric acid, but in Germany such addition is illegal.—T. H. P.

[*Brewing*] *Coppers and copper settings.* J. C. Shears. J. Inst. Brewing, 1908, **14**, 233—249.

The author describes the various forms of coppers used by brewers and the modes of manufacturing, setting and heating them. In fire-heated coppers he considers that the bottom should be as large as possible consistently with the sides being well inclined and curved in the flue, while the depth of liquor should not exceed 9 feet. The rivet lines should be arranged so as to be away from the direct line of draught, which causes corrosion of the seams. Fire-heating is considered superior to steam heating at less than 50—60 lb. pressure. Steam-heating is best applied from a jacket preferably supplied with superheated steam. The metal used should not be a pure copper, an alloy containing about 1 per cent. of arsenic having proved most resistant to fire heat. To prevent the hops burning on the bottom of the copper, it is usual to fix a mechanically driven rouser, and the author describes one consisting of a short cone of steel plate suspended some 18 inches from the bottom of the copper; this rouser is very efficient and does not cause the wear which accompanies the use of the chain rouser generally employed. "Wheel" and "split draught" flue settings are preferred to the "pigeon-hole" setting which is described as producing an "oven" or stagnant heat most detrimental to the life of the copper.—R. L. S.

Distillery; Practical application of pure cultures in the ——. P. Schidrowitz. J. Inst. Brewing, 1908, **14**, 264—280.

This is a description of the "Amylo" process of preparing alcoholic liquids for distillation as carried out at Seclin and other places. The raw grain, maize or rice, is treated with about 0·2 per cent. of sulphuric acid, which is only sufficient to neutralise the alkali carbonates and convert the phosphates into acid salts, leaving the mixture neutral to methyl orange. The mass is then liquefied by heating for one hour in a converter under 60 lb. pressure and afterwards transferred to the closed steel fermenting vessel in which it is again boiled, to secure the sterility of the vessel and fittings, and then cooled. The cooled mash at a sp. gr. of 1·060—1·090 is pitched with a pure culture of *mucor* and stirred to avoid the formation of a pellicle of mycelium. After about 20 hours the sweet wort produced by the action of the diastase secreted by the mucor is fermented by the addition of a pure culture of yeast. The gravity of the wash obtained is usually 1·0. The yield of spirit is high—in the case of maize between 7·6 and 8 gallons per cwt. of material—and the author considers that by the "Amylo" process an economy of 2·5 to 3d. per proof gallon of spirit is effected over the ordinary methods. He regards the process as suitable to the production of high-class plain spirit as well as of industrial alcohol, and, with certain modifications, as probably being available for the manufacture of whisky.—R. L. S.

Wood alcohol in Germany. U.S. Cons. Rept.; through Oil, Paint and Drug Rep., Apr. 27, 1908. [T.R.]

The production of wood alcohol (100 deg.) in Austria-Hungary and Germany is about 6,500,000 kilos. The estimated production of acetate of lime is from 27,000 to 28,000 metric tons, and about 110,000 tons of charcoal are produced. The importation of crude wood spirit into Germany for the first ten months of 1907 was 5,543·3 metric tons, of which 1,405·6 tons came from Austria-Hungary and 4,018·2 tons from the United States. The imports of crude acetone during the same period were 55·9 tons, most of which came from Austria-Hungary. The exports of crude wood spirit and acetone were 1,013·6 tons, of which 499 tons went to France, 152·3 tons to Great Britain, and 175·4 tons to Switzerland. The imports of refined wood alcohol were 97·4 tons, of which 95·3 tons came from Austria-Hungary. The exports of the refined product were 893·7 tons, of which France received 511·4 tons, Great Britain 110·6 tons, and Switzerland 94 tons. The exports of refined acetone were 685·5 tons, of which 510 tons went to Great Britain and 52·3 tons to British India.

Patents.

Malting apparatus. W. P. Rice, Chicago. U.S. Pat. 885,291, Apr. 21, 1908.

Two malting chambers (units) are arranged end to end with a space between them. Each unit is provided with a series of malting shelves which consist of flexibly-jointed sections, movable on rails from the supporting recesses of one unit, across the space, into the recesses of the other unit. The shelves move across an adjustable bridge, and arrangements are made either for moving each shelf with its charge from one unit to the other, or, when desired, for discharging the charge into the space across which the shelf travels. A device is also provided for loading a fresh charge on the shelf as it moves back into its first position, the grain being levelled by a levelling board.—J. F. B.

Beer wort; Process and apparatus for the production of ——. H. Breker, Cologne, Germany. Eng. Pat. 8682, April 15, 1907.

See Fr. Pat. 370,401 of 1906; this J., 1907, 270.—T. F. B.

Fusel-oil and its components; Process for the manufacture of ——. F. Ehrlich, Assignor to A. Sultan and I. Stern, Berlin. U.S. Pat. 885,591, April 21, 1908.

See Eng. Pat. 6640 of 1906; this J., 1906, 999.—T. F. B.

Peat; Treatment of —— [for producing alcohol, etc.]. G. J. L. Pradel. Fr. Pat. 385,015, Feb. 22, 1907.

See Eng. Pat. 5128 of 1907; this J., 1908, 416.—T. F. B.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

(*A.*)—FOODS.

Endomyces fibuliger, a new fermentation fungus and producer of the so-called chalk disease of bread. P. Lindner. Z. Spiritusind., 1908, **31**, 162—163, 177, 189—190.

This organism, which forms white, chalky spots on bread, closely resembles *Monilia variabilis*, from which it differs, however, by its ability to liquefy wort-gelatin. When it is cultivated in a drop of hopped wort, the mycelia soon exhibit the phenomenon of clasp-formation (Schnallenbildung) so often observed with the *Basidiomycetes*, while the older hyphæ undergo auto-digestion or emptying; at the edge of the drop are found the more vigorous cells with lateral yeast-like buds. Most of the conidia have the shape of a grape-stone, the free end being rounded and the basal part sharply pointed. Under certain conditions, *Endomyces fibuliger* forms asci containing hat-shaped spores similar to those obtained with *Saccharomyces anomalus*; each ascus contains mostly four, but sometimes only two spores, which are generally placed brim to brim. The fungus is the first known member of the ascomycetes which is at the same time a fermentation organism, a budding fungus, and a true hyphomycetes. The organism ferments sucrose vigorously, dextrose, *l*-mannose and lævulose with moderate rapidity, and raffinose, lactose, rhamnose, α-methylglucoside, and a mixture of *l*-sorbose and *d*-galactose only slightly. A large number of illustrations are given showing the organism in the various stages of its growth.—T. H. P.

Patents.

Vegetable nitrogenous nutrient ; Process of manufacturing ——. K. Okazaki and H. Yenjo, Tokyo. Eng. Pat. 8262, April 9, 1907.

See Fr. Pat. 376,373 of 1907 ; this J., 1907, 1025.—T. F. B.

Butter ; Process and apparatus for the de-acidification and purification of old ——. J. Bredenkamp, Barmen, and H. Christiansen, Ottersberg, Germany. Eng. Pat 8422, April 11, 1907.

See Fr. Pat. 375,075 of 1907 ; this J., 1907, 887.—T. F. B

(C.)—DISINFECTANTS.

Patent.

Formaldehyde ; Composition for generating ——. A. Eichengrün, Dusseldorf, Germany, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 885,233, Apr. 21, 1908.

A composition which generates gaseous formaldehyde and water vapour, when treated with water, is made by mixing polymeric formaldehyde (paraformaldehyde) with salts of permanganic acid and fixed alkaline compounds. —J. F. B.

XIX.—PAPER, PASTEBOARD, &c.

Wood-pulp ; Destruction of sodium sulphide in the liquors from sulphate ——. A. Ahlin. Papier-Zeit., 1908, **33**, 1181—1182.

The author discusses the question of the destruction of sodium sulphide in the process of recovering and causticising the alkaline liquors used for boiling wood by the sulphate process. The liquor obtained by the lixiviation of the recovered black soda ash contains sodium silicate as an impurity. The silica is generally separated from its combination with the alkali by passing carbon dioxide through the liquor or by adding sodium bicarbonate before causticising. The silica thus precipitated, is in a highly gelatinous form. If, however, more carbon dioxide be supplied than is necessary to liberate the silica, it will decompose the sodium sulphide and sulphuretted hydrogen will escape. The gelatinous silica causes great difficulty in decanting and washing, so that even with the most careful practice, about 5 per cent. of the alkali of the liquor is lost in the mud. By omitting the treatment with carbon dioxide, and adding a large excess of lime at first, the sodium sulphide is protected, but a gelatinous calcium silicate is precipitated which largely increases the volume of the mud and retains alkali. In concentrated liquors, *e.g.*, those with a density of 15° B., both the sodium hydroxide and the sulphide may undergo double decomposition with the calcium carbonate of the mud, and calcium hydrosulphide is formed This is oxidised by the air to form calcium thiosulphate, which reacts with the sodium sulphate in the liquor, giving sodium thiosulphate and calcium sulphate. The loss of sodium sulphide which thus takes place is higher the higher the degree of causticisation of the liquor. This ratio between the causticised and uncausticised alkali should always be kept as constant as possible and should only be varied when it is desired to vary the properties of the resulting pulp.—J. F. B.

Manila hemp ; Boiling —— *for paper making.* Papier fabrikant, 1908, **6**, 663—664.

The best method of treating dirty, tarry and greasy ropes of any kind is as follows :—7·5—8 cwt. of chopped rope are loaded into spherical rotary boilers containing 1·75 cwt. of caustic soda previously dissolved in sufficient hot water. The charge is boiled under a pressure of 2 atmospheres for 18—20 hours. After boiling, the liquor is discharged, the boiler is filled up again with hot water, and the contents are washed with this for an hour whilst rotating. This liquor is then run off and replaced by fresh hot water, the washings being repeated as long as the waters come away dirty. The contents of the boiler are then mixed with water, to which are added 4 buckets-full of thick, slaked lime-mud, and boiled again for 8—10 hours under a pressure of 2 atmospheres. The charge is rinsed with hot water in the same way as before, and is then ready for the breaking engines. Although this treatment is lengthy and costly, the perfect freedom of the product from tarry matters is ensured, and the relatively high prices obtained for Manila papers easily cover the cost of the process.—J. F. B.

Patent.

Fibres for the manufacture of paper and of other felted products ; Apparatus for refining ——. P. A. Sparre. First Addition, dated Nov. 21, 1907, to Fr. Pat. 380,243, July 23, 1907.

A machine is described in which paper-pulp or other fibres may be washed after beating and refining, instead of before these operations. It consists of a vertical cylindrical vessel to which is attached a funnel-shaped bottom. Between the conical portion and the cylindrical portion of the vessel is placed a metallic grid covered with fine wire cloth, through which the fibres cannot penetrate. The cylindrical vessel, which contains the pulp to be washed, is provided with fixed arms extending from its sides. Alternate arms corresponding with these are carried by a vertical rotary shaft and serve to keep the pulp in circulation. The wire cloth bottom is kept free from deposited fibres by means of a scraper attached to the shaft and revolving in contact with the wire. Fresh water enters above and the dirty water is discharged through the wire cloth into the funnel.—J. F. B.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

Rhubarb ; Substances in ——, *and related compounds.* O. Hesse J. prakt. Chem., 1908, **77**, 383—390.

Contrary to the opinion of Tschirch (Pharm. Zeit., 1899, **77** ; see also this J., 1901, 497), the author shews that the anthranol, $C_{15}H_{12}O_4$, derived from the emodin of rhubarb, forms bright yellow leaflets melting at 236° C., and is identical with that obtained from *Rhamnus Frangula.* Alemodin, m. pt. 223—224° C., when reduced with hydriodic acid forms a substance, $C_{15}H_{12}O_3$, similar to that obtained from emodin, and which melts at 182° C., and gives an olive-green coloration with ferric chloride. The author corrects some statements concerning rhein made several years ago (Pharm. J. Trans., 1895, **55**, 325). After crystallisation from ethyl acetoacetate, rhein, $C_{15}H_{10}O_6$, forms small yellow needles, which melt at 312°—316° C., with some sublimation. Diacetylrhein was prepared by the action of sodium acetate and acetic anhydride upon rhein. After crystallising from acetic acid, it melts at 240° C. It requires two molecules of potassium hydroxide to dissolve it, and is soluble in sodium carbonate solution. When the solution in sodium carbonate is allowed to stand, the acetyl group becomes replaced by sodium, and sodium-rhein separates as a purple-red flocculent precipitate on standing. The corresponding potassium compound, $C_{15}H_8O_6K_2$, was also prepared.—F. Shdn.

Amygdalin ; Hydrolysis of —— *by emulsin.* S. J. M. Auld. Chem. Soc. Proc., 1908, **24**, 97.

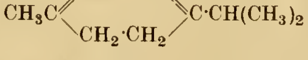
The hydrolysis of amygdalin by emulsin has been studied in detail by determining the hydrocyanic acid produced during the reaction. It has been shown that Jorissen and Hairs' " emulsin " is really a mixture of two enzymes, namely, true emulsin and a maltase-like ferment. Of particular importance is the fact elucidated that the activity of emulsin is intimately bound up with basic and acidic groups, as both acids and alkalis only render the ferment inactive and do not destroy it, except in high concentrations. Contrary to the statements of Tammann, the decomposition of amygdalin by emulsin nearly approaches completion, as much as 97 per cent. of the available glucoside being decomposed as measured by the hydrocyanic acid formed. The end-point of the reaction has been found to be independent of the temperature, and the temperature-coefficients of the action have been measured over a range of 45° C.

Terpenes and essential oils ; Contributions to our knowledge of ——. *Parts* **92** *and* **93**. O. Wallach. Annalen, 1908. **360**, 26—104.

Cyprus origanum oil ; Constituents of ——. *Isolation of a new terpene, "origanene."* S. S. Pickles. Chem. Soc. Proc., 1908, **24**, 91.

THE essential oil yielded by the principal origanum plant of Cyprus has been examined and found to consist mainly of carvacrol (84 per cent.). There are also present (1) a hydrocarbon. $C_{10}H_{16}$, apparently a new terpene, for which the name *origanene* is proposed (2·5 per cent.) ; (2) cymene, which, together with associated terpenes (b. p. 170—180°), constitutes 8·5 per cent. ; (3) terpene alcohols (3·5 per cent.), and (4) a high-boiling residue (1·3 per cent.), besides very small quantities of a second phenol which gives a purple coloration with ferric chloride, and a volatile acid, probably isobutyric acid. The results of experiments on the constitution of the hydrocarbon "origanene" lead the author to conclude that the terpene is probably—

$\Delta^{1:3}$*-p-menthadiene,*



$$CH_3C\left<\begin{matrix}CH{-}CH\\CH_2\cdot CH_2\end{matrix}\right>C\cdot CH(CH_3)_2$$

Bismuth tri-iodophenylate ; A basic ——. O. Carrasco. Boll. Chim. Farm., 1908. **47**, 109—111. Chem. Zentr., 1908, **1**, 1735—1736.

2·4·6-TRI-IODOPHENOL is best prepared by adding gradually, with agitation, a solution of iodine in potassium iodide to a solution of phenol in potassium hydroxide, and separating the iodo-compound by addition of acid (carbonic, sulphurous, or dilute sulphuric acid). The compound is purified by washing with water, decolorising with sulphur dioxide, drying at 40°—50° C., and re-crystallising from benzene ; it melts at 156°—157° C. On shaking an alkaline solution of the compound with an approximately molecular proportion of bismuth nitrate dissolved in a 45 per cent. aqueous solution of glycerol, a heavy, yellow, amorphous powder separates. This precipitate, when washed with water by decantation and dried at 35° C., consists of the monohydrate of bismuthoxytri-iodophenylate, $C_6H_2I_3.O.Bi(OH)_2$. If, however, the precipitate be washed by decantation with water at 80°—90° C., it becomes decolorised and swells up, and the anhydride of bismuthoxytri-iodophenylate, $C_6H_2I_3.O.BiO$, is obtained. This substance has been introduced into commerce under the name of "neoform." It is a yellow powder, insoluble in the usual solvents, and on boiling with water, especially in presence of alkali, undergoes hydrolysis. When warmed with nitric acid, iodine is evolved, and picric acid and bismuth nitrate are formed.—A. S.

Bromates of the rare earths. C. James. J. Amer. Chem. Soc., 1908, **30**, 182—187.

THE author has investigated a large number of compounds of the rare earths, such as sulphites, xanthates, succinates, double carbonates with sodium glycollates, methyl sulphates, iodates, bromates, oleates, etc., with a view to finding types of isomorphous salts greatly varying in solubility, and capable of fractional crystallisation, suitable for the separation of the rare earths. The bromates were found to be best suited for this purpose, and were prepared as follows : The rare earth material, generally as oxalates, is mixed to a paste with sulphuric acid and heated until fumes of sulphuric acid cease to be evolved. The residue is finely powdered, dissolved in ice-cold water, and the solution poured over excess of barium bromate, contained preferably in a large evaporating dish on the water-bath ; the mixture is kept well stirred. The precipitate is allowed to settle, and if no precipitate is produced on addition of warm barium bromate solution to the clear supernatant liquid, the solution is filtered, and evaporated until a drop nearly solidifies when stirred on a watch glass. About half the substance in solution is found then to crystallise out on cooling. By using casseroles instead of porcelain dishes, especially when working with small quantities, rapid crystallisation and also the tendency of the material to creep up the sides of the vessel, are avoided. The most soluble fraction is very pink and gives an intense erbium spectrum. The thulium red is also very strong. The least soluble fraction is still pink, giving intense dysprosium and holmium bands and a weak erbium spectrum. The oxide of this fraction is orange coloured, showing that terbium collects at this end. After about 20 fractionations, the least soluble portion forms brilliant colourless crystals, dissolving in water with a greenish-yellow colour and showing faint samarium and holmium but stronger dysprosium bands. Practically the whole of this fraction consists of yttrium. The most soluble fraction is reached when the solution is nearly colourless and consists then largely of ytterbium. The results show that the rare earth bromates arrange themselves in the following order of solubility : Samarium, terbium, dysprosium, holmium, yttrium, erbium, thulium, and ytterbium—which is similar to the order of solubilities of the oxalates in ammonium oxalate. The bromate method gives especially rapid separations of thulium from erbium and ytterbium. It is concluded that the use of the ethyl sulphate method in conjunction with the bromate method would give a good separation of yttrium from dysprosium and holmium, and of thulium from ytterbium.—W. S.

Rare earths ; A scheme for the separation of the ——. C. James. Chem. News, 1908, **97**, 205—209.

A COMPARATIVELY simple scheme for the separation of mixtures of the rare earths is offered, based upon the results of several years' investigation of the various methods proposed for fractionation, and personal trial of the applicability of many other compounds which had not previously been employed for the separation of these elements.

The nearest approach to a quantitative separation is found in the case of cerium. This is due to the fact that the properties of the metals of all these earths and of their salts, with the possible exception of cerium itself, vary among themselves by very minute differences. Bearing these observations in mind, the following scheme is presented :—The mineral is decomposed either by hydrochloric acid, sulphuric acid, potassium bisulphate, sodium hydroxide, or hydrofluoric acid. When hydrochloric acid is used, the whole is evaporated to dryness to render the silica insoluble. It is then warmed with a little concentrated hydrochloric acid, after which the mass is treated with water and filtered. The filtrate may then be precipitated either by oxalic acid or ammonium oxalate. If the liquid contains a large excess of mineral acid, ammonium oxalate is to be preferred. When sulphuric acid or potassium bisulphate has been used to break up the mineral, it is necessary to stir with cold water to obtain the solution of the desired elements. Fusion with sodium hydroxide and washing with water gives a residue of oxides. These are dissolved in hydrochloric acid. Hydrofluoric acid decomposes many minerals, such as niobates, tantalates, &c., in the cold, giving a residue of rare earth fluorides, while silicon, niobium, tantalum, &c., go into solution. The insoluble fluorides are decomposed by means of sulphuric acid. The sulphate or chloride solutions are then precipitated either by ammonium oxalate or oxalic acid, as mentioned above. Having obtained the earths in the form of oxalates, they are treated as follows :—

Zirconium and thorium.—Should the rare earth oxalates contain these elements, they may be separated by boiling with a solution of ammonium oxalate, when the whole of the zirconium and nearly all of the thorium pass into solution. The residue is filtered off and washed with ammonium oxalate solution. On the addition of an excess of hydrochloric acid to the filtrate, thorium oxalate alone is precipitated, while the whole of the zirconium is held in solution by the oxalic acid produced by the action of the hydrochloric acid on ammonium oxalate. As zirconium oxalate is soluble in an excess of oxalic acid, this reagent alone may be used in the absence of thorium. In this connection it should be remembered that the oxalates of cerium and of the earths of the yttrium group are somewhat soluble in hot concentrated ammonium oxalate solution, so that varying amounts go into solution. Thorium can, however, easily be separated from the yttrium earths which remain with it, by means of the double sulphate of thorium and potassium, which is insoluble in a solution of potassium sulphate, while the corresponding compounds of the yttrium group are soluble. The crude thorium oxalate is converted into sulphate, and the cold solution is stirred with solid potassium sulphate. Sulphate solutions of the earths are the best to work with for this purpose, for if other compounds are used, care must be taken to keep the solution from being too concentrated, otherwise members of the yttrium group may be precipitated also. After the removal of the yttrium earths, cerium earths are still present, and thorium may be separated from these by means of the solubility of its oxalate in ammonium oxalate, or, according to Glaser, by the solubility of thorium oxalate in ammonium acetate (this J., 1896, 675; 1897, 468); also by the method of Wyrouboff and Verneuil, in which thorium is precipitated by hydrogen peroxide (this J., 1898, 265, 1068). These methods are given under the separation of cerium and thorium, because under usual conditions these separate together from the rest of the rare earths.

In the next step there are three alternatives which depend upon the composition of the oxalates as approximately determined by the solubility of the double sodium or potassium sulphates in potassium or sodium sulphate solution, viz.:—(*a*) If containing 20 per cent. or more of the yttrium earths and only a trace of thorium; (*b*) if containing 20 per cent. or more of the yttrium earths together with thorium; (*c*) if containing less than 20 per cent. of the yttrium earths.

(*a*) When the material consists of 20 per cent. or more of the yttrium earths and practically no thorium, the oxalates are converted into sulphates by mixing with strong sulphuric acid and carefully igniting until fumes of sulphuric acid are no longer evolved. The residue is then powdered and dissolved in ice-cold water. The resulting sulphate solution is stirred with solid sodium sulphate, which throws down the double sulphates of sodium and the cerium earths. Another method, which is simpler if the oxides will dissolve in acids, is to ignite the oxalates, and dissolve the oxides so obtained in hydrochloric acid or nitric acid, dilute the solution, and treat with solid sodium sulphate until the double sulphates are precipitated. However, when oxalates rich in cerium are ignited, the oxides which are formed dissolve with great difficulty in hydrochloric or nitric acid, and so in this case it is better to treat the oxalates with sulphuric acid as mentioned above. Extra care must be taken when the chlorides or nitrates in solution are stirred with solid sodium sulphate, for if the solution is too concentrated, metals from the yttrium group will be precipitated also. This precipitate contains some of the yttrium group of earths, while small amounts of samarium, gadolinium, and europium remain in solution. The precipitate is separated by filtration and washed with a solution of sodium sulphate. The insoluble double sulphates consist chiefly of cerium, lanthanum, praseodymium, neodymium, samarium, europium, and gadolinium, together with small amounts of the yttrium earths in which the terbium, dysprosium, and holmium contents are considerably increased. These double sodium sulphates constitute Fraction A. The filtrate, on the addition of an excess of oxalic acid, throws down the oxalates of terbium, dysprosium, holmium, yttrium, erbium, thulium, ytterbium, and scandium, together with some samarium, europium, and gadolinium. This precipitate forms Fraction B.

(*b*) The composition of the oxalates in this case is very similar to (*a*), the only difference being the thorium content. The sulphate or chloride solution is treated with sodium sulphate and the insoluble double sodium cerium group sulphates, forming Fraction A, filtered off. Since sodium thorium sulphate is somewhat soluble in sodium sulphate solution, the filtrate is saturated with potassium sulphate, when the remaining thorium is precipitated as thorium potassium sulphate insoluble in potassium sulphate solution. After separating the precipitate, the filtrate is treated with an excess of oxalic acid, the insoluble oxalates being filtered off and washed. This material is added to Fraction B.

(*c*) In this, the third and last alternative, the oxalates consist almost entirely of the cerium metals, and it is best to start the work of separation from the point A.

Cerium and thorium.—The next operation consists of separating cerium together with thorium, if the latter is present, from the other elements forming Fraction A. This is best carried out by treating the nitrate solution with an excess of zinc oxide and potassium permanganate. If the material is in the form of the insoluble double sodium sulphates, it should be boiled with sodium hydroxide in excess. The resulting hydroxides are filtered off, well washed with hot water, and dissolved in nitric acid. In dealing with oxalates that contain large amounts of lanthanum, praseodymium, and neodymium, it is only necessary to ignite, when the oxides so obtained will readily dissolve in nitric acid. As a rule, when cerium is present in large amounts, since the oxide dissolves with great difficulty, the oxalates are converted into sulphates. The sulphate solution is then poured into fairly strong and boiling sodium hydroxide. The rare earth hydroxides formed under these conditions filter rapidly, and after washing with boiling water are dissolved in nitric acid. The nitrate solution obtained by any of the above methods is neutralised, stirred rapidly by means of a motor, and an excess of zinc oxide added. On the addition of potassium permanganate, cerium peroxide is precipitated, and the addition is continued until the liquid, after continued stirring, remains red. This method leaves a little cerium in solution, which is separated later. The precipitate, consisting of cerium and manganese peroxides, together with thorium and a small amount of lanthanum, praseodymium, and neodymium, makes Fraction C. The filtrate is saturated with sodium sulphate, producing a precipitate of the double sulphates of sodium with lanthanum, praseodymium, neodymium, &c. This, after filtering and washing with sodium sulphate solution, constitutes Fraction D. To this last filtrate, containing small amounts of the yttrium group, an excess of oxalic acid is added. The oxalates so obtained are united with those forming B.

Thorium.—Although thorium is not now considered a rare earth, methods for its purification do not seem to be altogether out of place. The cerium peroxide contains large amounts of manganese, which is first removed by dissolving in strong hydrochloric acid and precipitating the earths by means of solid sodium sulphate until no more insoluble double sulphates separate. The liquid is then filtered, and the precipitate washed with sodium sulphate solution. A portion of the thorium remains in the filtrate, but this can be separated either by means of oxalic acid or else by stirring with solid potassium sulphate.

The cerium sodium sulphate is boiled with an excess of sodium hydroxide, the residue filtered off, washed with boiling water, and dissolved in nitric acid. The nitrate solution is then neutralised by means of ammonia, after which peroxide of hydrogen is added (Wyrouboff and Verneuil, *loc. cit.*), and the whole boiled for a few minutes. Some of the filtered solution should then be tested by treating with an equal volume of hydrogen peroxide and boiling, and the process repeated until no precipitate is thus obtained. The filtrate is reserved for the preparation of pure cerium. The thorium precipitate, having the composition, $Th_4O_7N_2O_5$, is very impure, and may have a yellow or even an orange colour after standing for a short time. It is highly important that the peroxide of hydrogen be free from phosphoric acid, otherwise an insoluble cerous phosphate may be thrown down with the thorium. The crude thorium obtained as above may be purified by treating the nitrate solution with an excess of warm ammonium oxalate. The soluble portion can then be converted into the oxalate, and treated again with warm ammonium oxalate. Thorium can be separated from cerium (Glaser, *loc. cit.*) by the solvent action of ammonium acetate on thorium oxalate. This, as well as the ammonium oxalate method, can be applied to the cerium precipitate. The whole is dissolved in strong hydrochloric acid and precipitated by means of oxalic acid. Glaser says:—"Thorium is separated best by converting the oxalates into sulphates, the greater part of the free acid neutralised with ammonia, the solution boiled, and boiling ammonium oxalate added in excess.

After a short time (as soon as oxalates of the cerium metals have formed, but before the liquid has cooled, a solution of ammonium acetate is added. When cold, the entire cerium group is precipitated as oxalates, while thoria remains in solution. After prolonged standing, best over-night, the insoluble oxalates are removed by filtration (F); in the filtrate precipitate thoria with ammonia in excess, filter, and wash." All the thorium precipitates are accumulated at E. Another treatment or two with hydrogen peroxide in neutral nitrate solution gives a very good thorium product. Thorium can be obtained very pure in the following manner:—Thorium hydroxide is first prepared by adding a slight excess of ammonium hydroxide to a solution of thorium nitrate, and washing well the precipitate thrown down. This is then added to a solution of acetylacetone in absolute alcohol, and the mass heated on the water-bath for a short time, after which it is filtered and allowed to crystallise. The acetylacetonate is then placed in a very small retort and carefully distilled in a vacuum. The portion that condenses in the neck of the retort and in the receiver, is dissolved in concentrated nitric acid, boiled for a short time, diluted with water, filtered, and precipitated by means of oxalic acid. Thorium oxide obtained by igniting this oxalate is absolutely snow-white, even after long ignition. A determination of the equivalent gave an atomic weight of 232·3. Thorium may also be purified by the sulphate method as follows:—Anhydrous thorium sulphate is dissolved in ice-cold water until the liquid is saturated. (According to Urbain, ammonium acetate aids the solution). The filtered liquid is heated to 20° C., when nearly pure thorium sulphate separates. It is then dehydrated, and the treatment repeated two or three times.

Cerium.—F is the starting-point for the preparation of pure cerium. If Wyrouboff and Verneuil's method for separating thorium has been used, the purification is easily carried out by slightly modifying the zinc oxide and potassium permanganate method. If other methods have been used, it is best to convert the oxalates, &c., into nitrates. The liquid is neutralised with ammonia, and treated with hydrogen peroxide in order to remove the last of the thorium. To the solution of cerium nitrate, freed from thorium, sufficient ammonium nitrate is added to form the double salt. An excess of potassium permanganate is run in, and only enough cream of zinc hydroxide added to precipitate most of the cerium, care being taken to leave some in solution, for otherwise praseodymium and neodymium will accompany the precipitate. The whole is then heated by steam, filtered, and washed with water containing a little ammonium nitrate. The precipitate is dissolved in concentrated hydrochloric acid, the solution diluted, and the cerium precipitated with oxalic acid (G). The oxalate obtained by this method usually contains a little zinc and manganese, the latter colouring the oxide brown; so for the final purification, the oxalate is treated with a slight excess of sulphuric acid, and the whole heated until fumes of sulphuric acid are no longer given off. The resulting sulphate is dissolved in cold water, and the filtered solution heated on the water-bath. The sulphate that separates is washed with boiling water. This material should give an oxide with only a pale yellow tint. The mother-liquor is treated with oxalic acid, the oxalate which is thrown down being worked up with the next lot. The filtrate from the cerium peroxide still contains cerium, which is removed by adding an excess of zinc oxide, and more potassium permanganate should the colour be discharged. The precipitate obtained here is mixed with F. The filtrate is precipitated with an excess of oxalic acid, and the insoluble oxalates, consisting of lanthanum, praseodymium, neodymium, &c., constitute Fraction H.

Lanthanum, &c.—Fractions H and D contain lanthanum, praseodymium, neodymium, samarium, europium, and gadolinium, together with small amounts of the yttrium earths and some cerium.

These are best separated from each other by the fractional crystallisation of certain double nitrates, such as those formed by the rare earth nitrates with ammonium, magnesium, manganese, or nickel nitrate. For the separation of lanthanum and praseodymium, the double ammonium nitrates are by far the best, and for separating praseodymium from neodymium the manganese salts are to be preferred. However, when one is working on the large scale it is better to start with the double magnesium nitrates, as the more soluble portions crystallise more readily than is the case with the double ammonium nitrates. The double magnesium nitrates,—$2[M'''(NO_3)_3],3[Mg(NO_3)_2],24H_2O$ (Demarçay, this J., 1900, 462), are prepared by dissolving the rare earth oxides in a known amount of nitric acid. An equal amount of nitric acid is then neutralised by magnesium oxide, after which the two solutions are mixed and evaporated until after blowing on the surface, small crystals form. Water is sprayed over the surface, and the whole allowed to crystallise for about twenty-four hours. The mother-liquor is then poured off and evaporated further, while the crystals are heated with water until dissolved, the correct amount to use being soon learned by experience. Both fractions are again allowed to crystallise for a like period, the concentration of the solutions being such that half of the solid separates on cooling. Two fractions have thus been obtained, and in subsequent fractionations the more soluble moves in one direction and the less soluble in the opposite. After the crystallisation of the second series is complete, the liquid from the most soluble portion is poured off and evaporated, while the liquid from Fraction I. is used as the solvent for the crystals forming Fraction II., adding water or evaporating as may be necessary. The least soluble portion, Fraction I., is again dissolved by heating with water. The above is repeated many times. When the fractions at either end become too small to work, they should miss one crystallisation, and then be added to the next lot. After a few series of crystallisations, the least soluble portion becomes very light coloured, later growing nearly colourless, and finally takes a faint green tinge. When the fractions at this end no longer show the characteristic absorption bands of neodymium, they should be placed aside and mixed together according to the amount of praseodymium contained therein; in other words, fractions of the same colour are united.

The most soluble portion changes very rapidly. It soon takes a yellow colour, and shows a samarium spectrum, together with the bands of dysprosium, holmium, and erbium. Sometimes at this stage the liquid refuses to crystallise, or else a precipitate may form. If either of these things happen, it is best to dilute with water and saturate with solid sodium sulphate to separate the yttrium earths and impurities that have accumulated and interfere with the crystallisation. The insoluble double sodium sulphates are converted back to the double magnesium nitrates in the same manner as already described, and the solution will be found to crystallise readily on evaporation. The filtrate from the double sodium sulphates is precipitated with an excess of oxalic acid, and the oxalates of the yttrium group which are thrown down are added to lot B. The neodymium bands finally become very weak in the most soluble fractions, and these are set aside for the preparation of samarium, europium, and gadolinium. After the samarium has been separated in this manner, the more soluble portion of the remaining fractions rapidly acquires a beautiful amethyst colour, and when this occurs, it is separated from the rest as neodymium. After the process has been continued a little longer, it will be found that the material has been split up into four groups according to the order of their solubilities. Commencing with the least soluble, we have:—1. Lanthanum and praseodymium. 2. Praseodymium and neodymium. 3. Neodymium. 4. Samarium, europium, and gadolinium, together with small amounts of terbium, dysprosium, &c.

Lanthanum.—Lanthanum and praseodymium are best separated from each other according to the method of Auer von Welsbach. (Monatsh, Chem., vi., 477), which consists in the fractional crystallisation of the double ammonium nitrates of the type, $M'''(NO_3)_3,2(NH_4NO_3),4H_2O$. These compounds are crystallised from water containing nitric acid to the extent of one-tenth the weight of the dissolved solid. To prepare the double salts, the oxides are dissolved in the required amount of nitric acid, and for every three parts of acid required for the oxides, two additional parts are neutralised by ammonium hydroxide. The resulting solutions are mixed, filtered, and evaporated until small crystals form on blowing over the surface of the liquid. A little water is sprayed over the surface, and the whole set aside for twenty-four hours. The process of fractionation is then carried out in the same manner as with the double magnesium nitrates. By this method lanthanum ammonium nitrate is soon obtained perfectly colourless, and a saturated solution gives no praseodymium absorption spectrum even when observed through very thick layers. The lanthanum ammonium salt does not enclose anything like the amount of mother-liquor that the double magnesium compound does. Both cerium and praseodymium accumulate in the more soluble portion. The colourless lanthanum salt is dissolved in water, the solution acidified and precipitated by means of oxalic acid. This oxalate is treated with a slight excess of concentrated sulphuric acid, and the whole gently ignited until all free acid has been driven off. The sulphate is powdered and dissolved in water at about 1° C., until the liquid is saturated, after which it is filtered, placed in a water-bath, and gradually raised to 32° C. The solution soon changes to a solid mass, which is placed on a Buchner funnel and washed with hot water. The few grms. that remain in solution are thrown out by means of oxalic acid. The crystallised sulphate may be rendered anhydrous and submitted once again to the sulphate method. This lanthanum gives a fine white oxide.

Praseodymium.—There are two sources for praseodymium; firstly, from the more soluble portion obtained from the purification of lanthanum, and, secondly, from those fractions of the double magnesium nitrates which show a strong praseodymium spectrum. These are not mixed but treated separately. In the first case the crystallisation is carried on until no more colourless crystals separate, praseodymium accumulating in the more soluble fractions together with a little cerium. In the second case the double magnesium salts are converted into the corresponding manganese compounds, which are finally fractionally crystallised from nitric acid of specific gravity 1·3 (Lacombe, this J., 1904, 677). In order to do this, the magnesium double salts are dissolved in water, the solution acidified, and the rare earths thrown down by oxalic acid. The oxalates obtained are washed, dried, and ignited to oxides. The oxides are dissolved in a known amount of nitric acid. An equal amount of nitric acid is then neutralised by manganese carbonate, after which the two solutions are mixed. A precipitate of manganese peroxide is sometimes obtained at this point, but it is easily removed by adding a little oxalic acid and warming. The least soluble portion from this fractional crystallisation that no longer gives any neodymium bands in the spectroscope, is dissolved in water, acidified, and thrown down with oxalic acid. The fractions of praseodymium ammonium nitrate that are free from lanthanum are also dissolved and precipitated by oxalic acid. The praseodymium oxalate from the two sources is then united. This material may be impure owing to the presence of cerium. Cerium can be separated in several different ways. One method consists in treating the nitrate solution with potassium permanganate and a little sodium carbonate. A separation is obtained according to Wyrouboff and Verneuil (*loc. cit.*) by adding a solution of sodium acetate to a solution of the nitrates, and precipitating the cerium by hydrogen peroxide. The above methods throw down a certain amount of praseodymium also, so the precipitate should be worked up again. (Meyer and Koss, this J., 1902, 422, recommend magnesium acetate in place of sodium acetate.)

Neodymium.—Pure neodymium is obtained by continuing the crystallisation of the neodymium magnesium nitrate obtained somewhat earlier. After a few more series of crystallisations, the liquid assumes a beautiful bluish lilac colour, which is seen better when some of the solution is diluted with water. On observing the spectrum, the absorption bands in the blue stand out clearly. When the solution contains samarium or praseodymium, these weaker neodymium bands are usually a little hazy. An excellent test of the purity of neodymium is found by observing the colour of the oxide, which is blue only when pure.

Samarium and europium.—Samarium, europium, and gadolinium are contained in the mother-liquors which were obtained during the fractionation of the double magnesium nitrates. The solutions are evaporated, and the residue fractionally crystallised from nitric acid of sp. gr. 1·3 (Demarçay). The addition of the isomorphous bismuth magnesium nitrate aids enormously in the separation of these elements, as Urbain and Lacombe have shown (this J., 1903, 1365; 1904, 128). Its solubility places it between samarium and europium, and it also assists in the crystallisation of the syrupy mother-liquors, inasmuch as it carries down with it the more crystallisable portions. Samarium is obtained from the least soluble fractions. Europium is separated from the excess of bismuth magnesium nitrate which is found between the samarium and gadolinium fractions. The bismuth is thrown down by hydrogen sulphide, and the mother-liquor precipitated by means of oxalic acid.

Gadolinium.—The fractions between europium and dysprosium, etc., consist mainly of gadolinium magnesium nitrate. The solutions are acidified, and the gadolinium thrown down as oxalate. This is then washed and ignited to oxide. The resulting oxide is converted into the double nickel nitrate of the type $2Gd(NO_3)_3,3Ni(NO_3)_2,24H_2O$ (Urbain, this J., 1904, 1160), which is then fractionally crystallised from nitric acid of density 1·3. Terbium is left in the most soluble portion. Fraction B contains oxalates of terbium, dysprosium, holmium, yttrium, erbium, thulium, ytterbium, and scandium. This material is converted into the anhydrous sulphate, the latter dissolved in cold water, and poured over an excess of barium bromate (James, see preceding abstract). By the fractional crystallisation of the bromates, small amounts of samarium and gadolinium are rapidly separated in the least soluble portion, while the next fractions contain terbium, and give oxides of a deep red brown colour. Dysprosium and holmium are more soluble than terbium. Yttrium places itself between holmium and erbium. The most soluble portion contain erbium, thulium, and ytterbium.

Terbium, dysprosium, and holmium.—These elements are extremely difficult to separate. Operations with the bromates are still in progress. Terbium separates in the least soluble fraction, together with samarium and gadolinium. The separation of dysprosium from holmium is extremely slow, and so much so that the bromate method is of no value for this work. Urbain recommends the fractionation of the double nickel nitrates from nitric acid of density 1·3 to separate samarium and gadolinium from terbium, dysprosium, and holmium. The more soluble portion, consisting of terbium, etc., with some gadolinium, is converted into the simple nitrate, and fractionally crystallised from concentrated nitric acid in the presence of bismuth nitrate. Terbium collects with the bismuth nitrate in the fractions between gadolinium and dysprosium. Fractional crystallisation of the ethyl sulphates gives dysprosium. Small amounts only of dysprosium and terbium have been separated. The preparation of pure holmia has not yet been accomplished.

Yttrium.—Yttrium is obtained from the bromate fractions between holmium and erbium. Some fractions show holmium bands in addition to erbium. It is most easily prepared from the fractions that are free from holmium. The earths are precipitated from dilute boiling solutions of the bromates by the addition of boiling potassium hydroxide solution. The hydroxides are filtered off, washed, and converted into the nitrates. Yttrium is then separated by the method of Muthmann and Rolig (this J., 1898, 789) as follows:—The concentrated neutral nitrate solution is boiled, and a thick cream of magnesium oxide added until the liquid no longer gives the absorption bands of erbium. The fractions that contain holmium in addition to erbium can be put through the same process. Yttrium oxide, obtained by the bromate and magnesium oxide methods, is snow-white, and absolutely free from terbium, etc.

Erbium, thulium, ytterbium, and scandium.—These elements are separated from each other by the continued fractionation of the most soluble portion of the bromates. The erbium solutions become of a beautiful rose tint. Thulium collects between erbium and ytterbium. The mother-liquor contains ytterbium with a very little scandium. The neutral solution is saturated with potassium sulphate, when scandium potassium sulphate separates, as it is insoluble in potassium sulphate solution. The filtrate, on the addition of oxalic acid, gives a precipitate of ytterbium oxalate.

Peppermint oil; Adulterated ——. Ernest J. Parry. Chem. and Drug., 1908, 72, 770.

LARGE quantities of peppermint oil are just now being sold in London and the provinces, containing white petroleum as an adulterant. The following figures represent five samples of this oil:

Sp. gr.	Opt. rot.	Menthol.	Petroleum separated.
		Per cent.	Per cent.
0·892	— 13°	31	46
0·891	— 12°	29	44
0·893	— 14° 30′	29·5	48
0·8875	— 14°	29	49
0·895	— 13°	31	45

In addition to the fact that this oil is adulterated, the adulteration is one which has been held to be injurious to health. The difficulty in exposing this type of sophistication lies in the fact that oil of peppermint is not an article sold to any extent over the counter, and it is only possible to get at the adulteration by taking advantage of the section of the Sale of Food and Drugs Act which allows the inspector to intercept a delivery while in transit.

Cocaine and intoxicating drugs in India; Importation prohibited in certain cases. B. of T. J., May 5, 1908. [T.R.].

THE "Gazette of India" of 11th April last contains a Notification (No. 3,566), dated 9th April, 1908, prohibiting the importation in British India by sea or land, of cocaine by means of post, and also restricting its importation by any other means to cases in which it is imported by persons, or their authorised agents, who have been specially permitted to import the drug by a Local Government or Administration, or by the Madras Board of Revenue. The same issue of the "Gazette" contains a further Notification (No. 3,585), dated 9th April last, prohibiting the importation into the Madras Presidency of intoxicating drugs prepared from the hemp plant (*Cannabis sativa, variety indica*).

PATENTS.

Gelatin capsules and coatings for pastiles, pills and the like; Manufacture of readily soluble ——. H. H. Lake, London. From K. A. Lingner, Dresden, Germany. Eng. Pat. 8638, April 13, 1907.

GELATIN capsules and coatings as ordinarily prepared are not always dissolved in the alimentary tract. According to the present patent, solution is ensured by the incorporation with the gelatin, of enzymes or ferments which effect the solution of the gelatin in the alimentary duct. In order to prevent the gelatin from being dissolved before the capsules are used, the drying of the capsules or coatings is hastened as much as possible, and also the hydrogen or hydroxyl ions of the gelatin solution are maintained at such a concentration by addition of acids or of sodium carbonate that the enzymes or ferments remain inactive until they encounter an alkali or acid in the stomach or bowels. For example:—(1) Gelatin is mixed with sodium carbonate until the reaction is slightly alkaline, and then with 0·2 per cent. of pepsin. Capsules formed of this mass do not dissolve till they reach the stomach. (2) Gelatin presenting an acid reaction is mixed with 0·2 per cent. of pyocyanase. (3) Gelatin presenting an alkaline reaction is mixed with 0·2 per cent. of papain.—E. F.

Mellitic acid; Manufacture of ——. Read Holliday and Sons, Ltd., Huddersfield, and O. Silberrad, Buckhurst Hill. Eng. Pat. 24,662, Nov. 7, 1907.

CARBON, preferably such as will pass through an 80 or 90 mesh sieve, is boiled vigorously with nitric acid (sp. gr. 1·5) until the liquid assumes a pale amber colour; this usually occupies three days. The excess of nitric acid is distilled off at a temperature of 130° to 140° C., and the residue, which contains about 90 per cent. of mellitic acid, is extracted with water.—T. F. B.

Hæmoglobin; Process for the manufacture of preparations of ——. P. Lewy, Berlin. Eng. Pat. 27,113, Dec. 7, 1907.

BY adding pure glycerol to hæmoglobin, obtained from blood by centrifugal action, and free from serum, clear, stable preparations are obtained, containing up to 35 per cent. of hæmoglobin. They can be concentrated by evaporation *in vacuo*, to 60 per cent. strength.—T. F. B.

Hydrazine; Manufacture of ——. F. Raschig, Ludwigshafen on Rhine, Germany. Eng. Pat. 139, Jan. 2, 1908. Under Int. Conv., June 6, 1907.

HYDRAZINE is produced from monochloramine according to the process of Eng. Pat. 22,957 of 1907 (this J., 1908, 91), but without the aid of heat, if a larger quantity of ammonia be employed. The addition to the mixture of certain liquids thicker than water, increases the yields of hydrazine to 40 to 50 per cent. of the theoretical yield; such liquids as 5 per cent. solutions of cane sugar, glycerin, dextrin, or starch are suitable for this purpose. Yields of 60 to 80 per cent. may be obtained by adding solutions of gelatin, albumin, casein, &c., to a mixture of 9 parts of concentrated ammonia solution and 1 part of hypochlorite solution (containing about 70 grms. of active chlorine per litre).—T. F. B.

Camphene; Process of manufacture of ——. Dr. Schmitz und Co. Fr. Pat. 384,955, Nov. 12, 1907.

CAMPHENE is prepared by heating the hydrated haloid of pinene (pinene hydrochloride) with oxides, hydroxides or basic salts in presence of water at a temperature of about 160° C., the mixture being agitated continuously. It is not necessary that the constituents of the mixture should be soluble in water; in the case of the hydroxides of the alkaline-earths, the addition of a chloride of the earthy metal is advantageous, a basic chloride being thus obtained. The reaction is complete in 4—5 hours.
—J. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Moser rays; The so-called ——. E. Legrady. Z. Wissen. Phot., 1908, 6, 60. Phot. J., 1908, 48, 205—207.

PURE, dry hydrogen, nitrogen, and air have no action on photographic plates in the dark, neither has any of the metals in presence of the dry gases. With the moist gases, however, magnesium, zinc, cadmium, and aluminium gave strong images, but copper was inert. The images were strongest when produced in moist hydrogen, and weakest in moist air. It is therefore concluded that this action is due, not to hydrogen peroxide, but to ionised hydrogen. This conclusion is strengthened by the fact that dry hydrogen, in presence of spongy platinum or palladium, acts strongly on photographic plates; platinum and palladium alone are without such action. Moreover, this action on photographic plates is not due to radiation from the metals, since when moist hydrogen and nitrogen were passed through a box containing a piece of metal screened by mica, and a photographic plate, a strong image was still formed.—T. F. B.

PATENTS.

Coloured photographs; Process for production of ——. W. Merckens, Mülhausen, Germany, Assignor to J. H. Smith, Zürich, Switzerland. U.S. Pat. 885,066, April 21, 1908.

SEE Fr. Pat. 376,062 of 1907; this J., 1907, 1029.—T.F.B.

Photographic images; Manufacture of coloured ——. L. Didier, Assignor to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. U.S. Pat. 885,453, April 21, 1908.

SEE Eng. Pat. 7557 of 1905; this J., 1906, 198.—T. F. B.

Vitrification of gelatin ; Process of —— for photographic and coloured transparencies. J. Bernheim and V. Mathieu. Fr. Pat. 384,491, Feb. 5, 1907.

The process consists in hardening a film of gelatin by immersion in a solution of formic acid, sodium silicate, or any other substance possessing the property of hardening gelatin without impairing its transparency, with the object of obtaining a resistant gelatin film. The image is obtained by sensitising a film of gelatin in a 10 per cent. solution of potassium bichromate, exposing under a negative in the usual manner, squeegeeing on a glazed support, and developing in water at 40° C. The film on its support is then washed, soaked in a 10 per cent. solution of alum, and dried. A 10 per cent. solution of hard gelatin is run on the back of the film and allowed to set, after which the film is immersed in a solution of formic acid or other substance as above for 30 minutes, dried, and detached from the glazed support. The process is applicable to coloured as well as to photographic transparencies.—F. C.

XXII.—EXPLOSIVES, MATCHES, &c.

Cellulose ; Action of anhydrous nitric and sulphuric acids on ——. B. Rassow and W. v. Bongé. Z. angew. Chem., 1908, **21**, 732—737.

The authors investigated the action of acid mixtures, containing varying proportions of 100 per cent. sulphuric acid and 99·7 per cent. nitric acid on cellulose, with a view to obtaining a pure nitrocellulose free from admixture with partial decomposition products and containing a high percentage of nitrogen. The results of the nitrations and the proportions of acids used are given in the following table :—

	Acid mixture used for 5 grms. of cellulose.		Nitrogen, per cent.	Solubility in ether alcohol, 3 : 1.	Un-changed cellulose.	Percentage yield of nitro-product referred to original cellulose.
	H_2SO_4.	HNO_3.				
1	300	30	—	—	—	Product dissolves in the acid.
2	270	30	—	—	—	
3	240	30	—	—	—	
4	210	30	3·16 3·18	—	37·79 37·72	56·6 20·0
5	250	50	7·42 7·19	—	27·19 27·86	116·0
6	280	70	11·06 10·84	1·91	6·95 7·02	142·4
7	300	100	13·20 13·13	—	—	165·2
8	150	150	13·24 13·48	1·70	0·00	185·2
9	75	150	13·32 13·22	—	0·00	172·1
10	75	225	11·93 11·79	1·69	0·00	169·2
11	60	240	13·03 12·87	1·10	0·00	167·5
12	30	270	12·74 12·93	4·94	traces	151·0
13	15	240	12·25 12·09	—	—	175·8
14	0	250	10·98 11·00	0·00	0·00	150·0

The nitrocellulose was separated from unchanged cellulose by Lunge and Weintraub's method (this J., 1901, **20**, 1022). The results attained show that, to obtain an ester perfectly insoluble in water, an acid mixture must be used containing for every 7 parts of sulphuric acid, at least 1 part of nitric acid. The nitrocellulose thus prepared, contains 37·79 per cent. of unchanged cellulose. With anhydrous acids, it was found impossible to obtain such highly nitrated products as with ordinary commercial acids. Nitrocellulose, when prepared with nitrogen pentoxide, is obtained as a gelatinous mass, and is difficult to wash. The solubility of the products obtained with anhydrous acids, is generally small in the usual solvents for nitrocelluloses.—W. S.

Glyceryl nitrates [*nitroglycerins*]. W. Will. Ber. 1908, **41**, 1107—1125.

The lack of knowledge of mono- and di-nitroglycerin led the author to the further investigation of these compounds. *Dinitroglycerin* : Mikolajczak's method (Z. Glückauf, 1904, 629), was followed for the preparation of dinitroglycerin. It was found better, however, to stir the 10 parts of glycerin recommended, slowly into the 33 parts of nitric acid (sp. gr. 1·50), kept below 0° C., than to use the reverse method of addition. The nitration mixture was then poured into a minimum quantity of water, or ice, and neutralised with powdered marble. The impure dinitroglycerin separates as an oil, containing also some trinitroglycerin. Dinitroglycerin was also prepared according to the author's method (Ger. Pats. 181,385 IV. 78/c ; 175,751 IV. 78/c ; 12,955 IV. 78/c), by running 100 grms. of glycerin drop by drop into 500 grms. of an acid mixture containing sulphuric acid and nitric acid in the proportions of 3:1, and containing for every 100 parts, 9 parts of water. Agitating by air, and cooling with ice, was continued for 10 minutes after the addition of glycerin was completed. The mixture was then poured into 10 times its weight of water. After separation from trinitroglycerin, the acid solution was neutralised, and extracted with ether, and the ether distilled off. The residue of dinitroglycerin was then washed with a little water and dried over concentrated sulphuric acid.

By dissolving trinitroglycerin in sulphuric acid, and diluting the solution with water, dinitroglycerin was obtained and extracted with ether. The yield was about 65 per cent. Dinitroglycerin is a colourless or light yellow oil (sp. gr. 1·47), which solidifies below − 13° C., and distils without appreciable decomposition at 146° C. It is just as poisonous as the trinitrate, and is much more soluble in water (at 15° C., 8 per cent. go into solution). Dinitroglycerin dissolves in all proportions in dilute sulphuric and nitric acids. In strong sulphuric acid (70 per cent.), the dinitrate, like the trinitrate, undergoes denitration to mononitroglycerin and glycerin. Dinitroglycerin dissolves in ether, alcohol, chloroform, acetone, and a little less readily in benzene than trinitroglycerin. It is insoluble in carbon tetrachloride and petroleum spirit. When quite anhydrous, dinitroglycerin gelatinises nitrocellulose very readily. The author has been able to separate the dinitroglycerin into two isomerides. On standing exposed to the air, dinitroglycerin absorbs about 3 per cent. of water ; and, if in this moist condition it is mixed with kieselguhr, in about the same proportions as for dynamite, it is found to become crystalline and solid, on cooling to between 0° and − 20° C. On introducing a trace of this frozen mixture into the oily dinitroglycerin, containing 3 per cent. of water, more than two-thirds crystallise out in large colourless prismatic crystals. The oil, separated from the crystals, is found incapable of further crystallisation. The crystalline compound, designated "*Dinitroglycerin K*," is isomeric with the oily modification, "*Dinitroglycerin F*."

Dinitroglycerin K is easily soluble in water, alcohol and ether, and is readily recrystallised from benzene. It melts at 26° C., possesses a burning taste, and boils at 145° C., with decomposition. This crystalline dinitroglycerin is a hydrate, containing one molecule of water to three molecules of dinitroglycerin : $3(C_3H_6O_7N_2)+H_2O$. The crystals lose their water of crystallisation when dried over sulphuric acid, or when heated to 40° C. Anhydrous dinitroglycerin K is an oil (sp. gr. 1·47), which it was found impossible to crystallise. Dinitroglycerin K is similar to trinitroglycerin as regards its sensitiveness to percussion, and explodes violently when heated on platinum foil. It loses most of its explosive properties when exposed for a short time to moist air. Dinitroglycerin K forms with benzoyl chloride a crystalline benzoyl derivative, melting at 67° C., insoluble in water, but soluble in alcohol, ether, and benzene. With *p*-nitrobenzoyl chloride, a *p*-nitrobenzoyl ester is formed, soluble in ether, acetone, and chloroform. This compound crystallises from alcohol in small pyramidal crystals, melting at 94° C. Besides giving a means of easily identifying di- and mono-nitroglycerin, these benzoyl- and *p*-nitrobenzoyl esters possess the important property of more or less well gelatinising nitrocelluloses.

Dinitroglycerin F was purified by redissolving in warm water and extracting with ether. The oil so obtained, like its crystalline isomeride, loses about 3 per cent. of water when dried over sulphuric acid or heated to 40° C. The isomerides resemble one another also in solubility, taste, and explosive properties. The benzoyl and acetyl esters, however, could not be crystallised. The *p*-nitrobenzoyl ester, on the other hand, crystallises from alcohol in yellowish rhombohedral tables melting at 81° C., which could be prepared and separated even in presence of dinitroglycerin K, owing to their difference in solubility and melting points. Both dinitroglycerin isomerides pass quantitatively into trinitroglycerin on further nitration, and give, by hydrolysis with alkali, the same mononitroglycide.

Mononitroglycerin.—By extracting the neutralised and concentrated aqueous mother liquor, obtained in the preparation of the dinitroglycerin, with ether, an oil was obtained, which on mixing with kieselguhr and freezing the mixture, solidified. A large portion of the oil, when treated with a small quantity of this frozen mixture, was found to crystallise out in long prismatic crystals of mononitroglycerin, melting at 58—59° C., and which could be crystallised from water, alcohol, or ether.

This mononitroglycerin contains no water of crystallisation and is non-explosive. It agrees with A. Mikolajczak's product (Ger. Pat. Applic., 25,176 (1903)) in giving a double salt with calcium nitrate,

$$[Ca(NO_3)_2+4C_3H_5(HO)_2(ONO_2)],$$

which, on recrystallising from alcohol, melted at 117° C.

α-Mononitroglycerin.—As with dinitroglycerin, mononitroglycerin separated into two isomerides. The crystalline compound, described above, melting at 58—59° C., represents the α-modification. On nitration it yields both the dinitroglycerin isomerides, as well as trinitroglycerin. α-Mononitroglycerin is also obtained by treatment of nitroglycide with water and gives a crystalline diacetyl ester, melting at 18—20° C., and insoluble in water. A dibenzoyl ester, in the form of colourless needles, melting at 68—69° C., was prepared by the action of benzoyl chloride in pyridine solution. The di-*p*-nitrobenzoyl ester was obtained as yellowish crystals melting at 139° C., and easily soluble in acetone and chloroform.

β-Mononitroglycerin was extracted from the mother liquor of the α-mononitroglycerin, with which it is isomeric, by repeatedly concentrating and washing out with ether. The yellowish syrupy liquid residue was further purified by redissolving in a large quantity of water and extracting with ether. The aqueous solution was then concentrated *in vacuo* and the mononitroglycerin taken up with ether. The liquid, left after expulsion of the ether, consisted chiefly of β-mononitroglycerin. Traces of the α-mononitrate still remaining in the oily liquid were separated out by crystallisation. On treating this oily β-mononitroglycerin with a fragment of the same frozen with kieselguhr, it formed tabular crystals, melting at 54° C. after being recrystallised first from ether, and then from water. It boils at 155°—160° C., and resembles the α-nitrate closely. It gives, however, no double salt with calcium chloride; and this circumstance may be used as a means of identification as well as of separating the two isomerides. The dinitrobenzoyl ester was obtained in yellow prismatic crystals, which were with difficulty soluble in alcohol, ether, benzene, and chloroform, easily soluble in acetone, and melted at 152° C. β-Mononitroglycerin is more readily nitrated to the trinitrate than its isomeride. Only the dinitroglycerin F could be prepared from β-mononitroglycerin. The constitutional formulæ, which the author deduces for these isomerides of mono- and di-nitroglycerin, vary according to which of the α-, β- or γ-hydroxyl groups in the glycerin molecule have had their hydrogen replaced by nitro groups.

The physical characteristics of the mono- and di-nitrates of glycerin are tabulated as follows:—

	Glycerin.	Mononitrate.	Dinitrate.	Trinitrate.
Specific gravity (at 15° C.) ...	1·27	1·40	1·47	1·60
Melting point	17° C.	α-nitrate: 58° C. β-nitrate: 54° C.	α-hydrate: 26° C. β-hydrate: liquid.	Labile mod.: 2·2° C. Stable mod.: 12·2° C.
Boiling point (at 15 mm.).	150—160° C.	Both isomerides: 155—160° C.	Both isomerides: about 145° C.	Driven off at 160° C. without boiling.
Solubility in water at 15° C.	All proportions.	70 per cent.	7·7 per cent.	0·16 per cent.
Hammer test (2 kilos.) ...... Fall in cm.	—	—	Anhydrous: 7—10 cm. Crystalline: 30 cm.	Less than 4 cm.
Heat of explosion	—	—	Anhydrous: 1250 cal.	1600 cal.
Temperature of combustion ..	4317 cal.	α-nitrate: 2812 cal.	K—anhydrous: 2088 cal., K—crystalline: 1986 cal., F—2055 cal.	1570 cal.
Gelatinising properties.........	—	—	Good.	Good.
Absorption of moisture —.....	80 per cent.	50 per cent.	11 per cent.	0·2 per cent.

Gelatin-dynamite, blasting gelatin, etc., as well as such dinitroglycerin explosives as the so-called Guhr-dynamite, begin to crystallise at temperatures over 0° C., by contact with a crystal of dinitroglycerin K.

Although when in the anhydrous condition, dinitroglycerin does not solidify at winter temperatures, yet on exposure to the atmosphere it becomes crystalline by its ready absorption of moisture. In view of these results, the author concludes that the dinitrate is not suitable, either in admixture or alone, as an explosive, as suggested by Mikolajczak, Nauckhoff (this J., 1905, **24**, 104), and other authors.—W. S.

PATENTS.

Explosive. V. Ansay, Liege, and C. Nameche, Spy, Belgium. Eng. Pat. 19,993, Sept. 7, 1907.

THE explosive consists of a mixture of 90 per cent. of ammonium or sodium nitrate, and 10 per cent. of the product obtained by nitrating the "residue of the distillation of coal-tar."—T. F. B.

Fuses; Substance for use in ——. F. Hyronimus. Fr. Pat. 384,792, Feb. 14, 1907.

PLUMBAMIDE is used for charging fuses for blasting or military purposes in place of fulminate of mercury. The substance is made as follows:—Dry ammonia gas is passed through molten sodium, and the resulting sodium amide is treated at 300° C. with nitrous oxide with the formation of solid sodium nitride. This compound is dissolved in water, dilute nitric acid added to obtain perfect neutrality, and plumbamide obtained by adding a solution of lead nitrate. The precipitate is washed with cold water and dried at a temperature lower than 100° C.—J. W. H.

Fuse; Safety friction ——. Rheinische Dynamitfabr. Ger. Pat. 196,359, June 6, 1907.

The device claimed consists of a piece of wire bent in the form of a bow, one end of which is fixed in a wooden plug carried by the case of the fuse, whilst the other end passes through an opening in the case into the charge of fuse-material, in such a manner that on pressing the wire bow, the friction produced by the free end of the wire causes ignition of the charge. The device may be enclosed in a movable metal casing, one portion of which is constricted, so that on moving this outer casing, the wire bow is pressed, and thereby ignition of the fuse effected. —A. S.

XXIII.—ANALYTICAL CHEMISTRY.

INORGANIC—QUALITATIVE.

Ferropyrophosphates; Reducing power of ——. P. Pascal. *See* VII.

INORGANIC—QUANTITATIVE.

Nickel and cobalt; Determination of ——, *in a solution containing no other metals.* E. Pozzi-Escot. Bull. Soc. Chim. Belg., 1908, **22**. 157—158. (See this J., 1908, 92.)

The solution is rendered slightly acid, diluted to a known volume, and two equal fractions are taken. In one the nickel and cobalt are determined together, either by chemical methods or electrolytically. The other is concentrated in porcelain to 10—20 c.c., introduced into a conical flask, and precipitated by addition of a great excess of hot saturated solution of ammonium molybdate and a few grms. of solid ammonium chloride. The solution is heated and cooled, the precipitate collected in a Gooch crucible and washed with cold saturated solution of ammonium chloride, dissolved in 250 c.c. of boiling water, and the nickel precipitated by means of potassium hydroxide and bromine. The washed precipitate is ignited and weighed, or redissolved and the metal deposited electrolytically.—J. T. D.

Nickel; Separation of —— *from cobalt and all other metals not precipitable by hydrogen sulphide.* E. Pozzi-Escot. Bull. Soc. Chim. Belg., 1908, **22**, 158—162.

Case 1.—*Determination of nickel and cobalt in presence of iron and manganese.*—The solution is precipitated by means of a large excess of ammonium molybdate solution, and the precipitate washed with cold saturated solution (preferably made at the moment, so as to be cold) of ammonium chloride. Cobalt and most of the manganese pass through; nickel, all the iron, and some manganese, are on the filter. The precipitate is dissolved in 200—250 c.c. of boiling water, and excess of ammonia added. On filtering and washing, the nickel alone passes through (solution of the precipitate and reprecipitation will separate any co-precipitated nickel). The nickel can then be estimated colorimetrically or electrolytically. Another electrolytic determination of nickel and cobalt together will give the cobalt by difference.

Case 2.—*Determination of nickel in presence of all metals not precipitable by hydrogen sulphide.*—After rendering first faintly acid and concentrating, the solution is precipitated by ammonium molybdate, and the precipitate washed as above. It contains, besides nickel, iron, aluminium, chromium, some manganese, zinc, and uranium, also barium, strontium, and calcium. It is treated with boiling water and excess of ammonia, and filtered. The solution is boiled in porcelain with potassium hydroxide till all ammonia is expelled, bromine added, and the black nickel hydroxide filtered off; this is redissolved, and the nickel determined in the solution by electrolysis. —J. T. D.

Analysis of alloys; The planimetric ——. A. K. Huntington and C. H. Desch. *See* X.

ORGANIC—QUANTITATIVE.

Malt analysis; Notes on ——. F. Bower. *See* XVII.

Malts; Use of copper or brass beakers in the determination of "extract" in ——. A. R. Ling and G. McLaren. *See* XVII.

Barley; Determination of the extract of —— *by the formaldehyde method.* A. Reichard and G. Purucker. *See* XVII.

XXIV.—SCIENTIFIC & TECHNICAL NOTES.

Cholesterol; Origin and formation of ——. J. Lifschütz. Z. physiol. Chem., 1908, **55**, 1—7.

The author states that he has succeeded in preparing cholesterol or closely-related derivatives of the same by the oxidation of oleic acid. 1·5 grms. of oleic acid were dissolved in 20 c.c. of glacial acetic acid and treated, at 80°—85° C., with 20 c.c. of a 5 per cent. solution of potassium permanganate and 80 c.c. of glacial acetic acid, added in small portions. The red colour of the mixture soon disappears, and the solution becomes dark brown. No evolution of gas can be observed. A portion of the solution when gently warmed with concentrated sulphuric acid becomes first colourless and then violet to violet-red, with characteristic absorption bands (a broad band between the blue and green, a narrower one in the green, near the yellow, and another narrow band in the yellow). When the reaction-product no longer gave this coloration, it was treated with oxalic acid, filtered, the faintly yellow solution evaporated, and the residue freed from acetic acid by evaporating several times with alcohol, and dried. It was then boiled on the water-bath for 1—1½ hours with 5—8 per cent. alcoholic potassium hydroxide, and the soap solution, after expelling the alcohol, treated with water and nearly neutralised with sulphuric acid. The faintly alkaline solution was extracted with ether, and the ethereal solution evaporated. The solid fatty residue (25—30 mgrms.) had a faint yellow colour, and did not melt when heated on the water-bath. It gave Liebermann's cholestol reaction and also the Hager-Salkowski cholesterol reaction. The alkaline soap solution, after separation of the ether, contained the chief portion of the reaction product. This after further treatment was separated into 50—55 per cent. of a fatty substance, soluble in petroleum spirit, probably a mixture of palmitic and oleic acids, and 45—50 per cent. of an acid substance, insoluble in petroleum spirit, m.pt. 82°—85° C., acid value 460, possibly a cholesterol-polycarboxylic acid.—A. S.

Tryptase; Adsorption of —— *by solid bodies.* E. Buchner and F. Klatte. Biochem. Zeits., 1908, **9**, 436—438.

Following up the observation that flocks of blood-fibrin, after immersion in yeast cell-juice and thorough washing, possess the property of liquefying gelatin, attempts were made to remove the whole of the tryptase from the juice by this means. It was thought that the phenomenon might be due to a specific affinity, depending on a combination between the enzyme and the substratum as the first stage of proteolysis. This hypothesis, however, is now found to be unsound, since any solid colloidal substance has a similar action on tryptase. The phenomenon was observed in the case of silk, wool, cotton, linen, paper, and agar-agar, and, to a certain extent, with asbestos and glass-wool. Since a chemical combination between the tryptase and certain of these substances is inconceivable, the phenomenon must be classed as one of ordinary adsorption. This conclusion coincides with that of Hedin who found that bone-charcoal, if used in sufficient quantity, is capable of removing the whole of the tryptase from a solution of that substance.—J. F. B.

New Books.

Lead Refining by Electrolysis. A. Gardner Betts. First edition. John Wiley and Sons, New York. Chapman and Hall, Limited, London. 1908. Price 17s. net.

8vo volume, containing 383 pages of subject matter, and the alphabetical index. There are 74 ordinary illustrations and 16 plates. The subject matter is classified as follows:—I. Electrolytes for lead refining. II. Chemistry of slime treatment. III. Deposition of antimony from the fluoride solution. IV. Electrolytic refining of Doré bullion. V. Manufacture of hydrofluoric and fluosilicic acids. VI. Choice of constants. VII. Refinery construction, operation, and refining costs. VIII. Products. IX. Treatment of by-products containing lead. X. Analytical methods and experimental work. Appendixes:—I. Plant of the Consolidated Mining and Smelting Company of Canada, Limited, at Trail, British Columbia. II. Lead refining plant of the United States Metals Refining Company at Grasselli, Lake County, Indiana. III. Treatment of lead-refinery slime with solution of ferric fluosilicate and hydrofluoric acid.

Elements of Water Bacteriology with Special Reference to Sanitary Water Analysis. By S. C. Prescott and Chas. Edw. A. Winslow, Massachusetts Institute of Technology. 2nd Edition. John Wiley and Sons, New York. Chapman and Hall, Limited, London. 1908. Price 6s. 6d. net.

Small 8vo volume, containing 216 pages of subject matter, a list of references to literature covering 29 pages, and indexes of authors and subjects. The entire subject is treated under the following heads:—I, Bacteria in natural waters. II, Quantitative bacteriological examination of water. III, Its interpretation. IV, Determination of the number of organisms developing at the body temperature. V, Isolation of specific pathogenes from water. VI, Methods for the isolation of the colon bacillus. VII, Significance of the presence of B. Coli in water. VIII, Presumptive tests for B. Coli. IX, Other intestinal bacteria. X, Significance and applicability of the bacteriological examination. XI, Bacteriology of sewage and sewage effluents.

Verein der Zellstoff- und Papier-Chemiker. Hauptversammlung 1907, am 9, Dezember im Papierhaus zu Berlin, nebst Beiträgen, Preisarbeit, Preisausschreiben, Satzungen, Mitgliederliste. Herausgegeben vom Verein der Zellstoff- und Papier-Chemiker. May be obtained from the Secretary, S. Ferenczi, Berlin S.W. 11, Papierhaus. A. W. Hayn's Erben, Zimmerstrasse 29, Berlin.

Chemical Reagents: Their Purity and Tests. A new and improved text based on and replacing the latest edition of Krauch "Die Prüfung der chemischen Reagentien auf Reinheit." By E. Merck. Authorised translation by Henry Schenck. Archibald Constable and Co., Ltd., 10, Orange Street, Leicester Square, London, W.C. 1907. Price 6s. net.

8vo volume, containing 241 pages of subject matter, and the alphabetical index. In a preface by Dr. C. Krauch, the latter states that E. Merck has undertaken what he (Krauch) terms the "up-to-date revision," and it is this revised and translated edition which is here presented.

Industrie des Métaux secondaires et des Terres rares. Par Paul Nicolardot, D. ès Sc. Octave Doin, 8, Place de l'Odéon, 8, Paris. 1908. Price 5 Fr.

Small 8vo volume, containing 407 pages of subject matter, with 37 illustrations, and alphabetical indexes of authors and subjects. The subject matter is treated under the following heads:—I, Industrial uses of the secondary metals. II, Preparation of alloys of great tenacity from secondary metals. III, Use of alloys of great tenacity. IV, Preparation of filaments for incandescent lamps. V, Tungsten, (i), Discovery. (ii), Occurrence. (iii), The metal. (iv), Preparation and physical properties. (v), Chemical properties. Alloys. (vi), Minerals and mines. (vii), Mechanical and chemical treatment. (viii), Metallurgical uses. (ix), Tungsten steels and tungsten alloys. (x), Applications. (xi), Qualitative examination. (xii), Separation and determination. (xiii), Art products. Similarly treated are also the following:—Molybdenum. Vanadium. Titanium. Uranium. Metals utilised for illuminating purposes (incandescence and electric lighting). Zirconium. Yttrium Thorium. Cerium. Osmium. Columbium [Niobium]. Tantalum.

Bulletin of the Imperial Institute, Vol. VI., No. 1. 1908. Price 1s.

This issue of the Bulletin contains reports on recent investigations made in the Scientific and Technical Department of the Imperial Institute regarding teas from Natal, flax from new sources, cottons from India, Buazé fibre from Nyasaland, rubber of *Ficus elastica* from India, rubbers from the Gola Forest (Sierra Leone), and iron ore from Natal, together with general notices respecting economic products and their development.

Patent List.

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

Applications.

9154. Singer and Harsanyi. Dry distillation apparatus. April 28.

9207 and 9208. Boult (Goldman and Co.). Filters.* April 28.

9384. Kirkham, Hulett, and Chandler, Ltd., and Hersey. *See under* II.

9669. Clark and Kreul. Filters. [U.S. Appl., May 2, 1907.]* May 4.

9833. Schmatolla. Incinerating furnace. May 6.

9868. Cantenot. Apparatus for the continuous evaporation of saline solution. [Ger. Appl., May 6, 1907.]* May 6.

10,084. Blair, Campbell, and Maclean, Ltd., and Ferguson. *See under* VII.

10,221. Neef. Centrifugal drying apparatus.* May 11.

10,314. Aktiebolaget Separator, and Harje. Centrifugal machines for separating solids from liquids.* May 12.

10,384. Weitz. The mixture of gases. [Ger. Appl., May 13, 1907.]* May 13.

Complete Specifications Accepted.

10,777 (1907). Mackenzie (Caragol and Cole). Kilns. May 20.

14,675 (1907). Black and Lennox. Apparatus for cleaning or washing smoke, for evaporating or cooling liquid, &c. May 13.

15,350 (1907). Durant. Separation of solids from liquids. May 13.

16,480 (1907). Challis. Filters. May 20.

19,865 (1907). Breh. Washing and drying apparatus. May 20.

23,221 (1907). Bebbington and Mathieson. Apparatus for filtering, washing, and drying, for treating sodium bicarbonate and other products. May 6.

24,951 (1907). Duryea. *See under* XVI.

25,658 (1907). Soc. l'Air Liquide, and Claude. Temperature exchangers. May 6.

26,615 (1907). Lorcy and Maiser. Filtering apparatus. May 13.

28,635 (1907). Fiechter. Filter element for collecting dust and condensing fumes. May 20.

II.—FUEL, GAS, AND LIGHT.

Applications.

9150. Evans. Apparatus for measuring the explosive and calorific values of gaseous mixtures. April 28.

9228. Kirkham, Hulett, and Chandler, Ltd., and Perry. Apparatus for the manufacture of gas. April 28.

9306. Stubbers. Production of incandescent mantles.* April 29.

9377. Bansart. Coke furnaces. [Belg. Appl., May 15, 1907.]* April 30.

9384. Kirkham, Hulett, and Chandler, Ltd., and Hersey. Filters chiefly for gas purification. April 30.

9622. Laigle. Filaments for incandescent gas mantles. [Addition to No. 3785 of 1908.]* May 4.

10,098. Ward and Stevens. Filament for electric glow lamps. May 9.

10,155. Schmatolla. Firing retort or muffle furnaces by producer gas. [Ger. Appl., Nov. 1, 1907.]* May 11.

10,233. Simonini. Manufacture of incandescent gas mantles.* May 11.

10,307. Bowing. *See under* III.

10,339. Lewis. Electrode for arc lamps. May 12.

10,422. Rincker. Obtaining tar gas. May 13.

10,450. Gordon. Generators for suction gas plant. May 14.

10,532. Machlet. Preparation of carbonising gas. [Comprised in No. 25,087, Nov. 12, 1907.]* May 14.

10,558. Morgan and others. Manufacture of coal, water, or oil gas or mixtures of them.* May 15.

10,590. British Thomson-Houston Co. (General Electric Co.). Electric incandescent lamp filaments. May 15.

Complete Specifications Accepted.

1972 (1907). Parker. Distillation of coal and other carbonaceous substances. May 6.

10,804 (1907). Dixon. Treating bituminous coal to render it smokeless, and for recovering by-products. May 13.

11,240 (1907). Glasscoe. Gas making apparatus. May 20.

11,979 (1907). Deuts. Bock Bogenlampen Ges. Electrode for arc lamps. May 20.

14,371 (1907). Carpenter. Distillation or carbonisation of coal. May 6.

15,451 (1907). British Thomson-Houston Co. (General Electric Co.). Manufacture of refractory electric conductors suitable for lamps, furnaces, &c. May 13.

16,315 (1907). Dosek. Apparatus for generating gases by direct contact of combustion gases and water. May 20.

23,202 (1907). Hansford and Gibbons. Manufacture of gas and coke. May 20.

27,939 (1907). Huber. Incandescent gas mantles. May 20.

361 (1908). Limberg. Coke furnaces. May 6.

572 (1908). Williams. Gas washing or purifying contrivance. May 13.

3785 (1908). Laigle. Filaments for incandescent mantles. May 13.

8746 (1908). Auger. Manufacture of incandescent filaments. May 20.

9622 (1908). Laigle. Filaments for incandescent mantles. May 13.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

Applications.

9154. Singer and Harsanyi. *See under* I.

10,307. Bowing. Retorts for the destructive distillation of coal and other substances. May 12.

10,470. Wynne. Purifying petroleum oils. May 14.

Complete Specifications Accepted.

1972 (1907). Parker. *See under* II.

10,699 (1907). Marriott. *See under* X.

10,775 (1907). Pages, Camus, and Duchemin. Direct extraction of pyroligneous substances. May 13.

12,230 (1907). Malden and Malden. Treatment of tars and pitches. May 13.

IV.—COLOURING MATTERS AND DYESTUFFS.

Applications.

9104. Imray (Meister, Lucius, und Brüning). Separation of *o*- and *p*-chlorobenzaldehyde. April 27.

10,096. Act.-Ges. f. Anilinfabr. Manufacture of polyazo dyestuffs with aid of *p*-amidophenyl-arsenic acid. [Ger. Appl., Nov. 15, 1907. Addition to No. 8967 of 1908.]* May 9.

10,387. Newton (Bayer und Co.). Manufacture of derivatives of the anthraquinone series. May 13.

10,412. Johnson (Badische Anilin und Soda Fabrik). Manufacture of compounds and colouring matters of the anthracene series. [Addition to No. 14,578 of 1908.] May 13.

Complete Specifications Accepted.

8162 (1907). Imray (Meister, Lucius, und Brüning). Manufacture of vat dyestuffs. May 20.

9657 (1907). Johnson (Badische Anilin und Soda Fabrik). Manufacture of compounds of the anthracene series. May 6.

9742 (1907). Imray (Meister, Lucius, und Brüning). Manufacture of azo dyestuffs. May 6.

10,770 (1907). Johnson (Badische Anilin und Soda Fabrik). Manufacture of colouring matters of the anthracene series. May 20.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

Applications.

9432. Hall. Machines for scouring, bleaching, dyeing, &c., spun or manufactured fibrous materials. May 1.

9651. Newton (Bayer und Co.). Fixation of dyestuffs on fibre. May 4.

10,132. Calico Printers' Assoc., Ltd., and Fourneaux. Production of black on textile fibres. May 11.

10,289. Boult (Jefferson). Bleaching and treating cloth, warp, or other textile materials with liquids. May 12.

10,316. Hoinkes. Fixing and refining textile tissues before dressing. May 12.

10,649. Pickles. Calendering, schreinering, or like finishing of fabrics. May 16.

Complete Specifications Accepted.

10,088 (1907). Courtecuisse. Singeing threads. May 6.

10,542 (1907). Johnson (Badische Anilin und Soda Fabrik). Discharging dyed textile fibres and pastes therefor. May 13.

10,545 (1907). Berenguer. *See under* XIX.

10,873 (1907). Kirchhof. Apparatus for treating mercerised tissues or fabrics. May 6.

11,575 (1907). Chedlow, Dreaper, and Hall. Treatment of textile fabrics. May 20.

16,149 (1907). Lake (Chem. Fabr. vorm. Weiler-ter Meer). Printing with sulphurised dyestuffs. May 6.

17,430 (1907). Ransford (Cassella und Co.). Dyeing wool. May 6.

21,038 (1907). Dawson. Wool washing and scouring machines. May 13.

1273 (1908). Crepin. Bleaching and scouring textile vegetable substances. May 13.

VII.—ACIDS, ALKALIS, AND SALTS.

Applications.

9233. Allgem. Elektricitäts-Ges. Extracting nitrogen peroxide from nitric oxide air mixtures containing only a small quantity of nitric oxide. [Ger. Appl., May 13, 1907.]* April 28.

9772 and 9773. Weyer. Obtaining barium and strontium nitrates.* May 5.

9868. Cantenot. *See under* I.

9951. Effront. Fermentation process to obtain ammonia and volatile fatty acids from organic nitrogenous substances.* May 7.

10,084. Blair, Campbell, and Maclean, Ltd., and Ferguson. Vessels for boiling acids or acidulous substances. May 9.

10,181. Newton (Bayer und Co.). Manufacture of hydrosulphites. May 11.

10,522. Carrara. Preparation of zinc chloride.* May 14.

Complete Specifications Accepted.

18,096 (1907). Johnson (Chem. Fabr. Schlempe). Manufacture of hard cyanide briquettes. May 20.

20,613 (1907). Duvieusart. Manufacture of sodium sulphite and ammonium chloride. May 6.

20,906 (1907). Queisser. Making hydrogen peroxide stable in admixture with other substances. May 20.

23,221 (1907). Bebbington and Mathieson. *See under* I.

VIII.—GLASS, POTTERY, AND ENAMELS.

Applications.

9438. Chance. Glass manufacture. May 1.

9563 Bloxam (Siemens und Halske A.-G.). Manufacture of glass.* May 2.

9582. Calvert. Removing the enamel from metal articles. May 2.

9997. Winter, and The County Chemical Co. Composition for removing stoved enamels, &c. May 8.

Complete Specification Accepted.

14,417 (1907). Menzel. Glass furnaces. May 13.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Applications.

9746. Nussbaum. Treatment of wood. May 5.

10,554. Nussbaum. Preparation of wood. May 15.

Complete Specifications Accepted.

10,257 and 10,366 (1907). Cowper-Coles. Manufacture of cement. May 6.

11,514 (1907). Koepfer. Impregnating, colouring, or preserving wood. May 13.

860 (1908). Wilson. Fire-resisting composition. May 13.

X.—METALLURGY.

Applications.

9281. Roux. Extracting nickel and its alloys from the natural nickeliferous ferromagnesium hydrosilicates known as "garnierite." April 29.

9383. Reynolds. Manufacture of steel, and other metallurgical processes. April 30.

9534. Wigg and Peers. Recovery of zinc from residual liquors of wet copper processes. May 2.

9554. Flohr. Manufacture of iron or steel by the basic Bessemer process. [Addition to No. 10,440 of 1906.]* May 2.

9955. Flohr. Utilising blast furnace dust and dust ores. May 7.

10,260. Charlton. Smelting manganese ores. May 12.

10,569. Flower. Flux for soldering aluminium.* May 15.

Complete Specifications Accepted.

8255 (1907). De Ferranti. Metallurgical process and apparatus. May 20.

10,185 (1907). Stobie. Annealing, heating, or melting materials. May 13.

12,563 (1907). Jullien and Dessolle. Rendering electrolytic copper homogeneous. May 20.

17,344 (1907). Dwight and Lloyd. Ore roasting and sintering process. May 13.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

Applications.

9836. Cowper-Coles Galvanizing Synd., and Cowper-Coles. Electro-galvanising. May 6.

10,244. Thoms and Mossop. Electrodeposition of metallic alloys. May 12.

10,378. Cornelius. Electric furnaces. May 13.

10,520. New Ignition Synd., Ltd., and Sandy. Electrolyte for electric batteries. May 14.

10,535. Cohen, Cramer, and Geipel. Manufacture of electric cables. May 14.

Complete Specifications Accepted.

5301 (1907). Igevsky. Electric furnace. May 13.

8562 (1907). Paweck. Electrodeposition of zinc. May 20.

10,367 (1907). Cowper-Coles. Electrodeposition of iron. May 6.

10,699 (1907). Marriott. Pitch product for insulating cable trenches, etc. May 20.

15,451 (1907). British Thomson-Houston Co. (General Electric Co.). *See under* II.

23,586 (1907). Weman. Galvanic element. May 13.

27,385 (1907). Cowper-Coles. Apparatus for electrodeposition of metals. May 20.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

Applications.

9096. Pritchard. Apparatus for making soap. April 27.

9490. Von Romscki. Manufacture of soaps. May 1.

9572. Claessen. Manufacture of polyglycerin.* May 2.

9579. Claessen. Employment of glycerin substitutes.* May 2.

9758. Barbé, Garelli, and De Paoli. Treatment of fatty materials with ammonia under pressure. [Addition to No. 12,210 of 1907.]* May 5.

10,277. Doull. Refining, deodorising, decolorising, and purifying oils, fats, waxes, and their products. May 12.

Complete Specifications Accepted.

10,689 (1907). Irving. Soap or washing compound. May 20.

10,860 (1907). Austerlitz. Expressing oil from oil seeds. May 20.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc.

(*A.*)—Pigments, Paints.

Applications.

9083. Meurant. Production of colours.* April 27.

10,043 and 10,044. Wilson and Harris. Removing paint and varnish. [U.S. Appls., May 10 and Aug. 1, 1907.]* May 8.

(*B.*)—Resins, Varnishes.

Complete Specification Accepted.

24,699 (1907). Cie. Lincrusta Walton Française. Obtaining shaded effects on lincrusta and the like. May 6.

(*C.*)—India-Rubber.

Applications.

9187. Fitzgerald. Treatment of vegetable oils and other substances with gases, for use in making artificial indiarubber. April 28.

9956. Degen und Kuth. Vulcanising a rubber solution. [Ger. Appl., May 14, 1907.]* May 7.

Complete Specifications Accepted.

3480 (1907). Stange. Production of plastic and elastic substances. May 20.

10,008 (1907). Lugo. Manufacture of indiarubber products. May 6.

4714 (1908). Basler Chem. Fabrik. Regeneration of caoutchouc. May 20.

XIV.—TANNING, LEATHER, GLUE, SIZE, Etc.

Applications.

9652. Mills (A. W. Harrington Co.). Size composition.* May 4.

10,201. Reddan. Manufacture of material of the nature of leather from hides.* May 11.

XV.—MANURES, Etc.

Application.

9694. Halvorsen, and Norsk Hydro-Elektrisk Kvaelstofaktieselskab. Manufacture of fertilisers. [Norw. Appl., May 6, 1907.]* May 4.

XVI.—SUGAR, STARCH, GUM, Etc.

Complete Specifications Accepted.

19,633 (1907). Boidin. Treatment of grain and amylaceous materials previous to saccharification. May 6.

24,951 (1907). Duryea. Drying apparatus particularly for starch or starchy products. May 13.

214 (1908). Hoff. Manufacture of sugar from starch substances. May 6.

XVII.—BREWING, WINES, SPIRITS, Etc.

Applications.

9293. Desq. Alcoholometers. April 29.

10,082. Blair, Campbell, and Maclean, Ltd., and Ferguson. Apparatus for treating spirits during distillation. May 9.

Complete Specification Accepted.

16,291 (1907). Smith. Plant for treating water for whisky distillation and other brewing purposes. May 13.

XVIII.—FOODS; SANITATION, WATER PURIFICATION; AND DISINFECTANTS.

(*A.*)—Foods

Applications.

9106. Wedemann. Preparation of skimmed milk. April 27.

10,117. Pfleiderer. Treatment of butter. May 9.

Complete Specifications Accepted.

12,095 (1907). Riegel. Preparing yolk-emulsion for use in making edible fats, butter substitutes, etc. May 20.

25,890 (1907). Risberg. Emulsifying and homogenising milk, etc. May 20.

(*B.*)—Sanitation; Water Purification.

Applications.

9548. Moorwood, Moorwood, and Boaz. Purification of water. May 2.

9656. Losange. Biological purification of waste water and sewage. [Comprised in No. 25,362, Nov. 15, 1907. Under Rule 13.]* May 4.

9665. Candy. Purification of water. May 4.

10,557. Ives. Treatment of sewage.* May 15.

(*C.*)—Disinfectants.

Application.

9886. Schneider. Manufacture of disinfectants. [Ger. Appl., May 8, 1907.]* May 6.

XIX.—PAPER, PASTEBOARD, Etc.

Applications.

9268. Verein. Glanzstoff Fabr., A.-G. Manufacture of cellulose products. [Ger. Appl., Sept. 30, 1907. Addition to No. 27,707 of 1907.]* April 29.

9653. Mills (A. W. Harrington Co.). Waxing composition for paper.* May 4.

9982. Assadas. Manufacture of transparent or opaque plastic substances. [Fr. Appl., May 8, 1907.]* May 7.

10,529. Meister, Lucius, und Brüning. Manufacture on the paper machine of paper having relief-like effect. [Ger. Appl., June 7, 1907.]* May 14.

Complete Specifications Accepted.

9568 (1907). Tortelli. Utilising celluloid residua. May 6.

10,545 (1907). Berenguer. Preparation of concentrated solutions of cellulose and the manufacture of threads therefrom. May 6.

11,397 (1907). Béthisy, Fouchard, and Vignes. Manufacture of a non-inflammable substitute for celluloid. May 20.

27,676 (1907). Dixon. Paper making machinery. May 13.

27,707 (1907). Verein. Glanzstoff-Fabr. Manufacture of cellulose products. May 20.

27,948 (1907). Schopper. Testing paper pulp and apparatus therefor. May 6.

426 (1908). Metzger. Marbling paper, cardboard, &c. May 13.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

Applications.

9112. Bedford and Williams. Reduction of organic substances. April 27.

9365. Wellcome, Pyman, and Reynolds. Manufacture of therapeutic compounds. April 30.

9680. Imray (Meister, Lucius, und Brüning). Manufacture of dioxyphenylethanolamines. May 4.

9855. Imray (Meister, Lucius, und Brüning). Manufacture of reduction products of the oxyarylarsinic acids. May 6.

9951. Effront. *See under* VII.

10,379. Guy. Bacteria medium. May 13.

10,386. Barnard. Disintegrating bacterial or other cells or similar minute organic bodies. May 13.

10,670. Wellcome and Remfry. Manufacture of therapeutic compounds. May 16.

COMPLETE SPECIFICATIONS ACCEPTED.

10,783 (1907). Ellis (Chem. Fabr. vorm. Sandoz). Manufacture of camphene. May 13.

28,036 (1907). Schmitz und Co. Manufacture of camphor. May 6.

1330 (1908). Lake (Geh. Kommerzienrat K. A. Lingner). Manufacture of condensation products from phenols and formaldehyde. May 20.

1617 (1908). Ges. f. Chem. Ind. in Basel. Obtaining the active constituent of the bark of *Cascara sagrada.* May 20.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

APPLICATIONS.

9275. Zimmermann (Chem. Fabr. auf Actien, vorm. E. Schering). Silver photographic papers. April 29.

9666. Ilford, Ltd., and Renwick. Material for photographic and like purposes. May 4.

10,294. Rotary Photographic Co. (Neue Photographische Ges.). Photographic reproduction. May 12.

COMPLETE SPECIFICATION ACCEPTED.

20,384 (1907). Sanger-Shepherd. Manufacture of plates or films for colour photography. May 20.

XXII.—EXPLOSIVES, MATCHES, ETC.

APPLICATIONS.

9150. Evans. *See under* II.

9623. Bell. Manufacture of guncotton charges. May 4.

10,129. Bouchaud-Praceiq. Preventing spontaneous explosion of nitrated explosives. [Fr. Appl., May 10, 1907.]* May 9.

XXIII.—GENERAL ANALYTICAL CHEMISTRY.

APPLICATIONS.

9724. Weiss. Acidimeter. May 5.

9725. Weiss. Phosphatometer. May 5.

10,126. Palmer and Stead. Measuring the density or comparative densities of gases or mixtures of gases. May 9.

COMPLETE SPECIFICATION ACCEPTED.

26,924 (1907). Hubbard. Apparatus for automatic analysis and recording of gases. May 20.

Journal of the Society of Chemical Industry.

No. 11, Vol. XXVII. JUNE 15, 1908. No. 11, Vol. XXVII.

Official Notices.

ANNUAL GENERAL MEETING.

The Annual General Meeting will be held in the Armstrong College, Newcastle-on-Tyne, on Wednesday, July 22nd, at 10.30 a.m. A programme and request form were contained in the last number of the Journal.

In accordance with the provisions of By-law 18 of the Society of 1881, notice is hereby given that those members whose names are printed in *italics* in the list of Council (see p. 363, April 30th number) will retire from their respective offices at the forthcoming Annual Meeting.

Prof. R. Meldola, F.R.S., has been nominated to the office of President under By-law 8; Dr. J. T. Dunn, Mr. A. R. Ling, Mr. George C. Stone, and Mr. R. C. Woodcock, have been nominated Vice-Presidents under By-law 8; Sir Boverton Redwood has been nominated a Vice-President under By-law 11; and Dr. T. B. Wagner has been nominated a Vice-President under By-law 26. Prof. P. Phillips Bedson and Mr. H. Van der Linde have been nominated Ordinary Members of Council under By-law 26; and Mr. Thomas Tyrer and Dr. Ludwig Mond, F.R.S., have been nominated Hon. Treasurer and Hon. Foreign Secretary respectively under By-law 9.

Prof. W. Hodgson Ellis, Messrs. O. Guttmann and H. Hemingway and Dr. G. G. Henderson have been nominated, under Rule 18, to fill four vacancies among the Ordinary Members of Council. No ballot will be required.

The medal has been awarded to Sir Andrew Noble, Bart., K.C.B., F.R.S., for his researches on explosives.

By order of the Council,
Charles G. Cresswell, Secretary.

SEVENTH INTERNATIONAL CONGRESS OF APPLIED CHEMISTRY, LONDON, 1909.

A circular issued by the Joint Organising Committee of the Congress, which will be found in this number of the Journal, states that the Seventh International Congress of Applied Chemistry will be held in London from May 27th to June 2nd, 1909. It will find ample accommodation in the buildings of the University of London, the Imperial Institute, and the Imperial College of Science and Technology at South Kensington.

The Sections, both in number and kind, will be the same as those of the Sixth Congress at Rome; and the list of Sectional Presidents, Vice-Presidents, and Secretaries is virtually complete.

Local Committees, to further the interests of the Congress, are being formed by the various Local Sections of the Society, as well as in Belfast, Bristol and Cardiff. Similar Committees are being formed abroad, and from all quarters are forthcoming promises of support and attendance.

Private appeals for the necessary funds have met with a generous response, and a wider appeal is in contemplation at an early date, in order that the foreign visitors may have a worthy reception on this the first occasion on which such a Congress has been held in London.

Canadian Section.

Meeting held at Montreal on Friday, Jan. 3, 1908.

MR. MILTON L. HERSEY IN THE CHAIR.

CHEMISTRY: ITS VALUE IN MODERN FOUNDRY PRACTICE.

BY MILTON L. HERSEY, M.SC., AND IRA B. LESH.

The changing of ores into iron or steel castings usually involves at least two processes, reduction in a blast furnace, and treatment in converters or melting in open hearth furnaces for steel, and melting in cupolas or air furnaces for iron castings. The first is a smelting, the second a melting process. Smelting involves chiefly chemical reactions with incidental mechanical agencies and physical changes, and is entirely a reduction process. Melting is, in the main, mechanical, with incidental and sometimes undesired chemical changes, especially in cupola practice. For instance, much carbon is taken up by the iron in the blast furnace; while in the cupola very little, if any, is so taken up. This is accounted for by the difference in the fuel burden, the structure of the metallic mass at time of melting, the fact that in the cupola carbon is already about the saturation point, and other physical and chemical causes. Some eminent authorities hold that the cupola operation is in no sense a refining one; but it is possible to flux off many of the impurities charged into the cupola. For example, in high manganese mixtures, it is possible to more than offset the sulphur taken up from the fuel, producing a metal lower in sulphur than that charged into the cupola. The blast furnace is, however, the primary refining agent of cast iron products. For steel products, both the converter and the open hearth furnace furnish facilities for further refining and chemical changes.

In the steel industry the product is always closely checked by both chemical and physical tests. Indeed, the success of any steel plant depends very largely on being able to keeping the product well within the limits of rigid chemical and physical specifications.

In the cast iron industry, scientific methods are at present far less generally applied, and we cannot but wonder whether the wide difference in the relative strength and uniformity of iron and steel might not be largely decreased if both were handled with the same care and on the same scientific basis. The cast iron products comprise malleable cast iron, chilled cast iron, grey iron, and so-called semi-steel. Of these, the metal for malleable castings is usually melted in air furnaces, since they permit of lower sulphur in the product as well as a closer check on the silicons and carbons before casting. Not all malleable plants make use of the chemical laboratory. But if a closer chemical and physical check were kept on this class of castings, both in the melting and the annealing, a far smaller number of defective malleables would get into service, and many castings now made of steel might be made of malleable iron with a profit to both the consumer and manufacturer. By far the greatest amount of iron castings are in common grey iron and chilled car wheels. Nearly all the metal for this class of work is melted in cupolas, both on account of the lower cost of melting, the shorter time required, and the larger possible output from an installation requiring the same space and same initial cost. For very small cupolas up to 48 inches in diameter, the inside of the lining is usually parallel with the shell from the charging doors down to the bottom doors, with perhaps a very slight overhang at the tuyeres. For larger cupolas and long heats, it is wise to increase the thickness of the lining gradually from the tuyeres up to 12 inches to 18 inches; then gradually reducing to the original thickness at 24 inches to 36 inches from the top of the tuyeres. This serves two purposes, to form an overhang at the tuyeres and keep the melting iron from dropping into them, and at the same time furnishes an increased thickness of lining at the melting point, where it is most needed. This increase in thickness of lining may be from 2 inches to 6 inches, but if maximum melting capacity is desired, should be as little as possible and extend to the shortest possible distance above the melting zone. The bottom doors are hinged, so that after the heat is completed, they may be dropped with the slag, coke, etc., remaining from the heat, and the cupola more easily prepared for service next day.

The melting process is briefly this:—After the slag, etc., of the previous heat has been removed from the cupola and lining, and the lining patched out to proper dimensions, the bottom doors are put up and securely supported, the sand bottom of 2 inches to 5 inches put in, and the cupola is ready for charging. First shavings or straw are put in to ignite the wood and protect the sand bottom from being torn up or disturbed when the wood is thrown in; then fine wood followed by coarser, until there is sufficient to ignite the coke, usually up to 12 inches to 18 inches above the tuyeres, and on top of this about half of the coke desired for the bed. The cupola is then lighted and this bed burned until the wood is burnt out and the coke brought to a bright red, which should be uniform over the entire surface. The balance of the bed coke, that is the first charge of coke, is then charged as quickly as possible, nearly all draught shut off, and the succeeding, alternate charges of iron and coke put in, until the charging doors are reached, when the blast is put on and melting begins. Alternate layers of coke and iron are then added until the amount required for the day's work has been charged. The height of the charging doors above the bottom doors depends largely on the size of the cupola and local conditions. This should however be as great as possible within reasonable limits. We know 84 inch to 90 inch cupolas where this distance is 20 to 22 feet, and most excellent results are secured. A little more care is perhaps required in putting in the first charges, but this is more than offset by the saving in fuel and the decrease in loss by oxidation. We have melted in the same cupola charges of 2000 pounds to 8000 pounds of iron, and in a cupola of the same size charges of 10,500 pounds of iron, without any appreciable difference in the product, the larger charges using a little less fuel proportionately. The ratio of fuel should be about 10 pounds of iron to 1 pound of coke, or in bulk, 1 to 8; in a 72 inch cupola, this would give, with 12 inches of coke and 15 inches of iron, 700 pounds of coke and 7000 pounds of iron, which we have found a very satisfactory charge. We have never found a case where a melting ratio was secured as high as 10 pounds of iron to 1 pound of coke including the bed coke. Ratios of 12 and 16, and as high as 18, have been reported, but we have found that when the actual amount of coke and iron purchased and used for a given period was checked, the ratio was nearer 8 to 1 than 16 to 1. Efforts to obtain a high "melting ratio" have been known to result in the loss of the greater part of the work, the loss being attributed to high sulphur coke, when the whole trouble was due to a deficiency of coke.

The amount of the first, or bed charge of coke and iron will depend largely on the height of the tuyeres above the bottom, and this in turn depends on the extent to which the cupola hearth is to be used as a reservoir for the molten iron. This distance varies from 12 inches to 24 inches or even more, and enough coke should be used to bring the top of the bed coke 18 inches to 48 inches or more above the tuyeres, depending on the cupola dimensions, the length of the heat, the kind of iron to be melted, and class of castings to be made. We have known, for example, a number of cupolas with 90 inch shells where the coke bed charges were brought as high as 65 to 70 inches above the tuyeres, these cupolas being operated with excellent results.

If the charges of iron and coke are not of proper size, or in proper proportion, chemical analysis will at once disclose the condition, cause and remedy. Therefore one of the principal values of chemical analysis in foundry practice is to ensure proper cupola conditions; for if the average percentage of the elements in the mixture as charged does not come out in the product, the analysis will show just what and where the trouble is. It is possible to so calculate and arrange the cupola charges as to secure exactly the chemical composition desired in the castings.

Cast iron consists of pure iron associated with silicon, manganese, carbon, sulphur and phosphorus. The first three are generally beneficial in proper proportions, the last two, except in special cases, harmful and to be avoided as far as possible. When extra fluidity is required, without extra strength, phosphorus may be permitted up to 1·5 per cent.; otherwise it is usually kept as low as possible. Each class of castings requires quite well defined chemical composition, and this being ascertained, it is simply a matter of selecting such irons as will produce the required composition at lowest cost.

The greatest possibilities of saving in foundry practice are in the operation of cupolas guided by chemical analysis, and the fullest possible use of the cheaper irons, including scrap, as offered on the markets. If two irons have the same chemical composition, they will give the same product in the same cupola under the same conditions. There is no "bad iron" for the cupola. Every iron can be used in some quantity in any cupola mixture, if properly balanced chemically with some other iron. It is altogether a matter of cost and chemical composition, and an iron which of itself may be unsuitable for one class of castings, may be exactly suited to another class. To secure proper results, however, the coke and pig iron should be frequently analysed, and the average composition of the various scrap metals determined. It would evidently be misleading, and quite unnecessary, to analyse every car of scrap. Each class of scrap has its own particular limits of variability in composition. Malleable scrap has perhaps the widest variation, on account of the different systems of annealing, but this material is rarely used in cupolas at over 10 per cent. of the charge. Steel scrap and cast iron car wheels have perhaps the smallest variations, specifications for these materials being within very narrow limits. Locomotive castings, car castings, brake shoes, heavy machinery, light machinery, stove plate, grate bars, etc., have their own well defined limits of variability, and the expert cupola operator can use these in quite liberal proportion and still keep the composition of his castings very close to the calculated percentages.

The practice now most commonly used in iron foundries is to depend altogether on results obtained by previous experience with certain brands of pig iron, supplemented by grading from appearance of fracture. That is, a very dark soft open-grained iron will be called No. 1; one more grey and a little closer grained No. 2, and so on, until a chilled surface appears, which would be No. 5, and clear white iron No. 6 or 7. The idea in brief is that the fracture indicates the percentage of silicon, a No. 1 being about 3 per cent. and a No. 7 about ½ per cent. The effect of silicon is to retard the cooling process, thus permitting more of the carbon to change from the combined to the graphitic form, the result being a darker, softer and more open-grained iron. Iron in the molten state has all its carbon combined. In cooling, a portion changes to the graphitic form, the proportion thus changed depending largely on the rapidity of the cooling process. The presence of silicon retards this process and increases the proportion of graphitic carbon, producing softer iron up to the point where the silicon begins to displace carbon, when exactly the reverse effect results. From 3 to 3·25 per cent. is the limit of silicon allowable.

Silicon and carbon combine to reach the saturation point in cast iron, the excess being thrown off in kish or slag. This saturation point is practically from 15 to 16 per cent. The carbon element has, however, a value equal to 3½ times that of silicon, so that if the carbon is 4·50 per cent., there can be little or no silicon present. The maximum proportion in which these elements can exist together is then fixed between these limits, carbon being the element to be displaced when excess exists. For example, if the percentage of silicon in the metal as melted in the cupola is 3 per cent. and the carbon 3·5 per cent., we have $3{\cdot}5 \times 3{\cdot}5 + 3 = 15{\cdot}25$ per cent., which is about the saturation point beyond which the silicon begins to displace carbon and produce hard iron. The presence of manganese raises the saturation point for silicon and carbon so that in the high manganese alloys we may get carbon up to 6 per cent. This makes these alloys most valuable for re-carbonising in the Bessemer process.

It is at once evident therefore that the character of cast iron is determined, not only by the ratio of any or all of the other elements to the iron, but also by the ratio of these elements to one another. This must be taken into account and properly handled in working cupolas by analysis. In pig iron this condition is largely accentuated by the wide variety of treatment. If the pig beds are wet, or the iron cooled with water when very hot, the pigs will be chilled and close grained at fracture. A No. 3 or 4 iron, by appearance, may, by analysis, prove to be a No. 1. If the iron comes from the furnace very hot and rapidly into dry pig beds, it may show a No. 1 fracture and yet analyse Nos. 5 or 6.

Thomas West, in his latest work on the "Metallurgy of Cast Iron," gives cuts illustrative of some striking incidents of this kind, when a No. 6 iron by fracture analysed No. 1, and *vice versâ*. In one car of pig iron which we checked in the laboratory the silicon was only 0·65 per cent., whilst the fracture indicated 2·50 per cent. to 3 per cent. Our cupola results showed that the fracture was entirely misleading, and if the iron had been used on this basis, bad work could not possibly have been avoided. Hence the real danger in relying upon fracture for the grading of pig iron is apparent, where economy and uniformity of product are desired, these being the most important considerations in cupola practice.

It is not always possible to select strong, uniform irons by fracture only and thus avoid trouble, for a furnace cannot always make the same grade of iron, and an apparently weak iron may give most excellent results in the cupola. No. 6 charcoal pig iron, which is a white brittle iron, may be mixed with a 10 per cent. ferrosilicon, which is also a white brittle iron, and an 80 per cent. ferromanganese, also a white brittle iron, and give very strong, soft, grey castings. We have melted in an ordinary cupola a mixture containing over 60 per cent. of steel scrap, the balance being cast scrap and spiegel, and secured castings which were clean, smooth, free from blow holes, and soft enough to be easily drilled.

Another great objection to using only selected brands and grades of pig iron is that the foundry man must pay a premium to cover the loss sustained by the furnace on their so-called lower grades, which may in reality be just as good or better for his purpose if he knew the composition.

We have already referred to the great saving possible in mixture costs by the aid of chemical analysis. One example may be mentioned:—Canada imports yearly several thousand tons of Lake Superior charcoal pig iron, low in silicon, white fracture, grading No. 5 and No. 6. At least one-half of this could be replaced with steel scrap and Canadian pig iron at a saving of approximately $15.00 per ton, in addition to the advantage of using Canadian material for Canadian products. No. 6 charcoal pig iron and steel scrap, although apparently widely different, have approximately the same composition in all elements, except carbon, and as neither iron can be used much above 10 per cent. in any ordinary cupola mixture, the carbon deficit in the steel can easily be balanced by slightly increasing the silicon if necessary. In most cases when it is desired to harden a mixture, steel scrap can be used with great advantage and economy.

The supposition that a chilled casting when remelted would produce a harder casting than would result from remelted grey iron of the same chemical analysis, has been disproved by elaborate tests, both experimentally and in general practice. A chilled casting of same chemical composition will produce a slightly softer remelt on account of the slightly higher percentage of total carbon caused by rapid cooling. It is not very long since the tyres and hubs of car wheels were considered as separate materials for melting on account of one being chilled and the other grey iron. If the iron were remelted, after being cast in chill moulds, harder and closer grained castings would have been obtained, not because of first casting in chill molds, but because about 20 per cent. of the silicon would be lost and the sulphur would increase about 25 per cent. This process would cost perhaps $1.50 per ton. The same results could have been obtained by adding 5 per cent. to 10 per cent. of steel scrap in the first melting, or, if no special strength were required, by using brake shoes or other low silicon high sulphur scrap. One could thus save $1.50 to $2.00 per ton over the first mixture, or $3.50 per ton in all, with as good or better results. Many other instances could be cited.

Our method of calculating mixtures for cupolas, before charging, differs slightly from various other methods, but we have found it most satisfactory for our use. This consists simply in extending the amount in pounds of each element, according to the given analysis, taking the total of these, and thus ascertaining the average net analysis, after making proper allowance for loss in melting and sulphur taken up from the fuel. To this is added a column showing cost for the purpose of comparison.

In some cases and in special localities, it is cheaper to secure the proper amount of manganese by using an 80 per cent. ferromanganese either in the cupola or ladles. This is entirely a question of cost per unit of manganese. Manganese is useful, not only for the amount retained in the casting, but also for its desulphurizing effect on the iron. We have made tests with two bars from the same 50 lb. ladle of iron, one bar being poured from the metal as melted, the other after treating with 3 per cent. of ferromanganese. The first bar showed sulphur 0·18 per cent., the second 0·08 per cent., manganese being increased from 0·6 per cent. to 2·88 per cent. This metal in a bar 2 inches square was close-grained, tough, and quite easily machined, silicon being 2·25 per cent. In another similar test, sulphur was reduced from 0·10 per cent. to 0·04 per cent.

High silicon alloys are also now being made electrolytically up to over 95 per cent. silicon. Although the price of this material is very high, about $200 per ton, it can be economically used with good results when special soft castings are required and the quantity is not sufficient to make a separate cupola mixture possible. The cost per unit of silicon is not much higher than in the 8 per cent. or 10 per cent. silicon pig iron. In fact, if the foundryman knows just what composition he wants his castings to have, there is now no reason why he should not get it.

The so-called "iron medicines" of the foundry are simply mixtures of silicon, manganese, aluminium, etc., and these mixed with fluorspar constitute most of the patent fluxes.

In Canada, tests of cast iron products are usually mechanical only. These are made on test bars for transverse breaking strength, and on chilled blocks for observation of depth of chill. It is rare that any chemical analyses of these test bars or the castings themselves are made. Test bars and chilled blocks are very valuable for certain purposes, particularly to check the cupola operations within a few minutes after the metal is melted, and in some cases before it is poured into moulds; also to give daily comparative checks on cupola results of any given mixtures.

There has been much controversy over the size and shape of test bars. They should be uniform from day to day and of size and shape most representative of the class of work made. The 1-inch square bar cast horizontal, when properly handled, gives entirely representative and satisfactory results. When the same bar is used for drillings for analysis, a $1\frac{1}{8}$ inch to $1\frac{3}{8}$ inch section may be used, or a larger block cast on one end of the bar. For castings averaging over 1 inch in thickness a 1-inch bar would of course not give representative results as to combined and graphitic carbons. When using a bar with area greater than one square inch, distance between supports may be increased so as to give a breaking modulus equal to the 1 inch area. In no sense, however, can a test bar cast separately fairly represent a given casting. Difference in temperature when poured, size and shape of casting, condition of sand, treatment in cooling, and a multitude of other contingencies may render the bar and the casting quite different in the form of the carbons and consequent relative strength. In this emergency it has been suggested by some that a certain number of castings be tested to destruction, as in cast iron car wheels. This is manifestly impossible in many and very important cases. Neither the purchaser nor the manufacturer of locomotive cylinders would stand the expense of testing to destruction even one cylinder out of a hundred, and even if such test were made, it would not represent the other ninety-nine. The best method would seem to be to have such castings, and in fact all castings, made on chemical analysis, and their quality checked by physical tests, when practicable.

ESTIMATED MIXTURES.

Mixture for soft cupola grey iron castings.

Brand.	Pounds per charge.	Per cent.	Per cent. silicon.	Pounds of silicon.	Per cent. manganese.	Pounds of manganese.	Per cent. sulphur.	Pounds of sulphur	Per cent. Phosphorus.	Pounds of phosphorus.	Grade.	Grade units.	Cost 100 lb.	Total cost.
Special scrap. .	500	25	2·15	10·75	0·57	2·85	0·08	0·40	0·10	0·50	2	1000	0·77	3·85
AB pig iron—4	500	25	1·83	9·15	1·03	5·15	0·13	0·65	0·96	4·80	4	2000	0·81	4·05
XY pig iron—1	500	25	2·40	12·00	0·66	3·30	0·04	0·20	0· 6	4·30	1	500	1·00	5·00
Cast scrap . . .	500	25	2·00	10·00	0·40	2·00	0·12	0·60	1·00	5·00	3	1500	0·69	3·45
Total pounds	2000	100	—	41·90	—	13·30	—	1·85	—	14·60	—	5000	0·818	16·35
Grosspercentage	—	—	2·09	—	0·66	—	0·09	—	—	—	—	—	—	—
Loss by oxidation	—	20	0·42	25%	0·16	From c	oke 0·03	—	—	—	—	—	—	—
Net percentage	—	—	1·67	—	0·50	—	0·12	—	0·13	—	2·50	—	—	—

The manner of taking samples and drillings for analysis is of great importance. These should be taken so as to give a fair average sample, and special care used to get drillings free from dirt, sand, scale, or rust. Eight to 12 pigs should be selected, and at least two holes bored in each pig, an equal amount taken from each boring and intimately mixed. In taking drillings for analysis of castings, the drillings should fairly represent the metal from the surface to the centre of a cross section. The ratio of combined to graphitic carbon will be greatest at the surface, decreasing rapidly toward the centre. A knowledge of the ratio of combined to graphitic carbon, while of no value in pig iron analysis, is of great importance in the casting, as it largely determines the strength, softness, casting temperatures, and treatment in cooling.

One piece of coke or a handful of dust from a car load will not give a representative analysis of coke; 25 or 30 large pieces should be selected, and a small piece broken from each, these crushed and quartered down for final sample for analysis. One piece would manifestly not be representative, and if a sample is taken from the breeze, the sulphur may be very much higher than the average of the lot. Limestone, sand, flour, facings, clay, &c., should all be frequently checked. We have had samples of limestone which showed 20 per cent. in silica, and as the principal value of limestone is to flux off the silica, the low value of such limestone for cupola purposes is readily apparent. Many of the so-called facings leads are wholly or in part composed of very cheap materials, and while they may do the work satisfactorily, considerable variation in price would be apparent if these materials were bought on analysis. Many of the so-called graphites are simply carbonaceous shales and not graphites at all. While these shales are suitable facings for many classes of work, they should not be purchased as graphite. Chemical analysis will prevent the substitution of shale for graphite.

In short it is not necessary for the foundryman to do any guessing as to the composition of any of his materials or the results to be secured. By proper use of the chemical laboratory, complete and definite information can be quickly obtained as to the composition of all raw materials and finished products. He may know the exact relative value of all materials purchased as well as the quality of his product, and of this he may be assured even before the metal is melted.

Meeting held at Montreal on Friday, March 27, 1908.

MR. MILTON L. HERSEY IN THE CHAIR.

THE CHEMIST IN THE MODERN MEAT PACKING HOUSE.

BY J. T. DONALD.

The author describes the canning of meat, the manufacture of beef extracts, the treatment of beef fat for the production of oleo-margarine and lard compounds, the working up of the tankage, and the preparation of rennet, pepsin, adrenalin, and other pharmaceutical substances in meat-packing houses.

London Section.

Meeting held at Burlington House on Monday, May 4th, 1908.

DR. J. LEWKOWITSCH IN THE CHAIR.

ON SOME SIMPLE AND MIXED ESTERS OF CELLULOSE.

THE ALKALINE DECOMPOSITION OF NITRO DERIVATIVES OF CELLULOSE AND OTHER CARBOHYDRATES.

BY E. BERL, PH.D., AND WATSON SMITH, JUN., PH.D.

In the *Berichte* for 1907[*] is to be found a short account of some new esters of cellulose prepared by us. We now propose to give a more detailed account of these esters, and to furnish the results of an investigation on the decomposition of nitroderivatives of cellulose, starch, lævulose and glucose.

The first part of this work was undertaken with the intention of finally clearing up the important question as to the number of free hydroxyl groups in the cellulose molecule which are capable of substitution by acid radicles, and as a result it was found impossible to introduce more than 12 substituted groups into the cellulose molecule of $C_{24}H_{40}O_{20}$. This result agrees with that arrived at by Öst (Z. angew. Chem., 1906, **19**, 992; this J., 1906, 606) as also by Green and Perkin (J. Chem. Soc., 1906, **89**, 811; this J., 1906, 652).

Even the dodecanitrocellulose, containing theoretically 14·16 per cent. of nitrogen, has not yet been obtained in the pure state owing to its instability. The highest nitro product prepared so far, contains 13·92 per cent. of nitrogen, and probably consists of a mixture of endeca- and dodeca-nitrocelluloses. Berl and Klaye (Z. ges. Schiess u. Sprengstoffw., 1907, **2**, 403; this J., 1907, 1157) consider the nitration process as a reversible reaction:

$$C_{24}H_{40}O_{20} + nHNO_3 \rightleftarrows C_{24}H_{40-n}O_{20-n}(ONO_2)_n + nH_2O$$

and show that, after a certain maximum substitution is attained, the sulphuric acid of the nitrating mixture acts as a hydrolysing agent. Hoitsema (Z. angew. Chem., 1898, 173; this J., 1898, 374) has obtained a product containing 13·9 per cent. nitrogen by nitrating with pure crystallised anhydrous nitric acid. Here again the water liberated tends to reverse the reaction. As is well known, the use of excess of sulphuric acid in a nitrating mixture results in the breakdown of the cellulose structure. Partly for this reason, then, we were led to investigate the action on cellulose of a mixture of acetic acid (anhydride) and nitric acid according to several different methods. Three possibilities were open as a result of this combined action on cellulose, *viz.*, either to obtain pure nitro products or pure acetyl derivatives, or else to obtain mixed esters containing both acid radicles. All three results were, in fact, arrived at.

Action of acetic anhydride and nitric acid on cellulose.

Method I.—Carefully dried pure cotton-wool was treated with 10 times its weight of an acid mixture containing varying proportions of acetic anhydride and nitric acid (sp. gr. 1·48). About 0·5 c.c. of concentrated sulphuric acid was added to act as a catalyser. The product remained undissolved in the acid mixture, and after 48 hours standing at the ordinary temperature, was separated from the acid on a porcelain suction-filter and washed in running cold water until free from all traces of acid. Table I. gives the analyses and properties of the products obtained. The results are interesting as showing that acetic anhydride may be used in place of sulphuric acid as a dehydrating agent to prepare highly nitrated cellulose nitrates.

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[*] Ber., 1907, 903; (this J., 1907, 273).

TABLE I.

Action of acetic anhydride and nitric acid with a trace of conc. sulphuric acid on cellulose.

	Acid mixture.	Nitrogen per cent. (nitrometer).	Acetic acid.	Calculated for.	Polarisator microscope.	Solubility.
I.	50 grms. acetic anhydride 10 grms. nitric acid......	12·58	—	$C_{24}H_{30}O_{10}(NO_3)_{10}$. 12·78 per cent. N.	Structure well preserved. Steel blue colours.	In conc. H_2SO_4, difficultly soluble; also in chloroform.
II.	40 grms. acetic anhydride 20 grms. nitric acid	0·56	—	Unchanged cellulose.		
III.	30 grms. acetic anhydride 30 grms. nitric acid......	0·33	—			

Method 2.—By treating cellulose with a mixture of acetic anhydride and nitric acid without the addition of concentrated sulphuric acid, it was found that nitrocelluloses could be produced containing a high percentage of nitrogen. Mixtures containing varying proportions of acetic anhydride, glacial acetic acid, and nitric acid (sp. gr. 1·48), as seen in Table II., were found to act purely as nitrating agents on the cellulose. A very marked advantage of this acid mixture over the ordinary nitrating mixture of sulphuric and nitric acids, is that the dehydrating agent (acetic anhydride) may be used in almost any excess without any accompanying breakdown of the cellulose molecule.

TABLE II.

Action of acetic anhydride (A) *+glacial acetic acid* (E) *+nitric acid* (S) *on cellulose.*

	Time of reaction.	Acid mixture.	Nitrogen per cent. (nitrometer).	Acetic acid.	Calculated for.	Polarisation microscope.	Solubility.
	Hours.						
E	24	40 grms. A ..... 40 grms. E ..... 60 grms. S	—	—	Unchanged cellulose.		
D	24	40 grms. A ..... 40 grms. E ..... 40 grms. S	1·55	—	—	—	—
C	24	40 grms. A ..... 40 grms. E ..... 30 grms. S	12·97	—	$C_{24}H_{30}O_{10}(NO_3)_{10}$ 12·78 per cent. N.	Steel blue colours; fibres coarse.	With difficulty soluble in alcohol-ether.
B	24	45 grms. A ..... 45 grms. E ..... 20 grms. S	13·69	—	$C_{24}H_{29}O_{10}(NO_3)_{11}$ 13·50 per cent. N.	Steel blue colours; fibres coarse.	With difficulty soluble in alcohol-ether.
A	24	45 grms. A ..... 45 grms. E ..... 15 grms. S	13·13	—	$C_{24}H_{29}O_{10}(NO_3)_{11}$ 13·50 per cent. N.	Steel blue colours; fibres coarse.	With difficulty soluble in alcohol-ether.

It is interesting to note that the acid mixture, D, corresponds in chemical composition and boiling point exactly with A. Pictet and P. Genequand's acetyl orthonitric acid $(CH_3COO)_2N(OH)_3$ (Ber., 1902, **35**, 2526; this J., 1902, 1250). The liquid distilled quantitatively between 125° and 130° C.

In 1907, Pictet and Khotinsky (Ber., **40**, 1163) described the preparation of acetyl nitrate, CH_3COONO_2. This compound was prepared according to the author's methods by carefully mixing 15 grms. of nitric acid anhydride with 20 grms. of acetic anhydride. It was found that by treating 1 grm. of cotton with it for 24 hours at the ordinary temperature, a nitrocellulose resulted, containing 13·34 per cent. of nitrogen, which remained insoluble in concentrated sulphuric acid until after 2 days' standing.

It was found that nitrocelluloses prepared by the action of a mixture of acetic anhydride and nitric acid were somewhat more explosive than those prepared with ordinary nitrating mixture, although both products may contain the same percentage of nitrogen.

Action of nitrating mixture (*containing sulphuric acid and nitric acid*) *with acetic anhydride on cellulose.*

Method 3.—It was necessary to use great caution in mixing the acetic anhydride with the mixture of nitric and sulphuric acids; for, unless well cooled and stirred in slowly, the liquid will suddenly froth up with explosive violence, liberating volumes of oxides of nitrogen, and, according to Pictet, tetranitromethane. The decomposition is probably an autocatalytic one.

As will be seen from Table III. mixed esters, containing nitro and acetyl groups, were obtained by the action of this acid mixture on cotton. It is interesting to note with what suddenness the acid mixture loses its power to affect the cellulose on varying the relative proportions of the constituents contained in that mixture. In each case the cotton wool used, was treated for 24 hours with 10 times its weight of the acid mixture, in which it remained undissolved. Both products *a* and *b* were somewhat unstable and on standing for several days smelt perceptibly, although previously thoroughly well washed. The sweetish smell developed on standing some time, is characteristic of these mixed esters.

Analysis of the acetyl nitrocelluloses.—To determine acetic acid in presence of nitric acid in these cellulose esters, the product was first dried over phosphorus-pentoxide in a vacuum exsiccator, heated inside by small glow lamps to about 40° C. The nitrogen was determined as usual in the Lunge nitrometer. In order to determine the total acid, the cellulose ester is dissolved in concentrated sulphuric acid, and the clear solution introduced through the funnel into the flask constructed for the purpose (see Ber., 1907, **40**, 905). After washing the funnel down with dilute sulphuric acid and finally with water, the flask was connected to the condenser with a Ludwig's platinum connection. An ordinary rubber connection was found to vitiate the analysis results by about 1 per cent. The contents of the flask are steam distilled into a suitable receiver containing a known quantity of standard sodium hydroxide solution. The acetic acid is calculated as difference between the nitrometric determination and the total acid found.

Trial analyses:—Collodion cotton with 11·07 per cent. of nitrogen was dissolved in 6 c.c. concentrated sulphuric acid and the clear solution then run into the flask, diluted with freshly distilled water, and the contents steam distilled for 3½ hours into the standard sodium hydroxide solution, using phenol phthalein as indicator. Results were:—(*a*). Using the platinum tube connection, 11·39 per cent.; (*b*). Using ordinary rubber connection, 10·13 per cent. of nitrogen. The results of the distillation are usually slightly high, owing to small quantities of such decomposition products as formic acid, carbonic acid, etc., distilling over into the receiver.

TABLE III.

Action of acetic anhydride, sulphuric acid and nitric acid on cellulose.

	Time of reaction.	Acid mixture.	Nitrogen per cent. (nitrometer).	Acetic acid per cent.	Calculated for.	Polarisation microscope.	Solubility.
A	24	32 grms. X .. 8 grms. Y ..	11·16 N.	6·78 CH_3COOH	*a.* $C_{24}H_{30}O_{10}(NO_3)_9OCOCH_3$ 11·5 per cent. N; 5·47 per cent. CH_3COOH.	Fibres well preserved. Faint steel blue colour.	In chloroform with difficulty soluble. In conc. H_2SO_4 readily soluble.
B	24	24 grms. X .. 16 grms. Y ..	8·91 N.	13·49 CH_3COOH	*b.* $C_{24}H_{31}O_{11}(NO_3)_7(OCOCH_3)_2$ 9·0 per cent. N; 11·47 per cent. CH_3COOH.	Fibres broken; faint interference colours. Some fibres still show steel blue colour.	
C	24	20 grms. X .. 20 grms. Y ..	—	—	Unchanged cellulose.		

X = 40·66 per cent. H_2SO_4 + 43·85 per cent. HNO_3 + 15·49 per cent. H_2O.
Y = Acetic anhydride.

Action of acetic anhydride and sulphuric acid on nitrocellulose.

Method 4.—The results of this investigation have already partly appeared in the Ber., 1907, **40**, 903 (this J., 1907, 273). Without knowing previously that Messrs. Cross, Bevan and Briggs (Ber., 1905, **38**, 3532) had published an account of a similar investigation, in which they described a cellulose ester containing nitro, acetyl, and sulphuric acid residues, the action of a mixture of sulphuric acid and acetic anhydride was tried on nitrocellulose. In this manner pure acetylnitrocelluloses were obtained, which possessed the almost unchanged structure of the original nitrocellulose, and contained no sulphuric acid.

On dissolving nitrocellulose in acetic anhydride, and after several hours' standing, stirring the clear syrupy liquid into water, the nitro body is precipitated almost unchanged. On the other hand, if a few drops of concentrated sulphuric acid are added, a reaction is set up with sudden evolution of heat, which may become so violent that the liquid boils up and total destruction of the cellulose compound in solution, takes place. The temperature must therefore be kept low. After a short time has elapsed the clear slightly yellow liquid is poured into a large excess of cold water, and the resulting white precipitate well washed from all traces of free acid. By varying the time of reaction, products were obtained which varied somewhat largely in composition. The solutions in chloroform and ether-alcohol of these nitro-acetyl celluloses, give somewhat powdery residues on evaporating, whereas the solutions in acetic ester and in acetone give very tough transparent films. Although these esters contain from 3 to 4 per cent. of nitrogen, they are not appreciably more inflammable than pure cellulose acetates, so that they present characteristics which may make them of technical importance. It was found impossible to displace all the nitrogen of the nitrocellulose with acetyl groups unless a large excess of sulphuric acid was used, which resulted at the same

TABLE IV.

Action of acetic anhydride + 2 c.c. conc. sulphuric acid on nitrocellulose.

Time of reaction	Nitrogen per cent.	C.c. *N*/5 NaOH for $HNO_3 + CH_3COOH$.	C.c. *N*/5 NaOH for CH_3COOH.	CH_3COOH per cent.	Calculated for.	Solubility, etc. Polarisation microscope.
Hours. ½	4·19	43·97	29·02	34·84	$C_{24}H_{31}O_{11}(NO_3)_3(OCOCH_3)_6$ N = 4·06%; CH_3COOH = 34·79%	In acetoacetic ester and acetone easily soluble; in chloroform and alcohol-ether less soluble.
1	3·97	41·73	27·57	33·10	—	In polarisation microscope iridescent colours
2	4·54	50·23	34·03	40·86	$C_{24}H_{28}O_8(NO_3)_4(OCOCH_3)_8$ N = 4·81%; CH_3COOH = 41·24%	—
4	4·86	51·64	34·30	41·22	—	—
12	2·64	49·19	39·77	47·74	$C_{24}H_{29}O_9(NO_3)_2(OCOCH_3)_9$ N = 2·51%; CH_3COOH = 48·39%	—

time in a disintegration of the whole cellulose molecule so that only colloidal, ill defined products could be obtained on pouring the product of the reaction into a strong solution of common salt.

The action of glacial acetic acid on nitrocellulose in presence of a small quantity of concentrated sulphuric acid was found to be very slow. After 1 to 2 hours, the nitrocellulose remained practically unchanged except for being slightly more soluble in the usual solvents such as acetone, ether-alcohol, etc. On standing for 48 hours, however, the clear liquid became less viscous and on pouring into water, yielded a small quantity of a white flocculent precipitate, easily soluble in the solvents for acetyl celluloses, and containing no nitrogen. It is to be expected that by controlling more accurately the time of the reaction, pure acetyl celluloses may be prepared in this manner.

Action of phenylhydrazine on acetylnitrocellulose.—The acetyl nitrocellulose was dissolved in strong acetic acid, and a slight excess of phenylhydrazine added. The clear liquid was heated for some time on the water bath, and then poured slowly into dilute acetic acid, with constant stirring. A light yellow fibrous product was obtained which was purified by redissolving in acetic acid, precipitating with a large volume of water and then thoroughly washing with water. The compound was dissolved in acetone, precipitated with water and thoroughly washed with dilute alcohol, yielding a light yellow mass, composed of fine fibres and easily soluble in chloroform, acetone and acetoaceticester, from which latter solvent especially, tough light-yellow opaque films could be prepared. Analysis yielded the following formula :—

$$C_{24}H_{28}O_7(NO_3)_4(CH_3COO)_3N_2H.C_6H_5.^*$$

The alkaline decomposition of nitro derivatives of cellulose, starch, glucose and lævulose.—In "Researches on Cellulose," 1895—1900, p. 77—91, Cross and Bevan summarise the work done by Brown and Morris and by Fenton and Gosling and others, in the following general conclusions, namely :—The various forms of cellulose contain one or more groups or nuclei identical with that contained in lævulose and which are of ketonic character; also that similar groupings are contained in starches and dextrins, but that the proportion of such groupings represents a relatively small part of the whole structure.

These conclusions are confirmed by us in the present researches for we are able to show that by the action of alcoholic caustic soda on the nitro derivatives of lævulose and of cellulose, products are obtained which give one and the same osazone, melting at 145—146° C. We have also confirmed the fact that cellulose contains a glucose residue, in having found that the nitro derivatives of both cellulose and of glucose yield by the same treatment, relatively large quantities of oxypyruvic acid.

It is also shown by us that starch contains similar groupings as those contained in cellulose, by the preparation from starch nitrates of a product which resembles very closely oxypyruvic acid, in properties and chemical constitution.

Action of alcoholic caustic soda on nitrocellulose.—Will succeeded (1891) in isolating oxypyruvic acid as a definite decomposition product of cellulose, and found that the acid possessed optically active properties. This property of the acid was supposed by Will to point to presence of an asymmetric carbon atom, although at the same time the properties of the acid suggested the ketonic formula which contains no asymmetric carbon atom. In order to clear up this discrepancy and if possible to throw some more light on the constitution of the cellulose molecule, the action of alcoholic caustic soda on nitrocellulose was more fully investigated. Nitrocellulose was placed in portions of 5 grms. at a time in alcoholic caustic soda, the liquid being continually stirred in a large porcelain basin. Especial care must be taken to keep the temperature below 30° C.; if necessary, by placing the basin in powdered ice. In a very few minutes a flocculent precipitate separated from the pulpy liquid, accompanied by a sudden rise of temperature. This precipitate very soon changes from light-red to dark-brown, and settles to the bottom of the basin as a sticky semi-solid mass. After 10 minutes more, the mother liquid is poured off and the precipitated mass washed with a little absolute alcohol, and then dissolved in water. The aqueous solution is at once acidulated with acetic acid. This takes place with evolution of a mixture of gases such as oxides of nitrogen, prussic acid, carbonic acid, etc.; and at the same time the deep red-brown solution becomes almost colourless. On acidulation, a light yellow sticky scum settles out on the surface of the solution and becomes hard and granular on washing it in cold water. Analysis proves this body to be a low nitrated cellulose nitrate, namely the tetranitrocellulose. The acidulated aqueous solution was filtered, concentrated and then lead acetate solution added. Care must be taken not to add excess, as the lead salt of oxypyruvic acid is soluble in lead acetate. The light yellow precipitate of this salt was treated then with hydrogen sulphide, and the filtrate from lead sulphide concentrated and decolorised by heating with animal charcoal on the water bath. The precipitation of the lead salt was repeated generally twice, the almost colourless acid solution thus obtained, consisting chiefly of oxypyruvic acid. The yield amounts to seldom more than 7 to 8 per cent.

The tetranitrocellulose probably forms an intermediate stage in the breakdown of the cellulose molecule by the alkali, whilst the final products of the decomposition were found to consist chiefly of oxalic and formic acids. The tetranitrocellulose was purified by dissolving it in hot alcohol and precipitating it with water. This operation was repeated, when the dried substance was obtained as an amorphous white powder, easily soluble in alcohol, acetone and strong acetic acid. It burned with a faint puff. By warming a portion of the body with two drops of benzene and 1 c.c. sulphuric acid the characteristic odour of nitrobenzene was perceptible, indicating the presence of nitric acid groups. The analyses, however, show that the nitrogen in tetranitrocellulose is not all present in the form of nitric acid.

Nitrogen (in nitrometer), 5·35 per cent. Nitrogen (Dumas), 6·82 per cent.; carbon, 35·20 per cent.; and hydrogen, 3·70 per cent. Calculated for $C_{24}H_{36}O_{16}(NO_3)_1$: 34·74 per cent. carbon; 4·39 per cent. hydrogen; 6·76 per cent. nitrogen.

Action of acetic anhydride on tetranitrocellulose.—By the action of acetic anhydride with the addition of a few drops of concentrated sulphuric acid, a white powdery product was obtained, easily soluble in alcohol, acetone, aceto-acetic ester, chloroform, etc., and which proved on analysis to be a mixture of endeca-acetylmononitrocellulose $C_{24}H_{28}O_8(OCOCH_3)_{11}NO_3$, and dodeca-acetylcellulose, $C_{24}H_{28}O_8(OCOCH_3)_{12}$.

Action of phenylhydrazine on tetranitrocellulose.—This nitrocellulose is still further characterised by forming with phenylhydrazine, according to the method used in the case of nitroacetylcelluloses, already described, a compound answering to the following formula, $C_{24}H_{36}O_{15}(NO_3)_4N_2HC_6H_5$, which gave tough, orange yellow films, from aceto-acetic ester solutions. (Carbon, 39·66 per cent.; hydrogen, 4·84 per cent.; nitrogen, 9·52 per cent: calculated, carbon, 39·22; hydrogen, 4·58; nitrogen, 9·15 per cent.)

Properties of the oxypyruvic acid.—It was found difficult to obtain the oxypyruvic acid in a perfectly pure solid state. On incineration small quantities of ash were always found. The solid substance, which was obtained as a light brown powder by precipitating the concentrated syrupy solution with absolute alcohol, was very hygroscopic and on exposure to the air, soon liquefied by absorption of moisture. The acid had to be characterised therefore by the preparation of derivatives :—

The anilide of oxypyruvic acid.—The solution of the acid was evaporated down to a syrupy consistency and whilst still warm, aniline was added in slight excess. The liquid on well stirring, set almost at once to a deep red crystalline mass with evolution of heat. The substance was dried, washed with absolute alcohol, recrystallised from water, and finally from alcohol, by which means it was obtained in white transparent needles, melting at 178° C. The solution of the crystals in water was acid to litmus and optically inactive. It may be concluded therefore that the optical activity of the acid itself is probably caused by impurities.

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*Nitrogen (nitrometer) 4·56 per cent.; (Dumas), 6·22 per cent.; Calculated for total nitrogen, 6·69 per cent.; nitrogen as nitro radical 4·46 per cent. of nitrogen.

The analyses suggest the following formula for the compound, $HO.CH_2.C(:N.C_6H_5)COOH$. (Carbon, 60·07 per cent.; hydrogen, 5·26 per cent.; nitrogen, 9·96, 9·91 per cent.: calculated, carbon, 60·30 per cent. ; hydrogen, 5·08 per cent.; nitrogen, 7·82 per cent.)

Oxypyruvic acid is characterised particularly by its ready susceptibility to oxidation and fermentation. This is quite in accordance with Werner's theory that substances, which contain a number of carbon atoms divisible by 3, are always more readily fermented and oxidised. Under the action of the *Penicillium Glaucum* ferment, the optical activity, acidity and reducing action on Fehling's solution almost totally disappears within a few weeks. From the fermented liquid it was found impossible to prepare the anilide compound on addition of aniline.

Action of phenylhydrazine on oxypyruvic acid.—The osazone of oxypyruvic acid was prepared according to the usual method, and well purified by solution in sodium carbonate solution and reprecipitation with acid. By recrystallising several times from benzene, two fractions were obtained, one melting at 145—146° C. and the other at 215—216° C. The fraction melting at 215—216° was composed of fine blue black lustrous crystals, which on grinding in a mortar yielded a lemon yellow coloured powder. Analysis proved this fraction to be the osazone of oxypyruvic acid, which according to Will and Aberson melted at 207° C. Their lower melting point was due to admixture with the lower melting fraction (145—146°), which was probably not separated by these authors. Analysis of the osazone of oxypyruvic acid: carbon, 63·44 per cent., hydrogen, 4·97 per cent., nitrogen, 19·02, 19·15 per cent. ; calculated for $C_{15}H_{14}N_4O_2$, or $C_6H_5NH.N : CH.C(COOH): N.NH.C_6H_5$,, carbon, 63·70 per cent., hydrogen, 5·01 per cent., nitrogen, 19·86 per cent.

Action of alcoholic caustic soda on glucose nitrate.—Glucose nitrate containing 13·30 per cent. of nitrogen and prepared from glucose by the action of a nitrating mixture, containing 16 per cent. of water was treated with alcoholic caustic soda, exactly as for nitrocellulose. The glucose nitrate was introduced into the reagent in small quantities at a time to prevent too sudden rise of temperature. On stirring, the liquid changed to orange yellow and then deep red, with precipitation of a semi-solid, sticky, red mass. This substance was separated from the mother liquid by decantation, then dissolved in water, acidulated with acetic acid, and heated for same time on the water-bath until liberation of gas had ceased. A partially denitrated nitroglucose, containing 8·21 per cent. N., was precipitated by the acidulation and corresponded to tetranitrocellulose A lead salt was precipitated from the acid solution by the addition of lead acetate. This salt was treated with hydrogen sulphide and the filtrate from lead sulphide evaporated down with animal charcoal. The properties of the acid solution thus obtained, were found to correspond exactly with those of oxypyruvic acid, giving an osazone (M.P. 215—216°), an anilide (M.P. 178° C.), and reducing Fehling's solution. It was optically active, turning the plane of polarisation to the left.

Action of alcoholic caustic soda on lævulose nitrate.—By the treatment of lævulose nitrate containing 12·74 per cent. of nitrogen with alcoholic caustic soda, it was found to yield, as in the case of nitrocellulose and glucose nitrate, a product of partial denitration containing 8·84 per cent. of nitrogen, soluble in alcohol, acetone etc.

An acid solution was isolated and purified from the lead salt and was found to exhibit properties similar to those of oxypyruvic acid. It strongly reduced Fehling's solution and was optically active, turning the plane of polarisation to the left. No compound could, however, be prepared by the action of aniline ; but with phenylhydrazine an osazone was obtained, soluble in sodium carbonate solution and reprecipitated by acids. By recrystallising from benzene two fractions were separated. The fraction melting at from 75°—80° C. was obtained in too small quantities to bear further investigation. The light orange yellow crystals melting at 145—146° C. were easily soluble in alcohol acetone, benzene, etc., and on mixing it with the osazone from nitrocellulose, which also melted at 145—146° C., the melting point remained constant proving both to be identical.

Action of alcoholic caustic soda on starch nitrate.—The starch nitrate as a snow-white powder containing 14·08 per cent. of nitrogen was treated with alcoholic-caustic soda in exactly the same way as in the three former cases. The action of the alkali on the starch molecule was somewhat slower, a dark brown semi-solid mass, representing the sodium salt, being again in this case precipitated with a rise of temperature. On acidulating the aqueous solution of the sodium salt, a mixture of gases, nitric oxides, prussic acid, carbonic acid, etc., were evolved, and a partial denitration product containing 5·76 per cent. of nitrogen again precipitated. The acid solution was precipitated with lead acetate, and, from the lead salt obtained, the acid was liberated by the action of sulphuretted hydrogen, and purified.

The almost colourless acid solution was found to be laevo rotatory and to reduce Fehling's solution strongly. It possessed the characteristic aldehydic odour of caramel. With phenylhydrazine, it yielded an osazone compound which dissolved in sodium carbonate solution and was reprecipitated by acid. By recrystallising from benzene it was separated into two fractions. The fraction melting at 167° C. was not further investigated. The product which melted at 88—90° C. was soluble in alcohol and acetone, but with difficulty in benzene. It crystallised best from a mixture of petroleum spirit and ether. Analysis showed the substance to be probably the hydrazone of a homologue of oxypyruvic acid, which might be represented by either of the following formulae,

$$C_6H_5.NH.N : CH.CH_2.CHOH.COOH, \quad \text{or}$$
$$C_6H_5NH.N : C\ (COOH)CH_2.CH_2OH.$$

	Mol. wt.	Hydrogen. per cent.	Carbon. per cent.	Nitrogen per cent.
Found	201	5·74	57·13	12·66
Calculated	208·14	5·82	57·65	13·46

THE MECHANISM OF FILTRATION.

BY EMIL HATSCHEK.

Filtration is the separation of liquids from solid particles contained in them by means of a partition having pores of such size that they do not permit the passage of the particles, while allowing the free flow of the liquid. The phenomena arising in this process are extremely well-known in practice, but have not yet received any analytical treatment. Such a treatment, if carried out generally, would be excessively complicated, and would call for a mathematical apparatus out of all proportion to the probable value of the results. It is therefore advisable to consider only one or two cases, specially selected for their simplicity, and yet made sufficiently typical to explain a great many peculiarities of the process of filtration.

Fig. 1 represents a section of a septum, showing two of the openings and the probable stream lines and vortices set up by the liquid in its passage into these orifices. Two spherical particles are suspended in the liquid, and will obviously be carried as far as possible into the orifices by its flow. This process occurs all over the surface of the septum, and the distribution of successive layers of particles depends entirely on the relation between the sizes and mutual distances of the orifices on the one hand, and the sizes and shapes of the particles on the other. If the mean distances between the orifices are considerably larger than the maximum diameters or dimensions of the particles, the first layer of particles deposited will be widely separated, and may contain particles deposited secondarily on the solid surface of the septum between other particles, which, as explained,

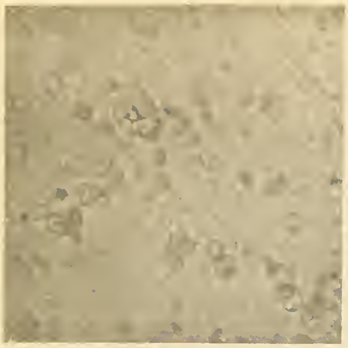


FIG. 6.

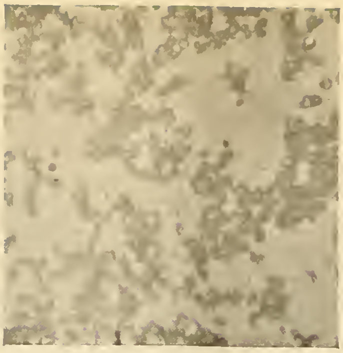
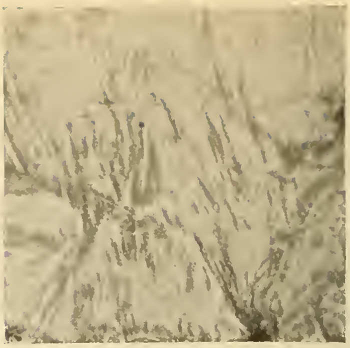


FIG. 7.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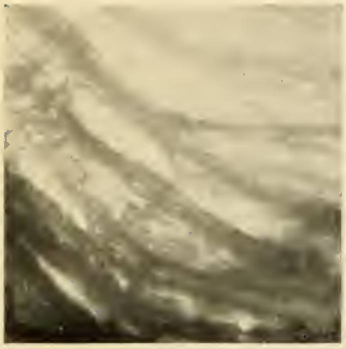
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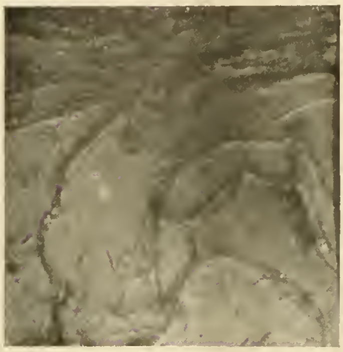
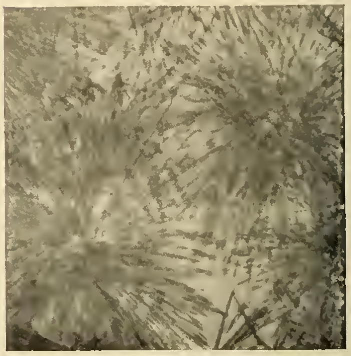


FIG. 10.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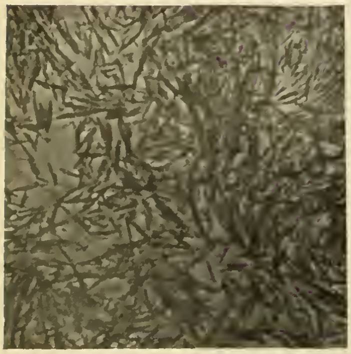
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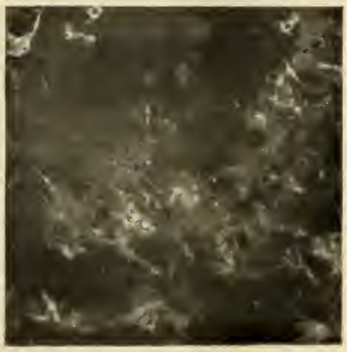
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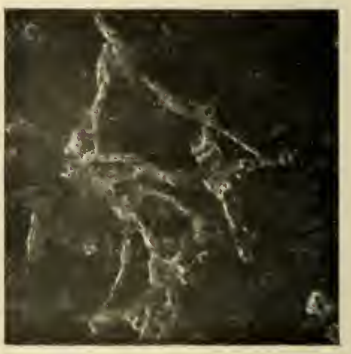


FIG. 16.

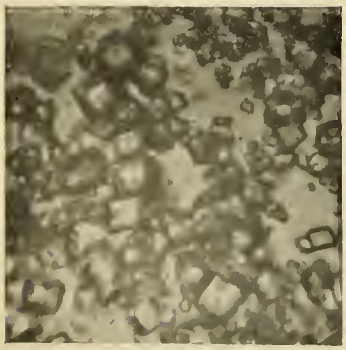


FIG. 17.

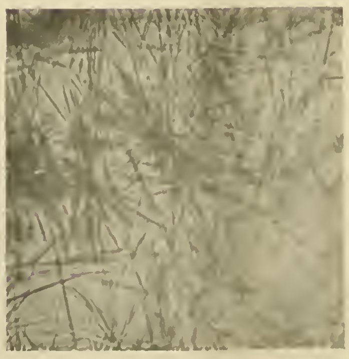
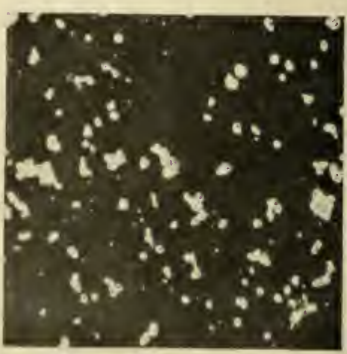


FIG. 18.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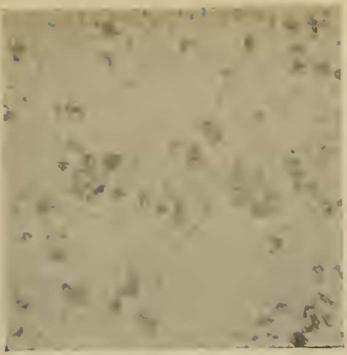


Fig. 20.

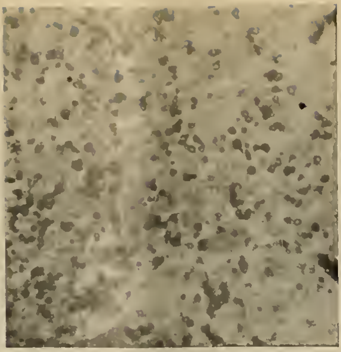


Fig. 21.

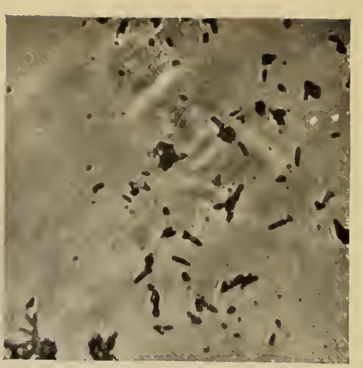
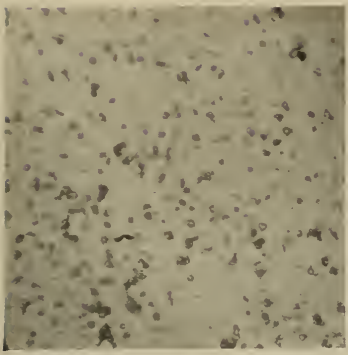


Fig. 22.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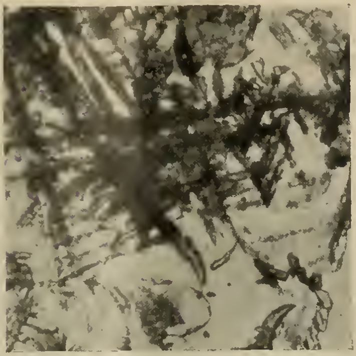
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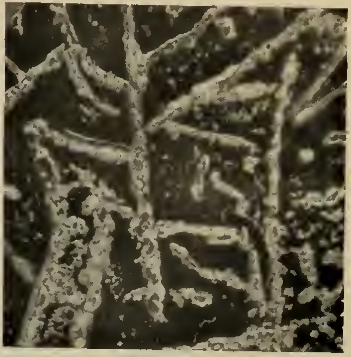
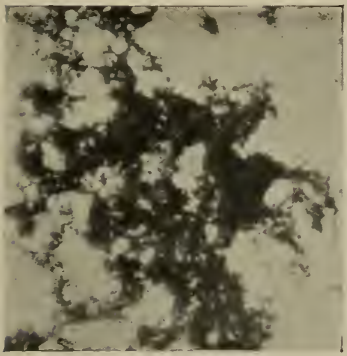


Fig. 25.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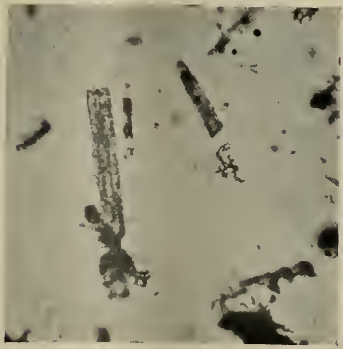


Fig. 27.

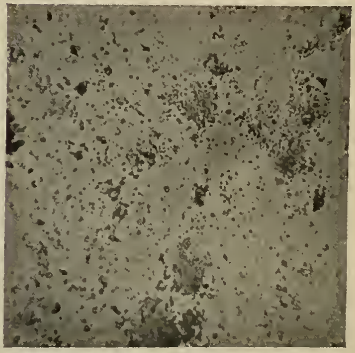


Fig. 28.

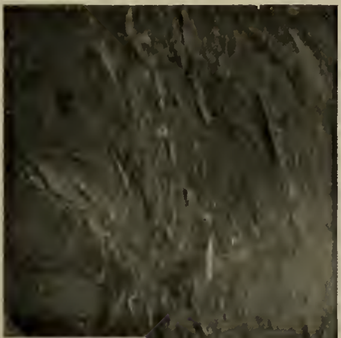


Fig. 29.

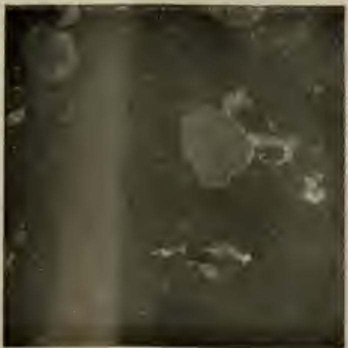


Fig. 30.

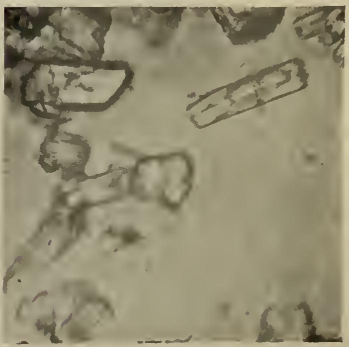


Fig. 31.

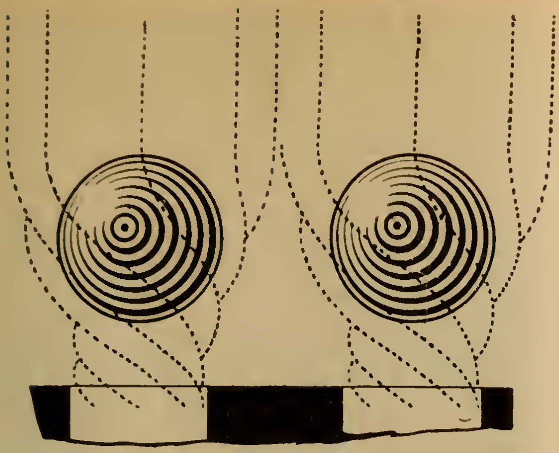


Fig. I.

have been carried over orifices. If, on the other hand, the mean diameter of the particles is greater than the mean distance of the orifices, it is obvious that not every orifice can be covered by one particle. The whole problem of the structure of the deposit of solid matter is, therefore, a purely stereometric problem of very great complexity even in the hypothetical case of particles of a definite geometrical shape.

For the purpose of considering a simple case, we choose a septum consisting of agglomerated spherical or cylindrical particles, of which a surface view is shown in Fig. 2.

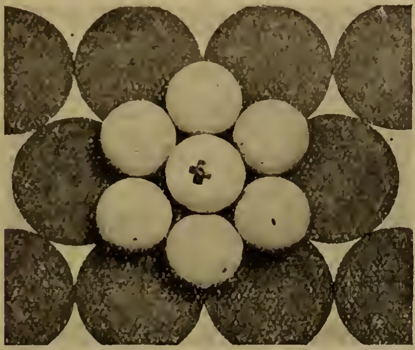


Fig 2.

The openings in this filtering surface are, therefore, the spandrils between the circles in contact. If the radius of the circles forming the surface is R, the area of a spandril is 0·162 R^2. In an area, A, of sufficient size and suitably chosen, there are two spandrils for each circle, so that the total area of the orifices is 0·093 A. To cover this surface uniformly, let us assume spherical particles of such a diameter, that they are in mutual contact when placed centrally over the spandrils, which position they would tend to assume under the influence of the flowing liquid. It is at once apparent that six such particles will place themselves over the six spandrils surrounding each circle, and that a seventh particle, marked +, will be deposited secondarily in the centre of the first six. It is now obvious that the area of each spandril is throttled to a considerable extent. If we make the assumption, which is not strictly correct, that the area obstructed by the particle is the circle cut off on it by the surface of the septum, the amount of throttling is easily calculated. The area of such a circle is 0·0744 R^2, and the area of one spandril, which remains clear, is 0·0876 R^2. The total free area, instead of the expression given above, *viz.*, 0·093 A, is now 0·0502 A, or less than 54 per cent. of the original cross-section. The structure of the further layers of the deposit is that of the first layer, *i.e.*, they also consist of spherical particles in mutual contact. The arrangement of the passages is, however, quite different in the second and further layers as shown in Fig. 3. In this figure, the first layer,

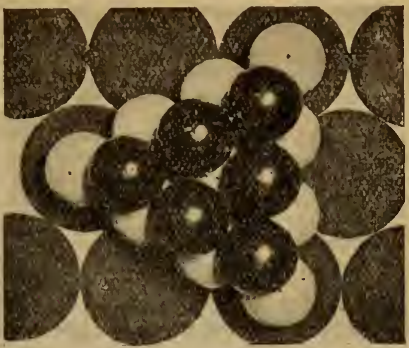


Fig. 3.

i.e., the layer resting immediately on the septum, is shown in white, and the second layer dark. It will be seen at once that the particles cannot arrange themselves, as in the first layer, centrally over every passage, but only over alternate ones. Half the passages between the spheres of the first layer are therefore uncovered and half of them covered by the particles of the second layer. The latter passages will be considerably obstructed, but the total free passage area is about 30 per cent. greater than that of the throttled septum. This structure, as already mentioned, is the same throughout the further layers.

From this extremely special and simple case, a number of important conclusions may be drawn. The first point illustrated is that a considerable throttling of the free passage area of the septum is caused by the very first layer of particles deposited on the same. This amount of throttling is specific for any given septum and any given size of particles; with a septum having openings of suitable shape and with particles of suitable shape and size, it is possible to stop the flow of liquid almost immediately, and although this case naturally hardly ever occurs in practice, yet the considerable pressure necessary for filtering various precipitates is caused to a preponderating extent by this throttling effect of the initial layer of deposit. In most cases, in fact, the free passage way in every succeeding layer is probably greater than the free passage way left in the throttled orifices of the septum, just as in the special instance selected for illustration. The second point, which is clearly shown by the preceding discussion, is, that the whole structure of the deposit is very largely determined by the size and distribution of the orifices in the septum, and their relation to the diameter of the particles. The particles shown in Fig. 2 were chosen of such a diameter as to be in mutual contact when placed over the openings in the septum. If we now assume that the same septum is used for filtering particles of somewhat smaller diameter, say three-quarters of that first shown, the following conditions will prevail:—Six particles will still, by the flow of the liquid, be carried over the six spandrils; they will, however, no longer be in mutual contact, nor with the seventh particle deposited somewhere between them, or, in other words, the percentage of voids in the deposit will be considerably larger than in the case shown in Fig. 2. In practice the irregularity of the particles, and the equalising effect which this irregularity produces in a cake of some thousand layers—a cake of barium sulphate one inch thick contains from 5000 to 7000 layers—masks this condition, but it can generally be noticed that the surface in contact with the septum is wetter, *i.e.*, has a larger percentage of voids, when the septum is more porous.

A further question of considerable importance is not illustrated in the case of spherical particles, or of regular polyhedra, *viz.*, the tendency of particles to align themselves with the stream lines. This depends on the velocity of the flow and on the shape of the particles, which naturally tend to arrange themselves so as to offer the minimum resistance to the flow of the liquid. The ultimate structure of a deposit consisting of asymmetric particles will therefore be settled chiefly by their behaviour in the stream lines, and modified by such other factors as their relative size and the distribution of the pores in the septum. In most cases, however, the arrangement will not be one in which the maximum number of given particles is contained in a given space, as, *e.g.*, the arrangement which would be produced by prolonged shaking of the same particles. In the deposits or "cakes," as generally obtained by filtration under pressure, this feature can be made evident at once. In this case, the voids are filled by the mother liquor, and any treatment which reduces the percentage of voids will cause the liquor to appear, or in other words, the cake to become wet. It is a perfectly familiar fact that apparently dry cakes of, *e.g.*, calcium sulphate or calcium carbonate, which break with a clean fracture, can be reduced to an almost liquid mass by mere shaking. A cake with which this is not possible is simply the result of a fortunate accident.

As already mentioned, the particles will tend to place themselves so as to offer the minimum resistance to the flow of the liquid. As this resistance increases very rapidly with the velocity, limit values are possible with particles of a certain shape. If the particle has, for instance, the shape of a rhombic pyramid, as shown in Fig. 4, it may keep the position shown with respect to the stream lines if the velocity is small, as even the section at right angles to the latter is such as to offer very little resistance. With an increasing velocity of flow, which will have the further effect of producing vortices, the particle, will, however, ultimately assume the position shown in Fig. 5. In this case, it may pass right through the orifices if the cross section is sufficiently small. This consideration explains the effect, which is also well known from practice, that certain precipitates will pass through a filter if filtration is begun at high pressure, whereas they will not do so if the pressure at the start is extremely low and is only gradually increased as the deposit forms.

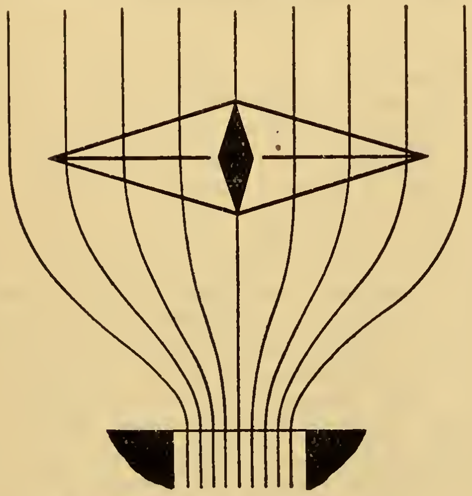


Fig. 4.

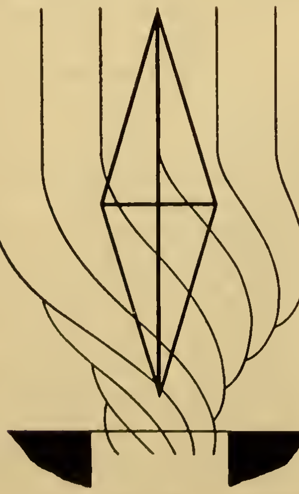


Fig. 5.

The foregoing considerations apply only to precipitates consisting of rigid particles, whether crystalline or amorphous. Apparently rigid particles are frequently met with, even in the latter case, for instance, calcium carbonate, which, from cold solutions, precipitates in the form of globules, as shown in Figs. 6 and 7. A vast number of amorphous precipitates, however, cannot be described as consisting of rigid particles, and their behaviour when arriving on the septum or forming successive layers must be considered separately. Figs. 8 and 9 show copper ferrocyanide precipitated on the slide. These precipitates form skins or membranes apparently possessing a further structure, which is not quite clear, in spite of the high magnification of 350 dias. employed. Another precipitate of a similar character is that of alumina, shown in Fig. 10, and enlarged about 150 dias. If a liquid containing particles of such membranes is filtered, various conditions may arise according to the velocity of flow. If the latter is great, the membranes may be destroyed by the currents and vortices in the liquid even before touching the septum, and as their ultimate structure is extremely fine, they will pass through the filtering medium. This, for instance, happens regularly with Prussian blue, if the pressure at the beginning of filtration is at all high. If the velocity is very low, the membranes may settle down on the septum, and would then be torn through, where they cover the orifices in the latter. The same thing would happen in successive layers; but, with a speed sufficiently low, the destruction of the precipitate would be very slight after the start, and filtration would proceed without any notable amount of precipitate passing through. If the membranes are somewhat tough, the tearing will cease after a certain thickness has been reached and the filter will be stopped. All these cases are well known in practice in connection with such precipitates as have been quoted, and similar ones like silica hydrate, which is present in most liquors obtained by leaching minerals with acids.

In the foregoing we have attempted to analyse the relation between velocity of flow and pressure for a given precipitate. A comparison between two different substances is also interesting. Assuming two different precipitates, the particles of which are of the same shape, but bigger in one case than in the other, it is probable that the first will have a small number of large openings, and the second a larger number of smaller openings between the particles, in the same space. If the aggregate area of these is the same in both cases, it is obvious that the few large openings will offer less resistance to the flow of the liquid than the many small ones or, in other words, the pressure required to produce the same flow will be smaller in the case of large particles. As, for any given precipitate, the size of the particles is surprisingly constant and uniform, it is not very easy to find examples. We give, however, in Figs. 11 and 12, photo-micrographs showing respectively calcium sulphate and an organic salt, the crystals of which bear a close resemblance to the needles of the sulphate. Both are photographed on the same scale, showing the calcium sulphate crystals to be about 2—3 times as large as those of the salt. The behaviour of the two precipitates in the filter is very similar. Both form a good, apparently dry, cake of fair cohesion which breaks with a clean fracture. While, however, cakes of calcium sulphate two to three inches thick can easily be obtained with a vacuum filter, *i.e.*, with a pressure of, say, 14 lb. per sq. in., filtration with the other precipitate practically stopped at 20 lb. per sq. in., when a thickness of only ½ inch was attained. To keep up a flow equal to that with calcium sulphate, it was necessary to use a pressure of

60 to 80 lb. In close connection with the foregoing is the behaviour of precipitates consisting of particles of different sizes, *i.e.*, composed of two or more substances. The smaller particles will be set in motion more quickly than the larger ones, and will reach the filter surface first. When a precipitate contains such particles notably smaller than the bulk, they will, therefore, either pass through the filter or stop the same. As even precipitates of uniform composition contain a small percentage of undersized particles, it is quite general to see these passing through the filter at the commencement of filtration, after which they are followed by clear filtrate. This is the natural consequence of the throttling of the orifices in the septum by the larger particles which succeed the first flow of very small ones. The throttled area of each orifice may be so small as to stop even the smallest particles, and this is the explanation, in somewhat more scientific language, of the statement generally made to account for this phenomenon, *viz.*, that it is not the filtering material itself, but the layer of the precipitate which acts as filter.

To produce the flow of liquid, which is the essence of the process of filtration, it is, of course, necessary that a difference of pressure should prevail between the two faces of the septum, apart from the capillarity of the latter, which is of no great practical importance. The excess pressure on the filtering side of the septum is hydrostatic, and due either to the column of the liquid itself, or to an artificial column produced by compressed air, or by a pump. As a great many misconceptions concerning the object and effect of pressure seem to exist in practice, the subject deserves extended consideration. The first object, and, as we shall see, the only effect of the pressure, is to produce the flow of liquid through the septum and through the gradually increasing layer of solid matter on the same. Increased pressure produces an increased velocity of flow, and theoretically the latter only increases as the square root of the former, if friction is left out of consideration. Friction is produced and pressure absorbed in three ways: (1) in forcing the liquid through the pores of the septum: (2) in forcing the liquid through the reduced orifices in the surface of the septum; (3) in forcing the liquid through the increasing number of layers of particles. The resistances specified under (1) and (2) are constant for a given particle, while that under (3) increases as the layers increase in number. Obviously, a thickness of deposit can be reached which does not permit any more liquid to pass with a given pressure. If the pressures under which a liquid escapes through an orifice without friction be plotted as abscissæ, and velocities as ordinates, the curve produced is, of course, a parabola. Fig. 13 shows this parabola for a certain septum in dotted line. The velocities of flow at various pressures with water and with the same septum were then determined experimentally and are plotted in full line. It will be noticed that the curve has an inflexion at A, which indicates that at that point, *i.e.*, pressure, the loss of head is a maximum for the septum under consideration. Experiments with a number of different septums and with various liquids all show this inflexion. Fig. 14 illustrates in a very striking manner the effect of extremely thin layers of deposit on the surface of the septum, which was predicted on purely theoretical grounds earlier in this paper. The top curve shows the velocity of flow through the clean septum with water. A layer of deposit was then formed by filtering water in which had been suspended a quantity of barium sulphate, sufficient to produce on the septum a layer only 0·3 mm. thick. The velocity of flow, as shown by the curve A, is reduced to less than one-fifth by this minute thickness, and it will be further noticed that the inflexion is shifted to the right-hand side of the diagram, *i.e.*, that the maximum resistance occurs at higher pressure. The two further curves, B and C, show the velocities after the addition of further barium sulphate, sufficient to double and treble respectively the thickness of the original layer. Consideration of these diagrams show that, for any given septum, the velocity at first increases approximately in proportion to the pressure until the point of maximum resistance is reached. After this point the ordinates of curve showing the velocities become more and more nearly proportionate to the square roots of the pressures. Until this point is reached, increase of pressure may therefore be justifiable as producing a saving of time or of filtering surface. Whether it is economical, depends on other considerations, and is particularly questionable in the case of compressed air. If, *e.g.*, a certain quantity of liquid has to be filtered, and compressed air at, say, 15 lb. or 30 lb. is used alternatively, the liquid will have to be replaced by the same volume of air at 15 lb. or 30 lb. In the first case, double the volume of free air must be compressed to 15 lb. pressure; in the second, three times the volume must be compressed to 30 lb. pressure. The power required in the second case is, roughly, about 2·4 times that required in the first. It is, therefore, impossible that the increase in velocity should be proportional to the increased expenditure of power. These considerations are quite clear, but the effect of the pressure on the structure of the solid layer is much less so, and is fairly generally misunderstood. The opinion seems to be widespread, and is certainly superficially plausible, that increased pressure produces a harder or dryer cake, especially where filtration takes place in a closed space, as in the chamber of a filter press; in other words, increased pressure is supposed to reduce the percentage of voids and to bring the solid particles into closer contact. The short analysis of the formation of the deposit, given at the beginning of this paper, is probably sufficient to show this view to be quite unfounded. While the particles are suspended in

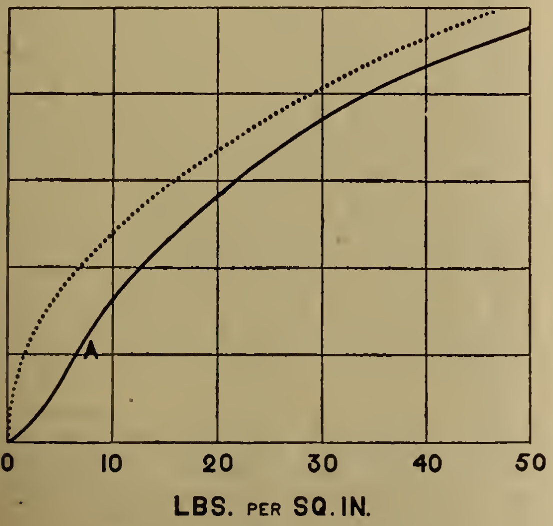


Fig. 13.

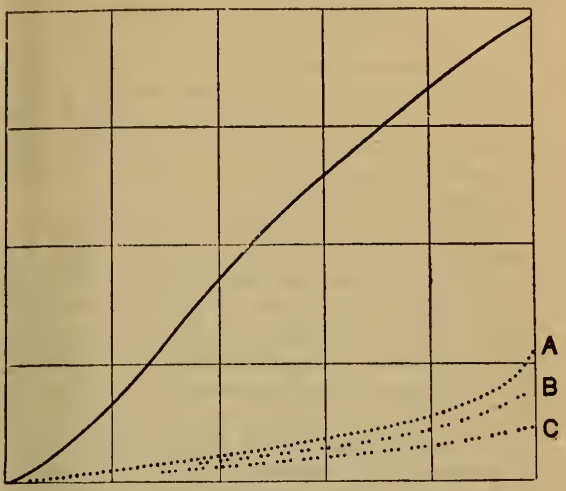
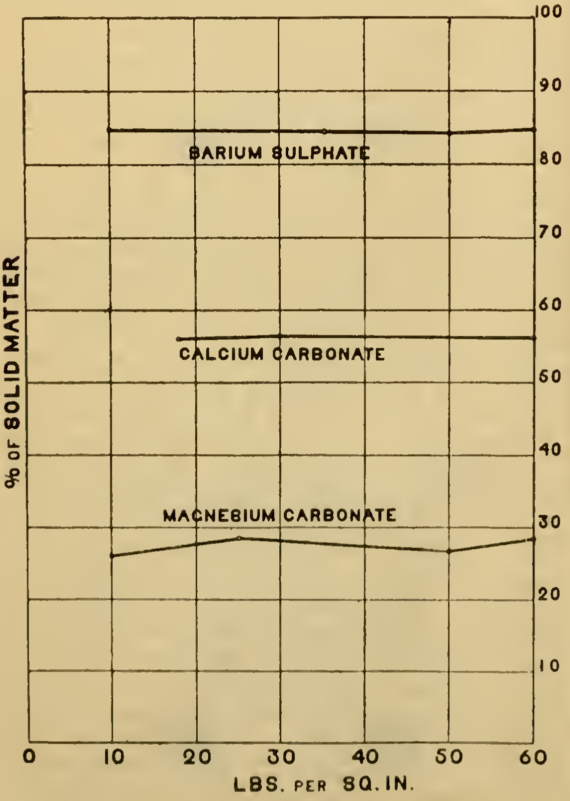


Fig. 14.

the liquid, they are not subject to unbalanced pressure, so that an increase in the latter cannot affect them. As soon as a particle reaches either the septum or another particle already at rest, it is exposed to an unbalanced pressure corresponding to the area over which it is supported. This pressure, however, whether great or small, always has the same direction or resultant, and will therefore always tend to place the particle in the same position. When all the particles are in mutual contact, *i.e.*, when the "cake" has formed, the pressure with which the particles are held together may be increased by increased pressure, but the structure of the deposit and the percentage of voids cannot be altered thereby. Needless to say, these remarks apply only to rigid particles, and not to such as are flexible, or plastic, or capable of coalescing, as, for example, the particles of paraffin in a chilled petroleum.

This point is easily settled by experiment, and the subjoined table gives the result of tests made in the following way:—A cell, representing practically a single chamber of a filter-press, was formed by clamping a short length of stout glass tube between a porous plate on one side, and a metal cover provided with an inlet branch on the other. The precipitate to be examined, mixed with water, was forced in through the inlet branch from a receiver, in which the desired pressure was maintained. The water filtered out through the porous plate and the tube gradually filled with precipitate, in the same way as a filter-press frame. No air was permitted to pass through the apparatus, so that the whole of the voids was filled with water, and the percentage could therefore be ascertained by drying. When the tube was filled with the deposit, it was slipped out sideways by just loosening the clamps holding the filter-plate and cover respectively, weighed with a boat, dried, and then weighed again with the boat. The amount of water lost represents the percentage of voids, as already explained. The table shows conclusively that, with precipitates differing widely as regards their structure and percentage of voids, the latter is practically constant; the small variations are well within the limits of experimental error.



A consideration of the septum naturally follows on that of the precipitates to be retained by it. Although nature and the arts have provided a very considerable number of porous materials, those used to any extent in practice are very few. They may be classified in a variety of ways, but the best criterion seems to be the nature of the particles forming the septum, more particularly whether they are rigid or flexible. Rigid particles may form a septum in two ways: they may either be simply in contact, or they may be agglomerated or fused together. The former structure is that of gravel, sand, and similar filters; the latter the structure of the various types of porous plates or cylinders used for different kinds of filtration. The filter composed of particles simply in contact has the advantage of extreme cheapness and of being easy to clean perfectly by a re-arrangement of the particles, assisted, if necessary, by some further cleansing process. By suitably selecting the size of the particles, the section of the passages may also be regulated between extremely wide limits. The drawbacks of this form of septum are principally two: it can only be used conveniently in a horizontal position, and it does not permit the easy removal of thick cakes of deposit without a simultaneous disturbance of the surface. A septum consisting of rigid particles in rigid connection may also be gauged, as regards its porosity, with great nicety, may be used in any position, and permits the removal of the deposit. It has the further advantages, that the size of the passages is absolutely fixed, and that the septum does not allow solid matter to pass at any time if it has been properly selected in the first instance. This quality chiefly distinguishes it from the filtering materials which we have next to consider, *viz.*, those consisting of flexible particles. It is obvious that a septum consisting of flexible particles may again be built up in two ways, *viz.*, the particles may be in irregular contact, or they may be arranged so that the septum assumes a definite structure, either as a textile or as a paper. The latter case resembles that of the septum consisting of rigid particles rigidly connected, but the resemblance is not complete. The fibres, *e.g.*, in a woven material, preserve their relative position through friction, but cannot be said to be otherwise tied to one another. The size of the passages in a flexible septum is, therefore, not permanently constant. Furthermore, the passages are not, as in the rigid septum, all of the same kind or order of magnitude. A woven material present the interstices between the crossing threads of the warp and weft, between the individual strands in either, and between the elementary fibres forming each strand of yarn. The chief advantage of the textile filtering material is its very great tensile strength, which comes into play owing to the peculiar method of support necessitated by its flexibility. In consequence of the latter, the filter cloth has to be supported over a very large number of points, such supports taking the shapes of the corrugations, truncated pyramids, or perforated plates used on filter-presses. Between these closely placed supports the cloth is simply in tension, whereas a solid septum similarly supported would be exposed to shearing strains, or, with supports further apart, to bending strains, both of which the usual solid porous materials are not well calculated to resist, unless they are made of some thickness. The filter cloth, on the other hand, is of a thickness so small that the aggregate of 30 or 40 pairs of cloths is negligible compared with the other necessary dimensions of the apparatus in which they are used. The lower limit of the size of the pores in a cloth also seems to be fairly high: while cloths are in daily use which retain yeast cells, the writer has not come across any which did not permit lactic or butyirc acid ferments to pass easily.

The conclusion is unavoidable that a consideration of the process of filtration is incomplete without the microscopic study of at least the more common precipitates dealt with in the chemical industries. Text books give, as a rule, information about the character of precipitates, *i.e.*, whether they are amorphous or crystalline, and to what system the crystals belong, but none as to the size of the particles, which is of more importance from the point of view of filtration. To forecast, or to understand, the behaviour of a precipitate, microscopic examination is indispensable, and very nearly sufficient. I have, therefore, examined and photographed a number of precipitates of general interest, in addition to those already mentioned in the course of the paper. Amongst the most important ones are, no doubt, the insoluble calcium salts, particularly the carbonate and sulphate. As regards the former, the text books state with great unanimity that it is precipitated in a crystalline form; that the crystals are aragonite exclusively above 70° C.; a mixture of aragonite and calcite between 70° and 30° C.; and calcite exclusively below 30° C. I have examined a very large number of calcium carbonates, partly taken from manufacturers' samples and partly precipitated in the test tube or on the slide; a number of these have been from the outset, and have remained, amorphous. At the moment of precipitation, the carbonate appears to be gelatinous, but this stage does not persist long enough to permit a photograph to be taken. Figs. 6 and 7 are taken from two samples precipitated at the ordinary temperature (about 15° C.); both are in the form of globules, with a very small amount of crystalline particles. Fig. 15 shows aragonitic carbonate from a manufacturer's sample, and Fig. 16 a similar carbonate precipitated in the test tube. Calcite crystals are present in both cases in small quantities. Fig. 17 shows a precipitate produced by adding a boiling solution of ammonium carbonate to a boiling solution of calcium chloride. The crystals are large and extremely well formed rhombohedra, and are, therefore, obviously calcite. This is in direct contradiction of the statement quoted above, *viz.*, that no calcite is formed above 70° C. Figs. 11 and 18 show crystals of calcium sulphate, produced by precipitating calcium chloride solution respectively with ammonium sulphate and magnesium sulphate. The size and formation of the crystals is remarkably uniform, and I have found this to be the case with various precipitants and within wide limits of concentration. Even when calcium chloride solution is decomposed by concentrated sulphuric acid, such crystals are formed. Sometimes, however, the sulphate is formed in the shape of small nodules, as illustrated in Fig. 19. This is a dark ground photograph of the calcium sulphate formed by decomposition of argols with dilute sulphuric acid.

The barium precipitates are very minute, as is well known in the case of barium sulphate, which is shown in Fig. 20. This precipitate was obtained from a saturated barium solution by dilute ammonium sulphate, both being cold. Fig. 21 shows barium chromate in well defined crystals, also of very small size. In a fairly large number of experiments, I have found it impossible to obtain larger particles, either by dilution or by varying the temperature.

Various lead compounds are shown in Figs. 22 to 26. Most of these are, like the corresponding barium salts, very small, as, *e.g.*, the carbonate and the chromate. Fig. 22 shows the carbonate enlarged 700 times. The shape of the crystals, which are isomorphous with aragonite, is well shown, but the photograph is slightly marred by diffraction lines round the crystals. The sulphate is somewhat larger, and is shown in Fig. 23, enlarged 330 dias. A very striking exception as regards size, and an even more striking illustration of the wide limits within which the size of the particles may vary according to the different methods of precipitation, is presented by lead chloride. Fig. 24 shows this salt precipitated from dilute lead acetate by dilute calcium chloride, in which case it forms very large and well developed dendritic crystals. Fig. 25 is a dark ground photograph of another part of the same preparation. If, however, the acetate is decomposed by hydrochloric acid, the crystals are very minute, as shown in Fig. 26. All these photographs are to the same scale, *viz.*, 330 dias.

An extremely interesting case is presented by magnesium carbonate. I was led to investigate this by the strikingly high percentage of water retained by the residue, *viz.*, over 72 per cent., as shown in the table. No probable shape of the particles could account for a percentage of voids between them sufficient to retain this amount of water, and the reason had, therefore, to be sought in the internal structure of the particles themselves. This is strikingly confirmed by the photograph, Fig. 27, which shows the dry carbonate enlarged 500 times. It will be seen that the precipitate consists of particles agglomerated in the shape of tubes, some of which recall the structure of Kieselguhr, a material well-known for its porosity. Fig. 28 was taken to show that the tubes illustrated do not represent the ultimate structure of the material, but actually consist of agglomerated particles. This is a photograph at 500 diameters, of the powder obtained by grinding up a small quantity of the dry precipitate on the slide with the finger tip It may be worth mentioning that the whole specimen is not a laboratory product, but was taken from a commercial sample, and the very peculiar structure has therefore resisted the effects of filtration.

The foregoing are examples of precipitates, either crystalline or at least forming discrete particles of definite size. A large number of precipitates, however, come down in the shape of membranes, flakes, or other aggregations. Copper ferrocyanide, shown in Figs. 8 and 9, and mentioned before, is a good example of this class. Ferrous ferrocyanide is precipitated in similar masses. Aluminium hydroxide is similarly formed, and two specimens are shown in Figs. 10 and 29. An interesting and industrially important specimen is arsenic sulphide, as obtained by de-arsenicating sulphuric acid by means of hydrogen sulphide. A dark ground photograph of this is shown in Fig. 30, and illustrates well the flakes in which the sulphide is formed. This was also taken from a commercial sample and the structure has survived two filtrations and very prolonged washings. Fig. 31 shows crystals of sodium silicofluoride, which are interesting as illustrating the limit at which a powder becomes fairly palpable. They are the largest particles I have examined, and no longer cohere when the residue is dried, but fall to powder.

While the foregoing examples of different precipitates show the variety of shapes which they assume, and the influence of these shapes on their behaviour during filtration, the value of a microscopic examination of the finished product, undertaken, as it were, after the event, is not great. It would find its proper scope and be of real practical utility if carried out experimentally, as a guide to the best method of precipitation. We have seen that a number of precipitates can be obtained in different forms, and with particles of very different sizes. These variations are due to—often slight—changes in the concentration and temperature of the reacting solutions, and are even influenced by the amount of agitation. It would, therefore, be an easy matter to make a few comparative tests, and to select that method of precipitation—assuming of course that it fulfils the other requirements of the process—which gives the precipitate best qualified to behave satisfactorily in the subsequent filtration. Even here the requirements may differ; in one case great rapidity of filtration, *i.e.*, large particles, may be the desideratum, while in another the minimum percentage of moisture in the residue, *i.e.*, small particles, may have to be aimed at. These questions can be, and can only be, solved by comparative trials and microscopic examination of the product, and the labour involved would probably be well spent, if any improvement resulted in the process of filtration—a process which at present is considered so purely as a necessary evil that no steps are taken to adapt the material to the treatment which it must, after all, undergo.

DISCUSSION.

Mr. THOMAS TYRER said that the microscope gave some indication, by disclosing the structure of the particles of the precipitate, how filtration would proceed. The difficulties of filtration were largely overcome by adjusting the temperatures and specific gravities of solutions to the precipitate required.

Mr. B. CORCORAN said it seemed there was an analogy between filtration and sifting. If a substance was to be sifted or strained, a state of affairs as shown in the diagrams would not be allowed. Further, when filtering under these pressures, presumably soft bodies were being dealt with which had to be squeezed; but it seemed a roundabout way to remove moisture. It was often possible to get a side current so as to carry the larger bodies free from the apertures, and allow the smaller ones to pass through without much trouble.

Mr. O. Guttmann said that the author had approached an interesting subject from the standpoint of physical chemistry. The peculiar movement of the crystals in Tyndall's experiments on the melting and re-congelation of ice, the crystallisation under movement of Bock, whereby the size of the crystals could be increased, and the very fine grinding of cellulose by means of a beater, resulting in a mass setting as hard as a stone, instead of a spongy-pulp—all these had a chemical as well as a physical aspect. In this case also the author had shown, that, whether due to vortex motion, or to pressure, or to both, different structures of residues could be obtained, from different chemical compounds, which were well worth further investigation.

Dr. J. C. Cain suggested that it was common knowledge in works that crystalline substances filtered well and gelatinous substances filtered badly. If a substance was found to filter badly, the first thing one tried to do was to make it of a more crystalline nature.

Mr. Hatschek, in reply, said he had not been able to go into the question of a comparison between filtration and sifting, but the difference was that in filtration the arrangement of the particles was a stream-like phenomenon, which was determined by the orifices in the septum. The particles did not settle themselves as they would by continual shaking. A cake of calcium sulphate, when taken out of a filter press, would become liquid on agitation. The structure of a filter press cake was radically different from that obtained by continual shaking or sifting. The stoppage of orifices in the septum was really a useful feature, because the particles were never constantly of one size. In the case shown in Fig. 1, the prevailing quantity of spheres would be of one size, but some would be smaller, and these would be set in motion first and would go through. This was a commonly known thing, as evidenced by a small running of turbid filtrate at the beginning of a filtration. Then the large particles entered the orifices and throttled them, and, after that, the small particles would not go through and a clear filtrate resulted.

Take the case of yeast, which was frequently mixed with the bacilli of lactic and butyric acid, which were of much smaller magnitude than the yeast. If a liquid containing only the bacillus of lactic acid were filtered through cloth, it would all go through; but with a liquid containing both yeast and bacillus, after the yeast had deposited itself, the bacilli would be retained.

Manchester Section.

Meeting held at Manchester on Friday, April 3rd, 1908.

MR. R. H. CLAYTON IN THE CHAIR.

BEER ANALYSIS.

BY JOSEPH RACE, A.I.C.

I.—The Application of the Pulfrich Refractometer to the Estimation of Alcohol and Extract.

In the following paper the results are given of a study of the principal processes used in the analysis of beer. Special attention has been paid to the refractometric estimation of alcohol and extract (total solids), and to the determination of sulphates and chlorides, as considerable differences of opinion seem to exist as to the precautions necessary for obtaining accurate results.

The original gravity.—The alcohol and extract figures required for the calculation of the original gravity may be obtained by the usual distillation method, or by means of the Zeiss immersion refractometer. The latter method has been fully described in other journals, and although a general criticism of the principles on which the process is based will, the author hopes, be of interest, he only intends to deal in detail with the adaptation of this method to the ordinary refractometer.

The process is based on the fact that if the specific gravity and refractive index are known, the alcohol and extract percentages may be calculated, for if C_1 be the amount by which the refractive index is raised by each 1 per cent. of alcohol, C_2 the amount by which it is raised by each per cent. of extract, C_3 the amount by which the sp. gr. is lowered by each per cent. of alcohol, and C_4 the amount by which it is raised by each per cent. of extract, and X and Y are the percentages of alcohol and extract required,—

$$\text{then } r, \left.\begin{array}{r}\text{the refractive index of the sample}\\ -\text{the refractive index of water}\end{array}\right\} = C_1X + C_2Y,$$

$$\text{and } s, \left.\begin{array}{r}\text{the sp. gr. of the sample}-\\ \text{the sp. gr. of water (1·0)}\end{array}\right\} = -C_3X + C_4Y,$$

from these it follows that—

$$X = \frac{C_4r - C_2s}{C_2C_3 + C_4C_1} \quad \text{and} \quad Y = \frac{C_3r + C_1s}{C_2C_3 + C_4C_1}$$

Schwarz (Nordd. Brauer. Ztg., 973; Analyst. **12**, 200) was the first to determine these constants, but as his figures are incorrect it is unnecessary to discuss them further. Barth (Z. ges Brauw., 1905, **28**, 303—306) this J. 1905, 630, made a number of determinations of the values of C_1, C_2, C_3, C_4, and the figures so obtained substituted in the above expressions give the following formulæ:—

$$X = [0·007598r - 0·002923s]100,000.$$

and

$$Y = [0·003366r + 0·001303s]100,000.$$

Below I have given the percentages of alcohol and extract as determined by the distillation method, and from the refractive indices of the distillate and residue (at their original volumes) calculated the values of C_1 and C_2. All specific gravities are taken at 15·5° C. and the refractive indices at the same temperature for the sodium line D.

	Alcohol per cent. by wt.	$C_1 \times 100,000$	Extract per cent.	$C_2 \times 100,000$
1....	3·55	57·0	2·46	160
2....	3·26	56·9	3·23	157
3....	3·78	57·8	3·38	162
4....	4·50	58·0	3·49	158
5....	4·93	58·5	4·12	159
6....	5·10	59·0	4·19	157
7....	5·37	59·8	5·04	157
8....	5·70	60·1	5·30	158

It will be seen that as the alcohol percentage increases, C_1 also increases, whilst C_2 seems to be practically constant for all percentages at which well attenuated English beers usually fall.

C_3, as the following table shows, decreases continually with increasing alcohol percentage, and as the solution curve for sugar is practically a straight line within the limits for the sugar content of beer, C_4, like C_2, is constant.

Alcohol per cent.	1000 – Sp. gr.	$C_3 \times 1000$
2·0	3·80	1·90
3·0	5·46	1·82
4·0	7·18	1·79
5·0	8·78	1·75
6·0	10·38	1·73
7·0	11·88	1·69
8·0	13·22	1·63

An examination of the above figures shows that C_1 increases at practically the same rate that C_3 decreases, and thus, for the purpose of calculation, the constants determined for any particular sample should be applicable to all other samples in which X and Y are within reasonable limits. For samples under about 4·5 per cent. of alcohol the formulæ of Barth give very satisfactory results, but over that figure the tendency is to give rather low results for both X and Y. For such samples I prefer the formulæ,

$$X=[0{\cdot}00778r-0{\cdot}0029s]100{,}000.$$
$$Y=[0{\cdot}0035r+0{\cdot}00130s]100{,}000.$$

A comparison of the results (expressed as grms. per 100 c.c.) given by the formulæ after correction for temperature is shown below :—

Alcohol per cent. by distillation.	Alcohol by Barth's formulæ.	Alcohol by modified formulæ.	Extract by drying.	Extract by Barth's formulæ.	Extract by modified formulæ.
5·76	5·68	5·78	4·00	3·93	3·95
5·21	5·13	5·22	3·65	3·61	3·63
5·43	5·37	5·47	3·83	3·75	3·77
6·10	6·00	6·10	4·21	4·13	4·17
4·89	4·84	4·94	3·27	3·24	3·27

The modified formulæ give on the average 0·5 to 0·7° higher original gravity. The original gravity is calculated in the usual way from the alcohol and extract figures by the use of spirit indication tables. There is no doubt that the refractometer method gives results which are quite as accurate as those obtained by distillation, and as much less time is required, the process would be a great boon to those having many determinations to make.

Chlorides.—50 c.c. of the sample is evaporated with 0·5 grm. of barium carbonate and subsequently ignited to a black ash. The ash is well extracted with hot water, filtered, and titrated with silver nitrate in the usual manner.

Ratcliff (Analyst, **32**, 86) states that it is unnecessary to make alkaline in order to fix the chlorine, but from the results of a large number of experiments the author is of opinion that unless previous to evaporation and ignition the solution is made distinctly alkaline, a considerable loss of chlorine will result. Barium carbonate gave the most satisfactory results, as it obviates the tendency of the ash to fusion, and, being insoluble does not interfere with the subsequent titration. The method of Loubiou (Rep. Pharm., 1898, 3, **10**, 493) is rapid, but as the author was unable to obtain a satisfactory end reaction he found it of very little value.

Sulphates.—The estimation of sulphate is sometimes important in tracing the origin of a beer, although the modern tendency to use artificial hardening mixtures has to a great extent impaired its utility. The ordinary process of evaporation, ignition, washing, and treating with barium chlorides is now generally acknowledged to give low results. Windisch (Woch. f. Brau., 1905, **22**, 17; this J., 1905, 155) first called attention to this fact, and recommended the use of caustic soda or baryta. In confirmation of this I give the results of a number of determinations obtained from a series of beers, with and without the addition of an alkali. In all samples of beer showing a normal amount of acidity, 2·5 c.c. of normal sodium hydroxide solution for 50 c.c. of the sample will be found quite sufficient to prevent the loss of sulphate:—

Sulphuric anhydride in grains per gallon.	
Without soda.	With soda.
52·87	63·42
38·16	41·65
20·73	34·81
19·00	38·12
33·27	40·36
16·65	23·28
32·38	36·83
35·04	38·19

In a recent paper in the Analyst (Vol. **32**, 84), Ratcliff suggests that the presence of acid phosphates is one of the causes of the loss of sulphuric anhydride on ignition. That this is the case will be seen from the following figures, which are the results of a number of experiments in which 0·1 grm. of gypsum was ignited with various substances :—

Added substance.	Loss of sulphuric anhydride per cent.
0·1 grm. acid pot. phosphate	36·8
0·1 grm. acid pot. phosphate : lower temp.	20·8
0·1 grm. acid pot. phosphate + 0·2 grm. starch	38·7
0·1 grm. acid sodium phosphate	38·7
0·2 grm. starch	3·1
0·1 grm. disodium hydrogen phosphate .	nil.
0·2 grm. silica	nil.

Sodium sulphate when ignited at low temperatures with acid phosphates shows no loss of sulphate, but when the temperature is raised by the blowpipe a considerable loss occurs. The loss of sulphuric anhydride by these ignitions is probably due to the formation of acid potassium sulphate, which then decomposes into the neutral sulphate and sulphuric acid. Calcium sulphate and acid potassium phosphate being of the same molecular weight, the quantities used were also molecular.

If the reaction took place according to the following equations, $CaSO_4+KH_2PO_4=CaHPO_4+KHSO_4$; $2KHSO_4=K_2SO_4+H_2SO_4$, the theoretical loss would of course be 50 per cent., but as the maximum is rather under this figure the action must partake of the nature of a mass action, the point of equilibrium depending largely upon the temperature at which the reaction takes place.

That the sulphuric acid is actually lost as such was proved by heating some of the mixture in a Rose crucible surrounded by asbestos to prevent access of sulphur from the flame, and drawing the gases evolved through wash bottles containing soda. In this way sulphuric acid was proved to be present and phosphoric acid absent. Another experiment showed that the acid so absorbed was equivalent to a loss of 11 per cent. of sulphuric anhydride.

II.—All Malt and Substitute Beers with Special Reference to Yeast Nutrition and Toxic Action.

This research was undertaken with a view to determining whether or not it was possible to discriminate by means of chemical analysis between all-malt beers and those brewed with varying amounts of substitutes. Allen (Commercial Organic Analysis, Vol. I., 374) suggests that the nature and proportion of nitrogenous matter would be of material value for this purpose. If all beers were brewed under identical conditions and from malt of similar nitrogen content this might be the case, but when it is remembered that malt varies considerably in composition and that substitute beers are generally brewed under conditions favourable to the extraction of albuminoids, it is not surprising to find that they contain relatively large amounts of nitrogenous matter. The author has met with instances of worts containing as much as 20 per cent. of sugar substitutes which gave an albuminoid figure of over 6 per cent., when calculated on the solids, a figure which is equal to or above the average given by all malt worts.

As malt contains a considerable amount of phosphates and brewing sugars comparatively little, it was thought that the determination of the phosphoric acid in the ash would form a better means of differentiation than the nitrogen content. In the table of analyses it will be seen that in no instance did the phosphoric acid in a substitute beer approach that of one brewed from malt only. In most cases they were at least 30 per cent. lower. It has often been assumed that in a malt wort the phosphates are present in such quantity as to interfere with the stability of the beer. Samples A and B, however, which are brewed practically entirely from malt, and which contain a higher percentage of phosphates, were proved to be of exceptionally good keeping qualities; but the higher alcohol and hop content of these samples must also be taken into account.

Matthews (J. Inst. Brew., 1893, 6, [5]; this J., 1893, 367) states that in his opinion a high residual phosphate content offers a fertile soil for the growth of bacteria, and that when the yeast is not the dominant organism there is risk of deterioration; also, that the presence of phosphates in large quantities is prejudicial to attenuation.

Stern (J. Chem. Soc., March, 1899; see this J., 1898, 1167) draws certain conclusions from his experiments on the nutrition of yeast that may be conveniently summarised as follows :—

Effect of the addition of inorganic nutriment containing 40—50 per cent. of P_2O_5.

Nitrogen content.	Assimilation of nitrogen.	Per cent. of nitrogen in yeast.	Attenuation.	Yeast crop.
Normal or above normal	Slight increase.	*Nil.*	Slight increase.	Increase.
Below normal	*Nil.*	Decrease.	Increase.	Slight increase.

Stern states that when the elements necessary for the growth of yeast are present, 0·025 grm. each of nitrogen (as asparagine) and inorganic nutriment (44 per cent. P_2O_5) per 100 c.c. are the largest quantities that could be assimilated by the yeast (0·325 grm.) under the conditions of the experiment. This he calls the "normal supply." The normal, therefore, approximates to 0·090 lb. of nitrogen and 0·037 lb. of phosphoric anhydride per barrel.

It will next be advisable to consider how far these conditions pertain to practical brewing. Taking first the case of an all-malt beer of standard gravity. This would give 14 per cent. of solids, or 50 lb. of solids per barrel (approx.). The solids of the wort contained 0·83 per cent. of nitrogen and 0·65 per cent. of phosphoric anhydride. A barrel therefore contains 0·41 lb. of nitrogen and 0·32 lb. of phosphoric anhydride, or 0·116 grm. and 0·091 grm. respectively per 100 c.c. After fermentation with 1 lb. of yeast per barrel, the beer gave the following figures :—Nitrogen 0·085 per cent. and phosphoric anhydride 0·045 per cent., or 0·30 and 0·168 lb. per barrel. The amounts lost during fermentation would be the equivalent of 0·11 lb. of nitrogen and 0·152 lb. of phosphoric anhydride.

About 7 lb. of yeast, including bottom yeast, per barrel were produced, and contained 0·072 lb. of nitrogen and 0·034 lb. of phosphoric anhydride.

Under these conditions, and assuming the amounts of nitrogen and phosphoric anhydride assimilated by the yeast to be the normal, then the wort before fermentation, assuming that the whole of the nitrogen and phosphoric anhydride is in an assimilable form, would be 4·82 times normal for the nitrogen, and 9·4 times normal for the phosphoric anhydride. As, however, only about 45 per cent. of the nitrogen is so available, and the whole of the phosphate is probably available, then calculated on this basis the wort was 2·17 times normal for nitrogen and 9·4 times normal for phosphoric anhydride. (Ratio P_2O_5: N=4·3: 1).

Reverting to Stern's experiments, the best result obtained as regards assimilation of nitrogen, attenuation of wort, and increase of yeast, when the nitrogen content was twice normal, was when the phosphoric anhydride content was 10 times normal or 0·25 grm. of inorganic nutriment per 100 c.c. It will thus be seen that the ratio obtained from the all-malt wort approximates to that found by Stern to be most suitable for similar nitrogen contents.

Two samples brewed with the use of about 20 per cent. of invert sugar gave the following results expressed in lb. per barrel :—

	Nitrogen.		Phosphoric anhydride.		Original gravity.
	i.	ii.	i.	ii.	
Before fermentation	0·360	0·382	0·173	0·221	i. 1052·8
After fermentation.	0·277	0·287	0·115	0·141	ii. 1063·2
Assimilated by yeast	0·083	0·095	0·058	0·080	

The yeast produced was 6 and 6·5 lb. per barrel, respectively, and contained :—

	I lb.	II lb.
Nitrogen	0·055	0·062
Phosphoric anhydride	0·031	0·033

If the nutriment actually assimilated is taken as normal, and it is assumed that 45 per cent. of the nitrogen is assimilable, the worts before fermentation are, calculated to normal values :—

	I	II
Nitrogen	2·85	2·77
Phosphoric anhydride	5·5	6·68
Ratio, P_2O_5/N	1·9	2·4

It will thus be seen that whilst an all-malt wort maintains the most favourable ratio of P_2O_5/N (for yeast nutrition), the substitute worts fall very much below it, and it is therefore evident that no excess of phosphoric anhydride is present in any of the worts. The substitute worts must, in fact, be considered deficient.

The above deduction is supported by the figures in the table where it will be observed that, when calculated to original gravity, the higher the phosphoric anhydride content, the lower the amount of unassimilated albuminoids. In further confirmation of this, a wort was prepared containing 40 per cent. of sugar extract, and divided into two parts. To one part 0·1 per cent. of acid potassium phosphate was added. Both samples were then pitched with equal quantities of the same yeast fermented, and the albuminoids estimated. The sample with the addition of phosphate contained 0·203 per cent. as against 0·269 per cent. in the other portion. Further, the table shows that there is no general material difference in the results of the analyses of all-malt and substitute beers; in fact, the only difference is in the percentage of phosphoric anhydride, and this is so small, even in the former, that no real nutritive value (as regards the human system) can be attached to it. The purchaser of samples brewed with the use of substitutes is therefore clearly not prejudiced by a deficiency or addition of any substance.

The products obtained from sugars and raw grains that are not present in malt are, according to Allen, (1) The acid decomposition products such as tyrosine and leucine, and (2) humin bodies. As regards the former, it is very uncertain that such products are peculiar to acid decomposition, as enzymic action produces amino bodies which are similar to, if not identical with tyrosine and leucine. Again, such bodies even if present would not be found in the wort after fermentation. Humin bodies, on the other hand, may possibly be found in the beer, but as little is known as to their toxic action and the quantity present can only be very minute, their presence is of no importance. Humic acid, the acid corresponding to these humin bodies, is probably present in all upland water supplies, and as no toxic action has been ascribed to this acid *per se*, it is extremely probable that the bodies from which it is derived are also harmless. Many of the unpleasant symptoms due to excessive use of beer have been attributed to the substitutes that may or may not have been used in its production, but it will be seen from the above that such an allegation is baseless. The physiological effects produced by beer, apart from the alcohol, must be due to the hop principles, and it is interesting to compare the amounts of the various principles present in beer with the medicinal doses of the same. The general constituents of *Humulus lupulus* (*vide* Hale White's Materia Medica) are (1) Lupulin, a liquid alkaloid; (2) luplinic acid, a bitter crystalline principle; (3) valerol, 1 per cent., an aromatic oil giving the odour; (4) resin; (5) tannin; (6) a sesquiterpene, $C_{15}H_{24}$. Griess and Harrow have also proved the presence of choline in beer. The official preparations of *Humulus lupulus* are :—*Infusum lupuli*, 1 in 20 (boiling water): dose 1—2 fluid ounces. *Tinctura lupuli*, 1 in 5 (alcohol, 60 per cent.): dose $\frac{1}{2}$—1 fluid drachm. *Lupulinum*: dose, 2—5 grains. Taking the infusion as the preparation most closely approximating to beer, the proportions are :—

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Results are in grms. per 100 c.c. except where otherwise denoted.	100% malt. A.	Malt. B.	14% M. 10% I. C.	28% I. 10% R. D.	20% I. E.	15% I. F.	25% I. G.	35% I. H.
Original gravity	1062·1	1061·7	1051·2	1039·1	1049·6	1053·1	1051·1	1060·3
Present gravity	1012·1	1005·8	1010·1	1009·5	1013·0	1006·1	1013·3	1021·3
Absolute alcohol by weight	5·39	6·02	4·51	3·32	4·08	5·07	3·78	5·10
Apparent attenuation, per cent.	80·5	90·6	82·2	75·7	73·8	88·5	73·9	64·6
Extract: total solids	5·25	3·81	4·35	4·04	5·02	3·53	3·23	5·30
Extract (3·86)	5·40	3·08	4·54	3·89	—	3·78	3·45	5·51
Ash	0·35	0·32	0·27	0·19	0·21	0·28	0·18	0·24
Potash (K_2O)	0·0197	0·029	0·027	0·021	0·024	0·026	0·022	0·025
Nitrogen	0·083	0·077	0·057	0·042	0·067	0·078	0·053	0·075
Albuminoids (N × 6·3)	0·523	0·485	0·359	0·264	0·422	0·493	0·334	0·473
Phosphoric anhydride	0·045	0·041	0·022	0·014	0·019	0·028	0·023	0·022
Volatile acidity calc. as acetic acid	0·012	0·012	0·012	0·020	0·018	0·018	0·024	0·014
Residual acidity calc. as lactic acid	0·132	0·115	0·117	0·130	0·120	0·115	0·136	0·127
Chlorine calc. as sodium chloride, grains per gall.	20·79	17·32	27·17	32·34	28·87	50·52	50·82	63·52
Sulphuric anhydride, grains per gall.	63·42	41·65	38·92	37·34	36·13	18·48	23·42	21·21
Albuminoid nitrogen calc. as percentage of total nitrogen	75	77	—	—	—	—	—	—
Albuminoids × 10,000—original gravity	84	78	70	67	85	93	65	79
Phosphoric anhydride × 100,000—original gravity	72	66	43	36	39	52	45	36

Results are in grms. per 100 c.c. except where otherwise denoted.	20% R. 15% I. I.	40% I. J.	15% M. 10% I. K.	10% G. 15% I. L.	B.P.G. and I. M.	I. N.	I. O.
Original gravity	1036·3	1037·2	1053·5	1052·7	1050·5	1048·8	1058·6
Present gravity	1004·6	1007·3	1009·8	1009·7	1009·9	1013·3	1016·2
Absolute alcohol, by weight	3·49	3·32	4·70	4·64	4·45	3·84	4·51
Apparent attenuation, per cent.	87·3	80·3	81·6	81·6	80·4	72·7	72·3
Extract: total solids	1·97	3·11	4·31	4·39	4·40	5·22	6·33
Extract (3·86)	2·61	3·39	4·68	4·63	4·47	5·28	6·43
Ash	0·36	0·20	0·38	0·32	0·22	0·23	0·24
Potash (K_2O)	0·021	0·020	0·023	0·024	0·020	0·021	0·023
Nitrogen	0·053	0·039	0·059	0·050	0·053	0·054	0·064
Albuminoids (N × 6·3)	0·333	0·245	0·371	0·315	0·333	0·339	0·403
Phosphoric anhydride	0·014	0·014	0·031	0·027	0·025	0·024	0·029
Volatile acidity calc. as acetic acid	0·016	0·012	0·013	0·018	0·014	0·015	0·013
Residual acidity calc. as lactic acid	0·130	0·124	0·130	0·125	0·120	0·124	0·118
Chlorine calc. as sodium chloride, grains per gall.	26·56	47·36	48·71	46·37	48·34	43·67	44·83
Sulphuric anhydride, grains per gall.	33·60	20·31	35·18	34·81	36·75	38·12	37·91
Albuminoid nitrogen calc. as percentage of total nitrogen	39	38	45	48	47	49	57
Albuminoids × 10,000—original gravity	91	65	69	60	61	69	69
Phosphoric anhydride × 100,000—original gravity	38	37	59	51	50	49	50

B.P.G. = Beane's Patent Gist. G = Glucose. I = Invert sugar. M. = Maize. R = Rice.

infusion, 1 in 20; beer, 1·75 in 360 (approx.), or 1 in 200. The amount of beer to be taken to obtain the medicinal dose of the infusion would be 10 to 20 fluid ounces, or, roughly, ½—1 pint. Choline is stated to be present in very small quantities, and considering the intensely poisonous effects of the administration of choline chloride, the statement is probably correct.

The general physiological effect of hops is stomachic and carminative (due to the volatile oils and bitters), and also, as a whole, soporific. When taken in excess hops act as a narcotic.

It is thus evident that, even assuming the toxicity of humin bodies and their presence in substitute beers, their effect can be so little compared with that of the hops normal to all classes of beers as to be quite negligible.

In conclusion the author wishes to thank Mr. Raymond Ross, F.I.C., F.C.S., for the facilities granted during the preparation of this paper and for many valuable suggestions. He is also indebted to Mr. William Duncan, F.I.C., F.C.S., for many hints that have proved invaluable.

Discussion.

The Chairman thought the figures showing the difference between malt beers and substitute beers were rather disappointing; still, it was gratifying to know that substitute beers were not prejudicial to health. Was an inferior quality of hops used in brewing the poorer class of beers, and had they any ill-effect on health?

Mr. **Raymond Ross** said that, with regard to the differentiation of beer by means of albuminoids and phosphoric acid, they had for many years regarded these figures as of primary importance in distinguishing malt vinegars from sugar vinegars. Far more notice had always been taken of the phosphoric acid than of the albuminoids. The causes of this could be seen by a reference to a paper by Allen. (Analyst, Vol. 19.) Phosphoric acid might be added with the intention to deceive. He thought that the character of the albuminoids might have more to do with the stability of beers than either the amount of albuminoids or phosphoric acid. Mr. Race had taken 45 per cent. of the albuminoids as assimilable. The albuminoid figure might be useful in determining the available nitrogen, as the compounds most easily broken down would be the most easily assimilated. It had been shown that each constituent of whiskey, excepting water, increased for many years on keeping (J. Amer. Chem. Soc., 1908, 30; this J., 1908, 173). It was well known that old whiskey was more beneficial than new, yet all the secondary products had increased. It was therefore evident that something else had a prejudicial effect on the system. Might not this be due to the presence of certain humin substances, the composition of which was by no means definite? One authority stated that he found 3 per cent. of nitrogen in them. Was it not possible that in the process of manufacture a great proportion of the hop alkaloids was lost? Only minute quantities of choline had been found in beer; to what extent it was present in hops he did not know. The fact that beers were dry hopped to give additional flavour supported the above contention.

Dr. G. H. **Bailey** said he could endorse what Mr. Race had stated with regard to the loss of sulphuric acid, unless precautions were taken. Mr. Race said he used barium carbonate and obtained a black ash. A common practice was to saturate the organic substance with sodium carbonate, but the difficulty in using carbonates for this purpose was that if too little were used there might still be loss, and if sufficient were used, the burning off of the carbonaceous matter was slow and incomplete, involving difficulty when extraction was made for the determination of chlorine and sulphuric acid by precipitation. He had found that sodium nitrate was most useful, but it was usually too impure to be employed without further purification. His practice was to moisten the material with concentrated nitric acid, and then pour on a solution of bicarbonate until this was neutralised. He then found that the ash would burn quite readily on heating, and on igniting there was no loss of chlorine or sulphuric acid.

Mr. **Race**, in reply to the Chairman, said that it was not usual to use an inferior quality of hops for the cheaper beers. A stronger variety was used, so that a smaller quantity would be required to obtain the desired effect. In reply to Mr. Ross, he pointed out that if the albuminoid ammonia as estimated by Graham's method were any criterion of the nitrogenous matter readily available for yeast nutrition, the all-malt samples would not contain nearly the whole of their nitrogen in that form. These samples were highly attenuated, and fermented under conditions favourable to the assimilation of nitrogen, so that it might reasonably be expected that the albuminoids remaining were not readily assimilable. Peptone, which was generally considered an excellent nutrient for yeast, yielded only about 30 per cent. of its nitrogen by Graham's process, so that that method was useless for the estimation of the substances available for yeast nutrition. Although it was possible that humin bodies were present in whiskey, it seemed improbable, as the only point at which the materials could be contaminated was during the curing of the malt, and even then it would only apply to those districts where peat was used for that purpose. Mr. Ross's hypothesis would also necessitate the humin body being volatilised from the fuel, condensed on the malt, and soluble in water. Beer, however, could not be contaminated in that way, as no peat was used for curing. H. T. Brown had stated that tyrosine and leucine must be, regarded as of comparatively low fermentability. Ehrlich however, had shown that under ordinary brewing conditions they were assimilated, and that leucine was probably the primary factor in the production of amyl alcohol, the esters of which were important as regards flavour. Tyrosine, which had actually been isolated from yeast, when fermented by yeast in the presence of sugar, yielded hydroxyphenylethyl alcohol, a crystalline body generally found mixed with the succinic acid after the extraction of fermented liquids with ether. This body had an intensely bitter flavour, and would certainly contribute to the bitterness of the beer (Ehrlich). In reply to Dr. Bailey, he pointed out that barium carbonate was only used for the estimation of the chlorides. Caustic soda was used for the sulphates, the ash being burnt perfectly white.

THE ESTIMATION OF ALCOHOL AND EXTRACT IN SPIRITS BY MEANS OF THE REFRACTOMETER.

BY JOSEPH RACE, A.I.C.

Experiments were first made to ascertain if the method of E. Reigler (Analyst, 21, 133; this J., 1896, 223) were applicable to the examination of such spirits as brandy and whiskey. To obtain comparative results, and to make the figures obtained as accurate as possible, all observations were made at the same temperature, *viz.*, 15·5° C., and for the sodium line. The observations were made with a Pulfrich instrument provided with an arrangement for keeping the temperature constant. The amount of alcohol in the mixtures was found by determining the specific gravity and reference to alcohol tables.

The following table sets forth the results obtained from a few mixtures of pure alcohol and water.

c = the refractive index of redistilled water = 1·33350 :—

Percentage of alcohol by weight = a.	Refractive index of mixture = b.	$\frac{b - c}{a} \times 100{,}000$
5	1·33645	59
6	1·33714	61
7	1·33785	62
8	1·33856	63
9	1.33928	64
10	1·34001	65
11	1·34074	65·8
12	1·34146	66·3
13	1·34219	66·9
14	1·34293	67·2
15	1·34368	67·8
16	1·34443	68·3
17	1·34517	68·7
18	1·34591	68·9

These figures show that the increase in refractive power per unit of alcohol is not constant for all proportions of alcohol and water, *i.e.*, the refractive indices of alcohol and water mixtures are not strictly proportional to the amounts of alcohol and water present. Reigler states that in wine, after allowance had been made for the extract, the difference between the refractive index so obtained and that of water divided by a constant (67—68) gave the percentage of alcohol present. The figures published, however, are those obtained with wines containing 10 to 13 per cent. of alcohol, and the figures given above show that between these limits the variations are not large enough to produce appreciable errors. The difference between the author's figures for the increase (65—66·9) due to each unit of alcohol and those of Reigler (67—68), is explained by the fact that one set is obtained from pure alcohol and water mixtures, whilst the other was obtained from wine analysis. The wine figures are higher, because of the relatively large amount of secondary products contained in the wine which are estimated as alcohol. All secondary products such as esters would be lost, together with the alcohol, during the evaporation of the wine, and no doubt some of the higher alcohols and volatile acids would disappear at the same time. In wine the proportion of secondary constituents is comparatively large, and since the refractive indices of these impurities are much higher than that of alcohol, they would easily account for the apparent discrepancies between the two sets of figures. The following are the figures obtained for the simpler members of each type of secondary products contained in wine:—

Acetic acid	1·37322
Ethyl acetate	1·37432
Amyl alcohol	1·40912
Ethyl alcohol	1·36444

The experiments on alcohol and water mixtures were continued so as to obtain the indices of all mixtures at about 5 per cent. intervals between 0 and 100 per cent. of alcohol. The results so obtained were accurately plotted out and the values given in the table then obtained by interpolation. Using this table instead of a constant, it was found that Reigler's method could be adapted to the examination of spirits. The refractive index of the spirit is taken at 15·5° C., and also that of the liquid obtained by the evaporation of 25 c.c. of the spirit almost to dryness and then making up to the original bulk. The difference between these results is due to alcohol and other volatile constituents, and the difference between the refractive index of the extract and that of water is due to the extractive matters contained in the spirit.

If a = refractive index due to alcohol and water; x = refractive index of spirit; y = refractive index of extract; and z = refractive index of water, then $a = x - (y - z)$. The percentage of alcohol is then found by taking the proportionate mean between two suitable figures in the table.

The following table gives a few of the results obtained by this method from numerous samples of spirits:—

It will be seen that the error is ± 0·0001, which is practically equivalent to an error of ±1 minute in the refractometer reading, or calculated on the alcohol percentage about 0·1 per cent. The possible error due to loss of esters and secondary alcohols is easily shown as follows. Suppose the spirit contains 100 parts of ethyl acetate and 400 parts of amyl alcohol per 100,000 parts of absolute alcohol. The increase in refractive power due to these would be:—(*a*) ethyl acetate 0·1 per cent. (refractive index of ethyl acetate − refractive index of ethyl alcohol) = 0·1 per cent. of (1·37432 − 1·36444) = 0·0000098, or say 0·00001. (*b*) amyl alcohol 0·4 per cent. of (refractive index of amyl alcohol—refractive index of ethyl alcohol) = 0·4 per cent. (1·40912 − 1·36444) = 0·0001787; total error = 0·000188.

If the spirit contained 50 per cent. of alcohol by weight the error would be 0·000094, or practically 0·0001.

Table of refractive indices of mixtures of alcohol and water.

Alcohol per cent. by weight.	Refr. Index.	Alcohol per cent. by weight.	Refr. Index.
1	1·33398	51	1·36334
2	1·33452	52	1·36358
3	1·33512	53	1·36380
4	1·33577	54	1·36401
5	1·33645	55	1·36421
6	1·33714	56	1·36440
7	1·33785	57	1·36458
8	1·33856	58	1·36475
9	1·33928	59	1·36491
10	1·34001	60	1·36506
11	1·34074	61	1·36520
12	1·34146	62	1·36534
13	1·34219	63	1·36548
14	1·34293	64	1·36561
15	1·34368	65	1·36573
16	1·34443	66	1·36585
17	1·34517	67	1·36597
18	1·34591	68	1·36608
19	1·34664	69	1·36618
20	1·34737	70	1·36629
21	1·34811	71	1·36639
22	1·34890	72	1·36649
23	1·34964	73	1·36659
24	1·35038	74	1·36667
25	1·35112	75	1·36675
26	1·35185	76	1·36681
27	1·35258	77	1·36686
28	1·35330	78	1·36685
29	1·35401	79	1·36681
30	1·35471	80	1·36675
31	1·35538	81	1.36668
32	1·35601	82	1·36660
33	1·35659	83	13·6652
34	1·35711	84	1·36643
35	1·35757	85	1·36634
36	1·35801	86	1·13625
37	1·35843	87	1·36616
38	1·35885	88	1·36607
39	1·35923	89	1·36598
40	1·35960	90	1·36589
41	1·35996	91	1·36579
42	1·36032	92	1·36567
43	1·36067	93	1·36554
44	1·36012	94	1·36539
45	1·36136	95	1·36524
46	1·36180	96	1·36509
47	1·36213	97	1·36494
48	1·36245	98	1·36478
49	1·36276	99	1·36461
50	1·36306	100	1·36444

Nature of Spirit.	Percentage of alcohol.	Refractive Index.			Percentage of extract.	Increase due to each percentage of extract.
		from Table.	Found = a.	$y—z$.		
Brandy	34·00	1·3571	1·3570	0·00062	0·539	0·00115
,,	40·95	1·3599	1·3600	0·00093	0·801	0·00116
,,	50·96	1·3633	1·3632	0·00078	0·661	0·00118
,,	38·50	1·3590	1·3591	0·00078	0·666	0·00117
,,	42·24	1·3604	1·3605	0·00086	0·729	0·00118
,,	37·44	1·3686	1·3687	0·00078	0·676	0·00116
Scotch Whiskey	38·85	1·3592	1·3591	0·00015	0·140	0·00106
,,	34·00	1·3571	1·3570	0·00011	0·105	0·00105
,,	36·78	1·35835	1·3584	0·00047	0·450	0·00105
,,	46·46	1·3620	1·3620	0·00061	0·560	0·00108

New York Section.

Meeting held at Chemist's Club on April 24, 1908.

MR. GEORGE C. STONE IN THE CHAIR.

MANUFACTURE OF FERROCHROMIUM IN THE ELECTRIC FURNACE.

BY PROF. ROLAND CALBERLA.

A series of experiments was carried out with a view to producing ferrochromium in an electric furnace from pure chromic oxide and iron or magnetite. The aim was to reduce the percentage of carbon to a minimum, and to increase the chromium to a maximum. The best results were obtained when using a lime-fluorspar slag, to which chromite was added, the melting being continued for half an hour: longer periods increased the refining effect, but decreased the yields, especially that of chromium. The losses of chromium in all the experiments were very heavy. It is concluded that it was impossible, under the conditions obtaining, to entirely eliminate the carbon.

THE MANUFACTURE OF LITHIA FROM LEPIDOLITE.

BY WM. JAY SCHIEFFELIN AND THOMAS W. CAPPON.

The comparatively rare oxide, lithia, may be obtained from various minerals, but the sources principally utilised are spodumene, amblygonite, petalite and lepidolite. The lepidolite used in our process comes from Pala, San Diego County, California, and has the following composition:—lithia, 4·75 per cent.; alumina, 23·5—24·5 per cent.; potash, 12·5 per cent.; silica, 51 per cent.; fluorine, 2 to 4 per cent., with traces of iron, manganese, etc. Fusion and subsequent treatment of lepidolite with hydrochloric acid affords a ready means of decomposing the ore, but it was found desirable to have the bases present as sulphates, and eliminate the necessity for fusing the mineral; here, however, a difficulty presents itself. Unfused lepidolite, according to Dana, Mendeléef, and others, is only partly decomposed by acids—a conclusion which, it must be confessed, the first experiments of the chemist will tend to confirm, as without the adoption of special methods, a decomposition of from 60 to 75 per cent. is the most that can be obtained. Joss, of Vienna, appears to have been the first to solve the problem of decomposing lepidolite with sulphuric acid, but his memoir on the subject, beyond publishing the fact, gave no details of the method of decomposition followed. As a result the process remained practically a secret; chemists who repeated the experiments failed to get complete decomposition of the ore. (*Vide* Jour. Pr. Chem., Tieman of Columbia, and others.)

This too was our own experience, verified by repeated experiments. Finally it was found by adopting the following method, practically complete decomposition could be obtained (97 to 99 per cent.).

Decomposition of the ore.—The success of this operation is mainly dependent on two factors, reduction of the ore to a uniformly fine state of division, and careful regulation of the heat applied.

The lepidolite finely powdered in a pebble mill, and bolted through a 160 mesh sieve, is mixed with 10 per cent. more than its weight of sulphuric acid (66° B.) in a sheet steel mixer driven by power. The usual charge is 2,400 pounds of ore. The mixture is stirred for half an hour, and then run through a lead-lined sluice, on to a bed of a rectangular furnace, lined with fire-brick, 16 feet long, by 6 feet broad, and 2 feet high, with a rather flat arched top. The furnace is provided with a coke furnace at one end, and an oil burner at the other. The heat and flame pass over the material, then under the furnace bed by four flues, and return, still underneath, by four flues, passing thence to the chimney, which is fitted with a steam aspirator to increase the draft. The charge is kept at a temperature ranging from 112° to 120° C., stirring frequently for three hours. The heat is then raised to 136° C. The following conditions represent an actual decomposition of 95·3 per cent. For 3 hours, temp. in furnace was 120° C.; 1 hour at 136° C.; 1½ hours at 156° C.; 1½ hours at 194° C.; 1 hour at 280° C.; ¼ hour at 340° C.; a total of eight hours and a quarter. The maximum yield obtained on the industrial scale was 97 per cent., the average being 94 per cent. The furnace cake is removed and leached while still warm, to bring the bases into solution; once this is effected, and the silica separated, which is easily done, the problem of lithia manufacture is reduced to that of the removal in manageable form of the considerable amount of alumina present. Manganese, calcium, and alkalis present no difficulties. No absolute alcohol or platinum vessels are required.

Separation of alumina.—Here a departure from the procedure given in the published accounts was found necessary. These usually prescribe removal as hydroxide by milk of lime, whether or not a part has been removed as alum. A few preliminary experiments are sufficient to show the necessity for eliminating this product in some concentrated form, as the voluminous hydrate holds lithia tenaciously, and is difficult to wash by any method. Hence it is likely that any process that contemplates separation in the form of hydroxide, is doomed to fail. The advantage before referred to, of having the bases present as sulphates, now becomes apparent, as it opens up a way for the removal of part of the potassium and fifty per cent. of the alumina in the form of alum. The alum separation is effected by agitating the leached liquor, and adding sufficient potassium sulphate to convert all the aluminium sulphate not already so combined, into alum. A heavy precipitation of alum, in the form of a fine easily washed powder, the result of frequent stirring with an air current, takes place as the liquor cools. The first portions contain notable amounts of caesium and rubidium alum. In six days precipitation is complete.

The results, though good, are not as good in practice as they appear on paper; the calculated result is not obtained on account of an unexpected and rather curious change in the solubility of the alum, by which the mother liquor, instead of holding 10·5 per cent. (the strength of a saturated solution at normal temperature), is found to contain 23 per cent. of potash alum in solution. This difference (due to the solvent action of other salts present), while it adds to the labour, and somewhat impairs the completeness of the succeeding step (the alunite process), does not prevent it from reducing the residual alum from 23 per cent. to 0·57 per cent. in one precipitation. Otherwise the residual alum could be reduced to 0·2 per cent. or less.

Alunite separation.—This process removes alumina and potash as insoluble (basic) sulphates, leaving lithium sulphate in solution. It is based on the fact that by adding freshly precipitated aluminium hydroxide to alum solution, and boiling briskly, practically all the alumina precipitates as basic alum, or alunite (composition approximately $K_2SO_4,3Al_2O_3,3SO_3,6H_2O$).

Industrially, the process is carried out as follows: The mother liquor is decanted from the alum meal, and the latter centrifuged, affording a by-product of commercial value, in quantity sufficing to pay for the sulphuric acid used. The clear solution is tested to find the amount of free acid and alumina present, and the proportion of sifted whiting chemically equivalent to the free acid and one-third of the alumina, is gradually stirred into the liquor until the free acid is neutralised: the stirring by air current is continued for an hour, and the solution allowed to stand over night. Next day the rest of the whiting is added, the stirring continued for two hours and the liquor let stand to allow the calcium sulphate to precipitate, the liquor being kept cool to prevent one-third of the alumina (which now remains dissolved as free hydroxide) from prematurely precipitating. The removal of a third of the combined acid by whiting has the same effect as adding an equivalent of aluminium hydroxide. More could not be added, as 33 per cent. is the maximum amount of hydroxide the alum liquor would dissolve. In displacing aluminium by calcium, as above, it was found advantageous to substitute whiting for milk of lime, the usual precipitant, as the latter caused clotting with the alumina, much of the lime goes down unchanged carrying lithia with it, which cannot be washed out. When whiting is used, the precipitate as it forms is disintegrated by the escaping carbon dioxide, the calcium sulphate produced is more easily washed; nevertheless, under the best conditions, loss of lithia is inevitable with this precipitate. In the next stage, the clear solution is decanted from the calcium sulphate, and treated with freshly precipitated aluminium hydroxide, equal to half the alumina present in solution. The solution is rapidly brought to a boil (within an hour), and boiled for three-quarters of an hour, which precipitates the alumina, and much of the potash, as alunite. The aluminium hydroxide for succeeding operations may be prepared by treating alunite with sufficient potassium carbonate to remove all the sulphuric acid as potassium sulphate, and leave the alumina in a dense form as a mixture of hydroxide and basic carbonate, in which form it reacts easily to form the alunite. The clear solution is decanted from the precipitated alunite, and sufficient whiting added to precipitate the small amount (0·57 per cent.) of alumina left; it is boiled and finally made distinctly alkaline with hydrated lime, using for the purpose a "high calcium," not a dolomitic lime. The clear solution, which consists mainly of lithium sulphate, a small amount of calcium sulphate, and traces of manganese and iron oxide, is decanted and concentrated by boiling until a specific gravity of 1·112 (hot) is reached (the tank in which this is done should be tin lined). Another pound or two of calcium hydrate is added, and the liquor allowed to cool and settle; it is then decanted, and freed from residual impurities as follows:—

Separation of calcium, iron, etc.—The calcium is removed as oxalate, by adding ammonia and oxalic acid solution, stirring and keeping the solution alkaline. A solution of potassium hypochlorite is also added to ensure removal of all traces of iron and manganese; the solution is allowed to stand overnight, and the clear solution of pure lithium sulphate decanted into a tin-lined tank.

Precipitation of lithium carbonate.—One-third of the lithium sulphate solution is added, in a tin-lined tank, to a solution of potassium carbonate (sp. gr. 1·5) slightly in excess of the amount required to precipitate all the lithium, and the mixture heated quickly to boiling (using a tin coil), with agitation; the rest of the lithia solution is added, and the whole boiled briskly for five minutes. A white precipitate of lithium carbonate forms and settles rapidly. The supernatant liquor is decanted and the moist precipitate quickly washed with hot water, stirred for five minutes, and allowed to settle. The carbonate is finally washed in a centrifugal machine until the washings are free from chlorides, and show only the faintest trace of sulphates. It is then transferred to trays and dried at 140° F.

The following quantities represent operations during four weeks:—Ore, 7,200 lb.; sulphuric acid, 7,920 lb.; potassium carbonate, 1,602 lb.; whiting, 1,224 lb.; oxalic acid, 105 lb.; ammonia, 105 lb.; labour, five men for four weeks. *Products*:—Alum meal, 6,009 lb.; lithium carbonate, 513 lb.

Discussion.

Dr. W. E. **Wadman** asked what was the meaning of 97 per cent. decomposition of the ore? Did it mean percentage of lithia, or of alumina, or of potash made soluble, or did all the bases come out in the same ratio? (Dr. **Schieffelin** said that all came out in the same ratio.) The cost of the furnace, stated at $40.00, seemed to him remarkably small. Stress was laid on the value of having the bases present as sulphates. With solutions containing all the alumina, it was necessary to be able to remove a large part of it in the form of alum. However, there was a distinct disadvantage in working through the sulphates, owing to the greater solubility of lithium carbonate in the presence of the SO_4 ion than in the presence of the Cl. ion for instance. The final purified solution was stated to be practically pure lithium sulphate. This could hardly be the case, as this solution must have contained a considerable amount of potassium sulphate. Alunite removed only one-third of the potash existing as alum, and consequently two-thirds must remain with the lithium sulphate. This was of some importance for reasons above referred to—that lithium carbonate was notably soluble in potassium sulphate solutions. In any case in working with the sulphate, one must inevitably end up with a saturated solution of potassium sulphate, but the more there was present, the relatively greater was the loss from solubility of lithium carbonate. An important fact in the process was the very low yields obtained. In percentages of the possible amounts, the yields were 39 per cent. of alum, 60·8 of lithium carbonate, and 34 per cent. potash (K_2O) recovered. The losses amounted to about 9,000 lb. of alum, 330 lb. of lithium carbonate, and from 1,165 lb. of actual potash. So far from recovering any potash from the ore, there was an actual deficit of 265 lb. of potash from that added as carbonate.

The costs of the process appeared to be about 97·5 c. per lb. of lithia, from which must be deducted a revenue from the alum amounting to 20 c. per lb. of lithia, giving net cost of the lithia carbonate, 77½ c., this being a practically irreducible minimum on the basis of Dr. Schieffelin's figures.

He considered the ammoniacal time limit test prescribed by the U.S. Pharmacopœia was unnecessarily severe and difficult to comply with. The test for heavy metals was reasonable and reasonably easy to attain, but it was almost impossible to get rid of the last trace of iron, which was quite unobjectionable, but nevertheless responded to the hydrogen sulphide test.

Dr. **Schieffelin**, in reply, said that as the temperature in the furnace was below 300° C. nearly all the time, it was unnecessary to use fire-brick, except on the floor, and the cheapest brick was used for the rest of the furnace, the top being a flat arch of single brick and covered with sand. The furnace was held together by iron bars across the top, and took ten days to construct by the labour of one mason at $2.00 a day; the cost of the materials did not exceed $20.00. The potash and lithia in the filtrate from the final carbonate precipitation were not lost, as the filtrate was put back into the process. The cost also might be reduced slightly by selling the separated silica, which amounted to half the weight of the ore used, and which was in a very finely divided state. The separated alunite could also be used for the production of alum. Dr. Wadman's estimate of the cost was very close. In fact, they estimated it at 90 c. per lb. When the price of lithia was $3.50 per lb. they undertook to make it at a cost of $1.00 per lb. When the price fell to 40 c. per lb., due to the fact that the consumption did not increase in proportion as the production increased, manufacture was discontinued.

BLAU GAS: A NEW GAS FOR ILLUMINATING, HEATING, AND POWER PURPOSES.

BY PROF. WILLIAM HALLOCK.

Heretofore, it had been customary, in the case of compressed gas for illuminating purposes, to use only such gas or gas mixtures as remained gaseous even under the high pressure to which they were subjected. This condition necessarily limited the range of utilisable hydrocarbons, the tendency always being to eliminate just those gases high in carbon which are most valuable for heating and lighting.

Blau set himself the problem of producing a liquid which should be a mixture of several easily volatile compounds, or of such as are vapours at ordinary temperatures, and then compressing into it large quantities of the so-called permanent gases. For example, such hydrocarbons as propane, butane, isobutane, the pentanes, propylene, butylene, etc., are readily compressed to liquids, and in that state will dissolve large quantities of the permanent gases, hydrogen, methane, etc. In this connection two very important characteristics of such a solution under pressure must be reckoned with. First, the manner of its gasification on relief of pressure, and secondly, its commercial production. Conditions must be so-arranged that the permanent gases will not all be evolved first, and then the vapours, thus changing the composition of the gas. A pressure solution must be provided so that when the permanent gases are evolved they carry with them a constant proportion of the vapours. Only under these conditions will the constitution of the gas remain constant and the liquid be available. Thus, by combining the idea of reversing the proposition and using the coercible gases under the right conditions, did Blau satisfy the second requirement.

In the usual methods for the production of illuminating gas it is customary to carry on the distillation at comparatively high temperatures, in order to break up the higher hydrocarbons referred to above, thus furnishing a larger percentage of the permanent gases. Blau carries on his distillation at lower temperatures, 600° to 700° C., where a large percentage of the easily liquefiable gases is produced, together with a smaller percentage of the permanent gases. This whole product is then put through the usual processes for purification, and is then highly compressed. Under this pressure the heavier gases liquefy, and at the same time become saturated with the permanent gases. Any excess of the latter passes off for use in any of the usual ways, for example, running the gas engine for the compressor, and the like.

This pressure solution is then filled into steel cylinders, in which it is available for transport. The cylinders are of all sizes from ½ kilo. to 25 kilos. A medium sized cylinder of 10 kilos. or 22 litres would be about 5 or 6 inches in diameter and about 3 feet high. Such a cylinder, at 15 cents per kilo., would cost $1.50, and would supply a 50 c.p. incandescent burner for 480 hours, or four months at the rate of four hours per day. A kerosene burner would require about 120 litres or about 32 gallons.

The specific gravity of the gas is 1·105 (air = 1); that of the liquid is 0·59 (water = 1). *Thermal equivalent.* 1 kilo. gives 12,318 calories; 1 cb.m. = 1,000 litres gives 15,349 cal.

Intensity of light.	Consumption of Blaugas per hour.		
H. K.	Grms.	Litres.	Cb. ft.
50	21·00	17·0	0·63
100	35·00	29·0	1·07
500	122·00	98·0	3·63

Explosion limits.

Name of gas.	Upper limit.		Lower limit.		Range.
	Air.	Gas.	Air.	Gas.	
	per cent.	per cent.	per cent.	per cent.	per cent.
Coal gas	93	7	81	19	12
Acetylene	98	2	51	49	47
Blau gas......	96	4	92	8	4

For incandescent lighting it is very important to have a gas of high calorific value in order that the generation of heat may be as concentrated as possible. Concentration of heat means high temperature in the mantle, and experiment and theory agree that the radiation of a source is proportional to the fourth power of the absolute temperature (Stefan's law); and, moreover, according to Wien's displacement law, as the temperature rises, the proportions of energy available for illumination increase. For this reason the electric arc is the most efficient source of light, and such low temperature sources as the ordinary gas burner or incandescent electric light are very inefficient. The researches of Lummer, Pringsheim, Wien, Boltzman, Stefan, and others have amply proved the enormous economy of a high temperature source of light.

Journal and Patent Literature.

Patent Specifications may be obtained by post by remitting as follows:—

***English.*—8*d*. each, to the Comptroller of the Patent Office, C. N. Dalton, Esq., Southampton Buildings, Chancery Lane, London, W.C.**

***United States.*—1*s*. each, to the Secretary of the Society.**

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I.—PLANT, APPARATUS, AND MACHINERY.

Patents.

Separating vapour from the material from which it is generated. C. R. Hill, Broadstone, Dorset. Eng. Pat. 9229, April 20, 1907.

In order to facilitate the escape of vapour from moist heated masses of material, several perforated pipes are arranged in the mass so that their upper, open ends project into the vapour space above the surface of the material.—W. H. C.

Dry products from liquids and semi-liquids; Obtaining ——. D. M. A. G. Hawes, London. Eng. Pat. 17,323, July 29, 1907.

To prevent loss during the drying of material, due to fine particles being carried away by the current of air, the latter is caused to pass through the wire gauze of a revolving drum, which dips into water or other suitable liquid as it revolves. The film of liquid retains the fine particles, and the air escapes. The material retained by the liquid is recovered in the dry state by injecting into the drying chamber, in the form of spray, the liquid draining from the drum.—W. H. C.

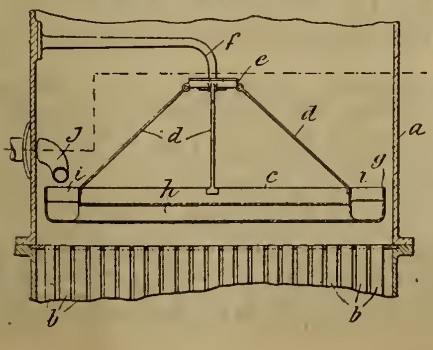
Distilling or rectifying columns; Plates for alcohol, petroleum, and like ——. R. Vallat, Paris. Eng. Pat. 9389, April 23, 1907.

See Fr. Pat. 376,872 of 1907; this J., 1907, 1040.—T. F. B.

Recovering volatile liquids; Process and apparatus for —— C. Harrison, W. Bate, and W. G. Perks, Hayle. Eng. Pat. 9941, April 29, 1907.

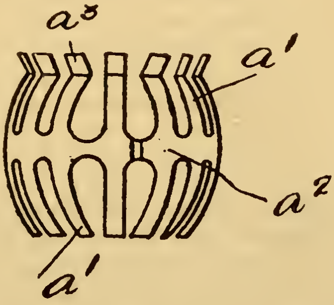
See Fr. Pat. 381,529 of 1907; this J., 1908, 140.—T. F. B.

Evaporating apparatus. F. I. Scard, London. Eng. Pat. 22,408, Oct. 10, 1907.



The liquid is fed into the evaporator through the pipe, *j*, and impinges against the vanes, or cups, *i*, in the annular trough, *g*, of the distributor, *c*, which is supported by the rods, *d*, and the disc, *e*, from a pivot of the bracket, *f*, in the steam space, *a*, above the tubes, *b*, of the evaporator. The impact of the liquid against the vanes, *i*, causes the distributor to rotate.—W. H. C.

Centrifugal liquid separators. E. W. Richmond and R. A. Lister and Co., Ltd., Dursley, Gloucester. Eng. Pat. 24,357, Nov. 4, 1907.



The claim is for a flexible support for the spindle bearing of a centrifugal machine. The support is cut out of sheet metal and bent round so as to take the form of a barrel as shown in the figure. The central portion, a^2, bears against the inner curved wall of a boss formed on the separator frame, and the "fingers," a^1, grip the spindle-bearing. The tips, a^3, of the upper fingers are bent back and bear against a conical nut screwed over the upper end of the spindle-bearing. By screwing up or unscrewing this nut, the tension of the spring can be adjusted.

—W. H. C.

Temperature exchangers. Soc. l'Air Liquide, and G. Claude, Paris. Eng. Pat. 25,658, Nov. 19, 1907. Under Int. Conv., Nov, 20, 1906.

In a cylindrical multitubular temperature exchanger, diaphragm plates are fixed at intervals in the casing to distribute the counter current evenly among the tubes. Each plate has a segment so cut away as to compel the counter current to take a helical path through the apparatus.—J. W. H.

Retort-furnace ; Regenerative ——. O. S. Eliel, La Salle, Ill. U.S. Pat. 885,740, April 28, 1908.

The claim is for a retort-furnace chamber divided by a central, vertical wall provided with a vertical gas flue. Four chequer-work regenerator chambers are arranged beneath the retort-chamber, two for gas and two for air, so that by reversing the dampers from time to time, both the gas and the air can be preheated.—W. H. C.

Chemical reaction between materials ; Process of obtaining a violent ——. C. G. P. de Laval, Stockholm, Assignor to Soc. Anon. Métallurgique Proc. de Laval, Frankfort, Germany. U.S. Pat. 885,766, April 28, 1908.

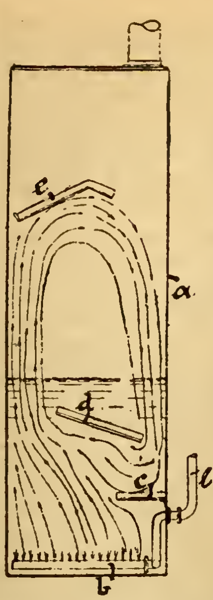
See Fr. Pat. 356,096 of 1905 ; this J., 1905, 1311.—T. F. B.

Filter elements ; Lining for ——. C. Sellenscheidt, Berlin. U.S. Pat. 886,420, May 5, 1908.

See Eng. Pat. 20,375 of 1907 ; this J., 1908, 66.—T. F. B.

Filter-plate. H. M. Ashby, Chicago, Ill. U.S. Pat. 886,464, May 5, 1908.

The entire circumference of a sheet of fibrous material (wood), is clamped between two rigid non-flexible metallic frames, so that the fibres of the sheet, constituting the filter-plate proper, are held under tension.—A. G. L.



Saturating pans [for saturating liquids with carbon dioxide, etc.]. H. Jürgens. Ger. Pat. 194,240, Nov. 3, 1906.

Baffle-plates, *c*, *d*, *e* (see Fig.), are arranged in the pan, *a*, in such a manner, that the carbon dioxide entering through *l b*, is forced to take the course indicated by the arrows.—A. S.

Mist or fog in chemical operations ; Prevention and condensation of ——. W. Ostwald. Ger. Pat. 195,080, Nov. 13, 1906.

The mist is exposed to varying pressure, whereby the larger particles increase in size at the expense of the smaller ones, and finally separate as drops. For this purpose, the mist may be passed through a piston- or diaphragm-pump. Or, the mist may be subjected to varying temperature as well as to varying pressure, for example, by producing, in the mist, an air-wave, which as is known, will cause variations of pressure and temperature corresponding with its period of vibration. A suitable air-wave can be produced by means of a singing flame in a portion of the tube through which the mist is passing, or by means of the mist itself acting through a pipe or whistle.—A. S.

Coke-ovens, with by-product recovery, in South Wales. H. G. Colman. J. Gas Lighting, May, 12, 1908, 353—355.

The author describes the coke-oven plant at Bargoed Colliery belonging to the Powell Duffryn Steam Coal Co. The installation consists of 100 Koppers' regenerative coke-ovens, 50 with longitudinal regenerators common to all the ovens, and 50 with separate transverse regenerators beneath each oven. The latter type have the advantage that it is not necessary to stop the regenerators if some of the ovens have to be cut off for repairs. The coal after mixing, washing, and draining, contains about 10 per cent. of moisture, 6 of ash, 1·1 of sulphur, and 19·5 of volatile matter. It is not compressed, but is charged from trucks through hoppers into the top of the ovens, and is levelled by hand. The average charge is 137 cwt. of wet slack per oven and the time of burning 27·9 hours. The coke is pushed out by an electrically driven ram and after being cooled in an atmosphere of steam in a Darby quencher, in order to preserve its bright appearance, slides down the incline to the conveyor by which it is taken to the screens. The yield of coke is 81·75 per cent. on the dry coal, of which 1·75 per cent. is breeze. The coke averages: fixed carbon, 91·76; ash, 7·84; moisture and volatile matter, 0·40; and sulphur, 0·91 per cent. About 36·5 lb. of tar and 19·5 lb. of ammonium sulphate are recovered per ton. The former is distilled on the works, and the sulphuric acid required for the latter is manufactured by burning the spent oxide used to purify the gas, and the hydrogen sulphide from the saturator. The burnt oxide after being rendered alkaline by treatment with ammoniacal liquor is used over again in the purifiers. About 10,000 cub. ft. of gas per ton of coal are obtained, having an average calorific value of 460 B.Th.U. gross, and

testing: carbon dioxide, 2·01; oxygen, 0·42; carbon monoxide, 5·21; ethylene, 0·80; hydrogen, 63·42; methane, 23·14; and nitrogen, 5·00 per cent. Only about half of the gas is required for heating the ovens, so that 50 per cent. is available for other purposes. This surplus gas is partly burnt under the boilers and partly used to generate power in gas engines, of which there are at present two at work, *viz.*, one of the Cockerill type of 650 h.p. and one of the Nürnberg type of 1200 h.p. The latter, when running at 100 revolutions, consumes 21·3 cub. ft. of gas (458 B.Th.U. per cub. ft.) per B.H.P.-hour, and is so satisfactory that a second engine of the same type to develop 2400 B.H.P., is being erected.
—W. H. C.

Light standards; Investigations on ——, and the present condition of the high-voltage glow lamp. C. C. Paterson. Nat. Physical Lab., Collected Researches, 1908, **3**, 49—96.

THE results of the investigations are given under the following headings:—A. Flame standards. (1). Influence of atmospheric conditions. (2). Curves showing variation of candle power due to humidity. (3). Photometric methods. (4). Description of flame standards. (5). Summary of results of intercomparisons in the National Laboratories of France, Germany, and Great Britain. (6). Comparison and criticism of the three principal flame standards. B. Secondary standards (electric). (1). Life curves of Fleming-Ediswan lamps. (2). Life curves of high-voltage glow lamps. C. Commercial glow-lamp testing. (1). Target diagrams of lamp by ten British makers. (2). Initial rating. (3). Life test. (4). Voltage regulation. (5). Comparison between normal life test and an overrunning test on glow lamps. (6). Measurement of mean spherical candle power. (7). Voltage regulator.

In the following table the relative values of the three chief flame standards, as determined in Great Britain, Germany, and France are shown:—

	Pentane.	Hefner.	Carcel.
National Physical Laboratory	1	0·914	0·982
Reichanstalt	1	0·917	0·991
Laboratoire Central	1	0·929	1·000
Laboratoire d'Essais	1	0·928	0·996

Consideration of the relative advantages and drawbacks of the three standards leads the author to conclude that the Hefner and pentane lamps are much more constant than the Carcel lamp; and that, as between the pentane and Hefner lamps, the whiter light of the former and its greater candle power (11 times that of the Hefner lamp), together with its greater ease of adjustment when making observations, greatly outweigh the advantages attaching to the Hefner lamp by reason of its simpler construction and the smaller correction required for changes in barometric pressure.—A. S.

Ammonia and hydrogen cyanide; Synthesis of —— [in a gas-producer]. H. C. Woltereck. *See* VII.

Fuel; Relation between the composition of a —— and its value in ceramic firings. A. J. Aubrey. *See* VIII.

Alcohol [denatured]; Action of —— on metals. Boulanger. *See* XVII.

Spirit; Formation of by-products in the combustion of ——. M. Altmayer. *See* XVII.

Rare earths; Non-toxicity of salts of ——. C. Bachem. *See* XX.

Sodium peroxide in certain quantitative processes. S. W. Parr. *See* XXIII.

PATENTS.

Peat; Processes of preparing ——. C. U. Greeley, Bangor, Maine, U.S.A. Eng. Pat. 9911, April 29, 1907.

SEE U.S. Pat. 863,385 of 1907; this J., 1907, 1001.—T.F.B.

Fuel; New —— for industrial purposes. F. Clauss, Berlin. Eng. Pat. 21,360, Sept. 26, 1907. Under Int. Conv., Sept. 27, 1906.

THE patent is for the use as fuel of formaldehyde or its polymerisation products or substances generating it, for a variety of purposes, including heating incandescent mantles, welding, soldering, and motive power, and in combination with ordinary fuels, and with explosives and flash-light powders, in order to improve the combustion and decrease the amount of smoke.—A. T. L.

Fuel; Artificial ——. H. G. Coales, Market Harborough. Eng. Pat. 1553, Jan. 22, 1908.

REFUSE from houses and works, screened if desired from fine ash, is pulverised in a dust manipulator of the kind described in Eng. Pat. 17,038 of 1905, large and hard pieces being rejected, and the material is incorporated with tar or pitch, or with both, in the proportion of 18 gallons of the binding agent to 1 ton of refuse. The mixture is compressed and moulded into briquettes.
—A. T. L.

Coal dust; Drying of —— for briquettes. O. Hörenz. Ger. Pat. 195,653, Jan. 24, 1907. Addition to Ger. Pat. 181,048.

THE coal dust is warmed under a pressure so slight, that the bituminous oils and tar cannot separate, but sufficient to prevent the inflammation of the coal dust.—A. S.

Coke furnaces. H. Limberg, St. Johann-Saarbrücken, Germany. Eng. Pat. 361, Jan. 6, 1908. Addition to Eng. Pat. 14,992 of 1907.

THE sagging of the unsupported cake of coal on the side of the furnace is prevented by filling the free space between the cake of coal and the walls of the furnace, by "breaking up" the rammed cake along its length. For this purpose the furnace cover is provided with transverse holes.
—J. W. H.

Coke-oven. V. D. F. Fieschi. Fr. Pat. 385,355, Dec. 19, 1907. Under Int. Conv., Dec. 19, 1906.

THE claim is for a coke-oven with vertical heating flues and separate regenerators beneath each oven. The gas enters the top of the flues, and the products of combustion pass down to the waste-gas flue. The flues, ovens, and regenerators are connected in such a manner, that, by adjusting the dampers, which are accessible from above, the ovens can be worked in three ways:—1, as non-recuperative ovens, in which case the gas passes directly from the ovens to the flues and is burnt; 2, as recuperative ovens, in which case the gas passes by a main to the by-product recovery plant, and then returns to the flues to be burnt; and 3, as recuperative and regenerative ovens, when as well as recovering the by-products, the air for combustion is preheated in the regenerators by means of the hot waste gas.—W. H. C.

Coal and other carbonaceous substances; Distillation of ——. T. Parker, London. Eng. Pat. 1972, Jan. 25, 1907.

SEE Fr. Pat. 378,621 of 1907; this J., 1907, 1131.—T. F. B.

Coal; Distillation of ——. C. C. Carpenter, London. Eng. Pat. 14,371, June 21, 1907.

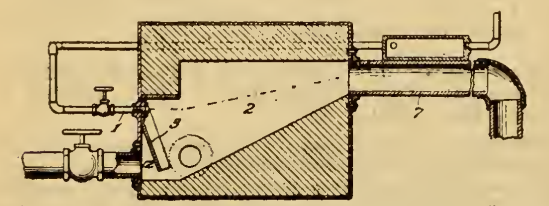
IN the charging of retorts for the distillation of coal, in the manufacture of illuminating gas, a core of coarse pieces is formed, surrounded by a layer or layers of greater fineness.—J. W. H.

Gas for heating and illuminating; Apparatus for the manufacture of ——. C. B. Tully, London. Eng. Pat. 10,346, May 3, 1907.

THE apparatus comprises a gas producer and a scrubber, the producer having one or more vertical retort-chambers arranged above the producer-chamber and surrounded by a heating jacket containing chequered brickwork. The retort-chambers are charged at the upper end, and the fuel column, which is continuous through the retort-chambers and the producer-chamber, rests on a grate arranged above a water-trough at the base of the producer.

The whole, or a part, of the producer gas may be burned in the heating jacket, the draught of primary and of secondary air being produced by a water-jacketed steam-jet exhauster at the base of the stack-pipe. The gases from the retort-chamber are forced or drawn by a steam-jet exhauster through a water-seal and through the scrubber, which contains a number of trays of coke through which water is passed. The retorts may be charged with cannel coal, and the coal-gas drawn off alone or in admixture with any proportion of producer gas; or steam may be introduced below the grate, to form a mixture of coal-gas and water-gas. "Methane-hydrogen gas" may be formed in admixture with coal gas, by introducing steam below the grate, and tar in the zone of incandescent fuel. Finally, the retort-chamber may be charged with coke, so that producer gas, water-gas, or a mixture of water-gas and "methane-hydrogen gas" is obtained. The controlling mechanism may be arranged to operate simultaneously the stack-valve, the steam-jet beneath it, the air-supply valves of the producer, and, if desired, the steam and tar valves of the producer also. —A. T. L.

Gas; Method of and apparatus for producing ——. E. H. Amet, Assignor to International Amet Co., Phœnix, Ariz. Ter. U.S. Pats. 885,903 and 885,904, April 28, 1908.



Liquid fuel is supplied by the pipe, 1, to the chamber, 2, which has an inclined floor as shown. Air is supplied to the lower part of the chamber, 2, by the pipe, 12, and the air and fuel meet beyond the baffle, 3. The fuel ignites in the chamber and is partially burnt, but the flame is extinguished at the narrow end of the chamber, 2, by the pipe, 7. The unburnt vapours and the products of partial combustion are "fixed" or converted into a permanent gas in the pipe, 7, by the residual heat passing from the chamber.—W. H. C.

Gas producer. J. R. George, Assignor to Morgan Construction Co., Worcester, Mass. U.S. Pat. 886,491, May 5, 1908.

See Eng. Pat. 16,263 of 1903; this J., 1903, 1189.—T. F. B.

Gas; Method of producing ——. F. Bauke, Berlin. U.S. Pat. 887,058, May 12, 1908.

See Fr. Pat. 365,334 of 1906; this J., 1906, 920.—T. F. B.

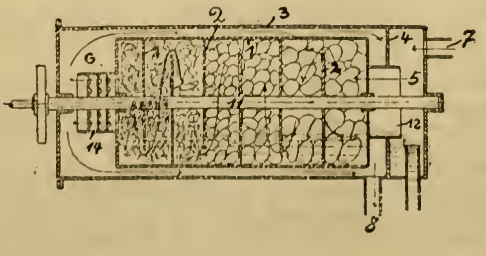
Producer gas; Process of recovering ammonia and heating air in the manufacture of ——. W. J. Crossley and T. Rigby, Openshaw. U.S. Pat. 885,980, April 28, 1908.

See Eng. Pat. 24,144 of 1906; this J., 1907, 957.—T. F. B.

Ammonia from coal gas; Extraction of —— *by washing with acids and saline solutions.* W. Feld. Fr. Pat. 385,628, Dec. 26, 1907.

See Eng. Pat. 27,567 of 1907; this J., 1908, 495.—T. F. B.

Gas purifier with rotating filter-casing. J. Matthew. Ger. Pat. 195,905, Sept. 13, 1906.



The filtering material is packed in the horizontal cylinder, 1, which is provided with baffle-plates, 2. This cylinder is supported in a chamber, 3, divided by the partition, 4, into the two compartments, 5 and 6. The crude gas enters through the pipe, 7, passes through the filter-casing, 1, into the chamber, 6, and leaves the chamber through the pipe, 8. The gas is treated with wet filtering material in the wide portion of the filter-casing, and with dry material in the narrow portion. For this purpose, a suitable liquid is introduced through the hollow axis, 11, until it reaches, in the wide portion of the filter-casing, a certain level, below the lowest part of the narrow portion, 14. The liquid flows away through the pipe, 12.—A. S.

Filaments for electric lamps. F. J. Planchon, Paris. Eng. Pat. 12,139, May 25, 1907.

Filaments are formed from compounds of albuminoid substances with "the anhydrides or acids of tungsten, molybdenum, titanium, tantalum, or uranium." The albuminoid substance, such as gelatin or casein, is dissolved in water or in alkali, and the solution is mixed with an alkaline solution of molybdic acid, for example. The whole is poured into dilute acid, and the precipitated albuminoid compound is filtered off and washed. This compound, either alone or mixed with a similar compound or with the albuminoid or acid constituents of such a compound, or with acid compounds such as phosphotungstic, phosphomolybdic, silicotungstic acids, is formed into a plastic mass with water or with alkali, and drawn into rods or filaments, which are received in an acid bath if alkali has been used. The filaments are dried, heated with exclusion of air, and finally heated by an electric current *in vacuo.*—A. T. L.

Gas analyser; Automatic ——. U.S. Pat. 881,986. *See* XXIII.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

Patents.

Tar; Dehydration of ——. A. Klönne. Ger. Pat. 196,240, Nov. 11, 1906.

Above the vessel in which the separation of the tar and water is effected, three rollers are mounted, of which the upper two are rotated in opposite directions. The mixture of tar and water is fed between the two upper rollers on to the surface of the lower roller, which may be heated, in order to soften any hard lumps. The tarry mixture passes round between the lower roller and the two upper rollers, whereby any bubbles of tar enclosing water are broken, and falls into the vessel below, where separation is effected in the usual manner.—A. S.

Hydrocarbons capable of absorbing water; Preparation of ——. J. Lifschütz. Ger. Pat. 197,662, Feb. 8, 1907.

It is stated that the water-absorbing capacity of vaseline is considerably increased if it be heated with aqueous solutions of chromic, permanganic, chloric, or other similar acids. For example, 100 parts of vaseline are mixed with 50 parts of a solution containing about 5 parts of a chlorate, and after addition of the requisite quantity of sulphuric acid to liberate the chloric acid, the mixture is boiled until most of the water has evaporated, and the smell of oxides of chlorine becomes apparent. About 25 parts of water are now added, and the boiling continued. These operations are repeated until the vaseline is capable of absorbing three times its weight of water, whereupon the solution is decanted off, and the vaseline washed with water. The vaseline containing absorbed water is suitable for medicinal and cosmetic purposes.—A. S.

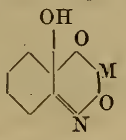
IV.—COLOURING MATTERS AND DYESTUFFS.

Indigotin; Potassium permanganate value of ——. O. Miller and J. Smirnoff. Ber., 1908, **41**, 1363—1367.

Chemically pure indigotin was prepared from both natural (Java) and artificial indigo by digestion of 35 grms. with one litre of glacial acetic acid containing 3 per cent. of concentrated hydrochloric acid. After filtering, and washing with 200 c.c. of boiling acetic acid, followed by hot water, the residue was dried, and the operation repeated five times in the case of the natural, and twice in the case of artificial material. The purified indigo was then crystallised from aniline (6 grms. in 1 litre). The product, on elementary analysis, gave numbers agreeing well with the theoretical. The pure substance was converted into the disulphonic acid and titrated with permanganate, when it was found that 100 parts of indigotin required 42·26 parts of potassium permanganate. This number agrees with that found by Mohr (42·16), but differs from that found by Skalweit (48·27). The authors are unable to account for the divergence of the number found by them from the theoretical (48·27). (See also this J., 1906, 735; 1907, 4, 182, 1172, 1174.)—J. C. C.

Mordant dyestuffs; Theory of ——. C. Liebermann. Ber., 1908, **41**, 1436—1444.

In Werner's recent paper on a new theory of mordant dyestuffs (this J., 1908, 439), Liebermann's theory of mordant dyestuffs was stated to have been applied only to those of the alizarin class. The author points out that he had applied his theory to many different classes of dyestuffs, and that it is practically the same as Werner's, with the advantage that only the ordinary theory of valency is required. In cases where a hydroxyl (or N.OH) group is adjacent to carbonyl and thus no salt formation is possible, this can take place if the hydrated form of the latter is postulated; thus, lake formation would give rise to such a compound as, for example,



where M denotes a metallic atom.—J. C. C.

Diazo-compounds and azo-dyestuffs; A reaction between ——. E. Grandmougin. Ber., 1908, **41**, 1403.

The author points out that he has formerly described instances of the reaction between diazo-compounds and azo-dyestuffs recently mentioned by Lwoff (this J., 1908, 440). Thus by the action of *p*-nitrodiazobenzene chloride on benzeneazosalicylic acid, *p*-nitrobenzeneazosalicylic acid and bis-*p*-nitrobenzeneazophenol are formed (the latter evidently by the elimination of the carboxyl group of the salicylic acid). Also, by the action of diazotised aminobenzoic acid on benzeneazo-*α*-naphthol, a mixture of bisbenzeneazo-*α*-naphthol and biscarboxybenzeneazo-*α*-naphthol is obtained. A similar reaction takes place when diazotised sulphanilic acid is used.—J. C. C.

Aminoazo-compounds; Yellow azo- and violet quinonoid salts of ——. A. Hantzsch and F. Hilscher. Ber., 1908, **41**, 1171—1187.

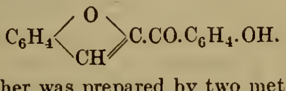
The authors find that a large number of aminoazo-compounds furnish two isomeric salts with various acids, the first example of this isomerism having been recorded by J. Thiele in 1903 (Ber., 36, 3965). The light-coloured salts (mostly orange-yellow) are considered to have the azo-constitution, whilst the dark-coloured salts (mostly violet) are quinonoid. The determination of the constitution was arrived at from a study of the absorption spectra. Dimethyl- and phenyl-aminoazobenzene, *p*-tolueneazodimethylaniline, *p*-bromobenzeneazodimethylaniline, etc., form chiefly the violet salts, whilst dibromotolueneazodimethylaniline and tribromobenzeneazodimethylaniline form principally orange salts. Aminoazobenzene gives both kinds in equal amount. In general, the orange-yellow, labile salts are first formed, and these change (by the addition of traces of acids or sometimes by friction) into the violet stable salts: the former crystallise in thin plates and the latter in needles. The light-coloured salts are usually obtained by adding an ethereal solution of the base to excess of acetyl chloride (bromide or iodide) diluted with ether, and the salts of acids insoluble in ether are prepared by adding an acetic acid or alcoholic solution of the base to excess of the aqueous acid.—J. C. C.

Gallocyanine dyestuffs; Condensation of —— *with amino-compounds.* E. Grandmougin and E. Bodmer. J. prakt. Chem., 1908, **77**, 498—510.

The authors have continued their previous work on this subject (this J., 1907, 312). The condensation product of Correine and *m*-aminobenzoic acid crystallises from alcohol in green needles, which give a red solution in concentrated sulphuric acid, changing to reddish-brown on dilution with water. The alkaline solution is blue-violet. When *p*-aminobenzoic acid is substituted for the meta-acid in this reaction, the product is similar and has the same properties. Correine and anthranilic acid give a product separating from alcohol in green crystals; *m*- and *p*-nitraniline condense readily with Prune and Correine, but *o*-nitraniline condenses less easily. The product of condensation of Correine with *m*-nitraniline forms dark olive needles dissolving in concentrated sulphuric acid with a red colour, which on dilution becomes reddish-brown and finally yellowish-green; when *p*-nitraniline is used, the product crystallises in bronze plates giving a red solution with concentrated sulphuric acid, which is not changed on dilution. Prune and methylaniline yield crystals dissolving in concentrated sulphuric acid to a reddish-violet solution, which changes to red on dilution. The solution in glacial acetic acid is blue. Prune and *p*-phenylenediamine furnish a crystalline powder dissolving in concentrated sulphuric acid with a red colour, which changes to reddish-brown on dilution; the glacial acetic acid solution is blue. Prune and benzidine condense to a substance dissolving in concentrated sulphuric acid with a reddish-violet colour, changing to red on dilution. It is nearly insoluble in alkalis, but gives a bluish-violet solution in chloroform. Correine and diethyl-*p*-phenylenediamine give blackish needles dissolving in concentrated sulphuric acid with a magenta-red colour, becoming browner on dilution. The substance dissolves in dilute acid with a red colour, which changes to blue when much diluted. The glacial acetic acid solution is blue.—J. C. C.

Chromophor, CO.C : C; Function of the double ——. F. Zwayer and St. v. Kostanecki. Ber., 1908, **41**, 1335—1341.

In view of the importance of the double chromophor, CO.C : C, in connection with the theory of the constitution of dyestuffs, the authors have made a study of 4′-hydroxy-1-benzoylcumarone,



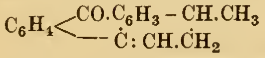
$$C_6H_4\left\langle\begin{array}{c}O\\CH\end{array}\right\rangle C.CO.C_6H_4.OH.$$

The methyl ether was prepared by two methods, namely, (1), by acetylating 2-hydroxy-4′-methoxychalkone, $HO.C_6H_4.CH : CH.CO.C_6H_4.O.CH_3$, (obtained by condensing salicylaldehyde and *p*-methoxyacetophenone in presence of sodium hydroxide), brominating the acetyl compound, and treating the resulting 2-acetoxy-4′-methoxychalkone dibromide with alcoholic potash; and (2), by condensing cumaryl chloride and anisol in presence of aluminium chloride. The methyl ether formed in this way separates from alcohol in white crystals melting at 103—104° C., and gives an intense yellow colour with concentrated sulphuric acid. 4′-Hydroxy-1-benzoylcumarone was prepared by condensing cumaryl chloride with phenol in presence of aluminium chloride, and hydrolysing the cumaryl ester of 4′-hydroxy-1-benzoylcumarone thus formed. The substance crystallises from dilute alcohol in yellow needles melting at 179—180° C., thus resembling 4-hydroxychalkone (pale yellow) and 4′-hydroxychalkone

(yellow) rather than 4′-hydroxyflavone (white). Its solution in dilute sodium hydroxide is yellow with a weak green fluorescence, and it gives a yellow solution in concentrated sulphuric acid. By similar reactions, 3′ : 4′-dimethoxy-1-benzoylcumarone was obtained; it forms colourless crystals from ether which melt at 90—91° C. The solution in sulphuric acid is orange-coloured.
—J. C. C.

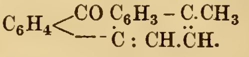
Benzanthrone derivative; An early ——. C. Liebermann and K. Roka. Ber., 1908, **41**, 1423—1427.

The substance described by Liebermann in 1882 as being produced from amyloxanthranol by the action of concentrated sulphuric acid, exhibits many similarities to the members of the benzanthrone group and probably belongs to this. The substance is considered to be a methyldihydrobenzanthrone (I) or a methylbenzanthrone (II).



$$C_6H_4<\begin{matrix}CO.C_6H_3-CH.CH_3\\ \text{—}\dot{C}:CH.\dot{C}H_2\end{matrix}$$

I.



$$C_6H_4<\begin{matrix}CO\ C_6H_3-C.CH_3\\ \text{—}\dot{C}:CH.\ddot{C}H.\end{matrix}$$

II.

It is oxidised by chromic acid to anthraquinonecarboxylic acid, and on reduction with hydriodic acid, yields a hydrocarbon dissolving in concentrated sulphuric acid to a colourless solution which becomes deep red on heating. Benzanthrone also gives these reactions.—J. C. C.

PATENTS.

Anthracene series; Manufacture of compounds of the ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 9657, April 25, 1907.

According to Eng. Pat. 29,750 of 1906 (this J., 1907, 1135), compounds of the anthracene series are produced by treating a 1-acetylaminoanthraquinone compound, or a halogen derivative of the same, with an acid chloride. According to the present patent, other acetylaminoanthraquinone compounds, when treated with an acid chloride such as phosphorus oxychloride, phosphorus pentachloride, or sulphuryl chloride, yield valuable condensation products. Either a monoacetyl-2-aminoanthraquinone or a diacetyl-2-aminoanthraquinone compound, or a mixture of any one of these compounds with any other of them or with a 1-acetylaminoanthraquinone compound may be employed. Instead of any of the above-mentioned compounds, their halogen derivatives may be employed. Most of the products are vat dyestuffs for cotton. The products obtained by heating 1-acetylaminoanthraquinone alone with an acid chloride, as in the former patent, should preferably be dyed whilst using less sodium hydroxide and a lower temperature than usual, and also with the addition of some sodium sulphate to the vat, reddish-brown shades being then obtained on cotton. But by employing a mixture of 1-acetylaminoanthraquinone with 2-acetylaminoanthraquinone, as in the present patent, a yellow vat-dyestuff is obtained, which can be employed in the usual manner, though in this case also, it is preferable to dye in presence of less sodium hydroxide and at a lower temperature than usual, and also with the addition of some sodium sulphate to the vat. By the action of phosphorus oxychloride on the acetyl derivative of the diaminoanthraquinone obtained by reducing *α*-dinitroanthraquinone (Ger. Pat. 72,685), a brown vat-dyestuff is obtained, but by employing a mixture of this diamino compound with 1-acetylaminoanthraquinone or 2-acetylaminoanthraquinone, products are obtained which respectively dye cotton in orange-yellow and yellow shades. The acetylation of the aminoanthraquinone compound and the treatment with the acid chloride can be combined in one operation; for instance by heating the aminoanthraquinone compound with either phosphorus oxychloride or phosphorus pentachloride together with either acetic anhydride, acetyl chloride, or sodium acetate, the new condensation products are obtained. If sulphuryl chloride be employed as the acid chloride, in the presence of an acetylating agent, acetylation and chlorination of the anthraquinone residue can be effected in one operation with the condensation. The compounds obtained according to this invention possess weak basic properties. They differ from the acetylaminoanthraquinone compounds from which they have been prepared, by not being re-converted into the original aminoanthraquinone compound by hydrolysing agents, such as sulphuric acid, at 70° to 80° C. Most of them are dyestuffs; others appear to have little or no affinity for the fibre, but can be used for the manufacture of dyestuffs.—E. F.

[Triphenylmethane] dyestuff; Green —— *and process of making same.* P. Julius, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 886,815, May 5, 1908.

See Fr. Pat. 371,742 of 1906; this J., 1907, 404.—T. F. B.

Vat dyestuffs containing sulphur [thioindigo dyestuffs]. Process for preparing ——. Badische Anilin und Soda Fabrik. Ger. Pat. 190,477, July 17, 1906.

The leuco-compounds of thioindigo dyestuffs, obtained by condensing thiosalicylic acid with the condensation product of chloral and formaldehyde (Fr. Pat. 367,709 and Addition; this J., 1906, 1143; 1907, 89), are treated in the cold with alkaline oxidising agents, or with acid oxidising agents, and the resulting substances heated with alkalis or alkaline-earths. The dyestuffs may be obtained direct from the leuco-compounds by oxidising with hot alkaline agents, or with sulphur or sulphur chloride according to Fr. Pat. 367,739 (this J., 1906, 1143).
—T. F. B.

Azo dyestuffs and intermediate products; Manufacture of ——. O. Imray, London. From Farbwerke vorm. Meister, Lucius, und Brüning, Hoechst a/Main, Germany. Eng. Pat. 9742, April 26, 1907.

See Addition of April 25, 1907, to Fr. Pat. 376,868 of 1907; this J., 1907, 1083.—T. F. B.

[Azo] dyestuff suitable for preparing lakes; Process for making an ——. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 385,570, March 20, 1907.

See U.S. Pat. 858,065 of 1907; this J., 1907, 920.—T. F. B.

Arylthioglycol-o-carboxylic acids; Process of making ——. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 385,675, March 25, 1907.

See Eng. Pat. 6930 of 1907; this J., 1908, 218.—T. F. B.

o-Hydroxy-p-nitranilinesulphonic acids; Preparation of ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 197,807, May 15, 1905. Addition to Ger. Pat. 188,378.

Derivatives of o-aminophenolsulphonic acids (*e.g.*, methyl or chloro derivatives) are treated with phosgene, nitrated, and the products saponified. The new o-hydroxy-p-nitranilinesulphonic acids are applicable for the manufacture of azo dyestuffs.—T. F. B.

Hydroxyanthrarufin and hydroxychrysazin; Preparation of ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 195,028, Jan. 9, 1906.

According to Liebermann and Boeck (Ber., 1878, 1617), hydroxyanthraquinones containing not more than one hydroxyl in each benzene ring, take up smoothly another atom of oxygen when fused with potassium hydroxide. In the case of anthrarufin and chrysazin, however, such a high temperature is needed for the reaction that only moderate yields of trihydroxyanthraquinone are obtainable. It is now found that much better yields can be obtained if the so-called oxidation-fusion method be employed. 10 kilos. of the hydroxyanthraquinone are heated with 40 kilos. of sodium hydroxide solution of 45° B. and 3 kilos. of sodium nitrate for 24 hours to 180°–185° C. in an autoclave. The product is mixed with water, calcium chloride solution added till a precipitate is no longer formed, and the calcium lake separated, washed, and decomposed with dilute acid. By this method anthrarufin yields 1·2·5-trihydroxyanthraquinone (m. pt. 273°–274° C.), whilst chrysazin yields the corresponding 1·2·8-trihydroxy compound (m. pt. 230° C.).—A. S.

Hydroxyanthrarufin and hydroxychrysazin ; Preparation of ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 196,980, June 29, 1907. Addition to Ger. Pat. 195,028.

THE process for making hydroxy derivatives of anthrarufin and chrysazin described in the original patent (see preceding abstract) can be made almost quantitative by performing the melting with a mixture of potassium and sodium hydroxides, or only the former, together with sodium nitrate.—T. F. B.

Phenanthreneanthraquinone ; Preparation of ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 194,328, Oct. 28, 1906.

PHENANTHRYLBENZOYL-*o*-CARBOXYLIC acid, obtained by treating phenanthrene with phthalic acid and aluminium chloride, is converted into phenanthreneanthraquinone by heating with phosphoric anhydride to 150° C. until the product is insoluble in alkali. The product is washed with water, and the quinone reduced by hydrosulphite solution and reprecipitated by oxidising the solution with air. The new quinone is a yellow substance, of m. pt. 234° C. : its solutions in sulphuric acid are violet-blue, turning brown when heated. It is a feeble yellow dyestuff, and may be used for preparing other dyestuffs.
—T. F. B.

β-Naphthylindigo ; Manufacture of halogen derivatives of —— and of intermediate products. O. Imray, London. From Soc. Chem. Ind. in Basle, Basle. Eng. Pat. 10,327, May 3, 1907.

SEE U.S. Pat. 872,227 of 1907 ; this J., 1907, 1274.—T. F. B.

Vat dyestuffs ; Preparation of red —— containing bromine. Basler Chem. Fabrik. Ger. Pat. 196,349, April 27, 1907.

THE condensation product of acenaphthenequinone with phenylthioglycol-*o*-carboxylic acid or 3-oxy-(1)-thionaphthene, is mixed with nitrobenzene, and the suspension treated with bromine at temperatures of 140° C. and upwards. The new dyestuffs, which are deposited from the solution on cooling, dye unmordanted wool blue-violet shades from the hydrosulphite vat ; these shades are converted to red by hot air or to yellowish-red by treatment with oxidising agents (*e.g.*, bleaching powder solution).—T. F. B.

Indigo vat employed in dyeing ; Preparation of the ——. H. Chaumat, Paris. U.S. Pat. 885,978, April 28, 1908.

SEE Fr. Pat. 379,041 of 1907 ; this J., 1907, 1196.—T. F. B.

Sulphur dye [sulphide dyestuff] ; New brown ——, and process of making same. M. R. Moffatt and H. S. Spira, Providence, R.I. U.S. Pat. 886,532, May 5, 1908.

WHEN wood-tar, from which the phenol and cresols have been removed by means of alkali, is fused with sulphur and alkali sulphides, a brown dyestuff is obtained, capable of dyeing unmordanted cotton a brown colour, which is fast to light, scouring, and cross dyeing. The dyestuff is partly soluble in water and readily dissolves in sodium sulphide solution, from which it is precipitated by acids.—F. SODN.

Trisazo dyestuff ; Red —— and process of making same. G. Kalischer, Frankfort, Germany, Assignor to Cassella Color Co., New York. U.S. Pat. 886,985, May 5, 1908.

SEE Eng. Pat. 14,787 of 1905 ; this J., 1906, 368.—T. F. B.

2-Amino-1-phenol-5-sulphonic acid ; Preparation of ——. L. Cassella und Co. Ger. Pat. 197,496, March 22, 1907.

THE new aminophenolsulphonic acid is prepared by sulphonating carbonyl-*o*-aminophenol, and saponifying the resulting sulphonic acid. It is fairly readily soluble in water, and forms an intensely yellow coloured diazo compound, the azo dyestuffs from which are deeper in shade than those obtained from the isomeric acids.
—T. F. B.

Sulphide dyestuffs ; Process for producing blue ——. Act.-Ges. f. Anilinfabr. Fr. Pat. 385,673, March 25, 1907.

SEE U.S. Pat. 864,644 of 1907 ; this J., 1907, 1044.—T. F. B.

Polynitrohalogen compounds of the aromatic series ; Production of ——. Act.-Ges. f. Anilinfabr. Fr. Pat. 385,199, Dec. 19, 1907.

POLYNITROHALOGEN compounds of the aromatic series are obtained when an aryl-sulphonic chloride, R.SO$_2$Cl, acts on a polynitro-phenol or -naphthol in presence of a tertiary base such as pyridine, quinoline, dimethylaniline, etc. Example 1 : A mixture of 80 parts of pyridine, 229 parts of picric acid, 176 parts of benzenesulphonic chloride, and 300 parts of nitrobenzene is heated to 80—85° C. for 4—6 hours. Volatile substances are removed by a current of steam, and the residual oil, which consists of picryl chloride, $C_6H_2Cl(NO_2)_3$, crystallises on cooling. Example 2 : 242 parts of dimethylaniline are added to 234 parts of 2 : 4-dinitro-1-naphthol and 190 parts of *p*-toluenesulphonic chloride ; the mass is heated to 80—85° C. for 3—4 hours, when, on cooling and adding alcohol, 2 : 4-dinitro-1-chloronaphthalene is obtained.
—J. C. C.

Sulphide dyestuffs ; Process for preparing brown and yellowish-brown ——. Act.-Ges. f. Anilinfabr. Ger. Pats. 194,198 and 194,199, Feb. 7, 1907.

2.4-DINITRO-2′-hydroxydiphenylamine or its 5′-methyl derivative is heated with sulphur and an alkali sulphide in presence of copper or a copper salt.—T. F. B.

Sulphide dyestuffs ; Preparation of blue ——. Act.-Ges. f. Anilinfabr. Ger. Pat. 197,083, March 27, 1907. Addition to Ger. Pat. 192,530.

THE blue sulphide dyestuff obtained by melting *p*-amino-*m*-chloro-*p*′-hydroxydiphenylamine with sulphur and sodium sulphide, is fast to washing and light, and is somewhat redder in shade than those obtained, according to the original patent, from aminohydroxydiphenylamine.
—T. F. B.

Anthracene derivatives ; Production of ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 385,358, Dec. 19, 1907. Under Int. Conv., Dec. 24, 1906.

HALOGEN derivatives of the anthracene series, when treated with fuming sulphuric acid, with or without the addition of boric acid, are converted into the corresponding hydroxy-compounds. Example : A mixture of 10 kilos. of 1 : 4-dichloroanthraquinone, 100 kilos. of fuming sulphuric acid (containing 10 per cent. of sulphur trioxide) and 5 kilos. of crystallised boric acid is heated to 200° C. Quinizarin is formed, and is isolated by pouring the mass into water and filtering. Under slightly different conditions of temperature and strength of sulphuric acid, 1 : 4-chlorohydroxyanthraquinone also yields quinizarin, and 1-amino-2 : 4-dibromo (or dichloro)-anthraquinone furnishes 1-amino-2-bromo (or chloro)-4-hydroxyanthraquinone.—J. C. C.

Anthracene dyestuffs ; Manufacture of ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 195,139, March 5, 1907.

p-AMINOHYDROXYANTHRAQUINONESULPHONIC acids are obtained by treating *p*-halogenhydroxyanthraquinonesulphonic acids with ammonia, in presence of a catalytic agent such as copper or its compounds —T. F. B.

Dibromoanthrarufin- and dibromochrysazin-disulphonic acids ; Preparation of ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 197,082, March 8, 1907.

DIBROMO-ANTHRARUFIN- and -chrysazin-disulphonic acids may be obtained by the bromination of the sulphonic acids at a high temperature, *e.g.*, 140° C., and in acid solution. Under these conditions the sulphonic acid groups of most other hydroxyanthraquinonesulphonic acids are replaced by halogens. The products dye unmordanted wool yellow, and chromed wool brown shades.—T. F. B.

Flavopurpurin ; Preparation of ——. R. Wedekind und Co. Ger. Pat. 194,955, Oct. 27, 1906.

Anthraflavic acid, obtained by melting salts of anthraquinone-2·6-disulphonic acid with alkalis, can be converted into flavopurpurin by heating with sodium nitrate and alkali hydroxide solution of greater strength than is generally used for such oxidations (a caustic soda liquor of boiling-point 185° C. is mentioned) ; the mixture is subjected to prolonged heating in a closed vessel at 215°—225° C.—T. F. B.

Oxazine dyestuffs ; Preparation of blue ——. Kalle und Co. Ger. Pat. 195,901, Nov. 30, 1906.

1·4·2-Diaminonaphthol or any of its sulphonic acids is converted into a blue oxazine dyestuff by heating in neutral aqueous or alcoholic solutions. The diaminonaphthol may be prepared either by reducing the product of nitrating 2·1-aminonaphthol, or by reducing the dyestuffs obtained by combining a diazo compound with 2·1-aminonaphthol.—T. F. B.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

Buazé fibre ; from Nyasaland. Bull. Imp. Inst., 1908, 6, 19—22.

Livingstone, in 1857, first drew attention to Buazé (*Securidaca longepedunculata*) fibre. The specimen examined at the Imperial Institute had been collected and prepared by natives at Zomba between April and June, 1905. The fibre was from 1 ft. 5 ins. to 2 ft. 2 ins. long, had a yellowish colour, and when cleaned, was strong and flax-like. On chemical examination the following results were obtained : Moisture, 6·5 per cent. ; ash, 1·8 ; α-hydrolysis (loss), 18·8 ; β-hydrolysis (loss), 23·5 ; acid purification (loss), 11·5 ; nitration (gain), 43·3 ; cellulose, 74·5 per cent. (see this J., 1907, 757). The length of the ultimate fibre was from 0·6 to 1·5 inches (mean, 0·9 inch). The fibre was not lignified. The sample as a whole consisted of two kinds of material—coarse fibres from the bark of thick stems and strips of bark from thinner twigs. The coarse fibre was very short, but might be utilised for the manufacture of rough bags. The bark from the twigs yielded, in a laboratory test, about 37 per cent. of fibre of good lustre and strength and of satisfactory colour, which might form a substitute for flax tow. It was found that the gums present on the fibre could not be removed by the ordinary methods of retting, and apparently the only way is to scrape them off by hand after the steeping process.—A. S.

Sulphite cellulose bleaches. See XIX.

Patents.

Artificial silk or like substances ; Filtering and spinning heads for machines for forming filaments of metamorphosed cellulose or similar material in the manufacture of ——. M. Waddell, New York. Eng. Pat. 7690, Mar. 11, 1907.

This combined spinning and filtering head consists of two discs, adapted to compress between them a suitable fibrous filtering material such as cotton, the discs being clamped together by a bolt passing through them. One disc is provided with a hollow lug, by means of which it is connected with a hollow pivot mounted upon a bracket. One arm of this bracket is also hollow, and is connected with a pipe leading to the reservoir containing the viscose or other similar solution. The other end of the hollow arm is connected with the opening in the pivot, which communicates, through the opening of the lug, with the interior space between the discs. In operation, the viscose or similar substance is forced through the communicating passages in the bracket, pivot, and lug, and enters the space between the two discs. It is then forced through the filtering medium and finally passes through a tube fixed on the other side of the filter and provided at its end with a spinneret, which delivers the material into a fixing bath.—P. F. C.

Cellulose ; Preparation of concentrated solutions of —— *and manufacture of threads from same.* E. Berenguer, Lisbon, Portugal. Eng. Pat. 10,545, May 6, 1907. Under Int. Conv., July 9, 1906.

All forms of cellulose do not give uniform results in the production of concentrated solutions. One reason for this is stated to probably be a transformation of the surface of the cellulose fibre, produced by the action of the air. It is also stated that in some plants, such as cotton and flax, the cellulose has already undergone this surface transformation before separation from the other constituents of the plant. According to the present patent, a cellulose which has not undergone this surface transformation is used, and the alteration of the surface is prevented by keeping it moist, by immersion in water or otherwise. It is then saturated with ammonia by placing it in an ammoniacal solution for some hours, and copper carbonate added in excess. The nascent copper hydroxide formed, acts energetically on the cellulose, so that a very concentrated solution is obtained. To form threads, this solution is passed through capillary tubes into a bath containing alcohol, ether, nitric acid, and water, to solidify the cellulose. Suitable proportions for such a bath are :— 8 kilos. of alcohol, 2 kilos. of ether, 0·5 kilo. of nitric acid, and 8 kilos. of water.—E. F.

Cellulose products ; Manufacture of new ——. Soc. Anon. Française la Soie Artificielle. Fr. Pat. 385,083, Dec. 16, 1907. Under Int. Conv., April 22, 1907.

A cuprammonium solution of cellulose is forced through fine apertures into a precipitating bath consisting of a strong solution of sodium hydroxide, to which has been added glucose, glycerin, or some other analogous substance capable of forming labile compounds with bases. —P. F. C.

Volatile solvents used in the manufacture of artificial silk ; Recovery of ——. O. Bucquet. Ger. Pat. 196,699, Feb. 10, 1907.

A liquid fat or fatty acid, either alone, or mixed with an oil of low solidifying point, is used as an absorbent of the vapours of volatile solvents. When the absorbent is saturated, the volatile solvent is recovered by distillation. —A. S.

Textile fibres from reeds or rushes ; Obtaining ——. F. Fuchs. Ger. Pat. 195,295, April 30, 1907. Addition to Ger. Pat. 180,396.

Reeds or rushes are treated with calcium or magnesium bisulphite solutions at a temperature of 100°—110° C. The fibres are not so strong as those obtained by treating with solutions of alkali, but their colour is superior. —T. F. B.

Flax, hemp, and like textile fibres ; Process for the treatment of ——. Syndicat des Procédés Rousseau, Paris. Eng. Pat. 18,337, Aug. 13, 1907.

See Fr. Pat. 381,153 of 1907 ; this J., 1908, 119.—T. F. B.

Waste liquors in which wool has been scoured ; Treatment of ——. E. Dowie. Fr. Pat. 385,194, Dec. 19, 1907.

A carbohydrate, such as sugar or starch, is added to the effluent to be treated, and the mixture is vigorously stirred by blowing in air or steam. By this treatment, the carbohydrate is largely converted into potassium sucrate, which remains in solution, whilst the mixture of fats and fatty acids, contained in the effluent, is liberated. This is separated from the solution of potassium sucrate, treated with an additional quantity of the carbohydrate, and heated to the boil for some time. The mass is then transferred into a hot receiver, and on standing, separates into well-defined layers, wool-grease being uppermost ; fatty acids form the second layer, below which is the solution of potassium sucrate, whilst the mud settles to the bottom.—P. F. C.

Bleaching, scouring or otherwise treating yarns or fabrics; Machine for ——. J. and F. Ashton, Hyde. Eng. Pat. 11,902, May 22, 1907.

A drum which is divided into compartments by radially disposed division plates, is supported, on a horizontal axis, in a tank containing the bleaching liquor. The circumferential portion of the drum is open, the material to be bleached being fed into and removed from the compartments whilst the drum is slowly rotating. An endless band of webbing or other suitable material is led over guide rollers, and underneath the drum, and prevents the material from falling out of the compartments during the passage through the liquor.—F. M.

Mercerised tissues or fabrics; Apparatus for treating ——. R. Kirchhof, Braunau-Oelberg, Bohemia. Eng. Pat. 10,873, May 9, 1907.

See Fr. Pat. 378,826 of 1907; this J., 1907, 1196.—T. F. B.

Dyeing apparatus. W. Friedrich, Dresden, Germany. Eng. Pat. 8568, Apr. 12, 1907.

Two vats and a supply reservoir are placed in communication with one another by means of pipes. Each vat is further provided with a perforated, hollow, and preferably rotatable shafting upon which the fabric to be dyed is directly wound. A centrifugal pump is connected with each shafting and also with the supply reservoir containing the dye-liquor. In operation, the dye-liquor is first pumped from the reservoir, through one of the perforated shaftings, and is forced radially through the roll of cloth into the vat. The dye-liquor overflows from this vat through the connecting pipe into the second vat. When the supply reservoir is thus emptied, the pipe connecting it with the pump is closed, and the direction of circulation is reversed. The dye-liquor then travels from the outside to the inside of the roll contained in the first vat, and in the opposite direction through the roll which is wound upon the shafting arranged in the second vat. This circulation is continued until the desired depth of shade is obtained. The dye-liquor is then replaced by water, and the material washed in a similar manner.—P. F. C.

Dyeing with sulphurised dyestuffs. O. Imray, London. From Farbwerke vorm. Meister, Lucius, und Brüning, Hoechst a/Main, Germany. Eng. Pat. 8631, Apr. 13, 1907.

A dye-bath prepared in the usual manner with a sulphurised dyestuff, sodium sulphide, and common salt, may be treated with a large quantity of sodium, potassium, or ammonium bisulphite without any of the dyestuff being precipitated. This addition protects animal fibres, leather, and such materials as paper, from the harmful action of the alkali sulphide, and enables them to be dyed without injury with a sulphurised dyestuff. Too great an excess of bisulphite must be avoided, as it unfavourably influences the dyeing. In place of bisulphites, sulphites may be used in presence of suitable acids or acid salts. *Example*:—A dye-bath is prepared with 3 grms. of Thiogen Blue B, 4·5 grms. of crystallised sodium sulphide, 4 grms. of crystallised sodium bisulphite, and 90 grms. of Glauber's salt per litre. Wool is dyed therein for 1 hour, then washed, and finally dried.—P. F. C.

Dyeing with sulphide dyestuffs in a hydrosulphite vat; Process for ——. P. Schneider. Fr. Pat. 385,087, Dec. 16, 1907.

100 kilos. of the dyestuff are kneaded with 20—100 kilos. of sodium hydroxide solution (36° B.), according to the solubility of the dyestuff employed. 100 litres of "liquid hydrosulphite" are next added, and the whole mixture is then heated to about 50° C. This treatment reduces and dissolves the dyestuff, and the solution thus prepared, together with about 4 litres of "liquid hydrosulphite," is added to 1000 litres of water which has been previously rendered slightly alkaline by the addition of 1—2 litres of ammonia. Cotton is dyed in this vat by giving it 1—3 baths, each of 30 minutes' duration, at 60° C. Wool is dyed by one bath of 45 minutes' duration at 50° C., whilst half-wool goods are worked in the bath at 30° C. for 15 minutes, and the temperature is then raised to 40° C. for a further 30 minutes.—P. F. C.

Skeins, fabrics, and the like; Process and apparatus for treating ——. H. Thies, Croesfeld, and W. Mathesius, Berlin. Eng. Pat. 10,578, May 7, 1907.

See Fr. Pat. 380,864 of 1907; this J., 1908, 72.—T. F. B.

Dyeing wool; Method of ——. R. B. Ransford, Upper Norwood. From L. Cassella und Co., Frankfort on Maine, Germany. Eng. Pat. 17,430, July 30, 1907.

In Eng. Pat. 12,831 of 1907 (this J., 1908, 401) a method was described of producing mixed effects on wool by first dyeing white wool with metallic oxides to a pale colour, and then mixing it with more or less deeply dyed wool. According to the present patent, the wool to be used for mixing purposes may, without affecting the fastness to light of the mixture, be shaded with suitable organic dyestuffs at the same time as it is dyed with metallic compounds. It has also been found that the light shades of wool may be dyed, for these purposes, by other coloured metallic compounds, such as sulphides or thiocyanates (sulphocyanides), instead of with metallic oxides. For example the wool for light shades may be dyed by boiling 100 kilos. in a bath charged with 4 kilos. of potassium bichromate, 0·5 kilo. of copper sulphate, and 4 kilos. of formic acid, and adding, after exhaustion, 0·25 kilo. of Alizarin Viridine. Again, antimony trisulphide may be fixed on wool by treating the latter for one hour at the boil with 4 to 6 per cent. of tartar emetic, rinsing, and then treating with 4 to 6 per cent. of sodium thiosulphate for half an hour at 40 to 60° C. The shade produced is reddish-yellow. A yellowish-olive shade is produced by boiling for one hour with 3 to 5 per cent. of copper sulphate, rinsing, and treating for ½ hour, at 40 to 60° C., with a 1 to 2 per cent. solution of ammonium thiocyanate. In this way copper thiocyanate is formed on the fibre.—E. F.

Dyeing machine. J. Hussong, Camden, N.J., Assignor to Hussong Dyeing Machine Co., Groveville, N.J. Re-issue 12,788, Apr. 28, 1908, of U.S. Pat. 661,343, Nov. 6, 1900.

A dye-vat is divided into two parts by a transverse, vertical partition, which does not reach quite to the top or to the bottom of the vat. One section contains the material to be dyed, and is provided with a perforated false bottom. The other section contains a horizontal partition, provided with an opening in which rotates a bladed wheel. This wheel is so arranged that when in rotation, it causes a current of the dye-liquor to flow from the dyeing section of the vat, through the perforations in the false bottom, underneath the partition, and then over the partition back into the dyeing compartment of the machine.—P. F. C.

Dyeing and bleaching wound bobbins on paper sleeves; Apparatus for ——. O. Rothemann. Fr. Pat. 385,623, Dec. 26, 1907. Under Int. Conv., Dec. 27, 1906.

See Eng. Pat. 28,510 of 1907; this J., 1908, 499.—T. F. B.

Printing with sulphurised dyestuffs; Process for ——. H. W. Lake, London. From Chem. Fabr. vorm. Weiler-ter-Meer, Uerdingen a/Rhein, Germany. Eng. Pat. 16,149, July 13, 1907.

See Fr. Pat. 385,259 of 1907; following.—T. F. B.

Printing with sulphide colours; Process for ——. Chem. Fabr. vorm. Weiler-ter-Meer. Fr. Pat. 385,259, Nov. 25, 1907.

The formation of black copper sulphide upon the copper rollers of printing machines, by the action of printing colours containing sulphide dyestuffs, can be prevented by dissolving the dyestuff in a solution of a monosulphide in the minimum quantity of water, then making the solution strongly alkaline with sodium hydroxide, and finally adding a suitable thickening. Part of the water of such printing colours can be replaced with advantage by such substances as ethyl alcohol and glycerin. If the sulphide dyestuff employed contain free sulphur or polysulphides, it is necessary to add a sulphite to the printing colour.—P. F. C.

Aniline black; Production of —— on the fibre. J. Y. Johnson, London. From E. Zeidler and P. Wengraf, Guntramsdorf, Austria. Eng. Pat. 25,310, Nov. 14, 1907.

It is found that a satisfactory Aniline Black can be produced upon material previously prepared with β-naphthol, by adding *p*-phenylenediamine to the mixture used for producing the black. Thus, a solution containing 5 parts of *p*-phenylenediamine, 120 parts of aniline oil, 130 parts of nitric acid (62 per cent.), 40 parts of sodium chlorate, 80 parts of potassium ferrocyanide, and 80 parts of acetic acid (33 per cent.) is suitably thickened with starch-tragacanth paste, and printed upon material which has been prepared, in the usual way, with β-naphthol. By printing a suitable diazo compound side by side with the Aniline Black mixture, a coloured pattern is produced, and the formation of the black is completed by steaming, in the usual manner.—F. M.

Sodium formaldehyde-sulphoxylate. B. R. Seifert and O. W. Meves, Radebeul, Germany, Assignors to Heyden Chemical Works, New York. U.S. Pat. 887,050, May 5, 1908.

See Fr. Pat. 366,867 of 1906; this J., 1906, 1092.—T. F. B.

VI.—COLOURING WOOD, PAPER, LEATHER, &c.

Straw goods; Two-coloured dyed effects on ——. H. P. Pearson. J. Soc. Dyers and Col., 1908, **24**, 137—138.

The straw which is obtained from wheat which has been sown thickly and then uprooted before it has attained maturity, possesses a very brilliant surface, due to a thin outer coating containing a large proportion of silica. When such straw is split lengthwise, the product has two surfaces of widely different properties, the outer silicious surface being bright and hard, whilst the inner one is dull and porous. Such split straw can be therefore mordanted on its inner side by treating it, first, with a lukewarm solution of tannic acid, and afterwards with a solution of an antimony salt. The mordanted straw can then be dyed cold with a basic dyestuff, the best results being obtained with New Methylene Blues. This treatment leaves the outer surface of the straw quite unaffected, and two-coloured effects can therefore be obtained by dyeing the outer surface a different colour by means of a substantive or an acid dyestuff.—P. F. C.

VII.—ACIDS, ALKALIS, AND SALTS, AND NON-METALLIC ELEMENTS.

Sicilian sulphur ores; Employment of —— for the manufacture of sulphuric acid. G. A. Bruhn. Chem.-Zeit., 1908, **32**, 457—458.

A criticism of the recent article by Oddo on this subject (see this J., 1908, 222).—A. S.

Alkali carbonate; Determination of —— in the presence of alkali hydroxide, by Winkler's method. S. P. L. Sörensen and A. C. Andersen. Z. anal. Chem., 1908, **47**, 279—294. (Compare this J., 1907, 642).

When excess of barium chloride is added to hot solutions of the pure normal alkali carbonates, only the normal barium carbonate is precipitated, but a more or less acid salt is said to be thrown down if the process be carried out at the ordinary temperature, and the supernatent liquid becomes distinctly alkaline. If the alkali carbonate contain hydroxide, a basic salt is precipitated along with the normal carbonate from hot solutions. To obtain accurate results by Winkler's method, therefore, the titration must be carried out in hot solutions, which are but faintly alkaline, and if bicarbonate or much hydroxide be present, the composition of the solution must first be approximately determined, and the final titration carried out, after addition of the necessary sodium hydroxide or hydrochloric acid. Sodium carbonate, dried by Lunge's method at 270°—300° C., is quite pure; but Le Blanc's results (*loc. cit.*) show that the alkali carbonate employed by him evidently contained bicarbonate, which would not be detected by his method.
—F. Sodn.

Potash; Extraction of —— from felspathic rock. A. S. Cushman and P. Hubbard. J. Amer. Chem. Soc., 1908, **30**, 779—797.

The felspar deposits in the eastern and central western United States, some of which contain as much as 10 per cent. of potassium oxide, would afford an unlimited supply of potash if an economical method of extracting it were devised. Of the suitable felspars, orthoclase and microcline (silicates of aluminium and potassium) are probably the most important. The material used in the authors' present experiments was an impure orthoclase of the following composition:—Silica, 68·29; alumina, 18·27; potassium oxide, 9·32; sodium oxide, 3·60; and phosphoric anhydride, 0·53 per cent. Extraction of the finely-ground material with water effected some decomposition, but the action soon ceased owing to the formation of new insoluble compounds, which protected the particles from further action. By removing the insoluble substances by abrasion, electrolysis, etc., fresh particles of the felspar were exposed and more potash extracted. Thus by re-grinding the powder 14 times and removing the absorbed alkalis by electrolysing the moist material, 3·54 per cent. was extracted by water alone. It was found by systematic experiments in the field, that a considerable proportion of the potash in finely-ground felspar was rendered available for plants under the action of water, and that this action was promoted by previously grinding the material with lime, gypsum, or ammonium salts. The potash may be extracted completely from the felspar by means of electrolysis, either with or without the assistance of hydrofluoric acid (this J., 1907, 608). Thus in experiments in which from 3 to 20 grms. of the powder, in different degrees of fineness, were placed in the anode chamber with 50 c.c. of water and 1 c.c. of hydrofluoric acid, whilst 200 c.c. of water were placed in the cathode compartment, the whole of the alkali was set free after 11 to 18 runs of 24 to 48 hours each, the reaction being completed first with the powders in the finest state of division. In the authors' opinion, however, the cost would prevent the use of this method on a commercial scale. A table is given showing the relationship between the speed of decomposition and the surface area of the substance. The finely-powdered felspar was passed through standard mesh sieves up to a 200-mesh sieve, and the material passing through the latter was separated by air elutriation (this J., 1907, 762) into 3 grades, which were microscopically measured, and calculated to have the following areas:—53,202, 292,685, and 510,486 sq. cm. per c.c. With these three powders, the liberation of alkali under the above-mentioned conditions was complete in 456, 336, and 288 hours respectively. Several fusion methods might be used for the liberation of the potash if the cost were not prohibitive. Thus, fusion with calcium chloride or with sodium nitrate, or mixtures of sodium carbonate and nitrate, effects the decomposition, whilst fusion with potassium compounds has the advantage of not yielding large quantities of valueless by-products. Thus, when orthoclase is mixed with potassium carbonate in the ratio of 1 to 1·6 parts, and the mixture heated at a dull red heat, decomposition is complete, and on the addition of hot water, a white flocculent precipitate is formed, which is readily soluble in dilute acid. This silicate is a potassium aluminium orthosilicate, analogous to the naturally occurring sodium aluminium silicate, *natrolite*, and is apparently formed by the following reactions:—

$$K_2O,Al_2O_3(SiO_2)_6+6K_2CO_3=6K_2SiO_3+K_2Al_2O_4+6CO_2\,;$$

$$6K_2SiO_3+K_2Al_2O_4+5H_2O=(H_2O)_2.K_2O,Al_2O_3(SiO_2)_3$$
$$+6KOH+3K_2SiO_3.$$

Swayze's process of decomposing felspar (this J., 1907, 1009) involves reactions similar to these, but in the authors' opinion, it is doubtful whether a separation of the products could be profitably effected. Another method might be based upon treatment of ground orthoclase with a certain proportion of hydrofluoric acid but without subsequent electrolysis. On filtering the product through cloth, nearly the whole of the potash is left on the filter as a double fluoride of potassium and aluminium, and may be readily converted into a soluble form by heating with lime. The drawback of this method is that the hydrofluoric acid cannot be recovered on account of the excess of lime. (See also Spiller, this J., 1882, 128.)—C. A. M.

Potassium tetrathionate; Action of potassium sulphite on —— in aqueous solution. A. Colefax. Chem. Soc. Trans., 1908, **93**, 798—811.

Spring (Bull. Acad. roy. Belg., 1874, [ii], **38**, 112) found that when a mixture of potassium sulphite and thiosulphate is treated with a quantity of iodine insufficient to oxidise all the sulphite to sulphate, potassium trithionate is formed. The author has now examined whether it is possible for a trithionate to be formed by the action of a sulphite on a tetrathionate, a result which would bring Spring's results into harmony with those since obtained by the author (Chem. Soc. Trans., 1892, **61**, 181, 1083). The course of the reactions was followed by means of determinations of the total iodine-titration value and of the acidity, whilst pentathionate was detected by measuring the rapidity with which an ammoniacal solution of silver nitrate was darkened. Preliminary experiments showed that potassium trithionate does not react with potassium sulphite in aqueous solution, but does with potassium thiosulphate, appreciable quantities of sulphite and tetrathionate being formed, together with a trace of pentathionate. Thiosulphate and tetrathionate react in aqueous solution to form pentathionate, the sulphite also formed being immediately re-converted into thiosulphate. Potassium sulphite reacts readily with pentathionate, with formation of thiosulphate. Further experiments showed that potassium sulphite and tetrathionate interact in aqueous solution, the sulphite being converted into thiosulphate. When molecular proportions of the two salts are used, no appreciable quantities of pentathionate are formed, and the conversion of sulphite into thiosulphate does not proceed to completion. When the proportions of the two salts are either $K_2SO_3 : \frac{1}{2}K_2S_4O_6$ or $K_2SO_3 : 2K_2S_4O_6$, however, the sulphite is completely converted into thiosulphate, and, in the latter case, a considerable quantity of pentathionate is formed.—A. S.

Potassium sulphite and potassium pentathionate; The action between ——. E. Divers. Chem. Soc. Proc., 1908, **24**, 122—123.

Debus published, in 1888, a paper on the polythionic acids (Chem. Soc. Trans., **53**, 278), which is still a classic on the subject, but can remain so only so long as later researches leave its accuracy in all essentials untouched. It is therefore important to point out that the accuracy of Debus's investigation of the action between a sulphite and a pentathionate is not affected by Colefax's quite recent work (Chem. Soc. Trans., 1908, **93**, 798; see preceding abstract), as it would appear to be from pp. 803—804 of that author's paper. Debus is in agreement with Colefax, but his work is more comprehensive than Colefax's, and with a wider object in view.

Colefax has found that potassium sulphite in solution is, nearly all, rapidly converted by potassium pentathionate into the thiosulphate, whilst Debus has stated that "potassic sulphite and potassic pentathionate form potassic thiosulphate and potassic trithionate." The latter author's experimental proof of this is given in an irregular form, for, instead of using potassium sulphite, he dissolved the potassium pentathionate in a concentrated solution of sulphur dioxide, and then added barium carbonate. He gives two chemical equations in explanation of this procedure, which are equivalent to $K_2S_5O_6+2K_2SO_3=K_2S_3O_6+2K_2S_2O_3$, an equation indicating a 50 per cent. fall in iodine titration-value, in accordance with Colefax's observations. By using barium carbonate, Debus accomplished an easy separation of the products, obtaining the thiosulphate as insoluble barium salt, and the trithionate as potassium salt, in crystals. Colefax worked throughout his investigations on molecular proportions of his salts, as was proper for the end he had in view, but the addition to the above equation of a second molecule of pentathionate is without effect on the action it expresses or on the iodine value.

Debus did experiment with potassium sulphite itself, converting it into thiosulphate by the pentathionate, but he employed solutions a hundred times stronger than those used by Colefax, with the result—not met with by the latter—that he also obtained much sulphur dioxide. His explanation of this evolution of sulphur dioxide is a suggestion of deep theoretical significance, if well founded, with apparently no other explanation possible in place of it. His experiment has no bearing on Colefax's investigation with highly dilute solutions, and Debus's explanation of it is certainly quite inapplicable to the results obtained in other ways, both by himself and by Colefax, as the latter has rightly pointed out in connection with his own work.

Soluble substance; Co-precipitation of ——, by certain precipitates. P. Frion. Compt. rend., 1907, **146**, 925—926.

The author has studied the precipitation of barium sulphate from solutions containing nitrates of lanthanum and of magnesium, and has determined the amount of lanthanum or magnesium compound contained in the precipitate. The results shew that: (1). The amount of the soluble substance carried down is roughly twice as great in basic as in neutral, and twice as great in neutral as in acid solution. (2). The amount increases with the concentration of the ion carried down, and is halved for each diminution of concentration to one-tenth of its former value. (3). It increases with the valency: ten times as much tervalent lanthanum as bivalent magnesium is carried down. (4). A given amount of precipitate carries down more of the associated substance (the concentration of this in the solution being constant), the more dilute the solution from which it is formed. The explanation is probably to be found in the laws of electrification by contact; the charge on each particle of precipitate is probably due to the ions H^+ or OH^-, and is considerably lessened by the presence of multivalent ions of opposite sign.—J. T. D.

Ammonia and hydrogen cyanide; Synthesis of —— [in a gas producer]. H. C. Woltereck. Compt. rend., 1907, **146**, 929—931.

In a Dowson producer, in which the entering air was heated to 250°—300° C., and the temperatures at 23 and 46 cm. above the grate were found to be 1220°—1340° and 1100°—1180° C. respectively, 82 cb. m. of air per hour were used, and 17 kilos. of wood-charcoal burnt. The issuing gases during the hour contained from 67 to 98 grms. of hydrogen cyanide and from 52 to 72 grms. of ammonia. The reactions producing them are probably, $N_2+O+H_2O+4C = 2HCN+2CO$, and $HCN+H_2O=NH_3+CO$, though it might have been expected that all water vapour would have been decomposed by the incandescent fuel. Possibly the ammonia resulted from the reaction, $HCN+CO_2+2H=NH_3+2CO$, though carbon dioxide is even less likely to be present than water. These results were obtained during a series of experiments in which air and ammonia were passed into the producer, with the view of forming hydrogen cyanide. With the conditions mentioned above, and 325 grms. of ammonia introduced during the hour, the hour's gases contained 277·4 grms. of hydrogen cyanide and 356 grms. of ammonia, equivalent to a total of 467·7 grms. of ammonia, an increase of 142·7 grms., or 44 per cent. of that originally used.—J. T. D.

Red phosphorus. G. Linck and P. Möller. Ber., 1908, **41**, 1404—1410.

Hittorf's method of preparing crystallised red phosphorus by heating phosphorus with lead, was repeated, using in one experiment yellow, in another red phosphorus. The crystals obtained were biaxial, probably monoclinic, but always contained lead. The specific gravity of these crystals varied from 2·300 to 2·423: probably the lowest value is most nearly correct. Crystals apparently formed by sublimation in the same experiments, gave figures from 2·285 to 2·331. Sublimation of ordinary red phosphorus *in vacuo* always gave a product destitute of crystalline structure, and having the same specific gravity as the original substance—2·15 to 2·19. Both the original and the sublimed product gave on heating for eight hours at 450° C., a crystalline substance of sp. gr. 2·280 to 2·304. It was found that mixed sublimates of phosphorus and arsenic were obtainable, and the specific gravities of three of these, containing respectively 28, 13, and 5 per cent. of arsenic, were determined. The figures obtained were found to be fairly concordant with those calculated from the specific gravities of crystallised red phosphorus (2·34) and arsenic mirror (4·7), or of the isotropic phases (2·14 and 3·71 respectively), but not with those in which the sp. gr. of metallic arsenic (5·7) was used in the calculation.—J. T. D.

Nitric acid; Electrolytic reduction of ——. H. E. Patten. *See* XIA.

Ammonia; Formation of —— *from its elements, by the action of electric discharges.* E. Briner and E. Mettler. *See* XIA.

Alkali chlorides; Electrolysis of ——. A. Brochet. *See* XIA.

Phosphate discoveries in the Society Islands. Board of Trade J., May 21, 1908 [T.R.].

RICH and extensive beds of phosphate have been discovered recently at Makatea, Society Island, about 120 miles N.N.W. of Tahiti. The deposits are estimated at over 30,000,000 tons, and contain 65 to 90 per cent. of pure phosphate.

PATENTS.

Nitric acid; Process for concentrating ——. H. Pauling, Assignor to Salpetersäure-Ind.-Ges., Gelsenkirchen, Germany. U.S. Pat. 887,266, May 12, 1908.

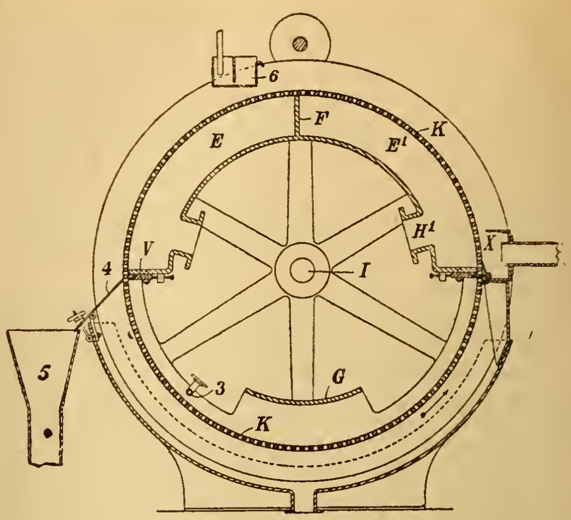
SEE Fr. Pat. 368,716 of 1906; this J., 1907, 24.—T. F. B.

Sulphite of sodium and ammonium chloride [from sea-salt]; Process for manufacturing ——. F. Duvieusart, Constantinople. Eng. Pat. 20,613, Sept. 16, 1907.

SEA-SALT is added to a saturated solution of ammonium sulphite heated to 40° C., and the whole heated to 95° C. The precipitated sodium sulphite is removed, and the liquid cooled to 40° C., when ammonium chloride is deposited and separated. To the mother-liquor, 35 kilos. (per 100 litres) of ammonium sulphite and a corresponding quantity of sea-salt are added, and the process is repeated. —A. G. L.

Filtering, washing, and drying; Apparatus for ——, *applicable to the treatment of bicarbonate of soda and other products.* J. Bebbington, Runcorn, and T. T. Mathieson, Tattenhall. Eng. Pat. 23,221, Oct. 21, 1907.

AN apparatus is described in which the operations of filtering, washing, and drying are carried out successively on the surface of a drum filter during its rotation. The drum, K (see Fig.), rotates on a horizontal axis, I. The internal parts shown in section are stationary, and form at E and E^I, vacuum chambers, and at G, a platform upon which the workman may stand to control the apparatus. The product to be treated is delivered at X, and filtered, the clear liquid being drawn off by the pipe H^1. The solid, after passing over F, is washed by water from the tank, 6, becomes dried before it reaches V, and is scraped off by the scraper, 4, into the funnel, 5. The lower part of the drum is cleaned by jets of water delivered at 3.—J. W. H.



Barium oxide; Process of making ——. C. B. Jacobs, Port Chester, N.Y., Assignor to H. R. Bishop, New York. U.S. Pat. 886,607, May 5, 1908.

BARIUM carbonate is intimately mixed with a suitable reducing agent, such as coking coal, say in the proportion, 40 parts by weight of carbonate to 16 parts of coal. The mixture is coked, so as to produce a porous mass, in which the particles of carbonate are suspended, and is then heated to decompose the carbonate. Carbon monoxide is evolved, and barium oxide remains, together with an excess of carbon.—F. SODN.

Potassium chloride manufacture; Production of potassium sulphate from mother-liquors of ——. G. Saeger. Ger. Pat. 196,500, Feb. 1, 1906.

MOTHER-LIQUORS, containing sulphate, from the manufacture of potassium chloride, are concentrated and allowed to crystallise. The crystals are agitated with water, or a suitable liquor from a previous operation, at about 70° C., and then separated by draining and suction. The residue contains 68—75 per cent. of potassium sulphate and 5—8 per cent. of potassium chloride. It is agitated with water at 55° C., and potassium chloride added; the latter dissolves and causes the precipitation of potassium sulphate, which is separated by draining and suction. This product contains 90—95 per cent. of potassium sulphate, and is separated from any adhering potassium chloride by washing with a small quantity of water.—A. S.

Sulphite waste liquors; Purification of ——. A. Kumpfmiller. Ger. Pat. 194,872, Aug. 1, 1906. Addition to Ger. Pat. 183,415.

ACCORDING to the chief patent, after removal of most of the sulphurous acid by evaporation, and separation of the calcium sulphite, the remainder of the lime was precipitated by addition of oxalic acid. According to the present patent, this residual lime is converted, by addition of a suitable acid, *e.g.*, lactic acid, into a calcium salt which has no injurious action in the process in which the sulphite liquor is to be subsequently used.—A. S.

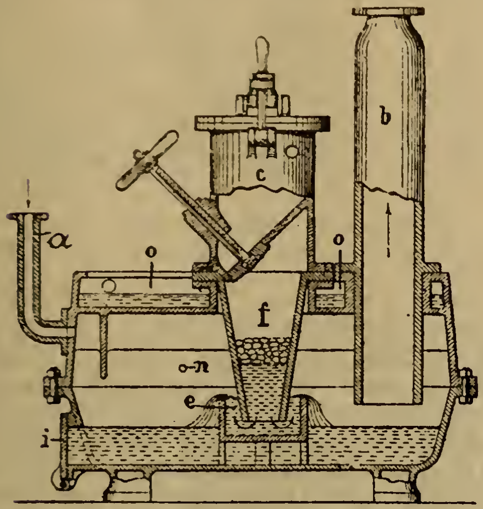
Silicon monoxide and silicon dioxide; Methods of making ——. H. N. Potter, New Rochelle, N.Y., Assignor to G. Westinghouse, Pittsburg, Pa. U.S. Pats. 886,636 and 886,637, May 5, 1908.

(1). FINELY divided silica is mixed with magnesium powder, or other metallic reducing agent, and heated to about a red heat, in an inert environment, until ignition begins, the proportions being such that only partial reduction, to silicon monoxide, takes place. The oxidised metal is subsequently removed. (2). Silicon dioxide, in a state of fine division, is produced by blowing a dust of silicon monoxide through a heated chamber, in which it reacts with an oxidising gas.—F. SODN.

Bromine vapour ; Condensation of ——. R. Sauerbrey and A. Wünsche. Ger. Pat. 196,111, Sept. 18, 1903.

The condensation of the bromine is effected by direct contact with cold water in a small tower, adjacent to a larger scrubber. A regulated quantity of cold water is allowed to flow over the packing material in the small tower. The mixture of bromine and water collects in a receptacle at the bottom of the tower, where the two liquids separate, and are drawn off through separate outlets. The water, containing up to 4 per cent. of dissolved bromine, is led into the scrubber, whereby the bromine is volatilised, and passes again into the small condensing tower.—A. S.

Sulphur ; Furnace for the combustion or melting of ——. Sachsenburger Akt.-Maschinenfabr. und Eisengiesserei. Ger. Pat. 196,371, June 16, 1907.



The furnace is shown in the accompanying figure. The sulphur is introduced at *i*, and after closing the door, is ignited by means of a suitable device inserted through the opening, *n*, the air necessary for combustion being supplied through the pipe, *a*. The sulphur dioxide escapes through the pipe, *b*, whilst molten sulphur collects on the bottom of the furnace. When the furnace has been started, fresh sulphur is introduced through *c*, into the funnel, *f*, the lower end of which projects into the molten sulphur in the compartment, *e*. The upper portion of the funnel is water-cooled as shown at *o*. Compressed air may be injected into the pipe, *b*, to burn any sulphur sublimed there.—A. S.

Stannic chloride ; Electrolysing ——. U. S. Pats. 883,140 and 883,141. *See* XIA.

Atmospheric nitrogen ; Oxidation of ——. Fr. Pat. 385,193. *See* XIA.

Oxides of nitrogen. Ger. Pat. 196,114. *See* XIA.

Nitrides ; Preparation of ——. Ger. Pat. 197,159. *See* XIA.

VIII.—GLASS, POTTERY, AND ENAMELS.

Saggar marls ; Some notes on ——. S. T. Wilson. Trans. Eng. Ceramic Soc., 1906–7, 6, 121–122.

The author gives the following percentage porosities of local saggar marl alone, and with additions of "grog," fired at the temperature (1) of the glost oven, (2) of a china biscuit oven.

	(1.)	(2.)
Marl alone	18	4
,, + 25 per cent. of dry grog, both marl and grog being mixed dry, before being soaked	13·4	10
,, + 25 per cent. of well soaked grog......	19·4	10·7

He concludes from column (1) that on adding dry grog, the grog pores are partially filled with clay ; and from column (2), that vitrification must have taken place in the grog as well as the clay. The following table shows that the size of grain of the grog does not affect the contraction on drying ; the fine grog gives the greatest porosity at a lower temperature, but at higher temperatures, when fired twice through the china biscuit oven, the percentage porosity is reversed.

Size of Grog.*	Contraction.				In volume.		Porosity.		
	During drying.	Glost. firing.	1st Bis. fire.	2nd Bis. fire.	1st Bis.	2nd Bis.	Glost.	1st Bis.	2nd Bis.
1	2	2	1	1	3·8	1	22·8	16·4	13·9
2	2	1	—	1	2·6	1	21·4	16·1	13·6
3	2	1	·5	·5	2·4	—	20·7	16·2	14·0
4	2	1	1·5	·5	4·2	·5	21·4	15·1	13·2

*1. Grog that has passed through $\frac{1}{16}$ in. riddle.
2. Grog that has passed through $\frac{1}{4}$ in. riddle and left on $\frac{1}{16}$ in. riddle.
3. Grog that has passed through $\frac{3}{8}$ in. riddle and left on $\frac{1}{4}$ in riddle.
4. 1 part through a $\frac{1}{16}$ in., and 2 parts through a $\frac{1}{4}$ in. and left on a $\frac{1}{16}$ in. riddle.

The reversal of the percentage porosity may be due to more surface contact, and vitrification consequently taking place in less time. A mixture of coarse and fine (not dust) grog gives the best saggars. With coarse grog alone, the saggars stand repeated firings without splitting, but will not carry the weight either in the bung or in the saggar itself, and with fine grog, even with its accompanying greater porosity, the saggars stand the weight, but not the changes of temperature. It is inferred that the largest sized grog gives the largest size pore, since the clay contracts, and the particles of grog do not. The larger the pore, the less the surface contact, and consequently the longer the time required for vitrification. Ultimately the grog and the marl must become equal in porosity to the marl itself. It appears that saggars which break on cooling after being fired in the china biscuit oven, show a diminished porosity, presumably caused by fusion of the marl, which contains a large percentage of iron, chiefly as carbonate, amounting to say 3–5 per cent. of metallic iron. During firing, if the oven gases do not contain a large amount of air in excess of that required for combustion, the iron compounds may be reduced to the ferrous condition, and thus promote fusion. The author considers this reduction of the iron compounds would be an obstacle to the use of gas-firing, because of the small excess of air needed for combustion in that method of firing.—W. C. H.

Frit ; A comparison of the costs of preparing —— *by the frit kiln versus the sagger method.* A. E. Mayer. Trans. Amer. Ceramic Soc., 1907, 9, 195–203.

Fritting, or the fusion of all or some of the ingredients of a glaze, before it is applied to the surface of the object to be glazed, may be carried out either in a special frit kiln, or in saggers, which are fired in a biscuit or glost kiln. In the former method, the mixture to be fritted is thrown into the heated kiln, and is thoroughly fused in about 3 hours, and can then be "tapped" out and run into water, which disintegrates it. In the second method, the biscuit saggers are first "flinted," then filled with the mixture, and burned. After it is taken from the kiln, the sagger is broken off the enclosed cake of glass, which is then put through a crusher to break it sufficiently fine for the glaze-pan. The weight of fritted material obtained, is of course less than the weight of the original mixture, owing to the loss of volatile constituents such as water, &c., and varies with each different glaze. A glaze of the following formula, gives good results in a frit kiln :—

$$(0{\cdot}04\ K_2O,\ 0{\cdot}69\ CaO,\ 0{\cdot}27\ Na_2O),\ 0{\cdot}27\ Al_2O_3\ (2{\cdot}53\ SiO_2,\ 0{\cdot}54\ B_2O_3.)$$

The author gives the cost of fritting this glaze at 0·31 cent per pound, allowing for cost of repairs to the kiln lining, grate-bars, actual cost of fritting, and loss of weight. The cost of fritting a glaze of the formula—

$$(0{\cdot}72\ CaO,\ 0{\cdot}28\ Na_2O)0{\cdot}33\ Al_2O_3(2{\cdot}77\ SiO_2,\ 0{\cdot}56\ B_2O_3)$$

in saggers, in a glost kiln, was 1·15 cents per pound, allowing for the cost of the sagger, cost of burning the kiln, putting the frit through a stone crusher, and loss of weight during fritting. The frit kiln method is not only cheaper, but has the further advantages that it takes less time, and consequently diminishes the amount of volatilisation of the fluxes, and allows softer glazes to be used than those that can be satisfactorily fritted by the sagger method.—W. C. H.

[Pottery] Bodies and glazes. C. Weelans. Trans. Amer. Ceramic Soc., 1907, 9, 483–492.

The author describes the steps by which the difficulties in the production of heavy, vitreous, non-absorbent sanitary ware were overcome. Apart from the difficulties that arise in forming these pieces in the clay state, both under-firing and over-firing are fatal to this kind of ware, and it is useless to re-burn the under-fired pieces, as they are unable to withstand the strain of contraction on cooling. Since the pieces were large, and of nearly the same size, it was not feasible to arrange them in the kiln in such positions that each would receive its suitable heat treatment. To meet the requirements of this class of ware, it was not possible to use two distinct body compositions, one of which could be matured in the higher, and the other in the lower temperature zone of the kiln (an up-draught circular kiln). The difficulties were solved by adjusting the glaze so as to permit firing the glost ware in the centre of the kiln, and the biscuit in the outer rings. The biscuit required a careful firing in the early stages, and long heat-soaking as the finishing point was approached. The glaze first used, fused earlier than was required, and the long firing caused it to flow badly, but these difficulties were overcome by raising the fusing point of the glaze, and by somewhat hastening the burn from the point at which the glaze began to fuse.—W. C. H.

Crystalline glazes. R. C. Purdy and J. F. Krehbiel. Trans. Amer. Ceramic Soc., 1907, 9, 319—407.

This investigation was limited to a simple alkali-alkaline-earth silicate, in which the crystalline effect is produced by some simple crystallisers, the whole designed to mature at cone 10. The following table gives the types of glazes studied :—

Name.	K_2O.	ZnO.	TiO_2.	SiO_2.	Oxygen ratio.
Bries glaze, No. 1 ..	·300	·700	—	2·000	4·000
Bries glaze, No. 2 ..	·309	·700	·300	1·700	4·000
Heath's glaze	·300	·700	·500	2·000	5·000
Sèvres glaze, No. 1 ..	·333	·666	—	2·000	4·000
Sèvres glaze, No. 2 ..	·166	·833	—	1·94	3·870
Sèvres glaze, No. 3 ..	·333	·666	·341	1·666	4·016
Sèvres blend A— 85 per cent. No. 1. 15 per cent. No. 2.	·308	·691	—	1·991	3·983
Sèvres blend B— 85 per cent. No. 3. 15 per cent. No. 1.	·308	·691	·290	1·709	3·998
Stull's glaze, according to Gates	·305	·695	·297	1·690	3·970

There are practically three crystallisers, viz., zinc oxide, titanium oxide, and manganese oxide. The points considered were :—(1) The effect of the alkalis, considered singly and together, on the development of crystals ; (2) "the proportional equivalent content of zinc oxide, and conducive to the best development of crystals" ; (3) the relative crystallising tendency of zinc, manganese, and titanic acid ; (4) the character and shape of the crystals induced by manganese ; (5) the limits of oxygen ratio permissible in crystalline glazes. It was found in every case that soda was not only more conducive to the development of crystals than potash, but the crystals formed in soda matrices were larger and more pleasing in growth and habit. The ratios of zinc oxide to alkali which were most favourable to crystallisation, except in the case of glazes with a high content of titanic acid, were within the limits,

$$0{\cdot}3ZnO:0{\cdot}7KNaO \text{ and } 0{\cdot}6ZnO:0{\cdot}4KNaO.$$

Manganese oxide had by far the greatest crystallising tendency, producing not only large crystals, but also crystals of surprisingly varied habits of growth. Zinc oxide had a tendency to produce large crystals in local areas, as though the crystallising substance had segregated. Titanic acid, on the other hand, produced crystals that were small, but evenly distributed throughout the mass. The character and shape of the crystals induced by manganese cannot be adequately described. In some cases, globular growths, that were handsome under a magnifying glass, produced *en masse* an effect that was not at all pleasing. Concentric growths, with delicate spiral lines in lighter tints, and crystals producing variegated fawn-coloured effects, were very beautiful. The limits of the oxygen ratio permissible in crystalline glazes were not established, but the statement that a ratio of 1 : 2·8 is better suited to the development of crystals than that of 1 : 4 seems to be correct. Schott also found that glasses crystallised more freely with an oxygen ratio well below 1 : 4, and when the RO constituents were composed of 1 of soda to 1 of lime, than when the soda was increased at the expense of the alkaline-earth.
—W. C. H.

Zinc silicate crystals ; Discussion on the so-called ——. L. H. Minton. Trans. Amer. Ceramic Soc., 1907, 9, 782—783.

Referring to an article on these crystals by F. H. Riddle (this J., 1907, 322), the author does not find it essential that a frit free from alumina should be used. A glaze with 0·18 equivalent of alumina, and 0·45 equivalent of lead oxide, made in the usual manner with felspar, clay, etc., and maturing at cone 02, gave good crystals. When the zinc oxide was fritted with the glaze, small crystals, producing a pretty matt effect, were obtained. For the colouring oxide, the better method is to add it to a similar glaze without zinc oxide, and not add it to the glaze itself. The crystal-forming glazes do not seem to be confined to any one special type. The glaze should be capable of holding large amounts of zinc oxide in solution, and when the proper degree of saturation is attained, the glaze should be cooled as slowly as possible in oxidising gases.—W. C. H.

Uranium oxide [as a ceramic colouring material] ; Discussion on ——. L. H. Minton. Trans. Amer. Ceramic Soc., 1907, 9, 777—781.

This paper gives a *resumé* of the author's experience with uranium oxide, and a comparison with Riddle's results (see this J., 1907, 320). The orange colour of uranium in glazes is produced by the presence of lead, and the depth of colour is proportional to the amount of lead. "Yellow uranium oxide" (sodium uranate) gives the clearest colour, is cheaper than the "orange," and less than half the cost of the "black." The author does not consider that the yellow colour is produced by either boric acid or alkalis, and a lemon yellow can certainly be produced without boric acid in the glaze. High equivalents of boric acid enable a glaze to take larger amounts of uranium oxide into solution, and hence give deeper colours. Though difficult to produce, good colours can be obtained with uranium oxide (U_3O_4) at high temperatures, for example, with a glaze of the formula :—

$$\left.\begin{matrix}0{\cdot}195K_2O\\0{\cdot}800CaO\end{matrix}\right\} 0{\cdot}36Al_2O_3 \left\{ 2{\cdot}58SiO_2 \right.$$

fired at cone 8. Uranium oxide (U_3O_8) is a feeble colouring agent, for though 0·006 equivalent gives a deep colour, its high molecular weight, 848, must be taken into consideration ; 0·006 equivalent of the oxide (U_3O_8) is equal to 0·0644CuO, and the colour of the latter is much greater. Further, when burned in saggers, with gas as fuel, the pieces were always yellow, but when burned in a muffle kiln with coal, they were invariably a deep olive-green. The tendency to turn green seems due to strong reducing conditions during burning.—W. C. H.

Fuel; Relation between the composition of a —— and its value in ceramic firings. A. J. Aubrey. Trans. Amer. Ceramic Soc., 1907, **9**, 713—725.

Some experiments were made with different coals in round, down-draught, periodical kilns provided with horizontal grate-bars. During the periods of full-firing, the draught, temperature, and composition of the exit gases were recorded every hour. It was found that for burning brick in these kilns, higher-grade coals were more economical, up to a certain limit of price. Not only was less fuel required to burn 1,000 bricks, but there was also a saving in time. It was also found that a fairly strong draught, say, about 9 mm., must be available at the end of the burn, and the draught curve corresponded somewhat with the temperature curve. Further, whenever a flame issued from the top of the stack, the analyses showed considerable amounts of carbon monoxide, and the amount of this gas increased when the carbon dioxide decreased during the period of high temperature. It was also noted that when the kiln was fired every hour, there were considerable fluctuations in the oxygen and carbon dioxide curves, but these fluctuations disappeared when the kiln was fired every 15 or 30 minutes. During the water-smoking periods, the temperature rises much faster in the top than in the bottom of the kiln, and 72 hours or more were required before the moisture disappeared from the bottom.—W. C. H.

Spitting-out. A phenomenon of the [pottery] decorating kiln. R. G. Cowan. Trans. Amer. Ceramic Soc., 1907, **9**, 493—505.

"Spitting-out" consists of the production of a minute bubble which forms in the glaze during the decorating kiln fire, provided the temperature of the kiln is high enough to soften the glaze and allow the bubble to form. Consequently spitting-out may be avoided by keeping the temperature of the kiln down, but this detracts from the brightness of the colours to be produced. If the temperature is raised high enough, the bubbles may burst, and leave sharp edges. To test the influence of sulphur on the production of spitting-out, various sulphur compounds were substituted for some of the ingredients of a whiteware glaze, *e.g.*, plaster of Paris in place of whiting, and it was found that spitting occurred with all the glazes containing sulphur, but of those without sulphur, very few, if any, spit. Another series of tests was made in which increasing amounts of boric acid were used in place of lead, in a high lead glaze. With increasing amounts of boric acid, no spitting was found, though the pieces were badly crazed. When a reducing atmosphere was maintained in the kiln, most of the pieces spit-out badly, especially where carbon had entered the glaze, either through crazes or rough, unevenly-coated spots, and nearly all the pieces showed a strong black discoloration. The effects of the degree of vitrification, and the thickness of the coating of glaze were also examined. In the glost kiln, one piece of easy-fired biscuit, with a thin coating of glaze, was blistered, but none of the other test-pieces. Under oxidising conditions in the decorating kiln, all the pieces that had developed sulphur blisters in the glost kiln, spit out, and also only a small percentage of the pieces which were not blistered in the first place, spit out in the decorating kiln. From these experiments, the tendency to spit seems to be increased by short firing of the biscuit and of the glaze, by a reducing atmosphere in the decorating kiln, and by the presence of sulphur, either in the glaze mixture, or from the glost kiln gases.—W. C. H.

Seger cones; Method of placing ——. L. H. Minton. Trans. Amer. Ceramic Soc., 1907, **9**, 784.

It has been suggested (Trans. Amer. Ceramic Soc., **8**, 166) that the bottom of a cone should be rubbed smooth with sand-paper, dipped in a paste of fusible red clay, and set on a thoroughly dry, unburnt tile. For low cones, Albany slip may be used for the tiles, but for cones 5 and 6 and upwards, a mixture of one-third of china clay and two-thirds of Albany slip is preferred. By this method the base of the cone is held firm, and does not become loose owing to the shrinkage of the clay used to support the cone in the ordinary method. The author does not consider that the "boiling" of the base of a cone is due to contact with wet clay, for cones 06 to 1, set, as described above, on dry slip tiles, always puffed out at the base before the tip began to curl, and the puffing-out always occurred on the broad side, just where the cone is stamped. The puffing-out can be taken as an indication that the tip will soon begin to curl.—W. C. H.

Porcelain for electrical purposes. A. S Watts. Trans. Amer. Ceramic Soc., 1907, **9**, 600—617.

This paper is a continuation of the author's work described in this J., 1903, 27, and deals mainly with the effects produced by various RO elements. The higher the lime and the lower the potash, the higher is the maturing temperature of the porcelain, and conversely. At cone 6 it requires 0·15 K_2O to 0·15 CaO to make porcelain; at cone 9, 0·075 K_2O to 0·15 CaO; and at cone 12, 0·050 K_2O to 0·15 CaO are the limits. With under-fired porcelain, the puncturing voltage is low; at the correct fire it is high, and again becomes low with over-fired porcelain, but not to the same extent as with the under-fired. The puncture voltage drops rapidly if over-firing has gone to the extent of producing a vesicular structure. The resistance of good or workable porcelains to puncture seems to vary little, and without much regard to composition or maturing temperature. Lead and manganese produced the best porcelains di-electrically, while zinc and iron gave the worst. Of the alkaline-earths, barium was near the head of the list, and magnesium next to the last.—W. C. H.

Porcelain; Fire-proof ——. M. L. Bell. Trans. Amer. Ceramic Soc., 1907, **9**, 637—645.

Fire-proof porcelain is ware which will stand sudden changes of temperature without rupture, and includes such articles as laboratory crucibles, tubes for chemical and physical experiments, baking dishes, etc. An ideal body would be one which could be heated to redness and then plunged into cold water without injury. To secure this result, experiments showed that a greater content of alumina than can be introduced from clay alone seems necessary. Two sources of alumina were tried, *viz.*, alundum (prepared by fusing bauxite) and aluminium hydroxide. The best results, very near to the ideal, were obtained with a body containing about 20 per cent. of Georgia china clay, 19 per cent. of Tennessee ball clay, 12 per cent. of flint, 22 per cent. of felspar, and 26 per cent. of aluminium hydroxide. The body was "biscuited" at cone 2, and glazed at cone 12. The lime content should not exceed 3 per cent., and there should be a small proportion of free silica.—W. C. H.

Porcelain-like material; Highly refractory —— free from silica. Heinecke. Z. angew. Chem., 1908, **21**, 687.

A mixture of pure alumina and pure magnesia, which has been previously heated to a very high temperature, is formed into the desired shape with the aid of a small quantity of an organic binding material, and fired at a high temperature, *e.g.*, in an electric furnace at a temperature corresponding to Seger cone 32. The product thus obtained is a highly refractory, translucent, porcelain-like material, which is more resistant to alkalis than sintered silicate mixtures are.—A. S.

Enamel used for enamelling cast iron sanitary wares; Types of ——. F. H. Riddle. Trans. Amer. Ceramic Soc., 1907, **9**, 646—660.

Workable enamels for cast-iron must fulfil the following conditions:—(1), They must fuse just below 1,000° C.; (2), they must mature quickly and lie smooth; (3), they must withstand sudden changes of temperature, and "fit" the iron perfectly; (4), they must be practically insoluble in water and weak acid solutions; (5), they must have a perfectly smooth vitreous surface; (6), they must present a pleasing appearance to the eye.

The following enamel was taken as a starting point :—

$$\left.\begin{array}{ll} 0{\cdot}4285 & PbO \\ 0{\cdot}2142 & BaO \\ 0{\cdot}1071 & CaF_2 \\ 0{\cdot}1428 & Na_2O \\ 0{\cdot}1071 & K_2O \end{array}\right\} \quad 0{\cdot}1071\ Al_2O_3 \quad \left\{\begin{array}{ll} 0{\cdot}9186 & SiO_2 \\ 0{\cdot}2857 & B_2O_3 \\ 0{\cdot}15 & SnO_2 \end{array}\right.$$

Oxygen ratio, 1 : 1·66

Series of experimental enamels, with varying proportions of the ingredients, were made up, and fritted and ground. The ground enamel was spread over a "slush coat," and fired on the trial pieces, in a muffle, at about 980° C. The following conclusions are drawn from the experiments :—

Alkalis.—These may range from 0·2 to 0·6 equivalent, but should be kept near the lower limit, as an excess is soluble in water. Most of the alkali should be introduced as felspar, in order to bring in combined alumina and silica. A certain proportion should also be added as nitrate to prevent reduction in the frit kiln. It is best to introduce boric anhydride as borax, therefore its sodium content must be reckoned with.

Fluorides.—In the tests these ranged from 0·083 to 0·125 equivalent, and the latter amount was satisfactory. It appears that as much as 0·25 to 0·3 could be used, if barium fluoride or sodium-aluminium fluoride ($Na_2Al_2F_9$) were employed. *Barium.* From 0·0 to 0·45 equivalent. To some extent barium is a substitute for lead, and when the content of the latter is high, the former should be low. The ratio of the sum of the barium and lead oxides to the other RO ingredients should be about 1 : 0·5 to 1 : 0·7. *Boric acid.* From 0·05 to 0·3 equivalent. It is introduced preferably as borax, where the sodium content will permit. The boric anhydride acts as a strong acid flux, but is expensive. *Lead oxide.* From 0·1 to 0·4 equivalent. A large content of lead makes the enamel transparent, but gives it an undesirable yellow colour. *Zinc oxide.* From 0·0 to 0·1 equivalent. Zinc oxide tends to overcome the yellow cast produced by lead oxide, but a high content of it raises the fusing point of the enamel. It tends to make the enamel opaque, but to a less extent than tin oxide. *Alumina.* From 0·1 to 0·25 equivalent. It should not be introduced from clay, and the higher the content of alumina, the less tin oxide is required. *Silica.* From 0·75 to 1·25 equivalents. It may be introduced as flint, felspar, or clay, and should be present in a large proportion to counteract the general basic character of these enamels. It prevents crazing, but in excess causes shivering, and raises the melting point. *Tin oxide.* About 7·5 per cent. of the fritted weight, or 0·15 equivalent, worked well. In these experiments the ratio of acid to base was slightly lower than in ordinary glazes, but ratios of 1 : 1·5 up to 1 : 2 are said to be common. From these conclusions the following formula is suggested for an enamel of this class :—

$$\begin{array}{r} PbO\ \text{and}\ BaO\ 0{\cdot}40 \\ \left.\begin{array}{r} K_2O\ 0{\cdot}15 \\ CaO\ 0{\cdot}15 \\ ZnO\ 0{\cdot}05 \\ Na_2O\ 0{\cdot}25 \end{array}\right\} \end{array} \quad 0{\cdot}15\ Al_2O_3 \quad \left\{\begin{array}{l} SiO_2\text{—}1{\cdot}0 \\ B_2O_3\text{—}0{\cdot}2 \\ SnO_2\text{—}0{\cdot}2 \end{array}\right.$$

It is advantageous to lower the content of lead and raise that of the barium.—W. C. H.

Enamel [on cooking utensils, etc.] ; Presence of antimony in ——. B. Bock. Chem.-Zeit., 1908, **32**, 446—447.

The white enamel used for covering metal cooking utensils, etc., is usually prepared with tin oxide, but, owing to the high price of the latter, various substitutes for it have been tried and some are actually in use. Of these substitutes, antimony oxide, or a preparation containing antimony, gives a very good opaque enamel, but the author considers that there is a considerable danger to health if food be cooked or stored in such articles. Cold water dissolves distinct traces of antimony from the enamel in about 12 hours ; boiling water has a much greater solvent action than cold water, whilst if the enamel be subjected to the action of a 0·5 per cent. solution of tartaric or lactic acid, or a 2 per cent. solution of acetic acid, considerable quantities of antimony are dissolved. That milk ought not to be boiled or stored in saucepans or jugs coated with antimony enamel is therefore obvious.—W. P. S.

Patents.

Plate glass ; Apparatus for the manufacture of ——. E. Gobbe, Jumet, Belgium. U.S. Pat. 887,623, May 12, 1908.

See Eng. Pat. 11,711 of 1907 ; this J., 1907, 1280.—T. F. B.

Glass opaque to actinic light ; Preparation of dark-coloured ——. O. Sackur. Ger. Pat. 197,663, Feb. 23, 1907.

Ordinary glass is heated to 400°—450° C. with a mixture of silver sulphide and silver sulphate or with mixtures containing these compounds. The two salts interact according to the equation : $Ag_2S + Ag_2SO_4 = 4Ag + 2SO_2$. The silver formed is partly taken up by the glass, and colours it brown, the depth of shade depending upon the temperature and time of heating. The process may be applied to ready-formed glass articles, these being embedded in the reaction-mixture and heated to the requisite temperature. Several articles can be coloured successively in the same reaction-mixture. The quantity of silver taken up by the glass is very small, and from the spent reaction-mixture, the separated silver can be recovered almost quantitatively, and worked up into silver sulphide and sulphate for further use.—A. S.

Mirrors ; Formation of —— *on transparent objects.* Chem. Fabr. von Heyden A.-G. Ger. Pat. 196,992, July 19, 1907. Addition to Ger. Pat. 178,520.

According to the chief patent and previous additions (see this J., 1908, 283), the objects were coated with pastes of finely-divided mercury or amalgams, obtained by reduction of mercury compounds in the wet way. According to the present patent, an adhesive, such as gum arabic, dextrin, etc., is added before, during, or after the formation of the paste of mercury or amalgam, and then after applying the mixture to the object, the adhesive is removed by washing.—A. S.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Bricks ; Relation of the hardness of —— *to their resistance to frost.* J. C. Jones. Trans. Amer. Ceramic Soc., 1907, 9, 528—576.

Purdy and Moore (Trans. Amer. Ceramic Soc., 1907, **9**, 204–318) have shown that brick shows a maximum amount of pore-space during the water-soaking and oxidation period of firing, owing to the expansion of the pores by escaping gases, and that the pore-space decreases as the fusion of the amorphous material of the brick proceeds. The power of a brick to withstand frost depends upon the total pore-space, the rate of flow through the pores, and the crushing strength. The characters of the brick that are altered during burning are :—The size of the pores, the amount of pore-space, the strength, and the rigidity. Harder burnt bricks have relatively finer pores, less pore-space, greater strength, and greater rigidity, and therefore drain more slowly, contain less water when saturated, have greater strength to resist the expansion of freezing water, but rupture with a smaller amount of expansion. The resistance to frost depends upon the relation between the gain in strength and loss of pore-space, on the one hand, and the decrease in the effective diameter of the pores and increase in brittleness on the other. If the former factors alter more rapidly during burning than the latter, the harder burnt brick will be more durable ; but if the latter factors alter more rapidly than the former, it will offer less resistance to frost. For the determination of the total pore-space, it is recommended that after drying and weighing, the brick should be placed in a pan with a small amount of boiling water, and boiled for six hours, more water being added from time to time, until during the last hour the brick is completely immersed. The rate at which a brick drains is obtained as follows:—(1) Dry the brick for 48 hours at 300° F., cool to say 75° F., and weigh. (2) Place the brick on edge in water at 75° F., the final depth of which, after the brick is placed, is 1 inch. (3) At the end of 15 minutes weigh the brick, after removing the surplus water on the surface. (4) Re-place the brick in water for 48 hours, and weigh again. The percentage of water absorbed in 15 minutes, taking the amount absorbed in 48 hours as 100, indicates the relative rate of absorption.—W. C. H.

Brick: Absorption tests on Wisconsin ——. H. Ries. Trans. Amer. Ceramic Soc., 1907, 9, 693—712.

The author has made some comparisons of the various methods of determining the amount of water a brick can absorb. In the partial immersion method, the brick was immersed to half its depth for 4 hours, and the absorption determined, and also the absorption at the end of a further 44 hours. The results obtained by the complete immersion method (48 hours) agreed closely with those obtained by the partial immersion method. In nearly all cases, after 4 hours' partial immersion, the brick had absorbed over 90 per cent. of the total quantity of water which it was capable of absorbing after 48 hours' partial immersion. The water absorbed by the brick *in vacuo* varied from 2·3 to 69·6 per cent. more than the quantity absorbed under atmospheric pressure. The following table gives a *resumé* of the results:—

Description.	Minimum.	Maximum.	Average.
Soft-mud brick	5·80	28·20	18·60
Stiff-mud ,,	13·05	24·30	20·26
Dry-press ,,	12·90	33·35	21·47

The low absorption of the soft mud brick is due partly to the fact that the (red burning) clays used burn hard and dense at a lower temperature than calcareous ones. In spite of high absorption, many of the bricks showed excellent crushing strengths, though there is a lack of relation between the two, and also between absorption and transverse strength.—W. C. H.

Paving brick; Influence of the rate of cooling on the toughness of vitrified ——. L. B. Coulter. Trans. Amer. Ceramic Soc., 1907, 9, 618—636.

Experiments were made to determine whether rapid cooling tended to increase, or, as is more generally supposed, to decrease the toughness of vitrified paving brick, as measured by the "rattler" test. Charges of previously soft-burnt brick were fired up to the best stage of vitrification in a small muffle test-kiln, and cooled at varying rates, rapid cooling being secured in some cases by opening more or less of the "wicket," and blowing in air with a fan. The following table gives a summary of the results:—

Burn.	Cooling period.		Minimum "rattler" loss.
	Hours above 550°.	Hours below 550°.	
1	75·0	105·0	15·71
2	30·5	59·5	16·65
3	17·5	30·5	17·43
4	17·0	11·0	16·75
7	17·5	16·5	16·12
5	6·5	12·5	19·61
6	7·5	32·5	15·92
8	6·5	39·5	15·88

The results of burn No. 5 were vitiated by the air blast having impinged directly on the hot brick. The position of the bricks in the kiln, with reference to the incoming and outgoing air-currents, was carefully noted in conjunction with the results of the "rattler" test. From all the data obtained, it appears that the rate of cooling has no appreciable influence on the toughness of the brick, provided the cooling is effected by means of air that has been heated to a temperature only slightly below that of the brick round which it circulates. If the air is at a decidedly lower temperature than the bricks, it causes them to "check" and break, and there is consequently a high loss in the "rattler" test. It appeared also that the bricks could stand rapid cooling during the stage from 550° to 100° C. better than during the stage from 1100° to 550° C. Rapid cooling tends to increase the percentage of broken brick in a charge, and the cause of breakage seems to be the formation of cracks or strains at the time of cooling, rather than to any increase of glassiness by the quick cooling.—W. C. H.

Glazes; Note on terra-cotta ——. C. W. Parmelee. Trans. Amer. Ceramic Soc., 1907, 9, 577—599.

The function of the various fluxing oxides was studied in a glaze (a variation of the Bristol type of glaze used for stoneware) of the general formula:—

$$\left.\begin{array}{l} 0{\cdot}2\text{—}0{\cdot}5\ K_2O \\ 0{\cdot}7\text{—}0{\cdot}0\ BaO \\ 0{\cdot}0\text{—}0{\cdot}7\ CaO \\ 0{\cdot}8\text{—}0{\cdot}1\ ZnO \end{array}\right\} 0{\cdot}55\ Al_2O_3 \left\{ 3{\cdot}30\ SiO_2 \right.$$

It was desired to develop a glaze, or study a group of glazes, suitable for architectural terra-cotta, applied upon an under-slip, and burned in a muffle kiln at cone 5. About 100 glazes were made, and the following general conclusions are drawn from the results obtained. When the RO group consists only of the two members, potassium oxide and zinc oxide, varying between the limits, $\begin{pmatrix} 0{\cdot}8\text{—}0{\cdot}5\ ZnO \\ 0{\cdot}2\text{—}0{\cdot}5\ K_2O \end{pmatrix}$, at least 0·4 equivalent of potassium oxide is needed to secure sufficient fusibility to yield a glaze. With three members of the RO group, viz., lime, zinc oxide, and potassium oxide, the best whiteness and opacity were found within the limits:—0·4—0·6 ZnO, 0·0—0·3 CaO, 0·2—0·5 K_2O, but fine lines due to the "parting" (or incipient "curdling") of the glaze were numerous, and the best glazes were found within the limits:—0·4 ZnO, 0·1—0·2 CaO, 0·4—0·5 K_2O. The glazes of this series did not exhibit any true crawling, though in some there were "fine lines due to parting preceding fusion." The tendency for parting cracks to form is most marked with a high content of zinc oxide, 0·3 equivalent or more, together with a low content of potassium oxide, 0·2—0·3 equivalent; and as it is seldom or never found in glazes with 0·4 and 0·5 equivalent of potassium oxide, however low the zinc oxide may be, a low content of potash seems to be largely responsible for the defect. Blistering occurred with only one glaze of this series, containing 0·3 ZnO, 0·3 CaO, 0·4 K_2O, but several members of the series in which baryta was also present, showed it, when burned in a short fire in a trial kiln, but not when repeated in the large kilns. A number of glazes containing zinc oxide, lime, and potassium oxide were opaque; in most, the potash content was low, but there was a wide range of zinc oxide and lime, so that neither can be considered to cause the opacity. Probably it may be attributed to the following conditions: (1), the presence of a silicate which acts as a solvent; (2), the existence of calcium silicate, or a calcium-aluminium-silicate; and (3), a similar zinc compound. A certain amount of either (2) or (3) will be dissolved by (1), and when this solvent is saturated, the undissolved material of (2) or (3) will give rise to opacity. An excellent opaque glaze, free from tin, contained 0·4 ZnO, 0·1 CaO, 0·5 K_2O. With three members of the RO group, viz.: baryta, zinc oxide, and potassium oxide, and no calcium present, only one matured glaze was obtained, containing 0·6 ZnO, 0·1 BaO, 0·3 K_2O. This had a good white colour, good opacity, but some defects due to "parting" of the glaze. More than 0·1 equivalent of baryta renders a glaze too refractory, and the use of barium was of no advantage, except in some cases where matt surfaces were developed. In the whole series of glazes, shivering is almost entirely confined to those which have less than 0·3 equivalent of zinc oxide. It is particularly common if the zinc oxide is 0·2, and the potassium oxide 0·2 equivalent.—W. C. H.

Salt-glazed sewer pipe; Surface pimpling on ——. A. J. Aubrey. Trans. Amer. Ceramic Soc., 1907, 9, 726—740.

Surface pimpling on salt-glazed sewer pipe is related to: (1), non-homogeneity of the body; and (2), heat treatment received in the burning of the ware. The body under consideration was composed of a drift clay, a shale, and a fireclay. Samples of the first two showed signs of fusion in the kiln, the shale particularly being over-burnt, blistered, and reduced. The product therefore consists of a refractory body, containing coarse particles of the less refractory ingredients, which tend to act in small particles similarly to the way in which they act when made into ware. It was found that the ware from certain kilns showed less pimpling than ware from other kilns, and also that when the material would pass a 16-mesh screen, the glazed pipe had a fairly smooth surface. Observations were made of the temperature, duration of firing, draught and kiln atmosphere conditions, and composition of the kiln gases during the period of full firing in the case of two kilns. The following conclusions are drawn from the observations:—(*a*). Pimpling on the surface of the pipe is due to incipient fusion, bubbling and swelling of small particles of shale, lying close to the surface of the pipe, "which particles it can be assumed would act similarly to large particles of shale burnt under similar conditions." (*b*). Fine grinding diminishes the size and number of the pimples. (*c*). The pimples appear at a temperature of 2000° to 2060° F. (*d*). The largest and most numerous pimples appear on pipe in fast-burning kilns, in which the temperature has been shown to rise considerably after the "salting" has started. (*e*). The short duration of the full fire period in fast-burning kilns is due to a large grate area compared with the kiln area.—W. C. H.

Portland cement; Formation of salt solutions in the setting of ——. Hart. Tonind-Zeit., 1908, 32, 754-755.

When Portland cement is thoroughly mixed with water and rapidly filtered, the filtrate contains in addition to sulphates and a small quantity of silicates, free lime and caustic alkali. On allowing the residual cement to set for nearly three hours, and again triturating with water, a solution is obtained after filtering, which possesses considerably greater alkalinity than that obtained above, thus showing that further changes take place in the course of setting. To determine the final products of the interaction of water and cement, the fresh mixture is allowed to set for $2\frac{1}{2}$ hours, and the filtrate from the triturated mass shaken with absolute alcohol, to separate the alkalis from the lime and other compounds. The result shows the chief constituent of the dissolved salts to be potassium sulphate, obviously formed by the double decomposition of the soluble potassium compounds and the gypsum added to regulate the setting of the cement. —O. R.

Colours, especially for cement roofing-tiles; Testing the value of ——. E. Cramer. Tonind.-Zeit., 1908, 32, 699—700.

Colours for cement roofing tiles must be fast to light, unaltered by cement, and resistant to weathering agencies. They must also possess a strong colouring power, and be easily miscible, and must not affect the strength or setting of the cement, nor give rise to any exudation. Only mineral colouring matters satisfy these conditions, and the author describes a few simple tests that may be used to determine the value of colours in some of these respects. The colour can be easily tested with respect to its resistance to the action of lime, and its fastness to light, but there is no simple laboratory test by which its resistance to weathering can be determined. The miscibility of the colour with the cement mixture, and also its colouring power, can be gauged by mixing a known weight of the colour with a known weight of white sand which will pass a sieve of 900 meshes per sq. cm. The subsequent sifting of the mixture takes a long time, but can be accelerated by adding, say 10 grms. of coarser sand to 50 grms. of the colour mixture. The sifted portions of several colour mixtures can be put into pill-boxes, and arranged in the order of their intensity, and the value of the colours determined by taking the sand-dilution and price into account. Any effect of the colouring material on the strength of the cement tiles soon shows itself in the process of manufacture. To test whether a colour will cause any exudation or "scum," a little of the colour is worked up with distilled water in a clock-glass, which is protected from dust, and the water allowed to evaporate. The dried colour should not show any bright coloured rim. The colouring materials should be tested with alcohol, as some colours on the market are simply sand, chalk, or gypsum coloured with organic dyestuffs.—W. C. H.

Patents.

Wood and the like; Method for impregnating —— with heavy-metal salts and aluminium combinations under hydraulic pressure. E. Marmetschke and H. Brüning, Schopfuth, Germany. Eng. Pat. 9316, April 22, 1907.

See Fr. Pat. 376,798 of 1907; this J., 1907, 1049.—T. F. B.

Artificial marble from gypsum; Process of manufacture of ——. W. McKee, Assignor to M. Jacobowsky and M. Bowsky, New York. U.S. Pat. 886,064, April 28, 1908.

Gypsum is subjected to a temperature of 200—225° F. until heated throughout, and is then saturated with a solution containing $\frac{1}{2}$ lb. each of aluminium sulphate, potassium hydroxide, and "sal soda" per one gall. of water. The excess of water is then driven off by heating.—A. G. L.

"Crucible compounds"; Process of manufacturing ——. C. Caspar, Stuttgart, Germany. U.S. Pat. 886,111, April 28, 1908.

The process consists in shaping small pieces of pure amorphous aluminium hydroxide by the addition of water, and then drying and heating them gradually to an intense white heat, which is maintained for some time, in a closed vessel, and cooling without access of air. Pure magnesia also may be mixed with the aluminium hydroxide.—F. Sodn.

Refractory basic materials in powder, which are easily moulded when wet, and can be baked hard when dry; Manufacture of ——. C. Caspar. Fr. Pat. 385,404, Dec. 20, 1907. Under Int. Conv., Jan. 5, 1907.

See U.S. Pat. 886,111 of 1908; preceding.—T. F. B.

Artificial stone; Manufacture of ——. J. C. Henderson, Oakland, Cal. U.S. Pat. 886,124, April 28, 1908.

A non-porous mould is first lubricated. A "fluid aqueous mass of Portland cement" is then poured into the mould, followed, before the initial set takes place, by sufficient dry Portland cement to take up the excess of moisture. More of the mixture of cement and water is then poured into the mould, followed by a further quantity of dry cement, and the process is repeated until the mould is filled. The mould may first of all be "veined" (lined) with a coloured Portland cement. —A. G. L.

Artificial stone; Process for hardening ——. E. Schwanenberg and A. Rinne, Hanover, Germany. U.S. Pat. 886,258, April 28, 1908.

See Fr. Pat. 369,206 of 1906; this J., 1907, 96.—T. F. B.

Artificial stone or mortar; Process for making impermeable ——. G. Schruf. Fr. Pat. 385,703, Dec. 30, 1907.

See Eng. Pat. 28,745 of 1907; this J., 1908, 449.—T. F. B.

Carbides; Manufacture of ——. H. Herrenschmidt. Fr. Pat. 385,140, Feb. 28, 1907.

Metallic oxides, or oxides of silicon or boron, or minerals containing such, are subjected to the action of boron and carbon in the electric furnace, as described in a previous patent (this J., 1907, 208); and, by increasing the proportion of carbon, the reduced metals or metalloids are further converted into carbides. For example, an intimate mixture of quartz 60 parts, boric acid (H_3BO_3) 70 parts, and carbon 65 parts, heated to complete fusion and then allowed to cool slowly, gives a crystalline mass of boro-silicon carbide. The products may be used in the manufacture of all kinds of abrasive and refractory materials, or of electrical conductors and resistances.—F. SODN.

Cement; Manufacture of ——. S. O. Cowper-Coles, London. Eng. Pat. 10,257, May 2, 1907.

AN inferior but cheaper cement is obtained by mixing cement produced electrically from slag and chalk according to Eng. Pat. 4530 (this J., 1907, 336), with one-third of its weight of granulated blast-furnace slag. (See also following abstract.)—A. G. L.

Cement; Manufacture of ——. S. O. Cowper-Coles, London. Eng. Pat. 10,366, May 3, 1907.

THE mixed raw materials are fused by means of an electric current (Eng. Pat. 22,425 of 1906; this J., 1908, 162), and the fused mass is dropped into cold water to disintegrate it.—A. G. L.

Cementing material and process of making same. T. W. Cappon, New York. U.S. Pat. 886,579, May 5, 1908.

THE cementing material consists of a mixture of calcium chloride, magnesium carbonate, and magnesium hydroxide, to which calcium hydroxide may also be added. Calcium carbonate is produced within the mass independently of the action of atmospheric carbon dioxide. —A. G. L.

X.—METALS AND METALLURGY.

Iron; Action on ——, *of water and aqueous solutions.* E. Heyn and O. Bauer. Mitt. Königl. Materialprüfungsamt, 1908, 26, 1—104.

PLATES of iron, brightened by emery, were exposed in beakers (usually for 22 days) to the action of the various liquids under various conditions—completely and partially immersed, with air, oxygen or other gas bubbled through the solution or passed over its surface, or in the case of air, with the liquid exposed to the atmosphere, the beaker being simply covered with a clock glass. Where exclusion of carbon dioxide was necessary, the liquid to be used was boiled for some time in a flask while pure hydrogen was bubbled through it. An arrangement of ⊤-pieces and stopcocks provided for, first:—hydrogen from the same generator being passed through the experimental vessel, containing the iron plates, till this was completely filled; next, the boiled liquid, after cooling, being driven over from the flask to the experimental vessel by the pressure of the purified air or oxygen to be used in the experiment; and, finally, the closing of connection between flask and experimental vessel, and the bubbling of the purified air or oxygen through the liquid in that vessel. The amount of action was in each case measured by cleaning off the rust from the plate, and determining the loss of weight. A series of initial experiments was made with distilled water and with the Charlottenburg water-supply, to ascertain the influence of oxygen and of carbonic acid. The following were the results:—1. Rusting takes place when carbon dioxide is rigorously excluded. 2. When air containing 15 per cent. of carbon dioxide is passed through the liquid, the amount of corrosion is not so much as double that which occurs with air freed from carbon dioxide: hence the small proportion of carbon dioxide in atmospheric air can exert no sensible influence on the process of rusting. 3. The mode of introduction of the oxygen greatly affects the rate of rusting: when the gas is passed through the liquid, the rate is twice as high as when it is led over the surface. 4. The corrosion is greater, the higher the oxygen-pressure in the atmosphere above the liquid: when pure oxygen is passed over, the attack is three times as great as with air under like conditions. 5. Pure carbon dioxide produces no rusting properly so called; it simply dissolves the iron like any other acid, with evolution of hydrogen, till the liquid is saturated with ferrous carbonate.

A series of experiments with water and saline solutions, all carefully deprived of dissolved oxygen, shewed that no decomposition of water by iron occurs, but that the effective agent in rusting is dissolved oxygen. In nearly all these cases minute losses did occur, but not more than were accounted for by the extreme difficulty of removing the oxygen absolutely. Metallic iron forms a most sensitive reagent for dissolved oxygen in water or saline solutions. Experiments made with the object of protecting iron in water from rusting by hindering the access of air, shewed that it was useless to cover the water with a layer of petroleum, as that substance is as "porous" to the diffusion of oxygen as water itself, but that powdered wood charcoal, worked into a paste with water, and then suspended in the liquid in silken bags weighted by means of glass rods, acted very efficiently in absorbing the dissolved oxygen, and reduced the rate of rusting by about four-fifths. A very simple examination of the conditions of rusting leads to the formula:

$$\frac{dv}{dt} = kc^1 = k_1(c_0 - c^1) = \frac{kk_1c_0}{k+k_1},$$

$\frac{dv}{dt}$ being the rate of rusting, c_0 the concentration of oxygen in the saturated liquid (at its surface, where exposed to the gas), c^1 the oxygen-concentration at the surface of the metal when the stationary state has set in, k and k_1 constants. Consideration of this shews that the metal will rust the more slowly, the deeper below the surface it is, as the oxygen has to reach it by diffusion through the intervening depth of water; that the most rapid rusting will be at the surface, or at other places where the metal is in contact with an air-water surface, as for example where bubbles have been caught below projecting flanges, etc. (the whole of the metal is brought into this condition if air be led through the liquid so as to keep it everywhere saturated, or if there be a continuous stream of liquid saturated with fresh air passing over the metal). Several series of experiments on these various points gave results agreeing with prediction: in the case of plates hung at different depths, however, the differences which at first exist, and which in the experiments, increased up to the end of about 15 days, gradually lessened as time went on, through other actions, chiefly the reaction of the iron on the ferric hydroxide to form a ferrous compound. A series of experiments in which hydrogen peroxide was added to the water did not give very decisive results, but served at least to shew that the effect of hydrogen peroxide was not greater than that of blowing air through the liquid, and thus gave no support to the "hydrogen peroxide theory" of rusting. Plates hung in the water of a model gasometer rusted, when the holder contained coal-gas, about half as rapidly as when it contained air, shewing that the diffusion of the coal-gas into the water hindered, but could not prevent, the diffusion into it of oxygen from the outside, and that the bell of a gasometer is liable to rust if not adequately protected by paint. Experiments on the influence of contact of another metal with the iron gave the following results:—Copper, in the town water, increased the rate of rusting of iron by about 25 per cent., in artificial sea-water by about 47 per cent.; in air-free water in a hydrogen atmosphere it produced practically no corrosion, so that the higher figures in the other experiments were not attributable to electrolytic decomposition of the water. Nickel produced an increase of 14—19 per cent. in the rate of rusting. Contact of cast-iron with the mild steel used for the experiments, reduced the rusting by 50 per cent. when the air was led over, and by 28 per cent. when it was bubbled through the liquid, the attack on the cast-iron being in each case about equal to that on the plate of mild steel. At 60° C. (all the other experiments were carried out in the cold) the cast-iron is more strongly corroded than the mild steel, the attack on which it lessens by only about 16 per cent. Overheating reduces the liability of iron to rust: experiments with portions cut from a boiler-plate, some overheated and some not, shewed that the amounts of corrosion of the overheated and the not overheated portions, when in contact under the water, were as 100 to 130. Brass, in contact with iron, has but little influence on the rate of rusting, as shewn by some experiments in which the metals were exposed for a year; but these experiments also, shewed that the rusting of iron in a mixture of equal parts of glycerin and water is only 6—9 per cent. of its rusting in water alone. A number of samples of cast-iron, containing varying amounts of manganese (0·46 to 3·08) and phosphorus (0·072 to 3·38 per cent.) were examined; the results shewed that the effect of these elements on the rate of rusting was negligible in comparison with that of other factors already discussed. Comparison was also made of mild steel, wrought iron, and cast-iron: the differences were found to be inappreciable, though the rates of attack of the same three substances by dilute sulphuric acid were found to be in the proportion of 1 : 2 : 100, shewing how futile are inferences drawn from corrosion by acids as to the behaviour of metals towards water and saline solutions.

Many experiments were undertaken on the behaviour of iron towards solutions of various salts, each salt being tested at different concentrations. With few exceptions, all the salts behaved similarly—in weak solutions, rusting occurred more slowly than in water, and as the concentration increased so did the rate of attack up to a certain "critical concentration," beyond which it diminished. The rate of attack by the "critical solution" is usually higher than that by water, but is lower in the cases of potassium, sodium, calcium, and barium chlorides, potassium and sodium sulphates, and sodium and calcium bicarbonates. The rusting, in the case of solutions near the "critical concentration," is usually very irregular and strongly localised; such local action is thus not always to be ascribed to irregularities in the metal, since it does not occur with solutions of other concentrations. The rate of attack by critical solutions (that of water being 100) varies from 90 to 98 amongst the substances named above, and from 102 for magnesium sulphate to 2390 for ammonium nitrate, a few important figures being sodium hydroxide 110, carbonate 133, phosphate 142, ferrous sulphate 217, ammonium chloride 376. About 40 salts were in all examined. The results shew that, contrary to common belief, aqueous solutions of alkali chlorides and sulphates do not cause iron to rust more rapidly than water alone does, and alkali carbonates are not always protective—only at high concentrations do they exert a protective action on iron. This protective action is exerted by solutions of other salts than carbonates at sufficiently high concentration, but is most strikingly exemplified in chromic acid and the alkali chromates, which in very dilute solution prevent the rusting of iron (though they exert a certain solvent action). In some cases, at least, the protective action of strong solutions appears to be due to their diminished solvent power for oxygen.

A large number of tables of results and also of graphic representations of these results are given, as also a large number of determinations of electrical potential differences between iron and salt solutions.—J. T. D.

Carnegie Research Scholarships; Abstracts of reports on research work, 1907 *to* 1908. Iron and Steel Inst., May, 1908. [Advance copies.]

1. *Steels; Microscopic features of hardened supersaturated* ——. E. Hess.

The author is of opinion that supersaturated steels consist, above the critical temperature, of austenite, a solid solution of carbon in iron. On cooling from above the critical temperature, austenite tends to split up into ferrite and cementite, the extent of decomposition depending on the rate of cooling. Even when quenched in iced brine, the test bars, though only of ¾-inch section, showed an alteration at the centre. It is therefore possible that the cooled bar does not represent the real condition of the steel at high temperatures. Thirty micrographs illustrate the paper.

2. *Iron, carbon and sulphur.* D. M. Levy.

The author found, while investigating the influence of sulphur on the relations of carbon to iron, that the whole of the sulphur, if not exceeding 0·8 per cent., exists in iron as ferrous sulphide and that its power of retaining carbon in the combined state is a physical and not a chemical quality. On cooling, austenite free from sulphur is the first to separate out, and then an austenite-cementite-sulphide eutectic, the cementite being interstratified with a jointed pearlite-sulphide component. In the absence of sulphur, the eutectic areas rapidly segregate and the massive cementite thus produced decomposes, with formation of grey iron. The presence of ferrous sulphide prevents this coalescence, owing to the persistence with which it retains its position, due probably to viscosity and surface tension, and as coalescence is a preliminary to the decomposition of the carbide, the iron tends to remain white. Several micrographs and a set of cooling curves are included in the paper.

3. *Iron and steel; Refining* —— *by means of vapour of metallic sodium.* A. Hiorth.

The author describes the effect of forcing metallic sodium to the bottom of crucibles containing molten iron and steel. The sodium is vaporised and bubbles through the molten metal, with production of sodium peroxide. The sodium is not lost in the process, as the peroxide can be collected from the surface of the metal. Analyses are given of five tests both before and after treatment, showing that, with the exception of the removal of oxygen, the general composition of the iron or steel is not altered.

4. *Iron and phosphorus; Constitution of compounds of* ——. B. Saklatwalla.

The author has carried out thermal and metallographic investigations of the combinations of iron and phosphorus. Pure iron and phosphorus were used, and great care was taken to prevent contamination during the production of the series of alloys. If the phosphorus does not exceed 1·7 per cent., it forms a solid solution with the iron. This solution forms with iron phosphide, Fe_5P, an eutectic containing about 10·2 per cent. of phosphorus, with a solidifying point a little above 1000° C. The triferro-phosphide, Fe_3P, also forms with the phosphide, Fe_2P, a higher eutectic containing about 16·2 per cent. of phosphorus and solidifying at 960° C. A still higher eutectic exists, having a solidifying point of about 1218° C. All the eutectics possess abnormal hardness.

Chromium and tungsten; Functions of —— *in high-speed tool steel.* C. A. Edwards.

Steels containing a sufficient amount of chromium and tungsten show, on cooling from 1320° C., no critical point below 900° C. The author believes that neither iron carbide nor the hypothetical carbide of tungsten are present, but that a double carbide of tungsten and chromium is formed, which is held in solution even when the metal is slowly cooled. On heating to 670° to 730° C., it separates out, while at higher temperatures, it is slowly decomposed. The paper is illustrated with micrographs and a series of curves.

6. *Troostite and austenite; Experimental researches on the cooling power of liquids, on quenching velocities, and on the constituents of* ——. C. Benedicks.

One essential condition for an efficient quenching liquid appears to be a high latent heat of vaporisation. The specific heat and the rate of flow are only of secondary importance, and the heat conductivity and probably the internal friction may be neglected. The cooling power of mercury is found to be less than that of water and nearer that of rape oil. Salt water is rather less, and methyl alcohol more, effective than fresh water. The duration of cooling (in inverse ratio to the speed of cooling) is directly proportional to the mass, but almost independent of the free surface area of the specimen. The occurrence of troostite depends on the cooling velocity and not on the quenching temperature. With a steel containing 1 per cent. of carbon, 0·15 per cent. of silicon, and 0·25 per cent. of manganese, a cooling velocity corresponding to $\tau = 0{\cdot}2$ seconds ($\tau =$ the time taken to pass from 700° to 100° C. on quenching) was too high to yield troostite in any noticeable quantity. A similar specimen wound with wire, to increase the mass, gave $\tau = 9{\cdot}5$ seconds on quenching, and, as the result of the slower cooling, consisted entirely of troostite. The preservation of austenite in carbon steel is dependent on high mechanical pressure, either occurring naturally in the interior of a bar or produced by external means. The fact that austenite does not occur in the outer layer of a hardened specimen is not owing to oxidation, but to the lack of the necessary pressure. If the mechanical pressure in an austenite-martensite specimen be decreased by grinding off a considerable portion of the metal, some of the exposed austenite will shortly become transformed into martensite. If the mechanical pressure on the surface be increased during cooling, the austenite will be preserved even to the extreme outer edge. Photomicrographs, plates of curves, and a bibliography accompany the paper.—F. R.

Thomas-Gilchrist basic Bessemer process; Düdelingen method of carrying out the ——. P. Goerens. Stahl u. Eisen, 1908, **28**, 682—686.

In the Bessemer process the silicon burns out first, and, by the heat of its combustion, raises the temperature of the bath. The high temperature so attained is advantageous for the burning-out of the carbon, which occurs next, but the combustion of the phosphorus in the basic process demands a lowering of the temperature, otherwise a long blow is necessary before the phosphorus is completely oxidised, and there is in consequence, a great loss of iron or of manganese in the slag. The process introduced by Flohr at Düdelingen consists in adding, at the end of the decarburising period, briquettes of mill cinder and lime, made by grinding the cinder with enough quicklime to combine with the water it contains, adding slaked lime to make up about 14 per cent. of total calcium hydroxide, and briquetting under pressure. The briquettes (which must be dense enough and hard enough to penetrate through the slag into the molten metal) are hardened by a few weeks' exposure to air or by heating in a drying stove, and are added in quantity determined by the circumstances of the charge. The reduction in temperature arises partly from the withdrawal of the heat necessary to heat the briquettes, and to dissociate the calcium hydroxide and the water resulting from it, and partly from the reaction of the iron phosphide in the bath on the ferrous oxide in the briquettes (which contain about 42 per cent. of ferrous and 34 per cent. of ferric oxide)—$5FeO+2Fe_3P=P_2O_5+11Fe$. The ferric oxide present is reduced to ferrous oxide at the expense of the iron in the bath, so that the whole of the iron in the briquettes may be considered present effectively as ferrous oxide. The dephosphorisation is no doubt aided by the finely-divided lime resulting from the disintegration of the briquettes, ready to form calcium phosphate with the phosphoric anhydride produced. The advantages claimed for the process are:—1. The loss of metal through oxidation is greatly lessened. 2. The quantity of lime required is lessened, as the dissolved iron oxide increases the solvent power of the slag for phosphoric acid. 3. The phosphorus content of the slag is increased to an extent corresponding to the smaller amounts of iron and lime contained in it. 4. Losses by projection are minimised, because of the shortened time both of the blow (for the temperature during decarburisation may be allowed to rise, and the process be thus accelerated) and the after-blow. 5. The amount of steam required is correspondingly lessened. 6. The converter bottoms and linings last for a greater number of charges.—J. T. D.

Titanium; Effect of addition of —— *to cast iron.* B. Feise. Stahl u. Eisen, 1908, **28**, 697—699.

Cast-iron without titanium was compared with the same iron to which 0·25, 0·50, and 1·0 per cent. of titanium, respectively, had been added. The addition of 0·25 per cent. produced a notable diminution in the elongation produced by a given load (to $\frac{9}{10}$ at low, to $\frac{3}{4}$ at high stresses), while further additions lessened this effect, so that the metal with 1·0 per cent. of titanium closely approached the original metal. The breaking loads of the four specimens were respectively 1230, 1660, 1410, and 1340 kilos. per sq. cm. If the total work required for fracture is calculated, however, the metal containing 1 per cent. of titanium is the highest; the figures, in the same order as before, being 0·046, 0·056, 0·053, and 0·066 kilogram-metre per c.c. Now that a reasonably pure titanium is commercially obtainable, much closer control over the composition of a metal containing titanium is possible than formerly, when low-grade ferrotitanium was the only available means of making the addition.
—J. T. D.

Mild steel embedded in concrete. R. T. Glazebrook, "Times" Eng. Suppl., May 20, 1908.

The following report of the engineering department of the National Physical Laboratory "On the Effect Produced on Samples of Mild Steel Embedded in Concrete" has been furnished by Sir John Brunner, at whose request the experiments were undertaken. "A strong wooden box was made and divided into five partitions, each partition being 12 in. long, 7½ in. wide, and 7½ in. deep. Specimens of mild steel of the following dimensions were prepared:—1. One inch diameter, 8 in. long, turned all over. 2. Eight inch lengths cut from a 1½ in. by 1½ in. bar with the scale left on. The partitons were half-filled with good Portland cement concrete and a specimen of each kind laid on the top, and the partitions were then filled up. This was done on December 21, 1906. The blocks were covered with water several times a week for a year, and for three months afterwards were left in the open subject to the weather. On April 20 one of the blocks was removed from the box and broken up, and the specimens removed. On examining the specimens carefully no trace of any action by the cement could be detected. The turned specimen was practically as bright as when it was put in, and the scale on the rough specimen was undisturbed. To test the possibility of any slight action the surface of the turned specimen was polished and etched and examined under the microscope side by side with a specimen of the same material cut from the centre of the bar. No difference in the micro-structure of the two specimens could be detected, and the conclusion is that in 16 months no action has taken place between the metal and the concrete. It is proposed to immerse one of the remaining blocks in the comparatively warm water of the cooling pond for six months and then to examine the specimens.

Gold amalgam; Average rate of accumulation and absorption of —— *by copper plates.* E. Halse. Trans. Inst. Min. and Met., May, 1908. [Advance copy].

"Accumulation" means the gradual formation of a hard scale of amalgam on the surface of the plate, which cannot be removed by the usual rubber scrapers. "Absorption" represents the amalgam that has actually been absorbed by, or has soaked into the plate, and which can only be recovered by melting down the plate. The writer details the accumulation occuring on three sets of "apron" plates in Columbia during a period of six years. By comparing the weight of scale accumulated, with the total value of the ore that had passed over the plates, he calculates the average rate of accumulation to be 1·27 to 2·07 dwt. per ton of an ore averaging about 11 dwt. per ton. The author entirely disagrees with the view that copper plates absorb a considerable amount of gold, sometimes estimated at 70 oz. per plate, even though they may have become saturated with mercury. The original plates from the above mill, which were $\frac{1}{16}$ in. thick, were found to be completely saturated with mercury, but when broken up, only yielded 4·243 oz. of fine gold. Other details are given showing that only 8·96 oz., 8 oz., and 9 oz. had been found in plates that had been in use for 4, 10 and 2½ years respectively. A paper on the same subject by W. F. A. Thomae is in agreement with the above. (See Trans. Inst. Min. and Met., May, 1908).—F. R.

Tellurium in assaying; Behaviour of ——. S. W. Smith. Trans. Inst. Min. and Met., May, 1908. [Advance copy].

From results of experiments on the scorification and cupellation of alloys of lead with tellurium, gold, and silver, the author offers a number of suggestions as to the probable causes of loss of precious metals in the assay of telluride ores for gold and silver, and recommends methods of avoiding them. In the crucible fusion of the ore, a low temperature should be employed, and the charge should be arranged to yield a large button of lead for collection of the precious metals. This large excess of lead also assists the removal of the tellurium during scorification or cupellation, so that the tellurium is largely expelled during the early portion of the operation. An excess of tellurium in the lead button, at the end of the cupellation, causes heavy losses of gold and silver, and may even result in complete loss if the amount of tellurium present is equal to one-tenth of the lead. The tellurium may be partly removed from the lead button by "soaking" it under an excess of litharge at a temperature between 700° and 900° C., and such treatment of the lead button from a crucible fusion, prior to cupellation, is recommended. The author suggests that the tellurium is converted into the black monoxide, first described by Divers and Shimose in 1883, with production of lead suboxide according to the equation :—$2PbO + Te = Pb_2O + TeO$. During cupellation, where excess of air is present, he agrees with others that tellurium dioxide is produced. An addition of silver to the lead button before cupellation reduces the loss of gold. The proportionate loss of silver during cupellation is greater than that of gold. A low temperature should be employed both for scorification and cupellation, but scorification is not recommended. (See also this J., 1908, 24.)—F. R.

Copper [*in ores*] ; *Volumetric method for* ——. G. S. Jamieson, L. H. Levy and H. L. Wells. J. Amer. Chem. Soc., 1908, **30**, 760—764

The titration of copper as cuprous thiocyanate with potassium iodate is recommended as an easy, rapid, and accurate method for the estimation of copper. The ore is decomposed and the copper converted into sulphate in the usual manner, silver, if present, being precipitated with a little hydrochloric acid before filtering. The filtrate is neutralised with ammonia, 10—15 c.c. of strong sulphurous acid solution added, and the whole boiled. 5—10 c.c. of a 10 per cent. solution of ammonium thiocyanate are added, according to the amount of copper present, and after stirring, the precipitate is allowed to settle and is then filtered off and washed with hot water. The filter with its contents is placed in a 250 c.c. glass stoppered bottle with 5 c.c. of chloroform, 20 c.c. of water and 30 c.c. of concentrated hydrochloric acid, and titrated with a standard potassium iodate solution, agitating well between additions. The violet colour imparted to the chloroform disappears at the finish with great sharpness. Solutions of potassium iodate keep indefinitely, and the pure salt may be readily procured. Each c.c. of a solution containing 5·892 grms. per litre, is equivalent to 1 mgrm. of copper.—F. R.

Vanadium [*in ores*] ; *Determination of* ——. A. M. Wilson. Eng. and Min. J., 1908, **85**, 962.

The method described is employed at the mill of the Vanadium Alloys Co., Colo., for a vanadiferous sandstone, containing a small quantity of uranium and only a trace of arsenic. One grm. of the finely-powdered ore is digested with 40 c.c. of nitric acid (1 : 1) on a water-bath. The presence of vanadium is indicated by the formation of dark red rings round the sides of the dish. The solution is evaporated to dryness, cooled, taken up with 20 c.c. of dilute nitric acid and 3 c.c. of concentrated sulphuric acid, evaporated until fumes of sulphuric anhydride are evolved, diluted to 30 c.c., and boiled till all the vanadium is dissolved. The silica is filtered off, and the filtrate and washings evaporated in a tall beaker to 30 c.c. Hydrogen peroxide is carefully added until the hot liquid assumes a deep red colour. Iron and any uranium that may be present are precipitated with sodium hydroxide and filtered off, the filtrate diluted to 350 c.c., acidified with sulphuric acid, boiled, and reduced with freshly prepared sulphur dioxide water until the solution is saturated and has turned blue. The excess of sulphur dioxide is removed by boiling for 20 minutes, while passing carbon dioxide through the liquid to avoid re-oxidation of the vanadium. The solution is then titrated hot with a standard potassium permanganate solution, 1 c.c. of which is equivalent to 0·0005 grm. of vanadium. Another method consists in fusing 1 grm. of ore with 3—4 grms. of sodium carbonate in a covered platinum crucible until the melt is quiescent, finally removing the cover and heating strongly for five minutes to ensure conversion of all the vanadium into pentoxide. When cool, 0·25 grm. of powdered sodium nitrate is added to the crucible, which is then just heated to redness until fusion is complete. The melt is dissolved out with hot water, filtered, acidified with concentrated sulphuric acid, and evaporated until the gelatinous silica settles out. The precipitate is filtered off, and washed ten or twelve times by decantation, and the filtrate diluted to 350 c.c., reduced, and titrated as above.—F. R.

Manganese ; *Notes on* ——, *and its compounds with carbon.* A. Stadeler. Metallurgie, 1908, **5**, 260—267, 281—288.

The metal used in the investigation was the purest obtainable commercially. It was made by the Goldschmidt process, and contained : Manganese, 95·80 per cent. ; iron, 1·05 ; aluminium, 1·46 ; carbon, nil ; sulphur, 0·091 ; silicon, 1·30 ; and phosphorus, 0·29. As manganese oxidises and volatilises readily at temperatures not much above its melting-point, it was found impossible to purify the metal to any extent by fusion with potassium permanganate, &c. The manganese-carbon alloys were prepared by fusing the metal with powdered sugar charcoal in an electrical combined kryptol and carbon-tube furnace, in an atmosphere of nitrogen. At a temperature of 1400° C., the largest amount of carbon taken up by the metal on prolonged heating, was 3·60 per cent. At about 2000° C. up to 6·72 per cent. of carbon was taken up, corresponding with the carbide, Mn_3C, which requires 6·77 per cent. These results agree well with those obtained by earlier investigators. All alloys containing more than 3 per cent. of carbon are immediately decomposed by water, with evolution of methane and hydrogen, according to Moissan. They are also decomposed fairly rapidly even by dry air, and by heating to 1100° C., being rapidly oxidised at this temperature by traces of air diffusing into the furnace. The melting-point of the metal free from carbon was found to be 1207° C. ; the metal containing 3·32 per cent. of carbon solidified at 1271° C., and with 6·72 per cent. at 1217° C. The specific gravities were found to be : Metal free from carbon, 7·089 ; with 0·96 per cent. of carbon, 7·053 ; with 3·01, 6·985 ; and with 6·72, 6·888. The formation of graphite was never observed, not even after the addition of 3 per cent. of silicon. The alloys containing 0·72—3·60 per cent. of carbon show a break in the cooling-curve at 817°—855° C. ; in addition, those with 0·3—1·2 per cent. of carbon show two other transition points, at 910—930° C. and 690—720° C. respectively. The alloys form a single series of solid solutions, with a maximum in the cooling curve. The mixed crystals are polygonal grains below the maximum-point, and needle-shaped beyond it. Annealing and tempering experiments showed that there is a break in the solubility during cooling, probably in all alloys containing from 0 to 3·6 per cent. of carbon. Within this break or gap, there are two sets of mixed crystals. Manganese will not take up pure carbon by cementation, so that the carbon in the alloys is not in the elementary state, but is present as dissolved carbide. The paper is accompanied by a number of good reproductions of photomicrographs.—A. G. L.

Chlorine ; *New application of* ——, *in metallurgy.* C. E. Baker. Trans. Amer. Electrochem. Soc., 1907, **12**, 155—163.

Chlorine, derived from the electrolysis of common salt, or of the metallic chloride finally obtained in the process, is allowed to act on the dry pulverised ore (sulphide, arsenide, telluride) contained in a tube mill, the action of the mill being to grind off the surfaces of chloride formed, and expose fresh ore to the action of the gas. Free sulphur, or sulphur chloride, is formed, according to the time of action of the gas. The product is then leached with water, chlorides thus being for the most part extracted, and the residue can be treated for gold. From the solution, copper is precipitated by metallic lead, then lead by metallic zinc. The ferrous chloride present is next converted into ferric chloride by passing in chlorine, and the zinc extracted by electrolysis, most of the chlorine being thus recovered to go through the process again.—J. T. D.

Mineral production of Japan. Board of Trade J., May 21, 1908. [T.R.]

The following are the statistics, issued by the Department of Agriculture and Commerce, of the mineral output of Japan in 1907, with corresponding figures for the preceding year :—

		1906.		1907.	
		Quantity.	Value,	Quantity.	Value.
			Yen.		Yen.
Gold	Momme	794,583	3,795,772	735,708	3,654,702
Silver	,,	20,161,481	3,239,765	23,519,189	3,852,043
Copper	Kin	58,746,257	26,302,204	63,061,157	‡27,000,000
Pig iron	Kwamme	10,536,061	1,939,689	11,610,995	2,137,584
Steel	,,	855,484	254,079	1,223,023	363,238
Lead	Kin	4,570,708	432,466	5,090,246	502,916
Tin	,,	39,880	40,891	50,074	52,371
Antimony, refined	,,	343,210	145,600	*	*
Mercury	,,	610	793	912	1,186
Pyrites	Kwamme	9,597,250	94,437	9,620,278	96,203
Chromic iron	,,	414,750	8,648	1,509,928	31,482
Manganese	,,	1,911,270	69,478	2,772,236	101,287
Arsenic ore	Kin	10,312	722	7,710	540
Zinc ore	Kwamme	3,793,095	208,165	4,134,982	226,928
Phosphoric ore	,,	837,340	18,447	*	*
Graphite	Kin	235,089	22,458	119,826	11,447
Coal	Ton	12,974,274	63,364,128	13,716,488	59,296,378
Peat	,,	71,374	112,699	63,550	101,680
Petroleum	Koku	1,378,211	3,840,430	†1,773,197	†7,390,685
Pitch	Kin	644,138	7,163	810,000	8,993
Sulphur	,,	45,722,221	612,461	47,515,538	631,757

Momme=2·41 dwts., kin=1·3228 lb. av., kwamme=8·2817 lb. av., koku=39·7 gallons.

* No figures available.

† These figures show the amount estimated in consideration of the present condition of the principal districts.

‡ Estimated.

Mineral production of Germany. Eng. and Min. J., May 9, 1908. [T.R.]

The advance figures from the official report of mineral production in Germany for the past year do not show any considerable changes from the preceding year.

The production of coal, iron ore, and pig iron is given below, in metric tons.

	1906.	1907.
Coal[1]	137,117,926	143,168,301
Brown coal	56,419,567	62,559,364
Total	193,537,493	205,727,665
Iron ore	26,734,570	27,705,504
Pig iron	12,292,819	12,875,159

Iron ore in 1907 includes 8377 tons mined in connection with other ores. Of the total output last year, 14,107,518 tons came from Elsass-Lothringen ; 7,492,870 tons from Luxemburg.

The production of petroleum was 81,350 tons in 1906, and 106,379 in 1907 ; that of asphalt was 117,412 tons in 1906, and 126,649 in 1907.

The production of ores, other than iron ore, was, in metric tons :

	1906.	1907.
Gold and silver ore	8,066	8,280
Copper ore	768,523	771,227
Lead ore	140,914	147,272
Zinc ore	704,590	698,425
Manganese ore	52,485	74,683
Arsenic ore	6,249	4,872
Pyrites	196,971	196,320
Miscellaneous	9,158	8,984

Of the copper ores last year 680,487 tons came from the Halle district, in which the Mansfeld mines are situated.

The production of metals, other than iron, was as follows : gold and silver in kilograms, others in metric tons :

	1906.	1907.
Gold, kg.	4,202	4,682
Silver, kg.	393,442	386,933
Copper, tons	33,046	32,473
Tin, tons	6,597	5,864
Lead, tons	150,741	142,571
Spelter, tons	205,692	208,195

Gold and silver include metal obtained from imported ores and bullion. Copper in 1907 includes 197 tons of black copper and 330 tons of bullion and matte ; 31,946 tons being refined copper. Tin includes metal from imported ores and concentrates.

The production of metallic salts and other by-products from metallurgical works was as follows, in metric tons :

	1906.	1907.
Tin chloride	987	1,812
Arsenic	3,052	2,904
Ferrous sulphate	13,376	14,033
Copper sulphate	6,758	5,284
Mixed sulphates	158	129
Zinc sulphate	6,092	5,145
Nickel sulphate	187	189
Metallic pigments	4,363	4,469
Miscellaneous products	6,367	6,369

The production of sulphur was 178 tons in 1906, and 176 in 1907. The sulphuric acid made in 1906 was 1,335,128 tons; in 1907 it was 1,380,016 tons, 1,255,421 tons being ordinary acid, and 124,585 tons concentrated acid.

The mining report gives the following statement of crude salts taken out, in metric tons:

	1906.	1907.
Rock salt	1,235,041	1,285,137
Kainite	2,720,594	2,624,412
Other potash salts	2,821,073	3,124,955
Kieserite, etc.	7,356	2,252
Boracite	161	114

The statement of prepared salts marketed is as follows, also in metric tons:

	1906.	1907.
Sodium chloride	635,171	665,552
Potassium chloride	403,387	473,138
Magnesium chloride	38,468	32,891
Sodium sulphate	81,175	80,347
Potassium sulphate	54,490	60,292
Potassium-magnesium sulphate	35,211	33,368
Magnesium sulphate	42,041	41,105
Aluminium sulphate	55,969	59,473
Alum	4,494	4,209

Graphite mined was 4055 tons in 1906, and 4033 in 1907; a decrease of 22 tons only.

Sodium peroxide in certain quantitative processes. S. W. Parr. *See* XXIII.

PATENTS.

Slags from steel and iron making processes; Treating ——, and utilising the products thereof. T. Twynham, Redcar, Yorks. Eng. Pat. 9073, April 19, 1907.

Silicious slag rich in oxides of iron and manganese, obtained in the acid Bessemer or acid open-hearth steel processes, is mixed with two or three times its weight of basic slag containing much lime, about 10 per cent. of iron oxide, and about the same quantity of phosphoric anhydride. The slag should be in the form of small pieces. Coke, also in small pieces, is added, and the mixture is heated, preferably in a basic-lined cupola furnace, where most of the iron and phosphorus and some of the manganese are reduced. The liquid mass is then run into a basic-lined receptacle, where it is further heated electrically, after the addition of lime and carbon, in order to reduce the rest of the manganese. An iron-manganese-phosphorus compound is obtained, which may be used in the basic Bessemer process. The slag contains about 45 per cent. of lime and 30 of silica, and may be utilised as usual.—A. G. L.

Ore-roasting furnaces. E. W. Kauffmann, Cologne, Germany. Eng. Pat. 13,692, June 13, 1907.

The invention refers to a furnace with superposed hearths, fitted with a common vertical stirring-shaft with the driving gear at the top, the object being to allow the shaft to be entirely or partly boxed-in without interfering with its expansion. For this purpose the hollow vertical shaft, which carries rakes operating on each hearth, is supported in a foot-bearing at the bottom of the furnace, whilst its upper end is bushed in a bearing secured to the furnace cover. A spur-wheel is keyed to the upper end of the shaft, which wheel is driven by a smaller wheel, the shaft of which carries a worm-wheel operated by a worm on a horizontal shaft with a fixed and a loose pulley driven by a belt from a power shaft common to a number of furnaces. Or else, the wheel at the top of the stirring shaft may be driven directly by the worm on the horizontal shaft, the teeth being so broad and so slanted as to allow for the upward movement of the first shaft due to expansion. Or, finally, the stirring shaft may be keyed to its driving wheel so as to allow of the vertical movement of the shaft, the wheel being fixed by its casing.—A. G. L.

Rust-proofing iron, steel, etc. A. Bontempi, New York. U.S. Pat. 881,221, March 10, 1908.

The invention is an improvement of U.S. Pat. application 285,240 of 1905. Iron or steel articles are rust-proofed by heating in a closed chamber for 2—6 hours at a temperature of 1000°—1800° F., in the vapour of non-corrodible substances, *e.g.*, a mixture of tannic acid, an oleaginous material, and a non-corrodible metal such as zinc, or its oxide; a pure metal such as zinc or lead; or hydrocarbons such as coal-tar or pitch. The articles may be first subjected to the Bower-Barff treatment (treatment with steam at high temperatures), in which case a tray of lime may be placed within the chamber to dry the steam. A small quantity of naphtha may be injected with the steam to give a black colour to the coating.—A. G. L.

Iron; Process of treating ——. P. Wilks, Dartmouth, Nova Scotia. U.S. Pat. 886,668, May 5, 1908.

A pile of sheet or scrap iron is heated to 2600° F. in contact with lime, and kept at this temperature sufficiently long to enable the impurities in the iron to diffuse to the surface and to combine with the lime. The pile is then "worked" at this temperature in order to expel the impurities and the lime.—A. G. L.

Steel; Preliminary treatment of pig-iron for conversion into ——. Ges. für Elektrostahlanlagen m.b.H. Fr. Pat. 385,072, Dec. 16, 1907.

Iron from the blast-furnace is first treated at a high temperature in an electrical furnace, with the addition of iron scale, calcareous slag, &c., a large proportion of the silicon and carbon being removed with but little loss of iron. Manganese compounds may also be added if much sulphur is present. The partly purified iron is then treated in a converter as usual. The process is especially suitable for iron rich in silicon and carbon. —A. G. L.

Aluminium alloy. W. Gosmann, Assignor to F. Krupp Akt.-Ges., Essen on Ruhr, Germany. U.S. Pat. 886,597, May 5, 1908.

See Eng. Pat. 16,726 of 1907; this J., 1908, 231.—T. F. B.

Ores; Process for the balling together of pulverulent or dusty ——. H. Dicke, Assignor to J. E. Goldschmid, Frankfort on Maine, Germany. U.S. Pat. 886,683, May 5, 1908.

See Fr. Pat. 360,576 of 1905; this J., 1906, 543.—T. F. B.

Agglomeration of fine ores by sintering in a revolving tube furnace. Dellwik-Fleischer Wassergas-Ges.m.b.H. Ger. Pat. 196,197, Feb. 1, 1907.

The low-grade gas used for heating the furnace, is previously strongly compressed, so that on igniting it, a flame is produced which will heat only the lower part of the tube furnace to the degree necessary for the sintering of the ore, whilst the upper part of the tube is heated by the fire-gases to a degree suitable for the pre-heating of the ore.—A. S.

Metals [gold and copper]; Process for extracting ——. D. R. Robertson, Denver, Colo. U.S. Pat. 886,866, May 5, 1908.

Gold, or gold and copper, are extracted from ores by treating the latter with *aqua regia*, agitating and applying steam to the mass until it is brought to the boiling point, adding 20 per cent. of cold water, filtering, and treating the filtrate with iron at a temperature of about 70° C. The precipitated metals are finally separated from the iron.—A. G. L.

Slimes treatment. C. E. D. Usher, Johannesburg, Transvaal. U.S. Pat. 886,900, May 5, 1908.

A solvent or wash-liquid is passed upwards through the slimes, at such a rate as not to disturb the homogeneity of the slimes materially. The clear liquid above the slimes is collected and used for further percolation.—A. G. L.

Copper-tin-antimony alloys; Separation of copper from ——. W. Richter. Ger. Pat. 195,792, Dec. 24, 1905.

The alloys in question usually contain from 30 to 70 per cent. of tin, 15—40 per cent. of copper, 0—3 per cent. of iron, 10—25 per cent. of antimony, and 5—45 per cent. of lead. They are oxidised in a German refining furnace, the hearth being made of fire-clay when alloys poor in lead are being treated, and of a mixture of lime, clay, and cement for alloys rich in lead. The oxidation is effected at a low temperature, care being taken to avoid fusion of the alloy. When the greater part of the alloy is disintegrated, and the mass has become sintered, the temperature is raised, and the fused material is vigorously stirred and treated with the air blast to convert the cuprous oxide into cupric oxide. The resulting mixture of oxides is ground, and treated with hot 50 per cent. acetic acid. The insoluble oxides of tin and antimony are separated and reduced to metal in a reverberatory furnace. The acetic acid solution, containing the lead and copper, is treated with sulphuric acid, and evaporated, the acetic acid being recovered by condensation. From the sulphate solution the copper is either crystallised out or precipitated with iron. The lead sulphate is reduced to metal in a reverberatory furnace.—A. S.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(A.)—ELECTRO-CHEMISTRY.

Ammonia ; Formation of —— from its elements, by the action of electric discharges. E. Briner and E. Mettler. J. Chim. Phys., 1908, 6, 137—178.

A mixture of nitrogen and hydrogen prepared by decomposing dry ammonia gas by means of an incandescent spiral of iron; platinum, or nickel, was subjected to the action of electric discharges under different conditions. In some experiments, a spark discharge was produced between platinum electrodes in the mixture of nitrogen and hydrogen contained in a glass bulb cooled by means of liquid air; the cooling has the effect of immediately removing, by condensation, the ammonia formed by the action of the discharge. With this device, it was found that the yield of ammonia increases with the intensity of the primary current (of a Ruhmkorff induction coil) up to certain point and then again decreases. For example, with a current intensity of 1·7 ampéres, the yield of ammonia was 25 mgrms. per kilowatt-hour, whilst with 2·0 and 2·6 ampéres respectively, the corresponding values were 55 and 42 mgrms. The maximum yield of ammonia is obtained at a pressure of 100 mm., but at pressures above that of the atmosphere, the yields appear to increase again somewhat. It is advantageous to work with short distances between the electrodes. Platinum electrodes give better results than those of copper or nickel. The best yields are obtained from a mixture in the proportions, N_2+3H_2 ; excess of hydrogen is less harmful than excess of nitrogen. By the action of the electric arc, better yields are obtained than with the spark discharge ; the yield increases continuously with the pressure, but the curve has a distinct inflection at 100 mm. The silent electric discharge gives better results than the spark discharge at the temperature of liquid air, but the converse is the case at the ordinary temperature. By using sulphuric acid as an absorbent to remove the ammonia as it is formed, yields are obtained at the ordinary temperature, similar to those obtained otherwise at the temperature of liquid air.—A. S.

Nitric acid ; Electrolytic reduction of ——. H. E. Patten. Trans. Amer. Electrochem. Soc., 1907, 12, 325—398.

The author concludes from the results obtained, that:—1. In electrolysing potassium nitrate, using a copper cathode and a porous diaphragm, in dilute sulphuric acid, increase in concentration of the acid increases the yield of ammonia and decreases that of hydroxylamine. 2. Increase of current density decreases the yield of ammonia when the cathode is copper, but increases it when the cathode is platinum. 3. Temperature, within ordinary limits, has practically no influence on the yield either of ammonia or of hydroxylamine. 4. Continuous deposition of copper at the cathode greatly increases the yield of ammonia. This is not due to a catalytic effect of the spongy copper, for it is equally operative when the cathode is amalgamated and its surface remains always the same. The effect reaches a maximum at a certain concentration of copper sulphate in the solution. 5. The cathode density being the same, a low cathode discharge accompanies a high yield of ammonia. 6. Nitrogen, either free or as oxides, is given off at both copper cathode and platinum anode. 7. Probably hydroxylamine is always a stage in the reduction of nitric acid to ammonia at a copper cathode. 8. By the electrolysis of sodium nitrite at a copper cathode in sulphuric acid solution, all the nitrogen is reduced to a form which is not oxidised by potassium permanganate.—J. T. D.

Alkali chlorides ; Electrolysis of ——. A. Brochet. Bull. Soc. Chim., 1908, 3, 532—543.

The action of cobalt oxide in preventing the formation of chlorates in the electrolysis of chlorides has long been known, but the author now states that his former interpretation of the action, as due to the formation of hypochlorite, cannot be maintained. Oxides, such as those of cobalt or nickel, rapidly destroy the hypochlorite, whilst those of copper, lead and iron, etc., with a more feeble action, scarcely prevent the formation of chlorate, and finally oxides of aluminium, zinc, chromium, and the like, without action on hypochlorites, do not influence the progress of the electrolysis. Cathodes of nickel are shown to be possible, but are risky, since the stoppage of the current, etc., may result in the formation of peroxide on the electrodes, and this, detaching itself, may prevent the formation of chlorate.—B. N.

Porcelain for electrical purposes. A. S. Watts. *See* VIII.

Antimony ; Electrolytic determination of ——. O. Scheen. *See* XXIII.

Patents.

Liquids ; Apparatus for treating —— electrolytically. A. O. Tate, Toronto. Eng. Pat. 13,891, June 15, 1907.

See U.S. Pat. 857,910 of 1907 ; this J., 1907, 877.—T. F. B.

Stannic chloride ; Electrolysing aqueous solutions of ——. F. von Kügelgen, Holcombs Rock, Va., and G. O. Seward, New York. U.S. Pats. 883,140 and 883,141, March 24, 1908.

According to the first patent, an aqueous solution of stannic chloride is electrolysed in a diaphragm cell. As soon as the current-efficiency drops considerably, and before stannic hydroxide is deposited in the anode compartment, the electrolyte is removed from both compartments. The mixed solutions are evaporated to a specific gravity of 1·4—1·5° B., and then further electrolysed.

According to the second patent, an aqueous solution of stannic chloride (sp. gr. 1·2) is placed in the cathode compartment of a diaphragm cell, the anode compartment containing aqueous hydrochloric acid of 20 per cent. strength. The cell may have walls of slate, a diaphragm of porous earthenware, tin cathodes, and graphite anodes. Electrolysis is effected with a current density of 4·2 ampères at the cathode. As soon as the current-efficiency drops considerably, the solutions are removed from both compartments. The catolyte, which now contains about 18 per cent. of hydrochloric acid and a little stannic chloride, is brought up to 20 per cent. strength and placed in the anode compartment, whilst stannic chloride is added to the anolyte until its sp. gr. is 1·2, after which it is placed in the cathode compartment, and the electrolysis continued.—A. G. L.

Electrolytic apparatus. B. E. F. Rhodin, Sault Ste. Marie, Ontario, Canada. U.S. Pat. 885,083, April 21, 1908.

A series of concentric ridges are arranged step-wise in the cell, each ridge being separate, and the outer ones higher than the inner. In the centre of the cell is a collecting chamber, and a return channel connects the "peripheral portion of the cell" with this chamber. Means are provided for propelling mercury through the channel.—B. N.

Electric furnace. P. Girod, Ugine, France. U.S. Pat. 885,745, April 28, 1908.

See Addition of Nov. 28, 1905, to Fr. Pat. 329,822 of 1903; this J., 1906, 546.—T. F. B.

Furnace; Electric ——. E. F. Price, Niagara Falls, N.Y., Assignor to Central Trust Co., New York. U.S. Pat. 886,856, May 5, 1908.

The furnace comprises a smelting chamber having an open bottom, or provided with a discharge opening, and a number of separate enclosed abutting receptacles, movable transversely across the bottom of the chamber or across the discharge opening. The receptacles are arranged to receive the molten furnace-product, and any one may act as the bottom of the furnace.—B. N.

Furnace; Electric induction ——. A. Hiorth. Fr. Pat. 385,660, Dec. 28, 1907. Under Int. Conv., Jan. 4, 1907.

See Eng. Pat. 28,542 of 1907; this J., 1908, 410.—T. F. B.

Voltaic high-current arcs; Apparatus for producing ——. H. Pauling, Assignor to Salpetersäure-Ind.-Ges., Gelsenkirchen, Germany. U.S. Pat. 887,220, May 12, 1908.

See Eng. Pat. 18,900 of 1907; this J., 1907, 1204.—T. F. B.

Nitrogen; Oxidation of —— *by means of electricity.* D. Helbig, Rome. U.S. Pat. 887,326, May 12, 1908.

See Fr. Pat. 352,090 of 1905; this J., 1905, 896.—T. F. B.

Atmospheric nitrogen; Process for the oxidation of ——. D. Helbig. Fr. Pat. 385,193, Dec. 19, 1907.

Two blast-pipes are fixed in the lateral walls of an electric furnace, at right angles to the electrodes, which pass through the end walls. Opposing blasts of air, under a pressure of several atmospheres, are thus made to impinge on the arc and produce two sheets of flame in a plane normal to the axis of the pipes and extending the length of the electrodes. The air leaves the furnace charged with oxides of nitrogen. Instead of having two electrodes, an arc may be produced by a triphase current between three electrodes, disposed at angles of 120°; this is a more effective arrangement.—F. Sodn.

Oxides of nitrogen; Furnace for the production of —— *from air.* A. Gorboff and V. Mitkevitch. Ger. Pat. 196,114, June 20, 1906.

The furnace is divided into two compartments by a horizontal partition, from the centre of which a hollow cone projects upwards into the upper compartment. Into the apex of the cone fits the lower end of a spiral tube, the other end of which passes through the wall of the upper compartment near the top. The upper compartment is also provided with an inlet and outlet for cooling water. An electric arc is produced in the lower compartment. The air is introduced through the bottom of the lower compartment, and passes vertically upwards, causing the arc to completely fill the interior of the hollow cone. The gases produced escape through the cooled spiral tube.—A. S.

Nitrides; Process for the preparation of —— *from metallic oxides or salts, by means of atmospheric nitrogen.* W. Borchers and E. Beck. Ger. Pat. 196,323, June 3, 1906.

The oxide or haloid salt of a metal capable of forming a nitride, is introduced into a bath consisting of a fused mixture of two or more haloid salts of alkali, alkaline-earth, or earthy metals, including the haloid salt of the nitride-forming metal. The fused salt mixture must contain fluorides in sufficient quantity to keep the metallic oxide in solution. A fused metal is introduced into the bath to serve as cathode, this metal being capable of dissolving the nitride-forming metal. The anodes are of a metal which does not melt at the temperature employed. On passing the electric current, the nitride-forming metal is separated and alloys with the fused metallic cathode in the outer compartment of the cell, into which, also, a current of atmospheric nitrogen is led, the nitride formed collecting on the surface of the molten cathode.—A. S.

Electric insulating materials, also suitable for building purposes; Process for the manufacture of ——. Wunner'sche Bitumen-Werke, Unna-Königsborn, Germany. Eng. Pat. 18,101, Aug. 9, 1907. Under Int. Conv., April 29, 1907.

See Fr. Pat. 379,359 of 1907; this J., 1907, 1239.—T. F. B.

Micas, artificial; Method of making ——. F. J. Machalske, Niagara Falls, N.Y., Assignor to R. Modjeski, Chicago, Ill. U.S. Pat. 885,934, April 28, 1908.

A charge containing "the non-alkali ingredients of a mica" is melted in an electric furnace, in the presence of silicon to act as an electric conductor, and an alkali hydroxide is incorporated with the molten mass, the product being allowed to cool in the presence of moisture. Carbon surfaces are not exposed to the charge during the process.—F. Sodn.

[Electrolytic] diaphragm and method of making the same. H. Hirtz, West Hampstead. U.S. Pat. 885,998, April 28, 1908.

See Eng. Pat. 28,129 of 1904; this J., 1905, 1230.—T. F. B.

Filaments for electric lamps. Eng. Pat. 12,139. *See* II.

Carbides; Manufacture of ——. Fr. Pat. 385,140. *See* IX.

(*B.*)—ELECTRO-METALLURGY.

Electric furnace; A new type of —— *for the smelting of iron.* B. Igewsky. Iron and Steel Inst., May, 1908. [Advance proof.]

The furnace utilises the hot surface of the firebrick walls as the conductor for the working current. In order to prevent the concentration of the current along the lines of least resistance, the body of the furnace is rotated, a commutator being arranged to cut out the electrodes which happen to be near or in the metal bath. The electrodes of sheet iron, are embedded in the joints of the brickwork, and need no adjustment. They remain at a moderate temperature because they retain the slag and even drops of metal which act as conductors. The experimental furnace is 175 mm. diameter and 215 mm. deep with a total capacity of 5·17 litres and a working capacity of 2 litres. It is rotated 20 times per minute and has 24 electrodes 23 mm. apart. The author prefers a current of 50—60 ampères at 250 volts. The operation is begun by warming the brickwork with the flame of a Bunsen burner; a little damp potassium hydroxide is added and the current switched on, the furnace being rotated continuously. The furnace begins to act as a conductor, and after a short time sodium hydroxide is added. Finally at a red heat, sodium carbonate is added. These alkalis while facilitating the starting of the furnace by making its walls more conducting, do not corrode the bricks so much as would be expected. At a bright red heat the charge is added.—J. W. H.

Carbon; Determination of —— *in steel, ferro-alloys, and plumbago by means of an electric combustion furnace.* C. M. Johnson. J. Amer. Chem. Soc., 1908, 30, 773—779.

A combustion tube furnace heated by the Hoskins resistance wire is described and illustrated. It consists of a steel tube, 29·5 cm. by 7·63 cm., containing a non-conducting packing of magnesia, in the centre of which is a quartz tube wound with the Hoskins wire. The combustions are conducted in another quartz tube, 60 cm. long and 1·9 cm. inside diameter, which is placed in the furnace. To ensure complete combustion of steel, the temperature must be maintained between 940° C. and 960° C. When oxygen is used, 2 grms. of steel should be decarbonised in three minutes and 5 grms. in six minutes, but the heating is continued for an additional 10 minutes. Pig iron and certain alloys such as ferro-chrome, ferroboron, etc., require the addition of red lead to assist decarbonisation. The products of combustion are purified from acid, sulphur, litharge, or chlorine fumes by passing through a jar of granulated 30-mesh zinc, and are dried by phosphoric anhydride. Advantages claimed for the electric furnace are:—A minimum time is required for the combustion; platinum boats, tubes, or crucibles are unnecessary; tubes are heated and cooled gradually; very little heat is radiated; space is economised. Tables showing over twenty assays checked by the ordinary methods are included in the paper.—F. R.

Iron ores; Electrothermic reduction of ——. A. E. Greene and F. S. MacGregor. Trans. Amer. Electrochem. Soc., 1907, 12, 65—79.

Charges of 10 kilos. of ore, with the necessary quantity of coke and varying amounts of lime, were smelted in an experimental furnace, the crucible of which formed one electrode, while a movable graphite rod formed the other. Temperatures were measured by an optical pyrometer. The ore was an ilmenite, containing 52 per cent. of iron, 26 per cent. of titanium dioxide, and 2 per cent. of silica. The results are tabulated below:—

Ratio: $\frac{CaO}{Al_2O_3 + SiO_2 + TiO_2}$.	Silicon in metal.	Titanium in metal.	Iron in slag.	Temp.	Quality of slag.	H.P.-years per ton of pig.
	per cent.	per cent.	per cent.	° C.		
$\frac{2\cdot25}{2\cdot90}$	0·05	0·00	2·95	1375	Medium fluid.	1·14
$\frac{2\cdot25}{2\cdot90}$	0·05	0·00	7·10	1593	Fluid.	2·25
$\frac{3\cdot50}{2\cdot90}$	0·06	0·00	6·37	1549	Infusible and viscous.	0·97
$\frac{3\cdot50}{2\cdot90}$	0·11	0·00	7·56	1675		0·93
$\frac{0\cdot75}{2\cdot90}$	0·14	0·20	—	1922	Very fluid.	1·22
$\frac{0\cdot75}{2\cdot90}$	0·21	0·04	—	1469	do.	0·79

No conclusions could be drawn as to the amount of silicon in the metal; but the conditions as to flux and temperature necessary to prevent the introduction of titanium are shown. The comparison of energy required to smelt the same charge at a high (1922°) and a low (1469°) temperature is also interesting.—J. T. D.

Rotating anodes; Electrochemical analysis with ——. A. M. Fairlie and A. J. Bone. *See* XXIII.

Patents.

Iron; Electro-deposition of ——. S. O. Cowper-Coles, London. Eng. Pat. 10,367, May 3, 1907.

By using the following electrolyte, iron having a close texture, difficult to rust, readily annealable, and which will not exfoliate during deposition, may be obtained:—Cresolsulphonic acid, 20 grms.; iron oxide, 30 grms.; 40 per cent. ferrous chloride solution, 1 litre. A current density of 75 ampères per square foot is used at a voltage of 0·75 volt, the temperature being preferably 65° C. The electrolyte is maintained as nearly neutral as possible by using a large anode and keeping iron oxide in suspension.—J. W. H.

Metals [lead, etc.]; Process of recovering —— *from their sulphide ores.* E. F. Kern, Knoxville, Tenn. U.S. Pat. 885,761, April 28, 1908.

The sulphide ore is smelted to matte, in order to remove impurities and to increase its electrical conductivity. This matte is then used as anode in the electrolysis of a fused electrolyte containing a metallic haloid compound. —A. G. L.

Aluminium and other metals; Art of reducing —— *[electrically].* H. S. Blackmore, Mount Vernon, N.Y. U.S. Pat. 886,757, May 5, 1908.

Metals, such as aluminium, are reduced from substances containing the same, by fusing the substances with the aid of a current, such as an alternating one, which does not yield metal, and which is passed through the fused material between contacts. At the same time, the metal is liberated by the action of a metal-yielding current, the latter being passed through the bath "in a path disposed parallel to or with the path of the heating current."—B. N.

Metals; Electrolytic process of producing ——. E. F. Price and W. S. Horry, Niagara Falls, N.Y., Assignors to Central Trust Co., New York. U.S. Pat. 886,857, May 5, 1908.

Alkali or alkaline-earth metals, such as calcium, are obtained by electrolysing a molten bath containing a haloid salt and an oxide of the desired metal, the anode consisting essentially of a carbide of the metal.—B. N.

Ferro-alloys; Process of producing low-carbon —— *[electrically].* E. F. Price, Niagara Falls, N.Y., Assignor to Electro Metallurgical Co., Chicago, Ill. U.S. Pat. 886,858, May 5, 1908.

A ferro-alloy, such as ferro-chromium, high in carbon, is first produced by electrically smelting a compound of the alloying metal, an excess of carbon, and a source of iron. The product is then heated to such a temperature, that the affinity of oxygen for the contained carbon is greater than its affinity for the alloyed metal, by constituting a body of the molten alloy the secondary of a transformer, and supplying electric current to the primary of the transformer, whilst subjecting the heated alloy to the action of an oxidising gas.—B. N.

Fusion of bodies readily volatilised [lead]; New process of —— *in the electric furnace.* H. Herrenschmidt. (1), First Addition, dated Feb. 19, 1907; (2), Second Addition, dated Feb. 23, 1907, to Fr. Pat. 371,260, Nov. 9, 1906 (this J., 1907, 328).

(1). Impurities, such as antimony, are removed from metallic lead, in order to purify the latter, by forming a screen of slag containing a suitable quantity of iron. After reduction, the iron and lead separate owing to difference in density, and the melted lead traversing the bath of iron is freed from its impurities. The following example is given: 100 parts by weight of the lead mineral containing antimony are mixed with 40 parts of iron pyrites, containing 30 to 35 per cent. of iron. The following mixture is prepared for the production of the slag: 30 parts by weight of lime, 40 of alumina, 30 of silica, 15 of sodium carbonate, and 15 of boric acid, with the addition of 15 parts of iron or its equivalent of oxide of iron. 40 parts by weight of this mixture are used for treating 100 parts by weight of the mineral.

(2). The screen of slag is employed in the extraction of iron, copper, etc., in order to avoid excess of heat, which favours the oxidation of the metal at the surface of the bath, and which also tends to bring about objectionable changes, such as brittleness, in the constitution of the metal.—B. N.

Furnace; Electric —— *for melting iron and converting it into steel.* J. I. Bronn. Ger. Pat. 195,817, May 12, 1906.

The iron is interposed in the current circuit as a heating resistance material. The furnace comprises several channels, with means for preventing inter-communication. By means of blocks of conducting material, the several channels are subjected in succession to the action of the same current. The contents of the individual channels can thus be submitted to different treatments and temperatures.—A. S.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

Carapa oil. J. Lewkowitsch. Analyst, 1908, **33**, 184—186.

In the author's opinion there is not sufficient justification for regarding the oils from *Carapa guianensis* and *C. touloucouna* as distinct, for botanists differ as to the plants belonging to separate species, and at Kew both names are regarded as synonyms for *C. procera*, D.C. A consignment of nuts from Uganda has been received here. These are stated to belong to a new species of tree, to which the name *C. grandiflora*, Sprague, has been given. The good kernels in the sample examined by the author yielded 30·26 per cent. of oil on extraction with ether. The cold-drawn oil was nearly white, whilst the hot pressed oil was much darker in colour. Both were solid at the ordinary temperature. The following values were obtained :—

	Cold-pressed oil.	Hot-pressed oil.
Sp. gr. at 40°/40° C.	0·9171	0·9215
Sp. gr. at 15·5°/15·5° C.	0·9261	0·9306
Solidification point	8° C.	10° C.
Melting point	15°—23° C.	20°—30° C.
Saponification value	198·1	201·8
Iodine value	83·7	72·6
Reichert-Meissl value	3·75	3·83
Unsaponifiable matter	3·75%	1·59%
Insoluble fatty acids :		
Fatty acids + unsaponifiable matter	94·03%	92·93%
Solidifying point (titer test)	34·9° C.	38·9° C.
Neutralisation value	202·3	202·4
Mean molecular weight	277·3	277·1
"Liquid" fatty acids (from ether-soluble lead salts)	72·82%	64·62%
Iodine value of "liquid" acids	94·74	94·71
Iodine value of "solid" acids	8·8	9·97

The solid fatty acids yielded 3·15 and 6·6 per cent. of "stearic acid" (m. pt. 65·6° C.) respectively. The oils, like other oils from seeds of plants of the Carapa family, had an intensely bitter taste. The author estimates the commercial value of the oil at about £24 to £25 per ton, and that of the seed-cake at about £2, assuming that the bitter taste would preclude its being used except as manure. The value of the kernels would then be £5 to £6 per ton.
—C. A. M.

Palmitic acid ; Preparation and properties of the bornyl ester of ——. O. von Soffe. *See* XX.

Patents.

Fatty matters ; Apparatus for the extraction of —— *by means of carbon tetrachloride.* P. Bernard, Lille, France. Eng. Pat. 28,364, Dec. 24, 1907.

The apparatus consists of a tetrachloride receiver, a distillation vessel, provided with closed and perforated steam coils, two condensers, a refrigerator, and two "extractor-receivers," furnished with closed and perforated steam coils. The various parts of the apparatus are connected by a system of piping with suitable cocks, so arranged that the solvent can be transferred from one "extractor-receiver" to the other, without the use of a pump. The extraction may be carried out by continuous distillation from the distillation vessel, or by introducing successive charges of solvent "into the extractor-receivers" and allowing the material to soak in them for a time, and then running off the solvent into the distillation vessel.
—E. W. L.

Fats, waxes, hydrocarbons, and mixtures of the same ; Process for separating the acid and neutral constituents of ——. A. Chatelan and P. Spiess. Ger. Pat. 191,871, March 30, 1906.

The process consists in neutralising the acid constituents, and separating the resulting soaps from the neutral fat or, in the case of wool fat or waxes, from the free alcohols (cholesterol, etc.). After treating the crude fat or wax with a base, so much of an absorbent material is added, that a dry pulverulent mass is obtained, from which the neutral fat can be easily recovered by extraction with a volatile solvent at the ordinary temperature. For example, 100 kilos. of wool fat are warmed with 5 kilos. of slaked lime, the product is mixed gradually with 170 kilos. of magnesium hydrosilicate, and the resulting dry powder is extracted with petroleum spirit at the ordinary temperature. The residue can be used repeatedly as an absorbent material, and is finally treated with mineral acid to decompose the calcium soaps, and the liberated fatty acids separated.—A. S.

Soap ; Mixing boiler for ——, *with apparatus having a planetary movement intended to cause soap or other products to circulate in a vertical direction, reversible at will.* Maison : Success. A. Migone and Co. Fr. Pat. 385,306, Dec. 9, 1907.

The boiler contains several cylinders which are open at the ends and are heated by steam coils. These cylinders revolve about a vertical axis in the boiler and mix the soap paste, and each has within it an endless screw-conveyor actuated by a separate movement from that rotating the cylinders, with the result that the soap paste is made to circulate upwards or downwards through the cylinders.
—C. A. M.

Soap soluble in hydrocarbons, oils, alcohol, and the like ; Preparation of a —— *from sulphonated castor oil.* C. H. Meyer. Ger. Pat. 197,400, Sept. 16, 1905.

Two hundred and seventy kilos. of castor oil are sulphonated with 60 kilos. of concentrated sulphuric acid, and the sulphonated oil is well washed with water and salt solution. In this way about 300 kilos. of "a sulphonic acid containing about 90 per cent. of fat" is obtained. This is treated at the ordinary temperature with an aqueous solution of sodium carbonate, until the product is neutral and dissolves in water to a clear solution, 12·5—13 kilos. of calcined sodium carbonate being required. The sodium salt of the sulphonic acid is heated in a boiler with indirect steam. Water vapour is evolved at first, and when this ceases, the mass is heated further to 130° C. After cooling, the product forms a viscous, clear, neutral oil, which with water forms a solution, clear at first, but becoming turbid later ; the solution lathers well. The product is also soluble in petroleum spirit, benzene, ether, etc., and in mineral and fatty oils.—A. S.

Soaps ; Preparation of medicated ——. O. Schmatolla. Ger. Pat. 197,226, July 3, 1907.

Fatty acids are used first for extracting the active constituents of drugs and then for the preparation of soaps by treatment with alkalis. For example, 100 parts of crushed *Cannabis indica* are warmed with 500 parts of the fatty acids from olive oil, and then the temperature is raised, and 10 parts of potassium hydroxide solution of 40° B. added gradually. The mixture is digested and agitated for 2 hours, with the aid of moderate heat, and is then pressed. The liquid portion is clarified by passing through a steam-filter, and worked up into a soft soap by means of potassium hydroxide solution of 20° B.—A. S.

Disinfection. Ger. Pat. 195,612. *See* XVIIIC.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(A.)—PIGMENTS, PAINTS.

Zinc white and white lead ; Comparative study of ——. Bull. Soc. d'Encouragement, 1908, **110**, 516—522.

The Commission appointed by the "Soc. de Médicine publique et de Génie sanitaire" to make comparative experiments with zinc white and white lead paints, have made observations, over a period of five years, of exterior paintwork in the two pigments, and report that from the technical point of view there is no disadvantage in substituting zinc white for white lead, and that this substitution is desirable from the hygienic standpoint.—A. T. L.

Patents.

Lampblack ; Manufacture of ——, and apparatus therefor. A. Wegelin, A.-G. für Russfabr. und Chem. Ind. and G. Wegelin, Kalscheuren, Germany. Eng. Pat. 28,189, Dec. 21, 1907.

In order to prevent superheating, and consequent coking at the surface, the tar or other carbonaceous liquid used in the manufacture of lampblack, according to the process described in Eng. Pat. 13,837 of 1903 (this J., 1903, 1190), and which is contained in a vessel beneath the combustion chamber, is circulated in the vessel by means of a centrifugal or other convenient pump, which withdraws liquid through a sieve from the bottom of the vessel and delivers it near the level of the liquid. The liquid is distilled exclusively by the radiant heat of the flame in the combustion chamber.—E. W. L.

Paint-remover and process of making the same. F. X. Govers, Owego, N.Y. U.S. Pat. 885,151, April 21, 1908.

Claim is made for a mixture of a phenol ester with a mineral salt, a volatile solvent, a proteid, and wax. Or the preparation may be the product of the action of a strong mineral acid upon a mixture of a phenol with an alkaline-earth salt or other salt of a fatty acid or other organic acid.—C. A. M.

Pigments. J. C. Heckman, Avalon, Pa., Assignor to W. J. Gilmore, Pittsburg, Pa. U.S. Pats. 887,042 and 887,043, May 5, 1908.

(1). A new pigment is obtained by treating furnace flue dust with a mineral acid, such as sulphuric acid, and subjecting the product to calcination. (2). "Coal mine sulphur" is treated with a mineral acid, such as sulphuric acid, and then calcined ; or the preliminary acid treatment may be omitted. The product is claimed as a pigment.—F. Sodn.

Water-colour for ceilings and the like. A. C. Anderson, Copenhagen. U.S. Pat. 887,452, May 12, 1908.

See Eng. Pat. 25,181 of 1907 ; this J., 1908, 511.—T. F. B.

Pigments containing zinc sulphide ; Manufacture of —— not affected by light. K. Albert. Fr. Pat. 385,096, Dec. 16, 1907. Under Int. Conv., Dec. 31, 1906.

Pure zinc sulphide is not acted upon by light, but when heated to redness, especially in the presence of sodium chloride, compounds are formed which alter on exposure to light, and which cannot be removed by washing with water. This may be obviated by adding to the zinc sulphide, before or during heating, sulphides, polysulphides, or hydrosulphides of alkalis or alkaline-earths, or substances that yield sulphides or polysulphides on heating, and subsequently removing all soluble substances by treatment with water.—C. A. M.

Composition or paint for the exterior of ships. P. Horn. Fr. Pat. 385,153, Dec. 18, 1907. Under Int. Conv., Dec. 28, 1906.

Condensation products of phenols and aldehydes (*e.g.*, that obtained by heating phenol with formaldehyde solution in the presence of hydrochloric acid) are incorporated with the paint. Such products being insoluble, the paint, unlike those containing metallic substances, &c., retains its toxic properties for a long period.—C. A. M.

(*B.*)—RESINS, VARNISHES.

Shellac ; A method of analysing ——. P. C. McIlhiney. J. Amer. Chem. Soc. 1908, **30**, 867—872.

The method is based upon the fact that when a solution of a mixture of rosin and shellac in absolute alcohol or glacial acetic acid is mixed with petroleum spirit, and water then added, separation takes place into two layers, the petroleum spirit carrying with it the rosin and the "wax" of the shellac, and leaving the resinous constituents of the shellac in the other layer. Two grms. of the sample are dissolved in 20 c.c. of glacial acetic acid or absolute alcohol, and the cooled solution treated, little by little, with 100 to 300 c.c. of petroleum spirit boiling below 80° C., and then with 100 c.c. of water, added drop by drop, with constant agitation. The petroleum spirit layer, which soon separates, is washed with water, filtered into a weighed flask and evaporated, and the residue of rosin mixed with "wax" weighed, dissolved in neutral alcohol, and titrated with *N*/5 or *N*/10 potassium hydroxide solution, so as to obtain the proportion of rosin (average combining value, 346). Or a preferable course is to separate the rosin by adding first an excess of alkali to the alcoholic solution, and then petroleum spirit, and to shake the mixture in a separating funnel with some water. The petroleum spirit layer is washed with water, the extraction of the alcoholic layer repeated, the united petroleum spirit extracts evaporated, and the residue of "wax" weighed. The alcoholic layer is then boiled in a weighed flask until free from alcohol, the rosin precipitated with dilute hydrochloric acid, and washed with water partly in the flask and partly on a filter. The particles on the filter are dissolved by means of petroleum spirit and reintroduced into the flask, the solvent evaporated, and the residue weighed. If a determination of the rosin only in a sample of shellac is required, the best method is to treat the petroleum spirit solution of the "wax" and rosin with a solution of sodium hydroxide prepared by dissolving sodium in 95 per cent. alcohol. The alkali combines with the rosin, which may then be extracted by shaking the solution with water, or better, slightly diluted alcohol. The "wax" may be separated from the shellac by two different methods in commercial practice, *viz.*, by filtering off the substance insoluble in alcohol or by filtration of an alkaline solution of the shellac, and these residues will probably differ in composition. The author, therefore, prefers to regard as "wax," the insoluble matter from an alkaline solution. He states that some constituent of shellac "wax" dissolves with difficulty in petroleum spirit, so that an increasing percentage of "wax" may be separated by increasing the proportion of solvent, until it amounts to 125 to 150 c.c. to 1 grm. of shellac containing about 5 per cent. of "wax." Pure shellac treated by the above-described process may yield a small amount (up to 1 per cent.) of resinous substances soluble in petroleum spirit. These are quite distinct from ordinary rosin, having a characteristic odour and low iodine value. With regard to the behaviour of other resins sometimes added to shellac, the following particulars are given :—Two samples of manila copal gave 41·2 and 43·3 per cent. respectively of substances soluble in petroleum spirit, and 411·7 mgrms. of the first of these and 470·7 mgrms. of the second neutralised 1 c.c. of *N*/1 alkali. Kauri resins yielded (1) 37·9 per cent. and (2) 27·0 per cent., the respective neutralisation values being 903·6 and 742·5 mgrms. Two samples of sandarac resin gave 34·9 and 36·19 per cent. of substances having neutralisation values of 541·2 and 552 mgrms. respectively. Dammar resin gave 89·9 per cent., and the resin of *Shorea roburta*, 69·5 per cent. of soluble matter respectively.—C. A. M.

Pinus serotina ; Essential oil of ——. C. H. Herty and W. S. Dickson. *See* XX.

Patent.

Turpentine or pine oils ; Method of subjecting —— to the action of light and air. Chem.-Werke Fürstenwalde B. Hecker and W. Zeidler. Ger. Pat. 196,907, Sept. 25, 1906.

The oils are subjected to the action of light and air whilst in a finely-divided condition, *e.g.*, after being forced through a spraying device.—A. S.

(*C.*)—INDIA-RUBBER, &c.

Rubber of Ficus elastica from India. Bull. Imp. Inst., 1908, **6**, 22—24.

Four samples of *Ficus elastica* rubber were examined, *viz.*, specimens of "tree rubber" and "mat rubber" from Assam, and "scrap rubber" and "biscuit rubber" from Madras. The results of chemical examination were as follows :—

	From Assam.		From Madras.	
	Tree rubber.	Mat rubber.	Scrap rubber.	Biscuit rubber.
	Per cent.	Per cent.	Per cent.	Per cent.
Moisture	0·7	2·1	0·9	4·0
Caoutchouc	78·0	80·0*	67·3	71·2
Resin	19·0	16·0	28·1	22·7
Proteids	0·9	—	0·9	1·0
Insol. matter	1·4	1·9	2·8	1·1
Ash.................	0·49	1·94	0·47	1·68

* Including proteids.

The "tree rubber" contained rather a high proportion of resin, but was valued at 4s. 3d. to 4s. 6d. per lb. in London as compared with 5s. 2d. for fine hard Para rubber. The "mat rubber" was weak and sticky, and worth only 2s. to 2s. 3d. per lb. in London. The "scrap rubber" and "biscuit rubber" were valued at 2s. 11d. and 2s. 5d. per lb. respectively in London as compared with 3s. 5½d. per lb. for fine hard Para rubber.—A. S.

Rubbers from the Gola forest, Sierra Leone. Bull. Imp. Inst., 1908, **6**, 24—27.

The chemical examination and commercial value (as compared with fine hard Para rubber at 5s. 2d. per lb.) of five samples of rubber from the Gola Forest, Sierra Leone, are given in the following table :—

Source.	Forest near Manina.	Bandi country.	Forest near Bobabu.	Morro River.	Tunkia forest.
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Moisture ...	10·3	20·1	11·3	14·2	4·4
Caoutchouc	66·7	67·4	77·6	62·0	81·5
Resin	11·8	4·5	5·3	21·3	5·0
Proteids ...	5·4	0·9	1·4	1·0	1·1
Insol. matter	5·8	7·1	4·4	1·5	8·0
Ash........	2·25	0·89	1·57	0·57	1·16
Value, per lb.	4s.	2s. to 2s.3d.	4s.	3s.	4s.

—A. S.

Patents.

India-rubber products ; Manufacture of ——. O. Lugo, New York. Eng. Pat. 10,008, April 30, 1907.

A rubber mixture is made by dissolving rubber in an oxidized vegetable oil at a temperature of 360°—400° F. Finely-powdered potassium permanganate, 2 parts, and linseed oil, 48 parts, are heated and stirred at 360°—400° F. until a sample is found on cooling to set nearly solid. Rubber ("shoddy") 50 parts, is now added, and the mass stirred until it is nearly solid, the temperature being maintained at 360°—400° F. Sulphur is added to produce a harder material.—J. W. H.

Caoutchouc ; Manufacture of solutions of ——. E. Fischer, Berlin. Eng. Pat. 1254, Jan. 18, 1908. Under Int. Conv., Jan. 19, 1907.

The advantages of symmetrical dichlorethylene (Eng. Pat. 19,568 of 1904 ; this J., 1905, 902) over other liquids, as a solvent for the preparation of rubber solutions, depend upon (1), its more rapid solvent action ; (2), its low boiling-point (55° C.) ; (3), its non-inflammable nature ; and (4), its low specific gravity. For example, the amounts dissolved on subjecting 10 grms. of each of two kinds of rubber to the action of 250 c.c. of each of the solvents named for 24 hours, with frequent shaking, were as follows :—

Solvent.	Sp. gr.	Amount dissolved, per cent.	
		Para.	Borneo.
Dichlorethylene	1·2694	99·5	95·9
Tetrachlorethane	1·588	75·6	46·4
Chloroform	1·494	74·9	56·8

The manufacture of such solutions in dichlorethylene is claimed under the patent.—E. W. L.

Elastic mass resembling caoutchouc ; Manufacture of ——. B. Sauton. Fr. Pat. 385,019, Feb. 22, 1907.

The viscous mass obtained by heating a mixture of glycerin and gelatin or other albuminoid substance is treated with linseed or other drying oil, with or without the addition of resins, pitches, hydrocarbons, etc., the product being subsequently treated with formalin or similar substance (trioxymethylene) and, if desired, with powdered metallic oxides. The linseed oil may be previously incorporated with sulphur or a sulphur compound, and the final mixture heated for at least an hour at 150° C. to vulcanise the oil. Claim is also made for an addition of textile material, preferably consisting of short fibres.—C. A. M.

XIV.—TANNING, LEATHER, GLUE, SIZE.

Tanning ; Critical review on and experimental contributions to the theory of the process of ——. E. Stiasny. Collegium, 1908, 117—161.

An elaboration of a previously published article on the theory of tanning (see this J., 1908, 413).—H. G. B.

Tannage ; A new method of ——. L. Meunier and A. Seyewetz. Compt. rend., 1908, **146**, 987—989.

Hydroquinone (quinol) is shown to be incapable of tanning hide substance without the presence of air and conditions favourable to oxidation. In the presence of alkalis and oxygen, however, the hide fibre takes a faint rose, violet rose, violet, and brown colour successively, and is rendered insoluble and resistant to the action of boiling water. If quinone be used in place of hydroquinone, the same colour changes are observed, and the skin is tanned equally well. Only one per cent. of quinone is needed on the weight of the pelt. If the skin be in an alkaline condition, the tannage is rapid ; if it be in an acid condition, the tanning action is very slow or absent. The presence of borax also prevents all action. The residual liquor, after tannage, yields a considerable amount of hydroquinone when extracted with ether. Part of the quinone used, therefore, is reduced to hydroquinone in the tannage. The action of quinone on aniline is compared, in which hydroquinone is formed together with mono- and dianilinoquinones, the amino group being partially oxidised. Similar reactions are thought to occur with the amino groups of gelatin. Quinone-tanned leather dyes well with acid, basic, and natural dyestuffs.—H. G. B.

Patents.

Tannage of skins ; Use of the oxidation-products of phenols, especially quinones, for the ——. A. Seyewetz and L. Meunier. Fr. Pat. 385,057, Feb. 25, 1907.

Phenols and their derivatives (except tannins) are employed for tanning in conditions favourable to their oxidation, *e.g.*, hydroquinone (quinol) in alkaline solution. Products of oxidation of the phenols, *e.g.*, quinones are also similarly used, the tanning matters being in each case gradually added to the pelt, after placing in a vat with a suitable quantity of water. The tannage is hastened by agitation, and the leather is afterwards washed, "sammed," and fat-liquored. The patent covers the use of these materials in conjunction with other known tanning materials, and the application of the leathers made by the process. (See also preceding abstract). —H. G. B.

Unhairing agents. E. Kantorowicz. Ger. Pat. 196,617, May 23, 1907.

Mixtures of sulphides with peroxides or per-salts, such as barium, calcium, sodium, magnesium, and zinc peroxides, or perborates, percarbonates, etc., are used as unhairing agents.—A. S.

Hides; Process for preparing [bating] —— in the manufacture of leather. O. Röhm, Esslingen, Germany Eng. Pat. 5377, Mar. 10, 1908. Under Int. Conv., June 6, 1907.

The hides are treated with a liquid prepared by extracting a pancreas of about 250 grms. weight with 1 litre of water and adding 10 c.c. of this extract to 990 c.c. of a solution containing 0·15 per cent. of ammonium hydrosulphide and 0·3 per cent. of sodium chloride. The liquid serves as a substitute for the dog-manure usually employed.—W. P. S.

Hides; Preparation of —— for the manufacture of leather. O. Röhm, Esslingen, Germany. U.S. Pat. 886,411, May 5, 1908.

See Eng. Pat. 5377 of 1908; preceding.—T. F. B.

Leather prepared with coloured extracts; Decolorisation of ——. Badische Anilin und Soda Fabrik. Ger. Pat. 193,074, March 7, 1906.

Leather which has been prepared with coloured extracts, can be easily decolorised by means of hydrosulphites at the ordinary temperature or with the aid of moderate heat.—A. S.

Leather substitutes. R. Weeber, Vienna. Eng. Pat. 15,253, July 2, 1907.

In the usual processes for the manufacture of leather substitutes from vegetable or other fibrous material and cementing agents such as balata, rubber, or gutta-percha, the benzine or other solvent used is allowed to evaporate from the mass, after it has been thoroughly amalgamated. The improvement now proposed consists in precipitating the balata, rubber or gutta-percha in and on the fibre, by the addition of such precipitants as acetone, alcohol, and methyl alcohol, thus obtaining a more complete impregnation of the mass by the binding agent, while at the same time, the recovery of the solvent is facilitated. —E. W. L.

Tanning materials; Continuous extraction of ——. G. F. Bögel. Ger. Pat. 195,245, Sept. 2, 1906.

The crude tanning material and the extracting liquid pass through a series of upright extraction vessels in opposite directions, the tanning material being conveyed through the vessels by means of screws, and the liquid passing from one vessel to the next by means of overflow pipes and injectors. At either end of the system is a centrifugal machine: in one, the extract is freed from fibrous matter and dirt, whilst in the other, the spent tanning material is dried and rendered suitable for use as fuel. —A. S.

Tanning materials in the form of fine powders; Extraction of ——. F. Heckmann and A. F. Diehl. Ger. Pat. 195,144, Sept. 4, 1906.

The extraction is performed in a closed vessel in which the material and the extracting liquid circulate continuously. The material is conveyed upwards from the bottom of the vessel to the top by means of a screw, and then falls downwards in the annular space surrounding the casing in which the screw works. The extracting liquid is withdrawn through the perforated bottom of the vessel, and re-introduced at the top. Between the perforated bottom of the vessel and the lower end of the screw-conveyor, there is a stirring device, and a distributor is mounted at the upper end of the annular space surrounding the casing in which the screw works.—A. S.

Catgut thread; Sterilised ——. H. Schmidt, Baden, Germany. U.S. Pat. 887,130, May 12, 1908.

See Eng. Pat. 7825 of 1906; this J., 1906, 770.—T. F. B.

Phosphorescent gelatin and its manufacture. J. Veyrier and E. Dannhauser. Fr. Pat. 385,253, March 6, 1907.

Phosphorescent substances are applied to sheets of gelatin or other suitable material. The phosphorescent matters are either sprinkled in a powdered form over the gelatin sheets, or are dissolved, and the solution spread over the sheets. They may also be incorporated in a solution of gelatin.—H. G. B.

XV.—MANURES, &c.

Acid soils; Nitrification in ——. A. D. Hall, N. H. J. Miller, and C. T. Gimingham. Proc. Roy. Soc., 1908, **80**, B., 196—212.

Nitrification is greatly reduced, and the nitrifying bacteria are only found sparingly, in the soil of certain of the permanent grass plots at Rothamsted which have received the same manurial treatment—ammonium chloride and sulphate—since 1856, and which are distinctly acid. In bulk, despite the acidity of the soil, it is found that nitrification still goes on slowly. Water extracts of the soil will not permit of nitrification unless they are previously neutralised. Experiments on the nature and extent of the acidity showed that it is chiefly due to sparingly soluble humic acids. Free hydrochloric and sulphuric acids are also present, since the soil extract contains soluble acid in quantities comparable to the amount of chlorides and sulphates also present and to the ammonium sulphate and chloride annually supplied as manure. The amount of nitrate produced by the bacteria does not suffice for the nitrogen taken up by the crop, which must, in the main, utilise the ammonium salts without previous change. The acidity is due to various micro-fungi, which remove ammonia from a solution of its salts and set free the acids with which it was combined. The acidity attained in this way is equivalent to that of the soil water on the acid plots. The continuance of nitrification in these soils is attributed to the irregular distribution of the materials composing them; they still contain particles of calcium carbonate, each of which acts as a centre for the nitrification process. The decline in fertility of the acid plots is due to the repression of the normal soil bacteria and the encouragement of the growth of moulds.—E. F. A.

Soils; Süchting's improved method of determining the acidity of ——. A. J. van Schermbeek. J. prakt. Chem., 1908, **77**, 489—497.

The author criticises severely Süchting's method for determining the acidity of soils (this J., 1908, 171). In this modification of Tacke's method, the amount of carbonic acid in the soil is neglected, the formation of other acids in the soil is not prevented, and it is not the amount of acid in the soil which is estimated, but the quantity which accumulates in a mixture of finely-divided soil and calcium carbonate when stirred with a considerable amount of water.—J. C. C.

Bacteria as agents in the oxidation of amorphous carbon. M. C. Potter. *See* II.

Potash; Extraction of —— from felspathic rock. A. S Cushman and P. Hubbard. *See* VII.

XVI.—SUGAR, STARCH, GUM, &c.

Sugars; Volumetric determination of reducing ——. II. Limits of accuracy of the method under standard conditions. A. R. Ling and G. C. Jones. Analyst, 1908, **33**, 160—167.

In the first communication (see this J., 1905, 753) it was recommended that the concentration of the sugar solution should be so adjusted that 20—30 c.c. were required to reduce 10 c.c. of Fehling's solution. The authors have now studied the effect of concentration on reducing power, with a view to extending the range of concentration of solutions which can be directly titrated and increasing the accuracy of the method. An indicator of the following composition was found to give better results than that previously recommended (*loc. cit.*):—Ammonium thiocyanate, 1·5 grms.; ferrous ammonium sulphate, 1 grm.; concentrated hydrochloric acid, 2·5 c.c.; water, 10 c.c. On the basis of their results, the authors have compiled the following table:—

Volume of Solution required by 10 c.c. Fehling's Solution.	Dextrose.		Lævulose.		Invert Sugar.		Maltose.	
	Dextrose in 100 c.c. of Solution.	Fehling's Solution equivalent to 1 grm. Dextrose.	Lævulose in 100 c.c. of Solution.	Fehling's Solution equivalent to 1 grm. Lævulose.	Invert in 100 c.c. of Solution.	Fehling's Solution equivalent to 1 grm. Invert.	Maltose in 100 c.c. of Solution.	Fehling's Solution equivalent to 1 grm. Maltose.
C.c.	Gram.	C.c.	Gram.	C.c.	Gram.	C.c.	Gram.	C.c.
20	0·2427	206·0	—	—	—	—	—	—
21	0·2332	205·1	—	—	0·2412	197·5	0·3888	122·5
22	0·2226	204·2	0·2411	188·5	0·2311	196·8	0·3711	A constant.
23	0·2138	203·4	0·2312	188·0	0·2218	196·0	0·3550	
24	0·2056	202·6	0·2222	187·5	0·2132	195·5	0·3402	
25	0·1981	201·9	0·2138	178·1	0·2052	194·9	0·3266	
26	0·1911	201·3	0·2060	186·7	0·1980	194·3	0·3140	
27	0·1846	200·7	0·1988	186·3	0·1910	193·9	0·3023	
28	0·1784	200·1	0·1921	186·0	0·1846	193·4	0·2915	
29	0·1728	199·6	0·1857	185·6	0·1787	193·0	0·2815	
30	0·1675	199·1	0·1798	185·4	0·1731	192·5	0·2721	
31	0·1625	198·6	0·1743	185·1	0·1678	192·2	0·2633	
32	0·1577	198·2	0·1691	184·8	0·1629	191·8	0·2551	
33	0·1532	197·8	0·1642	184·6	0·1583	191·5	0·2474	
34	0·1490	197·4	0·1596	184·3	0·1359	191·2	0·2401	
35	0·1450	197·0	0·1552	184·1	0·1497	190·9	0·2332	
36	0·1412	196·7	0·1511	183·9	0·1458	190·6	0·2268	
37	0·1377	196·4	0·1472	183·6	0·1421	190·3	0·2206	
38	0·1343	196·0	0·1435	183·4	0·1385	190·1	0·2148	
39	0·1310	195·8	0·1399	183·3	0·1349	189·8	0·2093	
40	0·1279	195·5	0·1366	183·1	0·1319	189·6	0·2041	122·5
41	—	—	0·1334	182·9	0·1288	189·4	—	
42	—	—	0·1298	182·8	0·1259	189·2	—	
43	—	—	0·1274	182·6	—	—	—	

The values for the volume of Fehling's solution equivalent to 1 grm. of reducing sugar are employed in the separate determination of two reducing sugars in a mixture. It is a constant in the case of maltose, since the reducing power of this sugar is practically independent of the concentration between the limits of the experiments. Of the Fehling's solution used in the experiments, 10 c.c. were found to be equivalent to 25·65 c.c. of a 0·2 per cent. solution of invert sugar. In using the table, the invert sugar equivalent of the Fehling's solution employed, must of course be determined, and the tabulated values corrected if necessary. The authors show that the average error of the method is about 1 in 300, that with lævulose being the greatest (1 in 100), and they consider that the method is not only much more rapid but quite as accurate as the gravimetric one. In some cases it is desirable to use a less or greater quantity of Fehling's solution than 10 c.c.; the authors have shown that with constant concentration of sugar solution, the volume required is directly proportional to the volume (5—20 c.c.) of Fehling's solution employed.—L. E.

Beetroot; New investigations on the pectin substances of the ——; their influence on the analysis, and their removal in manufacture. J. Weisberg. Bull. Assoc. Chim. Sucr. et Dist., 1908, **25**, 902—912. (See this J., 1889, 206, 1898, 475.)

If beetroot pulp, freed from sugar, be heated with water on a water-bath, a neutral solution of dextrorotatory pectin substances is obtained; these pectins are completely precipitable by basic lead acetate. If, however, the pulp is boiled with water, the solution, neutral at first, becomes acid, a portion of the pectin being converted into lævorotatory metapectic acid, which is not precipitable by basic lead acetate; the amount of metapectic acid produced increases with the time of boiling. The author has shown that addition of too great an excess of basic lead acetate to beetroot pulp also causes the formation of lævorotatory metapectic acid; he concludes from his experiments, that in the analysis of beetroot pulp by hot, aqueous digestion, not more than 5·5—6·5 c.c. of basic lead acetate solution (of 25° B.) should be used for 26 grms. of pulp, and that the time of heating on the water-bath at 90° C. should not exceed three-quarters of an hour. In the analysis by cold aqueous digestion, too great an excess of basic lead acetate also causes a decrease of the polarimeter reading. Of the dextrorotatory pectin substances (pectin and parapectin) present in the beetroot, only a small proportion passes into the diffusion juice (it amounts to 0·10—0·12, reckoned as sucrose, per 100 c.c. of juice) under normal conditions of working, and the amount that remains in the carbonated juice is practically negligible. The author has shown that by heating diffusion juice with considerable excess of basic lead acetate on a water-bath, at 90°—95° C., for 15—30 minutes, the polarimeter reading of the juice is decreased somewhat, owing to conversion of the pectin into lævorotatory metapectic acid. Similar experiments with juice from the second carbonation, showed that heating with excess of basic lead acetate causes practically no decrease of the polarimeter reading, thus indicating, that at this stage of manufacture, practically all the pectin substances have been removed. The author considers that this method of detecting pectin in diffusion juice and the degree to which it has been removed from carbonated juice, is a very satisfactory one. The method of determining pectin in sugar juice, based on the determination of the pentosan (araban) which it contains (see this J., 1899, 525), gives inaccurate results, owing to the presence of sucrose and other organic substances.
—L. E.

Sugars; Volumetric determination of reducing ——. III. Determination of sucrose and invert sugar in mixtures. A. R. Ling and T. Rendle. Analyst, 1908, **33**, 167—170.

The authors have investigated the influence of sucrose in mixtures of this sugar and invert sugar on the determination of the latter by the method previously described (see this J., 1905, 753). Solutions containing 0·15, 0·2 and 0·25 grm. of invert sugar per 100 c.c. and varying quantities of sucrose were titrated against 10 c.c. of Fehling's solution, the difference between the real and apparent invert sugar-contents thus being determined. The influence of sucrose was found to be negligible, provided that its amount does not exceed 25—30 per cent. of the total sugars; if present in greater amount, however, a correction must be applied. The following table of corrections applies to solutions containing 0·2 per cent. of invert sugar:—

Percentage of sucrose in the sucrose-invert sugar mixture.	Amount to be deducted from percentage of invert sugar determined by direct titration.	Percentage of sucrose in the sucrose-invert sugar mixture.	Amount to be deducted from percentage of invert sugar determined by direct titration.
33·3	0·20	93·8	0·24
50 to 80	0·40	96·1	0·15
86·2	0·30	97·2	0·24
88·2	0·30	98·0	0·23
89·7	0·30	99·0	0·14
90·9	0·33	99·2	0·12
92·5	0·26	99·3	0·10

—L. E.

Alkalinity [of raw sugars]; Electrochemical determination of ——. A. E. Lange. Z. Ver. Deut. Zuckerind., 1908, 453—468.

The author has made experiments on the determination of alkali in raw sugar by two electrochemical methods. The first depends on the fact that when an acid or alkaline solution is neutralised, its electric conductivity decreases to a minimum at the neutral point, and increases again if this point is passed. The second method depends on the fact that the E.M.F. between hydrogen electrodes in acid solutions of different ionic concentrations, which increases of course when alkali is added to the weaker solution, increases most rapidly when this solution is in the neighbourhood of the neutral point. The experiments showed, however, that though both methods are applicable to acid or alkaline solutions of pure sucrose, neither can be used in the case of raw sugars owing to the impurities which these contain. Comparative experiments with various indicators showed that phenolphthalein gives results which agree most closely with those obtained by the electrical methods, and the author recommends this indicator for the determination of the alkalinity of raw sugar.—L. E.

Gums; Uses, properties, and production of ——. Bull. Imp. Inst., 1908, **6**, 29—60.

For the determination of the viscosity of a gum, which is one of the most important factors in determining the quality, the method adopted at the Imperial Institute consists in using a capillary tube, enlarged at one part of its length into a cylindrical bulb, along a definite length of which, including the bulb, a measured volume of the liquid is caused to flow by its own pressure, the time in seconds required for this being noted. The results of the chemical examination of some gums from the Sudan and from Senegal (from species of *Acacia*, chiefly *Acacia Senegal*), from Northern Nigeria (probably mainly from *Acacia Senegal*), and from India are given in a series of tables.—A. S.

Gum; Exports of —— *from Senegal.* Bull. Imp. Inst., 1908, **6**, 45. [T.R.]

Year.	To France.		To the United Kingdom.		Total.	
	Quantity in cwts.	Value in £.	Quantity in cwts.	Value in £.	Quantity in cwts.	Value in £.
1897	96,800	188,860	—	—	96,800	188,860
1898	101,040	169,140	2,160	5,806	106,440	178,650
1899	82,980	140,876	—	—	82,980	140,876
1900	49,000	92,682	180	385	49,360	93,440
1901	62,980	116,438	—	—	62,980	116,438
1902	61,740	65,880	—	—	61,740	65,880
1903	42,526	39,173	242	197	43,261	39,871
1904	45,306	43,496	1,313	1,314	46,652	44,835
1905	49,482	50,776	—	—	49,482	50,776

The exports in 1904 and 1905 are for Senegal, Upper Senegal and Nigeria.

Gum arabic; Imports of —— *into the United Kingdom from France.* Bull. Imp. Inst., 1908, **6**, 47. [T.R.]

Year.	Quantity in cwts.	Value in £.	Average price per cwt.
			£
1897	7,000	18,844	2·69
1898	11,140	30,915	2·77
1899	16,990	45,372	2·67
1900	15,815	43,899	2·77
1901	10,754	24,844	2·31
1902	7,023	14,750	2·10
1903	10,774	18,105	1·68
1904	4,378	7,441	1·70
1905	7,360	11,879	1·61
1906	11,770	20,096	1·70

A considerable quantity of Senegal gum is now used in Germany, and the statement has been made that much of it is sold as Kordofan gum in that country.

Gum arabic; Exports of —— *from Northern Nigeria.* Bull. Imp. Inst., 1908, **6**, 48. [T.R.]

Year.	Quantity in cwts.	Value in £.	Average price per cwt.
			£ s. d.
1900	1,821	1,563	0 17 4
1901	4,041	3,448	0 17 0
1902	4,000	3,410	0 17 0
1905	4,140	3,728	0 18 0
1906	6,080	6,080	1 0 0

Gum arabic; Imports of —— *from Northern Nigeria into the United Kingdom. Ibid.*

Year.	Quantity in cwts.	Value in £.	Average price per cwt.
			£ s. d.
1897	166	401	2 8 3
1898	909	1,818	2 0 0
1899	55	110	2 0 0
1900	1,656	3,312	2 0 0
1901	2,416	4,417	1 16 6
1902	3,773	7,502	1 19 9
1903	2,833	3,116	1 2 0
1904	3,130	2,992	0 19 1
1905	4,041	4,849	1 4 0
1906	5,379	5,913	1 1 11

Gum arabic; Imports of —— *into the United Kingdom from Morocco.* Bull. Imp. Inst., 1908, **6**, 49. [T.R.]

Year.	Quantity in cwts.	Value in £.	Average price per cwt.
			£
1899	422	833	1·97
1900	402	939	2·33
1901	796	2,025	2·5
1902	637	1,410	2·21
1903	1,451	3,666	2·52
1904	1,201	3,019	2·51
1905	1,731	3,861	2·23
1906	2,073	4,142	1·99

Gum arabic (Ghati gum); Exports of —— *from India.* Bull. Imp. Inst., 1908, **6**, 55. [T.R.]

The following table shows the quantities and values of Indian gum arabic (Ghati gum) exported in recent years.

Year.	Quantity in cwts.	Value in rupees.	Value in £.	Average price per cwt
				£ s. d.
1899–00 .	46,254	7,70,947	51,396	1 2 3
1900–1 ..	37,553	6,99,883	46,659	1 4 10
1901–2 ..	55,941	7,54,719	50,315	0 18 0
1902–3 ..	38,019	4,54,639	30,309	0 15 11
1903–4 ..	39,760	5,02,486	33,499	0 16 10
1904–5 ..	28,377	4,34,604	28,974	1 0 5

The principal markets for Ghati gum in order of their importance are Germany, the United Kingdom, Belgium, and France; the imports into the last-mentioned country have risen steadily from 2,322 cwts. in 1900-1 to 4,279 cwts. in 1902-3.

Wattle gum; Imports of —— into the United Kingdom. Bull. Imp. Inst., 1908, **6**, 57. [T.R.]

Year.	Quantity in cwts.	Value in £.	Average price per cwt.
			£ s. d.
1897	1,063	1,667	1 11 4
1898	2,150	3,368	1 11 4
1899	2,186	2,593	1 3 8
1900	1,192	1,668	1 7 11
1901	620	815	1 6 3
1902	248	300	1 4 2
1903	263	379	1 8 10
1904	91	119	1 6 2
1905	97	112	1 3 1

Gum tragacanth; Exports of —— from Smyrna. Bull. Imp. Inst., 1908, **6**, 58. [T.R.]

Year.	Cwt.	Value in £.
1901	1,660	4,046
1902	3,000	9,577
1903	2,600	6,237
1904	2,300	5,104

Gum; Exports of —— from Basra. Bull. Imp. Inst., 1908, **6**, 59. [T.R.]

Year.	Packages (about 2 cwts. each).	Value in £.
1901	5,593	22,372
1902	6,098	24,392
1903	6,537	26,148
1904	7,683	30,732
1905	7,679	30,716

Patents.

Molasses; Process for the removal of potassium compounds from ——, and utilisation of the molasses so treated. L. Rivière. Fr. Pat. 385,139, Feb. 28, 1907.

The molasses is treated with the vapours of hydrofluosilicic acid produced by the action of sulphuric acid on fluorspar, or alkali fluosilicates, in the presence of silica. A number of vessels are employed for the preparation of the acid, so that some may be in operation while others are being re-charged. The precipitate, consisting of potassium or sodium fluosilicate, formed in the molasses, is removed and may be used for the production of a further supply of hydrofluosilicic acid (see this J., 1907, 936). The molasses thus treated, or the sugar obtained from it, may be employed for the production of alcohol, for the manufacture of molasses feeding cakes (in this case excess of hydrofluosilicic acid must not be used), and other food products. The alkali sulphates produced in the preparation of the hydrofluosilicic acid are converted into carbonates, and ammonia, glycerol, etc., may be recovered from the liquid left after distilling the alcohol. —W. P. S.

Gums of certain Sapotaceæ; Substance produced from the ——. M. M. Dessau, Merton. U.S. Pat. 886,482, May 5, 1908.

See Fr. Pat. 367,472 of 1906; this J., 1906, 1161.—T. F. B.

XVII.—BREWING, WINES, SPIRITS, &c.

Expressed yeast juice; Action of the electric current on ——. F. Resenscheck. Biochem. Zeits., 1908, **9**, 255—263.

An electric current of 0·042 ampère at 110 volts was passed, between platinum electrodes, through a quantity of Buchner's expressed yeast juice, contained in a U-tube, the connecting limb of which had been replaced by a piece of rubber tubing provided with a screw-clamp. During the passage of the current, the U-tube was surrounded by ice-water, and the temperature never rose above 6° C. A moderate evolution of hydrogen (at the cathode) and oxygen (at the anode) was observed, the amount of gas evolved being greater at the negative than at the positive electrode. Considerable quantities of proteid substances separated in the coagulated condition at both electrodes, the total amount thus separated varying from 3 to 5 grms. per 100 c.c. of yeast juice, according to the duration of the experiment; this coagulated proteid matter possessed no fermenting power. In experiments lasting for periods ranging from 1 to 3½ hours, it was found that invariably the cathode liquid showed a small increase, and the anode liquid a small decrease, of fermenting power. This may be due to the electrolytic dissociation of salts contained in the yeast juice, which would result in an increase of the concentration of basic ions at the cathode, and hence, as Buchner showed in 1897, an increase in the fermenting power of the juice. Attempts to obtain more pronounced effects by prolonging the electrolysis to 6 hours were not successful, both the cathode liquid and the anode liquid showing a considerable reduction of fermenting power. Addition of disodium phosphate to the yeast juice before electrolysis also had no favourable effect: the cathode liquid showed no increase of fermenting power, whilst the anode liquid showed a considerable decrease. Experiments with boiled yeast juice (see Harden and Young, this J., 1906, 490, 1111) showed that on subjecting this to electrolysis, its fermenting power was considerably diminished, both in the cathode and anode portions. The cathode portion of the electrolysed boiled juice, when added to expressed yeast juice, however, caused a greater increase of fermenting power than did an addition of the anode portion. Portions of boiled yeast juice were also precipitated by colloidal solutions of opposite electrical charges, *viz.*, ferric hydroxide and antimony trisulphide solutions respectively. The former produced considerable quantities of a flocculent precipitate, but the latter precipitated only traces of a fine reddish powder. In both cases the treated juice caused a smaller increase of the fermenting power of expressed yeast juice than did untreated boiled juice; the difference was smaller in the case of the juice which had been treated with antimony sulphide.—A. S.

Diastase preparations; Method for the routine valuation of ——. W. A. Johnson. J. Amer. Chem. Soc., 1908, **30**, 798—805.

A standard starch paste is prepared from potato starch which has been purified by washing with water, and dried firstly for three hours in a current of air, and subsequently for four hours at 80° C., so as to contain 90 per cent. of anhydrous starch. 22·22 grms. of this starch (= 20 grms. of anhydrous starch) are mixed with 100 c.c. of cold water, and the mixture poured into 800 c.c. of boiling water, boiled for 10 minutes, and made up to 1000 grms. In each test 50 grms. of the paste are used in 250 c.c. flasks clamped in a water-bath kept at 40° C., and 10 minutes is fixed as the time of action. In the case of liquid malt extracts, about 10 c.c. diluted to 100 c.c. are used, whilst 200 to 500 mgrms. of dry preparations in 100 c.c. of water are usually suitable quantities. Definite quantities of these dilute liquids (say 1 c.c. to 6 c.c.) are added to the flasks containing the starch paste, and after about 8 minutes, a few drops are tested with iodine solution (2 grms. of iodine and 4 grms. of potassium iodide in 250 c.c.). The test is repeated with 100 c.c. of starch paste in the different flasks, just as in Lintner's method of determining diastatic activity, new limits being found between which the real value must lie, and in every case the disappearance of all colour is taken as the end-point. In expressing the results in starch-converting power, allowance should be made for the fact that the statements of the manufacturers appear to be based upon results obtained with commercial starch, which contains about 15 per cent. of water. A table is appended of the results given by commercial samples. —C. A. M.

Brewing waters; Influence of —— on extract. E. Moufang. Z. ges. Brauw., 1908, **31**, 190—192, 197—202.

The author has determined the influence exerted on the extract of a malt by varying proportions of a number of different salts and acids in solution in the water employed. The principal salts occurring in brewing waters are classified as: (1), alkaline salts, such as sodium carbonate, sodium bicarbonate, magnesium carbonate, calcium carbonate, etc.; and (2), neutral salts, such as calcium and magnesium sulphates, sodium chloride, etc. The extract of a malt is diminished by alkaline salts to an extent increasing with the concentration of the salt and with its alkalinity. A gradual increase in the extract is observed with neutral salt solutions of increasing concentration, but such increase is only apparent and is due to the increased specific gravity of the mashing liquor employed; the amount of extract going into solution is not increased. Acids, such as lactic and sulphuric acids, and acid salts, such as potassium bisulphate, acid phosphates, etc., produce a real increase in the amount of extract dissolved; with lactic acid, the extract seems to reach a maximum when the solution contains about 0·8 grm. of the acid per litre. The colour, saccharification, running-off, brilliancy, and stability are generally influenced unfavourably by alkaline salts but not by neutral or acid salts or acids. The apparently higher extracts obtained by Eckardt's process are explained by the higher salt-content of the water.—T. H. P.

Butyric acid fermentation. E. Buchner and J. Meisenheimer. Ber., 1908, **41**, 1410—1419.

The authors have fermented glycerin and dextrose in presence of inorganic nutrient salts and calcium carbonate with *B. butylicus*. In both instances qualitatively the same products were obtained, *viz.*, normal butyl alcohol, ethyl alcohol, normal butyric, acetic, formic and lactic acids, carbon dioxide, and hydrogen. The quantitative relationships of these were as follows:—

	n-Butyl alcohol.	Ethyl alcohol.	Carbon dioxide.	Hydrogen.	Formic acid.	*n*-Butyric acid.	Acetic acid.	Lactic acid.
100 grms. of glycerin	19·6	10·4	42·1	1·9	4·0	0·7	1·0	3·4
100 grms. of dextrose	0·7	2·8	48·1	1·6	3·4	26·0	7·5	10·0

After allowing for the carbon dioxide liberated by the action of the acids on calcium carbonate, and calculating on the basis of the carbon content, the fermentation products isolated correspond in the case of glycerin to 83 per cent., and in that of dextrose to 85 per cent. of the fermented material. In both cases whether from the 3-carbon chain glycerin or the 6-carbon chain dextrose, a 4-carbon chain compound is the chief product. That this is an alcohol in the case of glycerin and an acid in that of dextrose must be attributed to the higher percentage of hydrogen in the former. It is considered that in both cases lactic acid is the first product: this is converted into acetic aldehyde and formic acid, and the aldehyde condenses to aldol. This aldol either undergoes rearrangement to butyric acid or loses water forming crotonic aldehyde, which, on reduction, yields butyric aldehyde or normal butyl alcohol. The ethyl alcohol is formed in the same way as during yeast fermentation. This theory has the following advantages. The decomposition of glycerin and of dextrose are attributed to the same mechanism, namely the fermentation of lactic acid, the formation of which from glycerin is not improbable. It also explains the varying relative proportions of lactic and butyric acids formed in different fermentations as noted by former observers. Formic acid is a direct product of the fermentation: on further action, it forms carbon dioxide and hydrogen, which latter reduces acetaldehyde to ethyl alcohol. It is suggested that an extension of the aldol condensation will give rise to the formation of such fats as palmitic and stearic acids from sugar. The paper contains full details as to the experimental methods of analysis adopted.—E. F. A.

Paraffin wax in the brewery; Employment of ——. Wenglein. Z. ges. Brauw., 1908, **31**, 209—211.

C. Henrich recommends the use of paraffin wax for coating the interior of fermenting vats, storage and transport casks, etc., in preference to pitch or varnish, on the grounds that it is more durable, more easily and cheaply applied, and that it impregnates the wood more thoroughly. Moreover, paraffin wax is not affected by contact with strong disinfectants. Cement vats as well as wooden ones, buckets and other wood utensils, bungs, and corks, should also be treated with wax. The wax employed should be quite white, odourless, tasteless, and free from acid, and should give no coloration on heating with sulphuric acid and water; its melting point should be above 60° C. (the higher, the better), and in the process of impregnation, it should not be heated beyond about 160° C., or at most, 180° C.—L. E.

Alcohol [denatured]; Action of —— on metals. Boulanger. 2nd Congress on utilisation of denatured spirit. Z. Spiritusind., 1908, **31**, 225.

In the cold, neither the alcohol, the denaturing agent, nor the carburising agent have any action on the metals used in the construction of automobiles. Isolated cases in which an attack on phosphor-bronze has been recorded are explained by the high ester contents (ethyl and amyl acetates) of the spirit used. At high temperatures the conditions are somewhat different. In a few cases the clogging of the admission valve by a tarry deposit has been observed; sometimes this tar decomposes at higher temperatures leaving a brown dusty residue. With good vaporisation this trouble is not observed. The catalytic decomposition of the alcohol vapour by contact with the hot metal surfaces, with the formation of acid products, as observed by Trillat, can scarcely happen in the motor, because the lubrication of the cylinder prevents the direct contact of alcohol vapour with metal; consequently aldehyde and acetic acid are only formed in quite insignificant quantities. In order to prevent damage by the acid condensation water, the cylinder should be greased after the motor has been in use. No other injurious substances are present, either in the spirit or in the carburising agent.—J. F. B.

Spirit; Cost of denatured—in France. Blondel. 2nd Congress on utilisation of denatured spirit. Z. Spiritusind., 1908, **31**, 225—226.

A history of the laws governing the denaturation of spirit, dating from 1814, is given. In the following table the cost of denatured spirit, according to the modifications introduced in 1902, is shown for various prices of raw spirit.

	Francs.	Francs.	Francs.	Francs.
Cost of raw spirit—				
100 litres of 90° alcohol	30·0	35·0	40·0	45·0
10 litres of wood spirit, 90°	8·5	8·5	8·5	8·5
0·5 litre of benzene ...	0·15	0·15	0·15	0·15
Analysis tax of 0·8 fr. per 100° alcohol	0·72	0·72	0·72	0·72
Manufacturing tax of 1·60 fr. per 100° alcohol ...	1·50	1·50	1·50	1·50
Statistical charge of 0·25 fr. per 100° alcohol	0·23	0·23	0·23	0·23
Cost of 110·5 litres of denatured spirit..........	41·10	46·10	51·10	56·10
Deduct rebate of 9 fr. per 100° alcohol	8·10	8·10	8·10	8·10
Net cost of 110·5 litres of spirit	33·0	38·0	43·0	48·0
100 litres of denatured spirits cost	29·864	34·389	38·913	43·438

—J. F. B.

Spirit ; Formation of by-products in the combustion of ——. M. Altmayer. 2nd Congress on utilisation of denatured spirit. Z. Spiritusind., 1908, 31, 225.

When vapours of alcohol are passed through a red-hot porcelain tube there are produced, in addition to carbon, aldehyde, naphthalene, benzene, phenol, carbon dioxide, acetic acid. hydrogen, methane, formaldehyde, ethylene, and water. A mixture of alcohol vapour and oxygen forms, in presence of platinum or other metals, water, carbon dioxide, and acetal, in consequence of incomplete combustion. The action is more intense the smaller the particles of the metal. Trillat has observed that the nature of the metal surfaces has a considerable influence on the formation of the by-products and their proportions. The presence of small quantities of water vapour depresses the ignition temperature of the mixture of alcohol and air, and thus influences the course of the oxidation and the proportions of aldehyde and acetic acid produced. Besides the various factors which influence the combustion of spirit in motors, such as the temperature of the mixture, the proportion of water vapour, and the pressure at the moment of explosion, the nature of the vaporiser also influences the composition and proportions of the by-products. Badly constructed vaporisers cause a large formation of by-products. Sorel has also stated that when alcohol is used alone in a motor, soot, aldehyde, and acids are produced owing to imperfect combustion. The production of these substances, which may cause corrosion of the motor, is to be attributed far more to a bad vaporisation than to the spirit itself. The production of aldehyde is said to neutralise the evil odours due to the combustion of the benzene by reason of its thiophene constituents. With good vaporisation and combustion, the use of alcohol produces nothing which can injure the motor.—J. F. B.

Denatured alcohol ; Industrial consumption of —— *in France.* 2nd Congress on utilisation of denatured spirit. Z. Spiritusind., 1908, 31, 325.

The total consumption of denatured spirit in France during 1906 amounted to 545,467 hectolitres, of which 374,506 hl. were used for heating and lighting, and 170,961 hl. for industrial purposes. For industrial alcohol, other denaturing agents may be used than those prescribed for burning purposes. In certain cases the addition of 15 litres of wood spirit to 100 litres of 90 per cent. alcohol is allowed. In other cases, where methyl alcohol might be objectionable, special denaturing agents are used, *e.g.*, the substance which it is intended to manufacture, or one of the raw materials used in such manufacture. The following list shows the number of litres of alcohol necessary for the manufacture of 1 kilo. of the various products:—Ether, 1·25 litres; antipyrine, 2·64 litres; mercury fulminate, 7·20 litres; caffeine, 15 litres; coumarin, 6 litres; chloral, 1·22 litres; calcium glycerophosphate, 7 litres. The consumption of alcohol in the collodion and artificial silk industry is very large. A single factory consumes ether and alcohol equivalent to 16,000 hl. of alcohol per annum for artificial silk and 1200 hl. for collodion. Denatured alcohol has been recommended for sterilising surgical instruments, but a suitable denaturing agent has not been found.—J. F. B.

Patents.

Grain and amylaceous materials ; Treatment of —— *previous to saccharification.* A. Boidin, Seclin, France. Eng. Pat. 19,633, Sept. 2, 1907.

Grain, such as crushed maize, is boiled with water during 10—40 minutes at a gradually increasing pressure up to 4 kilos. per sq. cm. This pressure is maintained for 5—20 minutes, so that the grain is thoroughly softened. The material is then discharged into another vessel in such a way that, in its passage through suitable discharging arrangements, it is allowed to expand suddenly, whereby the enclosed steam causes disintegration. It is necessary that the fall of pressure should be sufficient to cause the grain to burst; in most cases a fall of 2 kilos. per sq. cm. is sufficient. After the grain has burst, the disaggregated mass is subjected to a second cooking process, *e.g.*, at a pressure of 3—4 kilos. per sq. cm. which is maintained for 5—30 minutes, to complete the hydration of the starch. The product is then capable of uniform saccharification by malt, no starchy particles remaining in the grains and the residue being readily removable by means of a filter-press.—J. F. B.

Sugar ; Manufacture of —— *from starch substances.* M. Hoff, Zloczow, Austria. Eng. Pat. 214, Jan. 3, 1908.

See Ger. Pat. 197,468 of 1907; following.—T. F. B.

Starchy substances ; Saccharification of ——. B. Hoff, G. H. Zschiesche, and K. P. Schürer. Ger. Pat. 197,468, Dec. 28, 1906.

It has been found that *Oidium lactis* in presence of the smallest quantity of a saccharifying enzyme, such as malt diastase, converts starch rapidly and completely into dextrose. Potato pulp is boiled with a small quantity of water to form a stiff paste, cooled to 30° C., and infected with a pure culture of *Oidium lactis.* The whole is carefully mixed and exposed in thin layers at a temperature of 30°—35° C., for 12—18 hours, for the development of the fungus. The preparation is then, when mixed with malt or malt diastase, suitable for saccharifying potato pulp or other starchy materials for the preparation of distillery wash, starch syrup, or starch sugar. It is stated that by this method dextrose alone, with no appreciable quantities of dextrin and maltose are produced from the starch.—A. S.

Maize and ground cereals for the manufacture of alcohol ; Process and apparatus for cooking —— *at a low average pressure in a battery of boilers, in combination with sets of apparatus for saccharifying and cooling the wort.* F. Pampe. Fr. Pat. 385,266, Nov. 29, 1907.

The apparatus consists of a battery of boilers, four or six in number, in connection with two or three saccharifying and cooling vessels; the boilers and other parts of the plant are put into and out of operation successively, so that in each separate boiler there exists alternately a low and a high pressure; the contents of the various parts can also be mixed, saccharified, cooled, and emptied without interrupting the working of the whole plant. An arrangement is provided at the upper part of the boilers by which definite quantities of the flour are weighed out automatically and mixed with measured quantities of hot water; the flour is delivered in the form of a fine jet on to a conical surface which also receives the fine jets of water. Means are provided for preventing the steam from carrying over particles of liquid from one boiler to the next.—W. P. S.

Acetifiers ; Device for the automatic charging of —— *with wort and return-vinegar, alternately.* H. Popper. Ger. Pat. 193,493, March 6, 1907.

A suitable arrangement of Woulffe's bottles and siphon devices is described, whereby, alternately, wort and return-vinegar are automatically fed into the acetifiers. —A. S.

Alcohol ; Process of oxidising, esterifying, and purifying ——, *specially applicable to the ageing of brandy and the purification of spirits.* P. L. Mouquet. Fr. Pat. 385,136, Feb. 28, 1907.

The alcoholic liquid is placed in a vacuum pan, a definite quantity of a mineral or organic acid and an oxidising agent, such as potassium permanganate, potassium chlorate, etc., is added, and the air is exhausted from the pan. The contents of the pan are then heated and distilled. The oxidising agent added causes the formation of a certain amount of aldehyde, acetic acid, acetals, and esters, and these distil over with the alcohol. If pure alcohol alone be desired, the alcoholic vapours are passed through wood charcoal before being condensed. About 4 kilos. of charcoal are employed for every hectolitre of alcohol.—W. P. S.

Tanning matters, alcohol, and cellulose from wood. Fr. Pat. 385,279. *See* XIV.

Potassium bitartrate from grape marcs. Fr. Pat. 385,631. *See* XX.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

(*A.*)—FOODS.

Lemon juice; Improvement in the preparation of ——. B. Stock. Chem.-Zeit., 1908, 32, 476.

The improvement consists in the use of centrifugal machines instead of presses. The peeled fruit is crushed between toothed rollers and the juice separated in a centrifugal machine. The advantages of this method, which may be applied generally in the preparation of other fruit juices, consist in greater yields being obtained and in the juice being clearer and free from the bitter principles of the pips.—W. S.

Enamel [*on cooking utensils, etc.*]; *Presence of antimony in* ——. B. Bock. *See* VIII.

Nitrogen; Determination of ——. H. D. Richmond. *See* XXIII.

Patents.

Coffee extract; Process and apparatus for the manufacture of ——. W. Wislocki, Warsaw, Poland. Eng. Pat. 28,418, Dec. 24, 1907.

The coffee is extracted in a number of extraction chambers which are placed in a vessel containing water at a temperature of 70° C. The chambers are preferably made of glazed earthenware and are in communication with each other. Each is provided with a perforated false bottom and a lid through which pass a stirring apparatus and a pipe fitted with a tap. While the apparatus is in use, all the chambers with the exception of one are in action, the exception being the chamber which is being charged with fresh coffee. When this chamber has been re-charged, it is placed in communication with the extract chamber containing the most concentrated extract. The extracts are forced from one chamber to the next by admitting compressed air through the pipe in the cover, the extract being driven through the perforated bottom and thence upwards through a pipe into the next chamber. In the course of the process, each chamber is traversed by the weaker extract from the preceding chamber, and finally water passes from the first chamber into the second, whereupon the first chamber is removed and re-charged, and so on. The pipes connecting the chambers are provided with three-way taps, so that samples of the extracts may be drawn off as required.—W. P. S.

Alimentary product [*from cereals*]; *Process of manufacturing an* ——. L. A. Morel. Fr. Pat. 385,328, Mar. 9, 1907.

Barley, or other cereal, is subjected to a process which decorticates the grains and removes the germs. The whole kernels are next sterilised and placed in vessels from which the air is exhausted, and the vessels are then closed hermetically.—W. P. S.

Baking powder. J. H. Hooker and W. H. Thew. Fr. Pat. 385,434, Nov. 12, 1907. Under Int. Conv., Jan. 1, 1907.

See Eng. Pat. 53 of 1907; this J., 1908, 416.—T. F. B.

Milk and similiar liquids; Process and apparatus for desiccating —— *by means of heated drums.* J. M. Gabler-Saliter. Fr. Pat. 385,166, Dec. 18, 1907.

The milk is delivered in the form of a thin layer on to the surface of a rotating drum which is heated internally. The milk may be supplied from a vessel in which it has been previously heated under reduced pressure. The drum is surrounded by a fixed cover, and a current of air is circulated in the space between the drum and the cover, so as to aid the drying of the milk. The dried milk is removed from the drum by a scraper.—W. P. S.

(*B.*)—SANITATION; WATER PURIFICATION.

Patent.

Water; Treatment of —— *for domestic and industrial purposes.* J. D. Riedel, A.-G. Ger. Pat. 197,111, Oct. 26, 1906.

The water is filtered through hydrated aluminate-silicates, whereby injurious bases such as ferrous oxide, manganous oxide, lime, magnesia, etc., are displaced by bases which have no harmful effects. For example, by filtering a water containing ferrous and manganous salts through calcium aluminate-silicate, the iron and manganese are replaced by an equivalent quantity of calcium. The calcium aluminate-silicate can be regenerated by washing the spent filtering material with calcium chloride solution. For the preparation of soft water for domestic and industrial purposes, filtration through "sodium aluminate-silicate" is effective, calcium and magnesium being replaced by an equivalent quantity of sodium.—A. S.

(*C.*)—DISINFECTANTS.

Patents.

Sheep dips, disinfectants, etc.; Manufacture of cleansing fluids for use as ——. W. G. Little, East Grinstead, and H. Morris, Doncaster. Eng. Pat. 26,608, Dec. 2, 1907.

Eighty parts by weight of coal tar creosote are mixed with 20 parts of sulphonated castor oil, 2 parts of sodium hydroxide solution (20° T.) are added, and the whole is stirred and warmed until a transparent liquid is obtained.—W. P. S.

Resinates, compound; Application of —— *as insecticides.* F. Schirmer. Fr. Pat. 385,062, Feb. 25, 1907.

Compound resinates, such as sodium-calcium resinate, sodium-copper resinate, and mixtures of the same with alkali resinates, are employed in the dry state, or dissolved or suspended in water and other solvents, as insecticides for use on vines, trees, etc.—W. P. S.

Disinfection by means of volatile disinfectants in a closed apparatus. F. H. E. Lehmann, First addition, dated Dec. 11, 1907, to Fr. Pat. 363,362, Feb. 17, 1906.

After disinfection of the substance in a closed apparatus, the vacuum is restored in the vessel, and the sterile material freed from fat by extraction with volatile solvents. The recovery of the last traces of solvent from the substance is effected by means of a current of air or gas from the gasometer, so that the vapours of the solvent never come in contact with the atmosphere. The vapours of the solvent may be made to serve as a carrier of the disinfectant.—C. A. M.

XIX.—PAPER, PASTEBOARD, &c.

Sulphite cellulose bleaches; Contribution to the chemistry of ——. C. F. Cross and E. J. Bevan. Chem.-Zeit., 1908, **32**, 489.

Schwalbe (this J., 1908, 243) discusses the results of an investigation by the authors on hypochlorite bleaches (this J., 1890, 450). The authors held to their original statement that chlorination takes place with varying intensity in the non-cellulose part of the fibre, according to its constitution and to the general hydrolysing tendencies of the reagents on those parts. If the reaction is however allowed to proceed beyond a certain limit, hydrolysis and oxidation, with a subsequent chlorination of the cellulose molecule, takes place. These results have been recently confirmed in the researches on the chloramine reaction of the proteins (Cross, Bevan, and

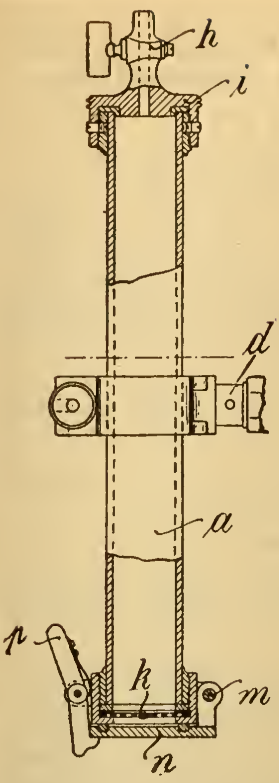
Briggs, this J., 1908, 260). The amino compounds contained in crude fibres used in the manufacture of textiles and paper and which are also contained in wood-pulp and in larger quantities in esparto, react with hypochlorites to give chloramines, playing therefore an important part in flax bleaching.—W. S.

Rosin size precipitates; Action of moist heat on ——. P. Klemm. Wochenbl. für Papierfab., 1908, **39**, 1369—1372.

It is well known that papers which are sized with rosin in the engine are not fully resistant to ink if they be dried at too low or too high a temperature. According to the author's experiments, the critical temperature for good sizing, other conditions being favourable, is about 80° C. But it is not sufficient merely to attain this temperature at any point in the drying of the paper; it is essential that a temperature of 80° C. be reached in all parts of the sheet whilst the latter still contains a considerable proportion of moisture. The reason for this is that rosin softens or melts in the presence of water at a much lower temperature than when dry. From his observations the author states the following rule for the drying of sized paper:—After the paper has passed over the first drying cylinder (which must not be too hot on account of the uneven tensions which would thus be set up), the temperature throughout the paper must be raised as rapidly as possible to 80° C. before much of the moisture has been evaporated. After this temperature has been established, any further increase of temperature as the paper dries will be likely to do harm, and the temperature of the cylinders should gradually decrease towards the end of the machine. The above points may be illustrated by microscopical examination of deposits of moist rosin-alum precipitates when spread in thin layers on glass slides. If the layer on the slide be dried at a low temperature, it will form an opaque, pulverulent deposit consisting of aggregates separated by innumerable canals of bare glass. If however the moist deposit be placed for a short time in an oven previously heated to 80° C., and allowed to dry at that temperature, the layer dries to a translucent varnish-like film which can only be removed from the glass by scratching. Under the microscope this film is seen to consist of minute globules of rosin cemented together, forming a continuous but not homogeneous structure. On the other hand the opaque, pulverulent, previously air-dried deposit is practically unaltered by heating at 80° C. If a pair of the glass slips, carrying an air-dried and a moist deposit respectively, be placed in an oven heated to 110° C. for 5 minutes, the opaque deposit is unaltered, whilst the moist deposit dries to a translucent film as in the previous case. But under the microscope this film, which has been formed at too high a temperature, is seen to be covered with numerous fine cracks which destroy its continuity. If the slips be left in the oven for half an hour at 110° C., the opaque layer becomes translucent by fusion of the dry rosin, but does not become continuous; in fact the canals between the aggregated particles become wider. The translucent film, by the prolonged action of the excessive heat, becomes much darker in colour, and oily globules of a decomposition product are formed. All these phenomena may be observed on a single slide by drying the moist layer over a micro-burner. The centre is thus over-heated, the outermost portions dry at a low temperature and remain opaque, whilst the correctly dried portion forms a ring between the two. The relative ink-bearing qualities of these three zones may be tested by drawing a line with a pen across the slide. Lastly, the author points out that the same phenomena may be studied in the paper itself by employing a dyestuff, such as alkannin or Soudan III, which stains the rosin but not the fibres; in this case thin cross-sections of the paper afford clearer observations than the flat paper itself.—J. F. B.

PATENTS.

Paper pulp; Method and apparatus for testing ——. L. Schopper, Leipzig, Germany. Eng. Pat. 27,948, Dec. 18, 1907.



The quality and condition of paper pulp, whether half-stuff or beaten pulp, is tested by measuring the volume occupied by the fibres when the water in which they have been suspended is drained off under standard conditions. The apparatus, illustrated in the figure, consists of a graduated glass tube, *a*, closed at one end by a removable cap, *i*, fitted with an air-cock, *h*, and at the other end by a cap, *n*, which can be made to swing clear of the tube on the hinge, *m*, by pressing the trigger, *p*. When this cap is released, it exposes a wire-cloth surface, *k*, which then forms the bottom of the tube, and through which the water can drain away, leaving the pulp in the form of a moist cake on the sieve. The tube, *a*, is mounted on a stand on a rotatable axis, *d*, and can be rocked by means of a crank fitted on to the end of *d*, its contents thereby being thoroughly mixed. A weighed quantity of pulp, corresponding to 2 grms. of air-dry substance, is diluted with water to 200 c.c., and the mixture is placed in the tube. The two caps being closed, the tube is rocked so as to mix the fibres uniformly with the water; the apparatus is then brought into a vertical position, the air-cock is opened, and the wire-sieve bottom is exposed. After the water has drained away, the volume of the cake of pulp which remains on the sieve is observed on the graduations of the tube.—J. F. B.

Fibre from vegetable tissues; Use of hot air in extracting ——. M. R. Kennedy, Dansville, N.Y., Assignor to The National Straw Pulp Co., New York. U.S. Pat. 885,851, Apr. 28, 1908.

The straw or other material is packed in a closed boiler which is connected by a pipe with a closed reservoir containing the solution required for the process. By forcing hot air into this reservoir, the solution is forced through the pipe and discharged on to the material under treatment. An arrangement is also provided for injecting hot air, or a mixture of hot air and steam into the boiler, and thus maintaining the solution at the necessary temperature, without materially diluting the solution by the condensation of vapour.—P. F. C.

Paper; Manufacture of variegated ——. O. Imray, London. From Farbwerke vorm. Meister, Lucius, und Brüning, Hoechst a/Main, Germany. Eng. Pat. 6492, Mar. 18, 1907.

Solutions of dyestuffs or colouring matters are sprayed from suitable nozzles over the web of paper, whilst it is on the wire bed, but after the greater portion of the water has been removed. A lateral to and fro motion, transversely to the direction in which the web is travelling, is given to the nozzles, so that the colour solutions may fall irregularly and finely distributed upon the paper web, and, being sucked through the pulp, colour it throughout, giving a mixed or marbled effect.—F. M.

Coloured paper ; Process of making irregularly ——. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 385,497, March 18, 1907.

See Eng. Pat. 6492 of 1907 ; preceding.—T. F. B.

Celluloid ; Manufacture of products or compounds resembling ——. L. Lederer, Sulzbach, Bavaria. Eng. Pat. 9537, April 24, 1907.

See Fr. Pat. 377,010 of 1907 ; this J., 1907, 1027.—T. F. B.

Celluloid residua ; Process for utilising ——. M. Tortelli, Turin, Italy. Eng. Pat. 9568, April 24, 1907.

See Fr. Pat. 373,273 of 1907 ; this J., 1907, 776.—T. F. B.

Cellulose ; Process for the esterification of —— *by fatty acids.* Soc. Anon. d'Explosifs et de Prod. Chim. Fr. Pat. 385,179, Mar. 2, 1907.

To 100 parts of a mixture of equal quantities of acetic anhydride and glacial acetic acid, 5 parts of anhydrous zinc chloride are added. To 7 parts of this mixture, 1 part of dry cellulose or hydrocellulose is added, and the whole is then heated to a temperature not higher than 70° C. until the mass becomes limpid and transparent. The acetylated cellulose is then precipitated by adding either water or benzene to the solution. Other members of the fatty acid series can be employed instead of acetic acid.—P. F. C.

Cellulose ; Manufacture of acetyl derivatives of ——. Soc. Anon. d'Explosifs et de Prod. Chim. Fr. Pat. 385,180, Mar. 2, 1907.

To 100 parts of a mixture of equal quantities of acetic anhydride and glacial acetic acid are added 5 parts of the solution of sulpho-acetic acid obtained by dissolving 10 grms. of sulphuric acid (66° B.) in 30 grms. of acetic anhydride and heating the solution to about 130° C. To 10 parts of the acetylating mixture thus prepared, 1 part of cellulose or hydrocellulose is added, and the whole mass is heated to a temperature not exceeding 70° C. until a clear solution is obtained. The acetylcellulose is then separated from this solution by the addition of water or some such liquid as benzene in which it is insoluble.—P. F. C.

Tanning matters, alcohol, and cellulose from wood. Fr. Pat. 385,279. *See* XIV.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

Coca leaves from Perak. Bull. Imp. Inst., 1908, 6, 86.

The specimen consisted of brownish-green, very brittle leaves, varying in length from 1 to 2 inches. The leaves resembled those of *Erythroxylon Coca*, Lam., var. *spruceanum*, as cultivated in Java. They contained: moisture (loss at 100° C.), 9·19 ; ash, 6·95 ; and total alkaloid, 0·64 per cent. They were valued at 7½–8d. per lb. on the London market in July, 1907.—A. S.

Frangula-emodin and aloe-emodin ; Trimethyl ethers of ——. O. A. Oesterle and E. Tisza. Arch. Pharm., 1908, **246**, 112—116.

The behaviour of the hydroxyanthraquinones on methylation allows of an insight being gained into the position of the hydroxyl groups relative to the carbonyl. To ascertain whether hydroxymethylanthraquinones exhibit similar differences on oxidation, frangula- and aloe-emodin, both of which have the constitution of a trihydroxymethylanthraquinone, have been investigated. The trimethyl ether of frangula-emodin, prepared by means of methyl sulphate, crystallises in bright yellow needles, m.p. 225° C. : it dissolves in sulphuric acid with a cherry-red and in nitric acid with an orange-red coloration. As this compound is so easily methylated, it does not contain a hydroxyl in the *a*-position, and is probably 2-methyl-2′.3.3′-trihydroxyanthraquinone. Treatment of aloe-emodin with methyl sulphate yields only partially methylated derivatives. By exhaustive methylation, a trimethyl ether, crystallising in reddish-yellow needles, m.p. 163°, is obtained. In view of this, at least two of the hydroxyl groups of aloe-emodin are in the *a*-position In agreement with this, aloe-emodin dyes animal fibres faintly but more strongly than frangula-emodin.—E. F. A.

Aucubin ; Occurrence of —— *in various species of the genus Plantago.* L. Bourdier. Arch. Pharm., 1908, **246**, 81—88. (Compare this J., 1907, 1065.)

Crystalline aucubin has been obtained from *Plantago major*, *P. media*, and *P. lanceolata* and identified by Bourquelot's biochemical method (this J., 1907, 721) in *P. arenaria*, *P. cynops*, and *P. psyllium*. These species of plantago contain invertase and emulsin in all their organs.—E. F. A.

Pinus serotina ; Essential oil of ——. C. H. Herty and W. S. Dickson. J. Amer. Chem. Soc., 1908, **30**, 872—874.

The pond pine, *Pinus serotina*, and loblolly pine, *P. tæda*, occur in patches in the pine forests on the Atlantic coast of the United States, but as they contain less oleoresin than the predominating *P. palustris* and *P. heterophylla*, are seldom used as a source of turpentine. Locally they are both known as "black pine." *P. serotina* is characterised by the pronounced odour of its freshly-cut wood. The specimen of oleoresin examined by the authors was very similar to that from the Cuban pine (*P. heterophylla*), being liquid and containing approximately the same proportion of crystalline acids, but it contained more mucilaginous substances than the oleoresins of the more common pines. The resin left after distillation was pale yellow and closely resembled good commercial rosin. Its acid value was 167. The essential oil had the odour of limonene. It gave the following results :—Sp. gr. at 20° C., 0·8478 ; specific rotation at 20° C., $[\alpha]_D = -105^\circ 36'$; refractive index at 20° C., 1·4734 ; acid value, 0 ; saponification value, 1·54 ; iodine value, 378 ; solubility in 95 per cent. alcohol at 22·5° C., 1 part in 1·35 ; in 85 per cent. alcohol, 1 in 8·10 ; in 80 per cent. alcohol, 1 in 16·20 ; and in 70 per cent. alcohol, 1 in 56·00 parts. When exposed to the atmosphere at the ordinary temperature, it evaporated more rapidly than ordinary turpentine oil from *P. palustris*. It also absorbed oxygen more rapidly during the first days of the experiment, though the total absorption after 3 months' exposure to air and light was practically the same in each case. It was separated by fractional distillation into the following fractions :—

Temperature.	Per cent.	Refractive index at 20° C.	Rotation in 200 mm. tube at 20° C.
° C.			
172—175	27·4	1·4716	−87°53′
175—180	57·0	1·4724	−92°21′
180—185	8·4	1·4744	−92°14′
185 and over.	7·2	1·5045	—

Some polymerisation was produced by repeated fractionation at the ordinary temperature. A large amount of limonene tetrabromide (m.pt. 103°—104° C.) was prepared from a fraction boiling at 175°—176° C. —C. A. M.

Essential oils ; Constituents of ——. *Santalol, $C_{15}H_{24}O$.* F. W. Semmler. Ber., 1908, **41**, 1488—1493.

Crude santalol was oxidised with ozone, the product distilled with steam, the distillate extracted with ether, and the ethereal extract fractionated. To obtain eksantalal (this J., 1907, 431), the distillate was shaken with bisulphite solution, which was afterwards shaken with ether. The ethereal extract yielded a substance, $C_{11}H_{16}O$, which boiled at 114°—116° C. at 10 mm., and melted at 157° C. The bisulphite solution was decomposed with sodium carbonate, distilled with steam, and extracted with ether. Tricyclic eksantalal, $C_{11}H_{16}O$, produced in this way, boiled at 110°—111° C. at 10 mm., had the sp. gr. 0·9846 at 15° C., $n_D = 1·48905$, and

$\alpha_D = +11° 30'$ in a 100 mm. tube. The aldehyde was reduced by sodium and alcohol to eksantalol; the oxime, nitrile, and eksantalylamine were also prepared. The nitrile, when hydrolysed, gave tricyclic eksantalic acid, $C_{11}H_{16}O_2$, which boiled at 163°—165° C. at 9·5 mm. A 50 per cent. solution of the acid in alcohol gave a rotation of +7° in a 100 mm. tube. It had the sp. gr. 1·0482 at 15° C., and $n_D = 1·49383$. When treated with formic acid, it gave a lactone melting at 98°—100° C. Eksantalic acid was dissolved in methyl alcohol and saturated with hydrochloric acid gas. The ester was boiled with alcoholic potassium hydroxide, when bicyclic, doubly unsaturated eksantalic acid, $C_{11}H_{16}O_2$, was produced, boiling at 168°—169° C. at 10·5 mm., with the sp. gr. 1·058 at 25° C., and $n_D = 1·50327$. From this, dihydrobicycloeksantalane, $C_{10}H_{17}CH_3$, was produced, boiling at 75°—77° C. at 10 mm., at 204° C. at 768 mm., and with the sp. gr. 0·8705 at 15° C., and $n_D = 1·47151$.—F. Shdn.

Arsenogene, a new arsenic compound of iron and albumin. E. Salkowski. Apoth.-Zeit., 1908, **23**, 114.

Thirty grms. of pure casein are peptonised with pure pepsin, in the presence of dilute hydrochloric acid, at 39—40° C. for 48 hours. The liquid is then filtered, neutralised with sodium carbonate, again filtered, and treated with 4 or 5 grms. of arsenic acid. The mixture is evaporated to a syrup, precipitated with alcohol, and the precipitate washed several times with alcohol and ether to eliminate uncombined arsenic acid. An aqueous solution of the product (1 : 50) is then treated with a 5 per cent. solution of ferric-ammonium sulphate; the precipitate which forms on standing is collected, and washed, first with water, then with alcohol and ether. If the precipitate should not form readily, its aggregation may be hastened by the addition of a little sodium carbonate solution, but not sufficient to impart an alkaline reaction. The *arsenogene* thus obtained is slowly soluble in 0·2 per cent. solution of sodium carbonate, both in the moist state, as precipitated, and after washing with alcohol. On standing, the solution becomes cloudy from the development of bacteria; but if sterilised, it remains permanently unaltered. Arsenogene is introduced for medicinal use.—J. O. B.

Thiosulphonates; Volumetric determination of ——. A. Gutmann. Z. anal. Chem., 1908, **47**, 294—303.

Thiosulphonates are quantitatively reduced by potassium cyanide, with the formation of sulphinates, according to the equation: $RSO_2SMe + KCN = RSO_2Me + KCNS$, where R is a univalent organic radical and Me is a univalent metal. The method is applied as follows: To a fairly strong solution of the thiosulphonate are added sodium hydroxide and an excess of potassium cyanide, free from chloride (about 1·5 mol. of cyanide to every mol. of the sulphonate). The mixture is heated for half an hour on the water-bath and allowed to cool, and the crystalline mass of sulphinate is then taken up with water and a few drops of sodium hydroxide solution, and the excess of cyanide titrated with *N*/10 silver solution, by Liebig's method. After this, an excess of the silver solution is added and much nitric acid to redissolve any silver sulphinate. The silver cyanide and thiocyanate are removed by filtration, and the filtrate mixed with a large excess of zinc nitrate solution, and allowed to stand for a long time, in order to precipitate all the sulphinic acid as the insoluble zinc salt. Then, without filtering, the excess of silver nitrate is determined with ammonium thiocyanate, by Volhard's method. Sulphonates, alkyl sulphates, and inorganic sulphites and sulphates do not interfere with the accuracy of the method, but sulphides must be first removed with cadmium carbonate, and halides and thiosulphates must be absent. In the presence of much sulphite or sulphate, sufficient nitric acid must be added to prevent the precipitation of the corresponding silver salts. The method already described for the determination of thiosulphates, based upon their reaction with potassium cyanide (this J., 1907, 991), is not applicable to the ester-salts of thiosulphuric acid, *e.g.*, sodium ethylthiosulphate.—F. Sodn.

Palmitic acid; Preparation and properties of the bornyl ester of ——. O. von Sobbe. J. prakt. Chem., 1908, **77**, 510—512.

In order to prepare the bornyl ester of palmitic acid in a pure state, it is essential that the borneol used should be quite free from isoborneol. 11·23 grms. of pure borneol are treated in ethereal solution with 1·67 grms. of sodium dust. After 20 hours at the ordinary temperature, the borneol is completely converted into sodium bornylate. 20 grms. of palmityl chloride, freshly prepared and distilled over sodium, are now added, in small portions at a time, to the mixture, through a reflux condenser, and the whole boiled for 2—3 hours. After cooling, water is added, and the ethereal solution separated and evaporated, when the ester is obtained. This crystallises from ether in white plates melting at 67—68° C., which feel greasy, and are readily soluble in the usual organic solvents.—J. C. C.

Benzyl alcohol; Preparation of —— *from benzaldehyde by means of potassium hydroxide.* J. Meisenheimer. Ber., 1908, **41**, 1420—1422.

Benzaldehyde is shaken with potassium hydroxide, put aside over night; the benzyl alcohol formed is extracted with ether, shaken with sodium bisulphite to remove unchanged aldehyde, and distilled. It is usually found that much decomposition and formation of benzyl ether takes place during distillation. The author shows this is due to sulphuric acid formed by the oxidation in the ether of sulphurous acid derived from the bisulphite. If, after treatment with bisulphite, the ethereal solution be shaken with sodium hydroxide, no decomposition results, neither does this take place if the treatment with bisulphite be omitted. Benzyl ether is conveniently prepared from benzyl alcohol by heating with a few drops of 30 per cent. sulphuric acid in an oil-bath at 210—220° C.—E. F. A.

Silver nitrate and pyridine; Equilibrium in the system ——. L. Kahlenberg and R. K. Brewer. J. of Phys. Chem., 1908, **12**, 283—289.

Excess of silver nitrate was mixed with pyridine in an apparatus similar to that used by Mayerhoffer and Saunders (Z. physik. Chem., 1899, **28**, 464), the glass screw stirrer of which was placed in a large hard glass test tube, kept at a constant temperature in a suitable bath. The entire equilibrium curve was established from the freezing point of pyridine (−48·5° C.) up to 110° C. It was found that three well-defined crystalline compounds are formed, of which the compound, $AgNO_3,6C_5H_5N$ had not been hitherto isolated. The compound $AgNO_3,2C_5H_5N$ melts without decomposition at 87° C., whereas $AgNO_3,3C_5H_5N$ and $AgNO_3,6C_5H_5N$, lose pyridine upon heating.—W. S.

Lead in cream of tartar, tartaric acid, and citric acid. R. R. Tatlock and R. T. Thomson. Analyst, 1908, **33**, 173—178.

In a report to the Local Government Board, MacFadden stated that 17 samples of cream of tartar examined contained from *nil* to 0·0033 per cent. of lead, with an average of 0·0015 per cent., and suggested that 0·002 per cent. should be fixed as the highest permissible limit. In the authors' experience, the amount of lead in about 100 samples of cream of tartar ranged from 0·0005 to 0·011 per cent., with an average of at least 0·005 per cent. They point out that it has been shown that $\frac{1}{10}$ grain of lead may be taken daily by an adult without any injurious effect, and suggest that a rather higher amount of lead than 0·002 per cent. might be allowed. In any case, in their opinion, the physiological factor ought to be taken into account before fixing a standard for lead. The amount of lead in 50 samples of tartaric acid ranged from 0·0005 to 0·012 per cent., results which do not support the current belief that cream of tartar contains less lead than tartaric acid. The amount of lead in 10 samples of citric acid was very similar to that in tartaric acid, the maximum being 0·010 per cent. In no instance was any sample of either acid or of cream of tartar found quite free from lead, and one sample of tartaric acid guaranteed to contain no lead contained 0·0015 per cent. With regard to the detection and estimation of lead in these compounds, the authors, notwithstanding difficulties some of which have already been noticed (this J., 1893, 169), recommend the colorimetric method in which ammonium sulphide is added to an alkaline solution of the substance containing a little potassium cyanide. In their method of applying the test, 10 grms. of cream of tartar are dissolved in 50 c.c. of water and 40 c.c. of $2N$ ammonia solution, and the solution made up to 100 c.c. and filtered, whilst the tartaric acid solution is prepared with 81 c.c. of $2N$ ammonia solution and 9 c.c. of water, and the citric acid solution with 85 c.c. of the ammonia solution and 5 c.c. of water, the liquids in each case being diluted to 100 c.c. To 50 c.c. of the filtrate are added 0·1 grm. of potassium cyanide and 1 c.c. of a colourless or nearly colourless strong solution of ammonium sulphide, and the colour matched against that obtained with a standard solution of a lead salt. Some samples of cream of tartar give a brown coloration in the alkaline solution, due to organic matter, before the addition of the ammonium sulphide, and to correct this error it is necessary to determine the amount of standard lead solution required to produce a similar coloration, and to make allowance for it in the final comparison. It is essential that the amount of lead in 50 c.c. of the solutions under comparison shall not exceed $\frac{1}{5}$ mgrm., and that no lead shall be added to make up a deficiency in colour after the addition of ammonium sulphide. Iron in the ferrous or ferric condition dees not interfere with the test when its quantity does not exceed $\frac{1}{4}$ mgrm.; otherwise it may cause the proportion of lead to appear too high. Copper and tin up to 1 mgrm. in 50 c.c. (the highest limit tried) do not interfere with the test, nor does a mixture of 1 mgrm. of these metals with $\frac{1}{4}$ mgrm. of iron, or 1 mgrm. of mercury or of nickel. Bismuth, however, gives a similar coloration to lead, and the authors have found no way of destroying its influence. It must therefore be determined by the potassium iodide test which is as sensitive as the ammonium sulphide test:—5 grms. of citric or tartaric acid are dissolved in 50 c.c. of water, or 5 grms. of cream of tartar in 27 c.c. of $N/_1$ hydrochloric acid and 23 c.c. of water, and the solution treated with 1 grm. of potassium iodide, and filtered. In the presence of as little as $\frac{1}{10}$ mgrm. of bismuth, a bright yellow coloration is obtained, and the amount of metal may be determined by comparison with the colour produced by a standard solution of bismuth nitrate added to 5 grms. of citric or tartaric acid. The addition of starch will prove that any yellow coloration is not due to liberated iodine.—C. A. M.

Rare earths; Non-toxicity of salts of ——. C. Bachem. Arch. intern. pharmacodyn, 17, 363.

The salts of lanthanum, yttrium, didymium, cerium, thorium, and zirconium are found to possess a relatively low toxicity, so that chronic industrial poisoning in the course of the manufacture of incandescent mantles need not be anticipated. Lanthanum sulphate and the nitrates of didymium, yttrium, and thorium, have an antiseptic action.—J. O. B.

Patents.

Camphor; Process of manufacturing ——. Dr. Schmitz und Co., Düsseldorf, Germany. Eng. Pat. 28,036, Dec. 19, 1907. Under Int. Conv., Dec. 19, 1906.

See Fr. Pat. 385,352 of 1907; following.—T. F. B.

Isoborneol from camphene; Process for preparing ——. Dr. Schmitz und Co., G.m.b.H. Fr. Pat. 385,341, Dec. 17, 1907. Under Int. Conv., Dec. 19, 1906.

Camphene (20 kilos.) is dissolved by the aid of acetone in 20 per cent. sulphuric acid (10 kilos.), and the solution boiled for 10 hours under a reflux condenser, or heated to 100° C. for 3—4 hours in an autoclave. The isoborneol which is obtained in a yield of 80—90 per cent. of the theoretical, is isolated in the usual manner. The sulphuric acid in this operation may be replaced by zinc chloride. —J. C. C.

Camphor; Process of preparation of ——. Dr. Schmitz und Co., G.m.b.H. Fr. Pat. 385,352, Dec. 18, 1907. Under Int. Conv., Dec. 19, 1906.

Metallic alcoholates of borneol and isoborneol are converted into camphor by oxidation with oxygen, oxides of the heavy metals, or peroxides. For example, 17 kilos. of isoborneol are treated with 2·3 kilos. of sodium in presence of 60 kilos. of toluene; the solution is cooled to 10—20° C., and dry air, free from carbon dioxide, is passed through. The temperature is raised slightly towards the end of the operation. When no more oxygen is absorbed, the product is washed with water, and the camphor formed is isolated in the usual manner. Instead of the above quantity of sodium, 4 kilos. of calcium may be used, or the oxidation of sodium isoborneol (19·3 kilos.) may be effected by means of mercuric oxide (30 kilos.) in xylene (60 kilos.) solution.—J. C. C.

Camphoric acid alkyl esters; Preparation of normal ——. J. D. Riedel, Akt.-Ges. Ger. Pat. 196,152, Feb. 6, 1907. Addition to Ger. Pat. 189,840.

Normal esters of inactive camphoric acid are obtained by the action of dimethyl sulphate or an arylsulphonic ester on a salt of inactive camphoric acid at the ordinary temperature; the heat of the reaction raises the temperature to about 60° C., which is sufficient to complete the esterification.—T. F. B.

Protocatechuic aldehyde; Process of manufacturing ——. G. Stalmann, Leipzig-Gohlis, Assignor to Schimmel und Co., Miltitz-Leipzig, Germany. U.S. Pat. 886,085, April 28, 1908.

See Eng. Pat. 18,992 of 1905; this J., 1906, 89.—T. F. B.

Anhydro-oxymethylenediphosphoric acid; Soluble salts of the —— *and process of making same.* S. Posternak, Paris, Assignor to Soc. Chem. Ind. in Basle, Basle. U.S. Pat. 886,852, May 5, 1908.

See Eng. Pat. 22,030 of 1904; this J., 1905, 39.—T. F. B.

Cream of tartar [potassium hydrogen tartrate]; Apparatus for the continuous manufacture of ——. P. Chauvin. Fr. Pat. 385,103, Dec. 14, 1907.

The mixture of tartar and wine lees is fed regularly from a hopper into a boiler of special construction, in which is arranged a filter-press, connected at its base with a valved pipe, passing out through the side of the boiler near the lower end. The boiling liquid is withdrawn through this pipe, without interrupting the process, and enters a jacketed open serpentine channel of rectangular section, where it is cooled by a stream of cold liquor moving upwards in the opposite direction, which in its turn becomes heated and is pumped into a tank, to be introduced into the boiler as required. From the serpentine channel the cooled liquor runs into a tank, from which it is pumped into an upper reservoir supplying the cooling jacket. The lower part of the boiler slopes in such a way, that the sediment gravitates into a special chamber, out of contact with the source of heat, and provided with taps above and below, so that the sediment may be removed during the process. Cream of tartar is thus manufactured rapidly and continuously.—F. Sodn.

Potassium bitartrate from grape marcs; Extraction of ——. C. Raynaud. Fr. Pat. 385,361, Dec. 19, 1907.

The potassium bitartrate may be extracted from grape marcs by means of boiling water. The extraction is greatly facilitated by using the water from the first extraction to extract a second quantity of marc, and so on till the liquor is saturated, when it may be allowed to crystallise.—F. Sodn.

Diformin; Process for making ——. Nitritfabrik Akt.-Ges. Fr. Pat. 385,618, Dec. 26, 1907. Under Int. Conv., Jan. 4, 1907.

See Eng. Pat. 28,723 of 1907; this J., 1908, 356.—T. F. B.

Tobacco; Removal of nicotine from ——. J. Sartig. Ger. Pat. 197,159, March 18, 1906.

The tobacco is arranged loosely, in layers or bundles, in a closed vessel, and treated with superheated steam at a temperature of about 140° C., the vessel being also heated externally to the same temperature, in order to prevent condensation of water. The nicotine is volatilised and carried away by the dry steam, and may be subsequently recovered by cooling. By this treatment the tobacco is finally obtained almost entirely free from nicotine.—A. S.

o-Hydroxyaldehydes; Preparation of aromatic ——. H. Weil. Ger. Pat. 196,239, Dec. 9, 1906.

o-Hydroxycarboxylic acids are reduced to the corresponding aldehydes by sodium amalgam in presence of boric acid and a neutral salt (*e.g.*, sodium chloride). 15 grms. of salicylic acid and 5·5 grms. of sodium carbonate are dissolved in one litre of water, 18 grms. of *p*-toluidine and 250 grms. of sodium chloride are added, and the mixture is vigorously stirred and cooled; 15 grms. of boric acid and then 2 per cent. sodium amalgam are added, the solution being kept slightly acid with boric acid, for which purpose about 120 grms. are required. The *o*-hydroxybenzylidine-*p*-toluidine is separated from the mixture, and the aldehyde distilled from a dilute acid solution. The acids may be reduced electrolytically with a mercury cathode under similar conditions, instead of by sodium amalgam.—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Ammonium thiosulphate or a mixture of sodium thiosulphate and an ammonium salt; Use of —— for fixing photographic plates and papers. A. and L. Lumière and A. Seyewetz. Bull. Soc. Franc. Phot., 1908, **24**, 217—223.

The solubility of silver bromide in sodium thiosulphate solutions is increased considerably by addition of ammonium chloride, so long as the concentration of the thiosulphate is below 40 per cent.: above this limit, the solubility is diminished. The same conditions apply in the fixation of photographic plates and papers by solutions containing ammonium thiosulphate. The amount of ammonium chloride which produces the maximum acceleration of fixation is considerably lower than the amount necessary for the conversion of the whole of the thiosulphate into the ammonium salt. The soluble double silver salts formed during fixation are much less stable than those formed when sodium thiosulphate alone is used, hence the use of ammonium salts in the fixing bath is not to be recommended, since the plates, etc., would rapidly deteriorate unless all trace of soluble silver salt were removed, and also the limit of utility of the fixing bath is much lower than in the case of sodium thiosulphate alone. (See Eng. Pat. 25,869 of 1906; this J., 1908, 38.)—T. F. B.

Patents.

Reproduction of images on glass, porcelain, ceramic, metallic, and other surfaces. M. Anthès, and E. Lloyd, Ltd., London. Eng. Pat. 24,214, Nov. 1, 1907.

The sensitising solution consists of ammonium or sodium bichromate, 2 grms., and a soluble carbohydrate, 4 grms., dissolved in 5 c.c. of water, mixed with nitrocellulose, 2 grms., dissolved in ether or acetone, 50 c.c., and alcohol, 150 c.c. The solution is applied to the surface to be provided with an image, dried, and exposed to light under the design, after which a suitable pigment is dusted on the warmed surface, and the image is developed by washing with water, and finally fixed on the surface by firing. The process may be applied to the reproduction of images on wood or other surfaces when firing cannot be resorted to: porous surfaces are enamelled previous to sensitising. A permanent model of the design, on glass, may be produced by the above process, from which any number of reproductions can be made.—T. F. B.

Films for photographic and other purposes; Manufacture of ——. J. H. Smith, Zurich, Switzerland. U.S. Pat. 886,883, May 5, 1908.

See Eng. Pat. 10,372 of 1905; this J., 1905, 1083.—T. F. B.

XXII.—EXPLOSIVES, MATCHES, &c.

Nitrocellulose; Decomposition of —— at temperatures below the explosion point. A. Saposchnikoff. Mémorial des Poudres et Salpêtres, 1907—1908, **14**, 42—64. (*See* also this J., 1904, 1112; 1906, 198; 1907, 640.)

The author has made a study of the test proposed by Mittasch (this J., 1903, 1208), and has made some modifications, the chief being that the nitrocellulose is not mixed with sand before being heated in the glass tube. From 0·2—0·3 grm. of nitrocellulose is taken and placed in a tube which will just contain this quantity. The tube is connected by a capillary tube to a gas-burette. The sample is then heated to the desired temperature, and the evolved gases are collected, measured, and subsequently analysed. The weight of the residue remaining in the decomposition tube is also determined.

Decomposition of an insoluble nitrocellulose containing 13·34 per cent. of nitrogen. The experiments were carried out, with 5° C. rise in each series, at temperatures between 120° and 150° C. Taking the extreme and middle temperatures, the following results were obtained.

	150° C.	135° C.	120°C.
C.c. of gas per grm.	325	236	161
Percentage loss of weight	70·25	61·8	47·84
Velocity of decomposition	7·85	0·372	0·084
Hours of heating	24	130	400

The author gives a series of equations, for each temperature, for the decomposition of nitrocellulose as represented by the formula, $C_{24}H_{29}(NO_3)_{11}O_9$. The following conclusions are drawn:—For temperatures above 140° C., the equations representing the decomposition of nitrocellulose are practically the same. The solid residue contains practically no nitrogen, but a considerable percentage of hydrogen. At 135° C. a marked change becomes apparent in the relative proportions of carbon dioxide to carbon monoxide, and of nitrogen to nitric oxide. The solid residue, on the other hand, contains practically no hydrogen, but a considerable percentage of nitrogen. The velocity of decomposition increases from 0·372 at 135° C. to 2·88 at 140° C.

Decomposition of a soluble nitrocellulose containing 12 per cent. of nitrogen. The decomposition of the nitrocellulose was carried out as before at temperatures from 120° C. to 160° C., and the following results were obtained at the temperatures indicated:—

	160° C.	140° C.	120° C.
C.c. of gas per grm.	298	268	156·5
Percentage loss of weight	70·6	65·0	48·6
Velocity of decomposition	32	3·5	0·275
Hours of heating	20	72	308

Equations are given representing the decomposition of the nitrocellulose molecule, $C_{24}H_{31}(NO_3)_9O_{11}$. Three zones of characteristic decomposition may be defined as follows. (1). 150°—160° C. The nitrocellulose loses the whole of its nitrogen and the greater part of its hydrogen, and the gaseous products of decomposition consequently contain a high percentage of water and nitric oxide. (2). 130°—145° C. The solid residue contains a considerable percentage of both hydrogen and nitrogen. (3). Below 135° C. The volume of the gaseous products is considerably decreased. The solid residue contains more nitrogen, very little hydrogen, and is much richer in carbon and oxygen.

Decomposition of pyrocollodion containing 12·75 *per cent. of nitrogen.*—The following figures show the results obtained with a nitrocellulose intermediate in composition between those already referred to:—

	160° C.	140° C.	120° C.
C.c. of gas per grm.	309	277·5	120
Percentage loss of weight......	70·8	63·5	41·8
Velocity of decomposition	39	3·57	0·15
Hours of heating	8½	77	382

The relative proportions of the constituents of the gaseous products of decomposition do not vary very much between 135° and 155° C. Above and below these temperatures, there is a very marked difference, more particularly as regards carbon dioxide, nitric oxide, and nitrogen. The course of the decomposition of pyrocollodion is in every way similar to that of soluble nitrocellulose containing 12 per cent. of nitrogen, and the solid products of the decomposition also present similar characters. In view of the fact that the Will test and the "fume" test are carried out at 135° C., the sudden increase in the velocity of decomposition of insoluble nitrocellulose above this temperature is of practical interest.—G. W. McD.

Safety-explosives; Miss-fires in the detonation of ——. Dautriche. Mém. des Poudres et Salpêtres. 1907—1908, 14, 5—25.

The attention of the French Commission on Explosive Substances, was drawn on several occasions to the fact that a safety ammonium nitrate explosive, when fired in the mine, only deflagrated instead of detonating. In view of the danger involved in such circumstances, the Commission decided to investigate the conditions which might render this possible. The explosive was of the following composition:—Ammonium nitrate (88 per cent.), nitroglycerin (11·86), and nitrocotton (0·14 per cent.). The method of experiment consisted in firing cartridges of the explosive, under varying conditions, in a bore-hole (45 cm. × 30 mm.), drilled in a block of concrete. Other experiments were carried out in a stout iron tube, closed with a brass cap, the latter being tapped to take the firing wires. Attention was first directed to the possibility of a variation in the proportions of the constituents of the explosive leading to deflagration instead of detonation. Various samples of explosive were made containing increased quantities of nitroglycerin, up to 47 per cent. It was impossible to make any of these compositions deflagrate, either in the open or in the bore-hole, even when, in the latter case, black powder was used as a priming material. Explosives containing a large excess of nitrocotton could be deflagrated, but it would be practically impossible, that a manufacturing error of this magnitude could be made. The ammonium nitrate safety cartridges in question were wrapped in paraffined paper, but it was proved that an excess of finely-divided paraffin added to the explosive did not cause it to deflagrate under the conditions of experiment. Small pieces of paper when intimately mixed with the explosive caused it to burn for a short time when a light was applied, but such conditions would be impossible in ordinary practice. By mixing the explosive with an excess of finely-divided charcoal it was found possible to produce deflagrations similar to those which had been observed in mines. The ammonium nitrate explosive in question, when mixed with 20 per cent. of charcoal, could be deflagrated by means of a fulminate detonator. Similar results, though of a less definite character, were obtained by adding coal dust to the explosive.

The Commission arrive at the conclusion that deflagrations in mines are due to the admixture of coal dust with the explosive during the process of tamping, when the paraffined wrapper of the cartridge may possibly be broken, allowing the explosive to escape into the bore-hole and mix with the coal dust invariably present. In order to avoid the danger incident on deflagration, the Commission propose: (1), the careful cleaning of the bore-hole from dust; (2), a regulation forbidding excessive ramming of the charge in the bore-hole; (3), increasing the strength of the detonators.—G. W. McD.

Patents.

Explosive substance. W. S. Winchester, Chanute, Kansas. U.S.A. Eng. Pat. 26,791, Dec. 4, 1907. Under Int, Conv., Dec. 4, 1906.

See U.S. Pat. 860,509 of 1907; this J., 1907, 948.—T. F. B.

Explosive. A. E. Charbonneaux, Los Angeles, Cal. U.S. Pat. 886,038, April 28, 1908.

An addition of 1 per cent. by weight of saccharin is made to the explosive, or the composition may consist of 1 part of saccharin and 3 parts of potassium chlorate. —C. A. M.

Explosive. C. E. Bichel, Hamburg, Germany. U.S. Pat. 887,027, May 5, 1908.

See Fr. Pat. 327,868 of 1902; this J., 1903, 963.—T. F. B.

Powder from nitrocellulose and nitroglycerin; Preparation of a ——. Ver. Köln-Rottweiler-Pulverfabr. A.-G. Ger. Pat. 195,486, Jan. 4, 1907. Addition to Ger. Pat. 175,399.

The stability and ballistic properties of a nitrocellulose-nitroglycerin powder are improved by addition of a soap or resin-soap.—A. S.

Detonators. L. Wöhler. Ger. Pat. 196,824, March 2, 1907.

The claim is for the use of azides of the heavy metals, such as silver azide or mercury azide, in place of mercury fulminate. It is stated that for the complete detonation of an explosive, only about one-tenth as much of these azides is needed as of mercury fulminate.—A. S.

XXIII.—ANALYTICAL CHEMISTRY.

APPARATUS.

Patents.

Gas analyser; Automatic ——. H. J. Westover, New York. U.S. Pat. 881,986, March 17, 1908.

The present patent relates to improvements in connection with the apparatus described in U.S. Pat. 883,274 of 1906 (this J., 1907, 115), and especially to a device comprising two connected floats, provided with electrical contact pieces, and so disposed that by differences of pressure, induced by absorption of a constituent of the gas, the floats break contact, thereby causing a record to be made on a suitable recording device.—A. S.

Gas analysis apparatus. J. F. Simmance and J. Abady, London. U.S. Pat. 887,706, May 12, 1908.

See Eng. Pat. 18,680 of 1906; this J., 1907, 1067.—T. F. B.

Gaseous mixtures; Device for determining constituents of —— *by absorption in a liquid.* Strohlein und Co. Ger. Pat. 190,240, July 8, 1906.

One limb of a U-shaped vessel containing the absorbing liquid, is provided with a tube, *r*, which has an automatic valve, *v*, in its lower portion. Inside this tube is a smaller tube, *i*, also provided with an automatic valve, *q*, and opening at *o*, into the absorption vessel. By means of this device, the gas after it has passed through the absorbent, can be drawn back into its original receptacle.

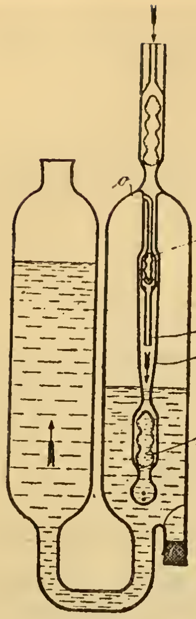


Fig 1.

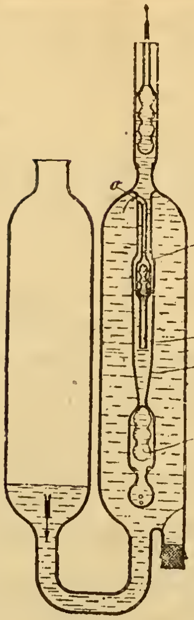
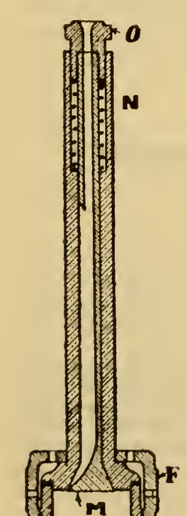


Fig. 2.

The course of the gas during its two passages through the apparatus is shown by the arrows in Figs. 1 and 2 respectively.—A. S.

INORGANIC—QUANTITATIVE.

Sodium peroxide in certain quantitative processes. S. W. Parr. J. Amer. Chem. Soc., 1908, **30**, 764.



The author describes a method of decomposing ores and other substances, by fusing them in a closed calorimeter (see Fig.), with a mixture of 10 grms. of sodium peroxide and 0·5 grm. each of potassium chlorate and benzoic acid. For the decomposition of a pyritic ore, 0·25 grm. of the ore is mixed with the above weight of the fusion mixture by shaking together in the cylinder, A, which is then closed with the screw caps, E and F, and placed in water, on account of the great heat generated during the reaction. Ignition is effected by dropping a short red hot slug of soft iron or pure nickel wire into the stem, where it lodges at the valve, M. On pressing the knob, O, the hot wire is allowed to fall into the chamber containing the mixture, the spring, N, re-closing the valve. Holes in the screw caps, E and F, permit circulation of water about the ends of the cylinder, so that rubber gaskets may be used. Fusion being complete in two or three minutes, the ends of the cylinder are removed and the fused mass is driven out with a short rod, a jet of hot water washing out the interior surfaces and the entire melt being brought into solution with a minimum amount of water. Within ten to fifteen minutes from the weighing of the ore, the sulphur may be in solution ready for precipitation with barium chloride. The method is specially recommended for the estimation of sulphur in coal, coke, etc. In these cases 0·5 grm. is taken and the benzoic acid omitted.—F. R.

Magnesium; Separation of —— from the alkalis by alcoholic ammonium carbonate. F. A. Gooch and E. A. Eddy. Amer. J. Science, 1908, **25**, 444—448.

THE authors have studied Schaffgotsch's original method (Ann. Phys., **104**, 482, 1858), and found that ammonium magnesium carbonate is appreciably soluble in Schaffgotsch's reagent, which consists of a solution of 230 grms. of ammonium carbonate in 180 c.c. of ammonia solution diluted to one litre and filtered. This difficulty was overcome by the addition of alcohol. The solution containing salts of magnesium and the alkalis is made up to 50 c.c. and an equal volume of absolute alcohol added. The solution is precipitated by addition of 50 c.c. of a saturated ammoniacal ammonium carbonate solution, containing 50 per cent. of alcohol, and the mixture stirred and allowed to stand for 20 minutes. If the amount of alkali salt originally present is small, the precipitate is collected on asbestos felt in a perforated crucible, washed with the alcoholic ammonium carbonate solution, dried, ignited, and weighed as magnesium oxide. If the amount of alkali salt originally present is large, the precipitate is purified by pouring off the supernatant liquid through the filter, dissolving the precipitate, re-precipitating ammonium magnesium carbonate, and filtering, etc., as at first.—W. S.

Rotating anodes; Electrochemical analysis with ——. A. M. Fairlie and A. J. Bone. Electrochem. and Met. Ind., 1908, **6**, 19—21, 58—60.

THE apparatus in use in the laboratory of the Tennessee Copper Co. consists of eight pairs of platinum electrodes, connected in series and arranged so that any pair may be cut out independently. Each anode consists of a stem, 108 mm. long, at the lower end of which are fixed ten radial blades with their faces set at an angle of 45°, the whole having a diameter of 31 mm. The cathodes are perforated cylinders, 52·5 mm. in diameter, in which the anode rotates. The weights of the platinum anodes and cathodes are 6 grms. and 16 grms. each respectively. The method for the determination of copper in comparatively pure material such as converter bars, is similar to that used with stationary electrodes, but where much iron is present, the ferrous sulphate, in a solution of which copper is practically insoluble, may become oxidized to ferric sulphate, causing the already deposited copper to be redissolved. It is therefore necessary to keep the degree of concentration of the solvents of copper, such as ferric sulphate and nitric acid, well within fixed limits. The material to be treated is decomposed, and converted into sulphate by the usual methods, depending on its composition, and from 1 to 2·5 c.c. of nitric acid are added before electrolysis, thus ensuring that just the necessary amount of nitric acid is present. The electrodes are then brought into the beakers by raising the latter and supporting them on stands, strips of glass with suitable openings for the anode stems being used as covers. For the assay of converter bars, 5 grms. are brought into solution as above and electrolysed in the presence of 2·5 c.c. of nitric acid. The anodes are rotated 400 to 500 times per minute for two hours, using 5 ampères per 100 sq. cm. of submerged cathode area, the temperature being between 50°—55° C. For mattes, 1 grm. is taken and electrolysed under similar conditions to those used for the converter bars, except that only 2 c.c. of nitric acid are present, and with a current of 3 ampères, the assay is finished in 45 to 55 minutes. For slags, 3 grms. are taken, and the determination is performed under the same conditions as for mattes except that only 1 c.c. of nitric acid must be present; the time required is 35 to 40 minutes. For ores, 1 grm. is taken and electrolysis is effected in the presence of 2 c.c. of nitric acid and with a current of 2 ampères, other conditions being as for slags; the assay is complete in 40 to 50 minutes. To determine the completeness of the deposition, a small portion of the solution is tested with hydrogen sulphide. The method described applies only to materials free from interfering elements, the presence of which would necessitate modifications.—F. R.

Antimony ; Electrolytic determination of ——. O. Scheen. Z. Elektrochem., 1908, 14, 257—263.

The method, proposed by A. Classen for the electrolytic determination of antimony by precipitation from a solution of a sulpho salt, has been objected to by later workers on the ground that the weight of precipitated metal may be as much as 2 per cent. above the theoretical. The author, investigating the process, points out that the cathodes employed in Classen's earlier work were basins of polished platinum, whereas in later researches either gauze electrodes or dishes with a roughened surface were used. Polished cathodes cannot be used for larger quantities than 0·1 to 0·15 grm. of antimony in 140 to 150 c.c. The author compared the results obtained by precipitating the metal in two matt-surface basins, one of which was but slightly roughened. Pure antimony was dissolved in concentrated sulphuric acid (1·5 to 2 c.c. for every 0·1 grm.) by gentle warming, the cooled solution diluted with water, and mixed with pure sodium hydroxide until the reaction was only feebly acid. 80 c.c. of a solution of sodium sulphide (1·14 sp. gr.) and 30 c.c. of a 30 per cent. potassium cyanide solution were added, and the volume made up to 140 c.c. with water. The solution was finally electrolysed with 1·2 to 1·3 ampères at 1·1 to 1·4 volts and a temperature of 60°—70° C. In this way, precipitating 0·2 to 0·5 grm. of the metal on the slightly deadened surface, good results, showing a maximum excess of 0·8 per cent., were obtained. Using the more porous surface, larger excess weights, amounting in some cases to 1·6 per cent., were obtained, pointing to a greater inclusion of extraneous matter in the pores. It is probable that the inclosed substance is partly formed by the reduction of the cyanide, and, in fact, on washing the precipitated metal with alcohol, an almost theoretical result can be obtained. It is not possible to estimate larger quantities of the metal by using a greater volume of solution, the values obtained being untrustworthy. A large excess of sodium hydroxide leads to too high a result ; where this cannot be avoided, the precipitated antimony must be dissolved in sodium sulphide containing polysulphides, and re-precipitated in a second basin. However, the amount of alkali (2 grms.) necessary in the separation from tin is without any detrimental effect. Finally, the author finds that the acceleration of the precipitation by using rotating anodes is impracticable, the high values obtained again pointing to the inclusion of impurities. The same objection applies to the use of gauze cathodes.—C. A. W.

Carbonic oxide ; Determination of —— more particularly in tobacco smoke. H. Marcelet. Bull. Soc. Chim., 1908, 3, 556—558. (See this J., 1906, 201.)

An improved form of apparatus is described for the estimation of carbonic oxide by means of iodic acid, and it is stated that the reaction is practically complete with gaseous mixtures containing from 0·8 to 1 per cent. of carbonic oxide. The length of the column of acid traversed by the gas is from 20 to 25 cm., but with gases richer in carbon monoxide than the above, better results will be obtained by lengthening the column of acid.—B. N.

Alkali carbonate ; Determination of —— in the presence of alkali hydroxide, by Winkler's method. S. P. L. Sörensen and A. C. Andersen. *See* VII.

Tellurium ; Behaviour of —— in assaying. S. W. Smith. *See* X.

Copper [in ores] ; Volumetric method for ——. G. S. Jamieson and others. *See* X.

Vanadium [in ores] ; Determination of ——. A. M. Wilson. *See* X.

Carbon ; Determination of —— in steel, etc. C. M. Johnson. *See* XIB.

Soils ; Süchting's improved method of determining the acidity of ——. A. J. van Schermbeek. *See* XV.

ORGANIC—QUANTITATIVE.

Nitrogen ; Determination of ——. H. D. Richmond. Analyst, 1908, 33, 179—184.

I. *The nitrogen factor for casein.*—Low results obtained by the author in the determination of nitrogen in casein by Kjeldahl's method were found to be due to the presence of impurities. A carefully purified sample, which had been extracted with ether, gave the following results :—Moisture, 11·76 ; fat, 1·46 ; lactose, none ; ash, 1·75 ; aldehyde (condensed from the ether), 0·41 ; nitrogen, 13·26 ; and nitrogen corrected for impurities, 15·67 per cent. The average results obtained in the determination of nitrogen in a specimen of casein by Dumas' method were 16·55 per cent., as against 15·26 per cent. by Kjeldahl's method (calculated on the dry, ash-free substance), whilst 1·30 per cent. of gas—at first regarded as nitrogen, but subsequently found to be carbon monoxide—was collected from the gases given off during the Kjeldahl process. The absence of nitrogen in these gases was proved, and the author attributes the higher result in the Dumas method to the presence of unburnt carbon monoxide. In his opinion, therefore, the Kjeldahl method must be regarded as more reliable than the Dumas method for the determination of nitrogen in casein, and probably in all proteins. The mean of the results of Kjeldahl's method, after making the above-mentioned corrections, was 15·65 per cent., which corresponds to the factor 6·39. II. *Triazo nitrogen.*—It was found by Forster and Fierz (Chem. Soc. Trans., **87**, 826 ; **91**, 855, 1350, 1942 ; **93**, 72) that only 16·3 per cent. of nitrogen (instead of 21·7 per cent.) was liberated by sulphuric acid from triazo-acetic ester, whereas camphorylazoimide and aromatic azoimides yielded two-thirds of their nitrogen under these conditions. The author finds that when formaldehyde is present, bis-triazo-acetic ester, which is of the type, $RCH(N_3)_2$, also readily yields two-thirds of its nitrogen with sulphuric acid. The addition of alcohol and mercury to the sulphuric acid increased the yield of nitrogen up to nearly 21 per cent., which is probably to be attributed to the reducing action of the mercury. A sensitive test for traces of halogens may be based upon the fact that when present, under these conditions, a whitish precipitate is formed in the acid in the case of chlorides and bromides, and a green precipitate, with some red coloration of the acid, in the case of iodides. The method of determining the nitrogen in triazo compounds recommended is to wash 0·1 to 0·2 grm. of the substance into a Lunge's nitrometer, with successive quantities of about 0·2 c.c. of alcohol (in some cases the author added 2 drops of 40 per cent. formaldehyde solution), and then to introduce 10 c.c. of sulphuric acid, little by little. The nitrometer is shaken, and the volume of gas liberated is measured in the usual way, and an allowance made for the pressure of the column of acid (*e.g.*, 6 mm. and 8·5 mm. in the two nitrometers used). The gas is taken as dry, and there is no appreciable vapour pressure from the acid mixture. Subsequently the residual nitrogen left in the substance may be determined by Kjeldahl's method, after washing out the nitrometer with small portions of sulphuric acid, and adding about 2 grms. of zinc dust to the acid mixture and washings. The ratio of nitrogen as ammonia to nitrogen as gas in the author's experiments varied from 1·83 to 2·03, after making a correction for the presence of carbon monoxide in the gas. It was found that the addition of formaldehyde did not make much difference in the results in the case of compounds in which only one triazo group is in combination with a carbon atom, though its use rendered the reaction more regular. Thus, in seven experiments in which formaldehyde was used, the ratio between the two forms of nitrogen only varied from 1·95 to 1·98, whence it appears that 1·9 per cent. of azidic-nitrogen is not evolved as gas. The author therefore applies a correction for this by multiplying the readings of nitrogen as gas by the factor 1·02. The sum of the nitrogen thus corrected, and of the nitrogen subsequently obtained as ammonia, were in close agreement with the total amount of nitrogen calculated in the case of various triazo compounds.
—C. A. M.

Halogens; Determination of —— in chlorobromo-organic compounds. H. Baubigny. Compt. rend., 1907, **146**, 931—933.

Attempts were made to separate chlorine from bromine by burning the compounds in chromic-sulphuric acid mixture, and collecting the chromyl chloride produced in water, and the bromine in alkaline solution of sodium sulphite; but it was found that free chlorine was always formed, so that exact separation could not be effected. The method adopted, therefore (and which gave excellent results), was to burn in chromic-sulphuric mixture in presence of silver sulphate (this J., 1903, 762, and 1904, 136) and determine the halogens, either separately, or together in one portion, and the chlorine separately in another, by the author's copper-sulphate and potassium permanganate method (this J., 1897, 635, and 1899, 176).—J. T. D.

Shellac; A method of analysing ——. P. C. McIlhiney. *See* XIII*B*.

Sugars; Volumetric determination of reducing ——. II. Limits of accuracy of the method under standard conditions. A. R. Ling and G. C. Jones. *III. Determination of sucrose and invert sugar in mixtures.* A. R. Ling and T. Rendle. *See* XVI.

Alkalinity [*of raw sugars*]*; Electrochemical determination of ——.* A. E. Lange. *See* XVI.

Diastase preparations; Method for the routine valuation of ——. W. A. Johnson. *See* XVII.

Thiosulphonates; Volumetric determination of ——. A. Gutmann. *See* XX.

Lead in cream of tartar, tartaric acid, and citric acid. R. R. Tatlock and R. T. Thomson. *See* XX.

XXIV.—SCIENTIFIC & TECHNICAL NOTES.

Metals; Solution of —— in non-metallic solvents: 2. Formation of compounds between metals and ammonia. C. A. Kraus. J. Amer. Chem. Soc., 1908, **30**, 653—668.

The author shows that according to the phase rule, the supposed compounds sodammonium, $NaNH_3$, potassammonium, KNH_3, etc., cannot exist. If ammonium is withdrawn from a solution of an alkali metal in ammonia, the vapour pressure continues to fall until a solid phase makes its appearance. After this, the pressure of the system remains constant until only free metal and gaseous ammonia are left. Alteration of the temperature of the experiment does not prevent this constancy of pressure, proving that the solid phase separating out is identical with the free metal and is not a compound. If this solid phase was a compound such as $LiNH_3$, a liquid phase could not exist unless an excess of ammonia was present, but the author describes an experiment in which a solution of lithium in ammonia exists in the presence of an excess of the metal. Calcium, however, forms with ammonia, the compound $Ca(NH_3)_6$, but a vapour pressure-composition curve is given, which shows that the supposed compound of Moissan, $Ca(NH_3)_4$, does not also exist. The solution of calcium in ammonia and the solid compound, $Ca(NH_3)_6$, have similar optical and electrical properties, and it is noticeable that the metallic characteristics of calcium are not destroyed by its combination. It is suggested that the compound, $Ca(NH_3)_6$, is simply a free positive ion which is present to some extent when a calcium salt is dissolved in ammonia, and the name *calcium hexammoniate* is proposed for it.—F. R.

Calcium; Antagonistic action of —— upon the inhibitory effect of magnesium. S. J. Meltzer and J. Auer. Proc. Roy. Soc., 1908, **80**, B, 260—261.

Subcutaneous injections of a magnesium salt bring rabbits to a profound state of anæsthesia and paralysis. This inhibitory effect is completely neutralised by the injection of a calcium salt. This experiment is analogous to the correction of an excess of magnesium in the soil by "liming."—E. F. A.

Trade Report.

Canada: Census of manufactures. Bulletin II., 70—75. Ottawa.

The following table gives particulars of certain Canadian manufactures in 1905, according to the Census of 1906:—

Industries.	Establishments.	Capital.	Wage earners.	Wages.	Value of products.
	No.	$	No.	$	
I. *Food products*	4,774	88,826,866	44,995	11,839,055	172,017,002
Baking powder and flavouring extracts	23	983,371	340	106,247	1,452,258
Condensed milk	5	607,000	172	61,720	855,409
Sugar, refined	8	13,412,517	1,694	863,026	18,268,260
Tallow, refined	3	194,820	79	36,403	270,370
II. *Textiles*	1,432	73,758,622	55,822	17,257,210	84,370,099
Textiles, dyeing and finishing	3	945,000	491	170,027	2,264,027
III. *Iron and steel products*	584	60,642,516	30,187	13,767,569	52,587,051
IV. *Timber and lumber and their manufactures*	2,234	148,416,643	77,968	28,952,869	109,500,970
Log products	1,321	97,605,078	50,108	18,050,335	67,112,286
Lumber products	482	19,381,019	11,572	5,012,078	20,528,667
Matches	3	252,000	278	69,093	226,743
Wood pulp, chemical and mechanical	22	11,164,768	2,265	885,949	3,793,131
V. *Leather and its finished products*	321	27,681,935	17,572	6,240,985	41,201,872
Leather, tanned, curried and finished	99	10,807,941	3,120	1,349,138	14,739,889
VI. *Paper and printing*	606	47,863,983	19,266	8,390,804	32,773,880
Cardboard	3	828,911	257	72,191	320,896
Paper	31	21,260,157	4,589	1,803,638	9,449,842
VII. *Liquors and beverages*	173	26,129,862	3,651	1,725,758	13,928,701
Aerated and mineral waters	64	1,809,406	638	306,831	1,949,951
Liquors, distilled	9	10,209,004	705	307,200	2,343,683
Liquors, malt	89	12,688,948	2,132	1 040,150	8,444,177
Liquors, vinous	7	684,204	57	14,674	253,929
Malt	4	738,300	110	50,903	936,961

Industries.	Establishments.	Capital.	Wage earners.	Wages.	Value of products.
	No.	$	No.	$	
VIII. *Chemicals and allied products*	141	16,039,312	3,281	1,247,332	15,290,822
Drugs	25	2,699,818	728	285,874	2,776,361
Explosives	5	879,500	103	47,531	464,718
Fertilisers	6	324,518	86	32,250	272,676
Oils	21	3,891,255	729	345,288	4,480,849
Paints and varnishes	25	3,054,202	642	239,913	3,717,181
Patent medicines	36	2,915,279	345	130,650	1,551,429
Salt	7	612,500	136	53,273	434,030
Starch	10	1,350,300	336	80,623	1,225,570
All other industries	6	311,940	116	31,930	368,008
IX. *Clay, glass, and stone products*	641	24,800,605	13,276	4,932,640	13,558,921
Abrasive goods	5	2,459,537	254	134,016	253,070
Brick, tile, and pottery	405	7,110,685	6,154	1,803,297	4,774,305
Cement blocks and tiles	17	172,440	337	140,903	375,130
Cement, Portland	15	8,916,689	1,300	590,101	2,271,002
Glass	7	863,500	1,362	469,364	1,421,773
Glass, stained, cut, and ornamental	9	112,308	115	62,781	200,026
Grindstones and pulpstones	6	231,000	111	34,675	68,504
Lime	50	1,820,387	897	466,529	1,139,416
Mirrors and plate glass	7	240,057	184	90,683	449,789
X. *Metals and metal products other than steel*	414	104,079,075	20,116	10,665,471	50,068,669
Smelting	18	87,476,829	9,307	5,880,459	28,418,328
XIV. *Miscellaneous—*					
Aluminium and aluminium ware	3	745,510	122	53,342	815,993
Asbestos	11	8,613,683	1,607	557,191	1,513,819
Carbide of calcium	3	922,000	137	55,462	234,700
Coke	3	1,579,203	281	185,172	1,278,659
Glue	5	192,500	147	29,218	362,302
Soap	20	2,584,699	530	191,001	2,956,309
Wax candles	3	70,000	14	5,560	40,000
XV. *Hand trades—*					
Dyeing and clean'ng	22	476,555	439	152,725	451,247

New Book.

Report to the Government of India, containing an account of the Research Work on Indigo performed in the University of Leeds, 1905—1907. By W. Popplewell Bloxam, with the assistance of S. H. Wood, I. Q. Orchardson, R. Gaunt, and F. Thomas, and under the general supervision of Mr. A. G. Perkin, F.R.S. Price 3s.

Large 8vo volume of 117 pages, containing: (1) A summary of work done in India, 1902–4. (2) Reprints and abstracts of various papers on indigo from this Journal and the Journal of the Chemical Society. (3) Consideration of the results of analysis of the indigo from "Mahai" of the plant grown at Pemberandah experimental plots, 1903. (4) Summary of the report made to the Gokernment of India as a result of the research work at Leeds, 1905—1907. An Appendix concludes the work.

Patent List.

Where a complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised. Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

Applications.

10,854. Schmatolla. Gas fired shaft furnaces. May 19.

11,019. Stare. Dehydrating apparatus. [U.S. Appl., May 21, 1907.]* May 21.

11,088. Macfarlane. Evaporators for concentrating liquids. May 22.

11,121. Imbert. Preparation of emulsions.* May 22.

11,385. Barker (Albaugh-Dover Co.). Liquid separators.* May 26.

11,546. Mazza and de Murietta. Separating the components of gaseous mixtures.* May 27.

Complete Specifications Accepted.

12,385 (1907). Smith. Rotary mixing machines June 3.

15,491 (1907). Hocking. Filters. June 3.

15,589 (1907). Bradford Dyers' Assoc., & Worsley. Vacuum evaporators. May 27.

27,798 (1907). Ruthenberg. Wood wool for filtering purposes. June 3.

488 (1908). Hampl. Separately collecting different portions of liquid discharged from a hydro-extractor. May 27.

4859 (1908). Imray (Meister, Lucius und Brüning). Mixing machines. May 27.

II.—FUEL, GAS, AND LIGHT.

Applications.

10,885. Wolfram-Lampen A.-G. Manufacture of filaments for electric incandescent lamps. [Ger. Appl., Nov. 29, 1907.]* May 19.

10,891. Wolfram-Lampen A.-G. Manufacture of filaments for electric incandescent lamps. [Ger. Appl., Oct. 7, 1907.]* May 19.

10,906. Beardmore & Co., Ltd., and others. Production of recoverable ammonia in the manufacture of producer gas. May 20.

11,296 and 11,297. Parsons. Facilitating combustion of fuel.* May 25.

11,524. Siemens und Halske A.-G. Manufacture of metal incandescence filaments free from carbon. [Ger. Appl., June 8, 1907.]* May 27.

11,533. Thomas. Gas producer.* May 27.

11,599. Rittersberg and Rubert. Producing filaments for electric lamps. [Ger. Appl., Sept. 6, 1907.]* May 28.

11,600. Rittersberg and Rubert. Producing filaments for electric lamps. [Ger. Appl., Oct. 30, 1907.]* May 28.

11,603. Siemens und Halske A.-G. Manufacture of tungsten incandescence filaments. [Ger. Appl., June 8, 1907. Addition to No. 16,489 of 1907.]* May 28.

11,688. Mueller. Regenerative coke ovens. [Ger. Appl., May 29, 1907.]* May 29.

Complete Specifications Accepted.

12,130 (1907). Catteau. Suction gas producers. June 3.

16,303 (1907). Franks. Manufacture of coal gas. June 3.

18,141 (1907). Jones. Coke ovens. May 27.

23,585 (1907). Fairweather (Gluhlampenwerk Anker). Producing electric illuminating bodies. May 27.

26,057 (1907). Koppers. Gas retorts. June 3.

27,833 (1907). Cowper-Coles. Furnaces for producing smokeless fuel. May 27.

66 (1908). Little. Arc lamp electrodes. June 3.

254 (1908). Sepulchre. *See under* X.

907 (1908). Suchowiak. Producing artificial fuel. May 27.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

Applications.

10,892 and 10,959. Seidenschnur. Treating crude petroleum. [Ger. Appls., Aug. 19 and Nov. 5, 1907.]* May 20.

11,140. Edeleanu. Purifying crude petroleum or petroleum products or distillates.* May 22.

Complete Specifications Accepted.

11,498 (1907). Marriott. Compositions for improving pitch and bitumen. May 27.

17,523 (1907). Knopf. Producing a fat from mineral oils for industrial purposes. June 3.

IV.—COLOURING MATTERS AND DYESTUFFS.

Applications.

10,755. Newton (Bayer und Co.). Manufacture of red colouring matters containing sulphur and capable of dyeing from a vat. May 18.

10,058. Lichtenstein. *See under* XXIII.

11,141. Johnson (Badische Anilin und Soda Fabrik). Reduction of indigo and similar colouring matters.* May 22.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

Applications.

10,922. Hindley. Obtaining variegated colour effects on fabrics.* May 20.

10,951. Shuman and Shuman. Apparatus for cleansing wool.* May 20.

11,314. Newton (Bayer und Co.). Printing. May 25.

11,637. Johnson (Hussong Dyeing Machine Co.). Dyeing material.* May 28.

Complete Specifications Accepted.

12,556 (1907). Dugour. Preparation for impregnating fabrics, etc. May 27.

12,695 (1907). Sharp. Starching and dyeing. June 3.

15,137 (1907). Bloxam (Kirchhoff und Neirath). Bleaching fibres, fabrics, etc. May 27.

20,747 (1907). Mitchell. Printing felt and like material. June 3.

23,675 (1907). Costikyan. Apparatus for printing or dyeing yarns. May 27.

23,736 (1907). Burgoyne. Treatment of wool or like fibres by dyeing, etc. May 27.

6766 (1908). Crumière. Manufacture of artificial horsehair and ribbons of cellulose. May 27.

VII.—ACIDS, ALKALIS, AND SALTS.

Applications.

10,781. England. Treatment of ammonium sulphate. May 18.

10,906. Beardmore & Co., Ltd., and others. *See under* II.

10,938. Brandenburg. Manufacture of tin salts. [Addition to No. 1461 of 1908.]* May 20.

11,388. Eydman. Purifying sea water or brine and separating the salts, etc.* May 26.

11,415. Norsk Hydro-Elektrisk Kvælstofaktieselskab. Production of pure sodium nitrite. [Appl. in Norway, June 1, 1907.]* May 26.

11,590. Loiseau. Manufacture of carbonic oxide.* May 28.

11,710. Siemens und Halske A.-G. Plastic mass from tungsten compounds. [Ger. Appl., Aug. 3, 1907.]* May 29.

11,732. Gaillard. Lead chambers for the manufacture of sulphuric acid.* May 29.

Complete Specifications Accepted.

11,338 (1907). Evans. Preparation of red oxide of iron, zinc sulphate, and sulphuric acid. May 27.

11,494 (1907). Köhler. Manufacture of sulphur compounds. May 27.

21,725 (1907). Meurer. Manufacture of metal sulphates from metal sulphides. May 27.

23,217B (1907). Johnson (Verein Chem. Fabr.). Manufacture of anhydrous, pulverulent sodium hydrosulphite. June 3.

23,217C (1907). Johnson (Verein Chem. Fabr.). Manufacture of pulverulent, anhydrous thiosulphate. June 3.

24,864 (1907). Morris, Raine, Kerr, and McLachlan. Production of a cyanide of an alkali metal. June 3.

24,865 (1907). Morris, Raine, Kerr, and McLachlan. Production of white lead and lead carbonate. June 3.

VIII.—GLASS, POTTERY, AND ENAMELS.

Application.

11,321. Grunzweig und Hartmann. Impregnating ceramic and other porous objects. [Ger. Appl., June 6, 1907.]* May 25.

Complete Specification Accepted.

11,849 (1907). Lascelles, and Illustrated London News and Sketch, Ltd. Ornamenting china. June 3.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Applications.

10,807. Polysius. Treating cement, ores, etc. [Ger. Appl., May 18, 1907.]* May 18.

11,062. Payne. Manufacture of fire-bricks, crucibles, retorts, etc.* May 21.

11,522. Timofeeff. Manufacture of cement. [Addition to No. 17,006 of 1906.]* May 27.

Complete Specifications Accepted.

12,137 (1907). Lefranc. Artificial stone. May 27.

19,523 (1907). Jupillat. Composition for plaster and the manufacture of tiles. June 3.

X.—METALLURGY.

Applications.

10,807. Polysius. *See under* IX.

10,830. Rees, Davey, and Martin. Extraction of metals from ores. May 19.

10,960. Gutensohn. White alloy. May 20.

11,008. Rayner (Innes, Procter, and Hayles). Apparatus for separating solution from slimes, sand, etc. May 21.

11,073 and 11,074. Cowper-Coles. Recovery of tin from tinned scrap-iron, etc. May 21.

11,105. Davies. Treating electrolytic copper during melting in a reverberatory furnace. May 22.

11,259. Lee. Reverberatory smelting furnaces.* May 23.

11,470. Williams and Bradley. Obtaining lead, zinc, and copper from ore. May 27.

11,525. Von Schlippenbach. Extracting zinc from materials.* May 27.

11,598. Rübel. Decarburisation of cast iron.* May 28.

11,605. Ges.m.b.H. Classen und Co. Manufacture of a soldering flux. [Ger. Appl., June 27, 1907.]* May 28.

Complete Specifications Accepted.

9415 (1907). Willey and Bartle. Slime concentrators. June 3.

11,606 (1907). Kuhne. Production of metals, metalloids, or alloys. May 27.

12,726 (1907). Goschen (Solis). Treating slimes, etc., with fluids. June 3.

12,748 (1907). Cowper-Coles. Rendering silver non-tarnishable. June 3.

15,943 (1907). Willey. Fluxes for aluminium solders. June 3.

16,834 (1907). Imbert. Treatment of ores by the precipitation process. June 3.

17,779 (1907). Lavington (Brown). Treatment of ores and metal bearing solutions. June 3.

28,511 (1907). Guggenbühl. Solder for aluminium or aluminium alloys. May 27.

28,687 (1907). Wibrin and Wibrin. Aluminium solder. May 27.

254 (1908). Sepulchre. Purifying blast furnace and other gases. June 3.

3982 (1908). Painter. Hardening steel. June 3.

5451 (1908). Barraia. Silver-like alloy. June 3.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

Complete Specifications Accepted.

9397 (1907). De Pont. Manufacture of compositions for electric insulation, etc. June 3.

11,471 (1907). Cowper-Coles. Electro-deposition of metals. May 27,

665 (1908). Strohmenger. Material for separating or enclosing the plates of secondary batteries. June 3.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

Complete Specifications Accepted.

6825 (1907). Genthe. Making linseed oil products. May 27.

12,849 (1907). Finlay. Production of soap. June 3.

18,253 (1907). Bloxam (Jacobi). Soap frames. May 27.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(*A.*)—Pigments, Paints.

Applications.

10,817. Lovell. Preservative and anti-corrosive paint. May 19.

11,399. Taylor. Manufacture of distemper. May 26.

11,638. White. Producing oxide of iron pigments. May 28.

Complete Specifications Accepted.

20,990 (1907). Merz. Preparation of colours or pigments for painting or printing. June 3.

21,601 (1907). Wegelin. Manufacture of soot. June 3.

24,865 (1907). Morris, Raine, Kerr, and McLachlan. *See under* VII.

(*B.*)—Resins, Varnishes.

Applications.

11,031. Pilgram. Production of a siccative.* May 21.

11,456. Strange, Pim, and Burrell. Manufacture of varnishes. May 26.

11,657. Castle. Manufacture of floorcloths, linoleums, patent leathers, etc. May 29.

(*C.*)—India-Rubber.

Application.

10,731. Torrini, Hoffmann, and Benoit. Material to take the place of vulcanised rubber. May 18.

Complete Specification Accepted.

23,755 (1907). Tolkien. Compound for use as a substitute for indiarubber. May 27.

XIV.—TANNING, LEATHER, GLUE, SIZE, &c.

Applications.

11,292. Baum. Material substituting leather. [Appl. under Rule 13, Jan. 24, 1908.]* May 25.

11,657. Castle. *See under* XIII*B.*

Complete Specifications Accepted.

18,773 (1907.) Rasmussen. Methods and extracts used in tanning. May 27.

2417 (1908.) Delignon. Machines for treating skins. May 27.

4358 (1908). Redlich and Pollak. Manufacture of quebracho extract. May 27.

XV.—MANURES, &c.

Application.

11,644. Harrison. Manufacture of fertilisers.* May 28.

XVI.—SUGAR, STARCH, GUM, &c.

Complete Specification Accepted.

12,762 (1907). Eastick. Purifying and making invert sugar and syrups. June 3.

XVII.—BREWING, WINES, SPIRITS, &c.

Complete Specification Accepted.

12,012 (1907). Armstrong. Brewing, distilling, &c. May 27.

XVIII.—FOODS; SANITATION, WATER PURIFICATION; AND DISINFECTANTS.

(*A.*)—Foods.

Applications.

11,597. Fischer. Production of lecithin, yolk oil, and cholesterin. [Ger. Appl., May 28, 1907.]* May 28.

11,653. Schwartz and Schwartz. Manufacture of beverages. May 29.

Complete Specifications Accepted.

8823 (1907). Kuhn. Treating liquids to prevent their fermentation. May 27.

22,195 (1907). Finkler. Rendering the nutrient constituents of grain, pulse, &c., accessible to digestion. June 3.

25,287 (1907). Schlüter and Paucksch. Method of producing flour. May 27.

25,809 (1907). Silberberg. Manufacture of flour. May 27.

(*B.*)—Sanitation; Water Purification.

Application.

11,204. Crawford. Solution of oxygen in distilled water. May 23.

XIX.—PAPER, PASTEBOARD, &c.

Application.

11,139. Bowden and Dodd. Manufacture of solutions of lower nitrates of cellulose. May 22.

COMPLETE SPECIFICATIONS ACCEPTED.

2794 (1908). Crumière. Eliminating copper from coagulated cellulose. May 27.

6766. (1908). Crumière. *See under* V.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

APPLICATIONS.

11,248. Hertkorn. Process for manufacturing camphors.* May 23.

11,335. Johnson (Deuts. Gold- und Silber-Scheide Anstalt). Manufacture of compounds of sodium and arylamines.* May 25.

11,457. Johnson (Boehringer und Soehne). Manufacture of salicylic acid derivatives. May 26.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

APPLICATIONS.

10,887. Cooper and Inman. Colouring sensitized photographic surfaces. May 19.

11,341. Klatte. Photographic dry plates. [Ger. Appl., Feb. 22, 1908.]* May 25.

XXII.—EXPLOSIVES, MATCHES, &c.

APPLICATIONS.

11,337. Matthews, Pim, and Strange. Solution or gelatinisation of cellulose nitrates, and their use. May 25.

11,807. Glen. Explosives. May 30.

11,812. Glen. Explosives. May 30.

XXIII.—GENERAL ANALYTICAL CHEMISTRY.

APPLICATION.

11,058. Lichtenstein. Instruments for estimating, comparing, or matching tints or colours on the appearance of bodies. May 21.

COMPLETE SPECIFICATION ACCEPTED.

1636 (1908). Brown and Duvel. Apparatus for the rapid determination of the moisture content of grain, &c. May 27.

Journal of the Society of Chemical Industry.

No. 12, Vol. XXVII. JUNE 30, 1908. No. 12, Vol. XXVII.

Official Notices.

ANNUAL GENERAL MEETING.

The Annual General Meeting will be held in the Armstrong College, Newcastle-on-Tyne, on Wednesday, July 22nd, at 10.30 a.m. A programme and request form were contained in the May 30 number of the Journal. The ticket of membership will be found in this number.

In accordance with the provisions of By-law 18 of the Society of 1881, notice is hereby given that those members whose names are printed in *italics* in the list of Council (see p. 363, April 30th number) will retire from their respective offices at the forthcoming Annual Meeting.

Prof. R. Meldola, F.R.S., has been nominated to the office of President under By-law 8; Dr. J. T. Dunn, Mr. A. R. Ling, Mr. George C. Stone, and Mr. R. C. Woodcock, have been nominated Vice-Presidents under By-law 8; Sir Boverton Redwood has been nominated a Vice-President under By-law 11; and Dr. T. B. Wagner has been nominated a Vice-President under By-law 26. Prof. P. Phillips Bedson and Mr. H. Van der Linde have been nominated Ordinary Members of Council under By-law 26; and Mr. Thomas Tyrer and Dr. Ludwig Mond, F.R.S., have been nominated Hon. Treasurer and Hon. Foreign Secretary respectively under By-law 9.

Prof. W. Hodgson Ellis, Messrs. O. Guttmann and H. Hemingway and Dr. G. G. Henderson have been nominated, under Rule 18, to fill four vacancies among the Ordinary Members of Council. No ballot will be required.

The medal has been awarded to Sir Andrew Noble, Bart., K.C.B., F.R.S., for his researches on explosives.

By order of the Council,

Charles G. Cresswell, Secretary.

SEVENTH INTERNATIONAL CONGRESS OF APPLIED CHEMISTRY, LONDON, 1909.

A circular issued by the Joint Organising Committee of the Congress, which will be found in the last number of the Journal, states that the Seventh International Congress of Applied Chemistry will be held in London from May 27th to June 2nd, 1909. It will find ample accommodation in the buildings of the University of London, the Imperial Institute, and the Imperial College of Science and Technology at South Kensington.

The Sections, both in number and kind, will be the same as those of the Sixth Congress at Rome; and the list of Sectional Presidents, Vice-Presidents, and Secretaries is virtually complete.

Local Committees, to further the interests of the Congress, are being formed by the various Local Sections of the Society, as well as in Belfast, Bristol and Cardiff. Similar Committees are being formed abroad, and from all quarters are forthcoming promises of support and attendance.

Private appeals for the necessary funds have met with a generous response, and a wider appeal is in contemplation at an early date, in order that the foreign visitors may have a worthy reception on this the first occasion on which such a Congress has been held in London.

Proceedings of Extraordinary General Meeting of the Society.

Held at Palace Chambers, Westminster, on June 15th, 1908.

Adoption of By-laws amended in accordance with suggestions made by the Privy Council.

The President took the chair at 5 p.m.

The Secretary read the minutes of the General Meeting held at the House of the Royal Society of Arts on March 13th, 1908.

The minutes having been duly confirmed:—

The President stated that the by-laws, prepared in accordance with the provisions of the Charter and passed in General Meeting, had been sealed and presented to the Privy Council, which had made suggestions for their amendment, the majority of which were verbal. One amendment, however, involved a principle, *viz.*, that, instead of appointing trustees, the Society should place its investments in its own name. The suggestion came from the Privy Council as being the practice of Corporations, and indeed one of the main objects of incorporation. The Council had carefully considered the matter, and had decided to adopt the Privy Council's suggestions in all respects. This meeting was called to consider, and if thought fit, pass the amendments, notice of which had been given in the Society's Journal for May 31st last, and which he would now call upon the Secretary to read.

The Secretary then read the notice convening the meeting and setting forth the resolutions amending the By-laws, as follows:—

BY-LAWS.

Take Notice that under the provisions of By-law 40 of the Society of 1881 the President and Council hereby convene an Extraordinary General Meeting of the Society to be held at five o'clock in the afternoon of Monday, June 15th, next, at the Offices of the Society, Palace Chambers, Westminster, for the purpose of considering and if thought fit passing the subjoined Resolutions setting forth certain amendments to the draft By-laws printed in the Journal of the 31st January last which were adopted without alteration at the General Meeting held on the 13th March last.

RESOLUTIONS.

(*a*) "That the words 'such investigation of all the circumstances as the Council may think fit' in the third and fourth lines of By-law 15 (Suspension or Determination of Membership by Council) be deleted and the following words be substituted in their place: 'the member first having had an opportunity of being heard.'"

(*b*) "That in paragraph (*b*) (V.) of By-law 19 (Constitution) the words 'The Trustees' be deleted."

(*c*) "That the words 'as the Council' in the sixth and seventh lines of the last paragraph of By-law 19 (Constitution) be deleted."

(*d*) "That the word 'them' in the third line of By-law 20 (The President) be deleted and the words 'the Council' be inserted in its place."

(*e*) "That the word 'them,' in the third line of By-law 21 (Vice-Presidents) be deleted and the words 'the Council' be inserted in its place."

(*f*) "That the words in the second paragraph of By-law 26 (Election of Council), 'names of retiring Trustees and' be deleted, and the words 'name of the retiring' be inserted in their place."

(*g*) "That the words 'and shall prepare' in the tenth line of By-law 33 (Hon. Treasurer) be deleted and the words 'prepare or' be inserted between the words 'shall' and 'cause' in the ninth line thereof."

(*h*) "That the word 'but' in the twelfth line of By-law 52 (Contents of Journal) be deleted and the word 'and' be inserted in its place."

(*i*) "That the words 'names of the Trustees of the Society' in the sixth and seventh lines of By-law 58 (Investments) be deleted, and the words 'name of the Society or in the names of three members of the Society who shall not be members of the Council' be inserted in their place; and that the words 'to the Trustees' in the tenth line be deleted."

(*j*) "That the whole of By-law 59 (The Trustees) be deleted and that the rest of the By-laws be renumbered accordingly."

(*k*) "That the words in the second and third lines of By-law 60 (Auditor) 'in manner provided by the By-laws for the election of a Trustee' be deleted."

(*l*) "That the words 'the Trustees' in the eighth line of By-law 63 (Annual General Meeting) be deleted."

(*m*) "That the words 'any of them' in the fifth line of By-law 70 (Minutes to be Evidence) be deleted and the words 'the Council or a Local Section' be inserted in their place."

(*n*) "That all the words after the word 'auditor' in the fifth line of By-law 77 (Custody of Charter Deeds and Securities) be deleted."

The above amendments are necessary in order to obtain the approval by the Privy Council of such By-laws in pursuance of Clause 40 of the Charter.

The President then moved, and the Hon. Treasurer seconded, that the resolutions set forth above be passed.

The motion was carried unanimously.

The President then moved, and Mr. J. H. Johnston seconded, that the Seal of the Society be affixed to the By-laws as amended. The motion was carried unanimously.

The Seal of the Society was then affixed and attested by the signatures of the President, Hon. Treasurer, and Secretary.

Mr. W. C. Hancock moved and Mr. H. S. Hawdon seconded, that a vote of thanks be accorded to the President for taking the chair. This terminated the proceedings.

STATEMENT OF REVENUE AND EXPENDITURE FOR THE YEAR 1907.

(Made up to the 29th February, 1908.)

REVENUE.

	£	s.	d.	£	s.	d.	£	s.	d.
Annual Subscriptions—									
2 Subscriptions for the year 1907 received in 1905				2	10	0			
306 Ditto ditto, in 1906				382	10	0			
3820 Ditto ditto, in 1907				4775	0	0			
44 Ditto ditto (to 29 February) in 1908				55	0	0			
—— (Sundry excess payments and 4172 balances)				14	6	8			
							5229	6	8
Entrance Fees (305 at £1 1*s.* 0*d.*)				320	5	0			
Life Composition Fees (2 at £20 0*s.* 0*d.*)				40	0	0			
"Collective Index" Subscriptions				28	8	0			
"Decennial" Index ditto				470	4	9			
							498	12	9
Interest from Investments—									
Gas Light & Coke Coy. 3% Consold. Stock	600	0	0	17	2	0			
Great Eastern Rly. 4% Irredeemable do.	1509	0	0	57	6	10			
Great Northern Ry. 3% Debenture do.	800	0	0	22	16	0			
Gt. Western Rly. 5% Guard. Prefce. do.	1250	0	0	59	7	6			
Metropolitan 3% Consolidated Stock	4476	9	2	127	11	8			
Midland Raily. 2½% Perpetual Prefce. do.	1696	0	0	40	5	8			
New South Wales 3% 1935 Stock	485	4	8	13	16	6			
New Zealand 3% 1945 do.	1000	0	0	28	10	0			
North British Ry. 3% Consd. Lien do.	1084	13	4	30	18	4			
Nottingham and Grantham Ry. 4½% do. do.	450	0	0	17	6	4			
Nottingham Joint Station 3% Debenture do.	200	0	0	5	14	0			
South Eastern Rly. 4½% Preferred Stock	673	0	0	28	15	4			
Southwark and Vauxhall Water Compy. 3% Debenture Stock	1000	0	0	28	10	0			
2½% Consols	1231	0	10	27	10	4			
Deposit account at Bank	..			37	18	9			
							543	9	3
	£16,455	8	0						
Journal—									
Advertisements				208	4	4			
Sales				600	8	9			
							808	13	1
							£7080	1	9

EXPENDITURE.

	£	s.	d.	£	s.	d.	£.	s.	d.
Journal Expenses—									
Publishing				2524	7	2			
Editorial—									
Editor's Salary	600	0	0						
Do. Expenses	61	13	11						
Abstractors	563	16	0						
Sub-Editor's Salary	150	0	0						
Indexing Journal	75	0	0						
Foreign Journals	15	0	0						
Sundry do.	8	4	3						
				1473	14	2			
French and U.S.A. Patents and Specifications				67	11	4			
Insurance of Stock				7	17	6			
							4073	10	2
"Decennial" Index (1896—1905)—									
On account of Compilation and Insurance of Manuscript				85	1	0			
Publishing Expenses				523	3	9			
							608	4	9
Sectional Expenses				690	3	4			
Annual Meeting Expenses				165	15	2			
							855	18	6
Secretary's Salary				300	0	0			
Assistant				200	0	0			
							500	0	0
Printing Sundries				40	1	11			
Stationery				55	9	7			
Library (Binding Books)				15	9	10			
Clerical Assistance				21	18	0			
Honorarium to Treasurer's Assistant				52	10	0			
							185	9	4
Office Expenses (Including Rent, Lighting, Telephones, &c.)				211	19	3			
Auditors' Fee				10	10	0			
Sundry Charges				6	7	0			
Bank Charges				9	2	4			
Solicitors' Charges				6	5	0			
							244	3	7
Hon. Treasurer's Petty Cash and Postage				26	3	9			
Secretary's ditto ditto				78	17	5			
							105	1	2
Expenses of Committee—"Internal Transport, Canals and Waterways"							47	17	5
Expenses in connection with the Charter of Incorporation							366	17	6
Investment—(£1231 0*s.* 10*d.* 2½% Consols)				1100	0	0			
Balance of Revenue over Expenditure							92	19	4
							£7080	1	9

THE TREASURER—IN ACCOUNT WITH THE SOCIETY OF CHEMICAL INDUSTRY

Dr. FOR THE YEAR 1907. Cr.

Dr.	£	s.	d.	£	s.	d.	£	s.	d.
To Cash on Deposit (1 January, 1907)				1000	0	0			
,, Balance at Bank (ditto)				393	11	4			
,, Cash in Secretary's hands (ditto)				16	16	9	1410	8	1
Annual Subscriptions—									
13 Subscriptions for the year 1905				16	5	0			
65 do. ,, ,, 1906				81	5	0			
3820 do. ,, ,, 1907				4775	0	0			
208 do. ,, ,, 1908				260	0	0			
4 do. ,, ,, 1909				5	0	0			
4110 Excess payments, and payments "on a/c" of subscriptions for various years				14	6	8	5151	16	8
Entrance Fees (305 at £1 1*s.* 0*d.*)							320	5	0
Life Composition Fees (2 at £20)							40	0	0
"Collective" Index Subscriptions (52, *Less* 4*s.* 0*d.* short)				28	8	0			
"Decennial" Index ditto (856, *less* 11*s.* 3*d.* short)				470	4	9	498	12	9
Interest from Investments—									
Gas Light and Coke Coy. 3% Consold. Stock	600	0	0	17	2	0			
Great Eastern Rly. 4% Irredeemable do.	1509	0	0	57	6	10			
Great Northern Rly. 3% Debenture do.	800	0	0	22	16	0			
Great Western Rly. 5% Guard. Prefce. do.	1250	0	0	59	7	6			
Metropolitan 3% Consolidated Stock	4476	9	2	127	11	8			
Midland Rly. 2½% Perpetual Prefce. do.	1696	0	0	40	5	8			
New South Wales 3% 1935 Stock	485	4	8	13	16	6			
New Zealand 3% 1945 do.	1000	0	0	28	10	0			
North British Rly. 3% Consd. Lien Stock	1084	13	4	30	18	4			
Nottingham and Grantham Ry. 4½% Consold. do.	450	0	0	17	6	4			
Nottingham Joint Station 3% Debenture do.	200	0	0	5	14	0			
South Eastern Rly. 4½% Prefce. Stock	673	0	0	28	15	4			
Southwark and Vauxhall Water Compy. 3% Debenture Stock	1000	0	0	28	10	0			
2½% Consols	1231	0	10	27	10	4			
Deposit account at Bank	43	9	0						
(*Less* Tax)	5	10	3	37	18	9	543	9	3
	£16,455	8	0						
Journal— Sales							155	19	1
							£8120	10	10

Cr.	£	s.	d.	£	s.	d.	£	s.	d.
By Journal Expenses—									
Publishing				2491	7	1			
Editorial—									
Editor's Salary	600	0	0						
Editor's Expenses	64	3	6						
Abstractors	593	13	1						
Sub-Editor's Salary	150	0	0						
Indexing Journal	75	0	0						
Foreign Journals	14	5	0						
Sundry Journals	7	10	4	1504	11	11			
French and U.S.A. Patents and Specifications	70	12	9						
Insurance of Stock	7	17	6	78	10	3	4074	9	3
Sectional Expenses—									
Birmingham and Midland Section				30	0	0			
Canadian Section				29	5	0			
Liverpool ditto				36	5	8			
London ditto				115	6	7			
Manchester ditto				64	1	0			
Newcastle-on-Tyne ditto				20	5	2			
New England, U.S.A. ditto				61	12	10			
New York, U.S.A. ditto				226	7	7			
Nottingham ditto				21	17	0			
Scottish ditto				38	4	0			
Sydney, New South Wales, ditto				10	11	7			
Yorkshire ditto				36	6	11	690	3	4
Expenses connected with Annual Meeting							165	15	2
Secretary's Salary (see also Sub-Editor)				300	0	0			
Assistant				200	0	0	500	0	0
Printing Sundries				19	13	8			
Stationery				55	4	6			
Library (Binding Books)				15	9	10			
Clerical Assistance				29	5	0			
Honorarium to Treasurer's Assistant (for work in 1906)				52	10	0			
Sundries				6	7	0	178	10	0
Expenses of Committee—"Internal Transport, Canals and Waterways"							47	17	5
Expenses in connection with the Charter of Incorporation							332	10	6
Office Expenses—									
Rent, &c.				161	5	0			
Gas and Electric Light				12	19	8			
Cleaning, Attendance, &c.				19	8	0			
Telephones, Furniture, &c., Sundry Requisites				17	18	7			
Fire Insurance				0	8	0	211	19	3
Auditors' Fee				10	10	0			
Bank Charges (*less* Rebate on Cheques returned)				9	2	4			
Solicitors' Charges				6	5	0	25	17	4
Investment—									
£2317 2*s.* 0*d.* 2½% Consols				2000	0	0			
Less Resold—£1086 1*s.* 2*d.* =£1231 0*s.* 10*d.*				900	0	0	1100	0	0
"Decennial" Index (1896—1905), paid on account				80	0	0			
Ditto, Insurance of Manuscript				5	1	0	85	1	0
Treasurer's Petty Cash and Postage				26	3	9			
Secretary's ditto ditto				78	17	5	105	1	2
Balance at Bank (31 December 1907)				588	6	5			
Cash in Secretary's hands (ditto)				15	0	0	603	6	5
							£8120	10	10

We have compared the above statement with the vouchers, counterfoils of the receipts issued and other records, and are of opinion it correctly exhibits the cash transactions of the Society for the year 1907. The amounts of the Metropolitan 3% Consolidated, 3% New Zealand, 3% New South Wales Stocks and 2½% Consols have been confirmed by the Chief Accountant to the Bank of England. Certificates for the remaining investments have been inspected and the Bank Balances have been certified to us by the Bankers.

23, St. Swithin's Lane, London, E.C.
20 March, 1908.

(Signed) MIALL, WILKINS, RANDALL & Co.,
Chartered Accountants.

Birmingham Section.

Meeting held at Birmingham University, on Thursday, March 12. 1908.

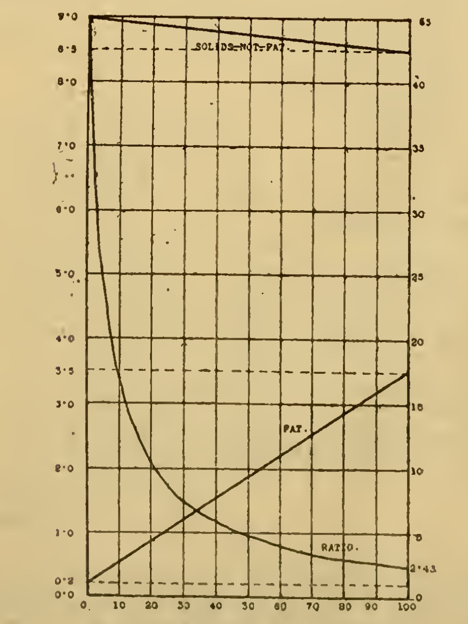
MR. HARRY SILVESTER IN THE CHAIR.

THE CALCULATION OF MILK ADULTERATION.

BY J. F. LIVERSEEGE, F.I.C.

Last year a sample of milk purchased under the Sale of Food and Drugs Acts, and submitted to me for analysis, contained 5·9 per cent. of solids-not-fat and 0·7 per cent. of fat. It had been artificially coloured. I made the following observations on the certificate:—"Comparison of the above results with the minimum limits fixed by the Sale of Milk Regulations, 1901, viz., solids-not-fat, 8·5 per cent.; fat, 3·0 per cent., shows that the said sample of milk was deficient of 30 per cent. of the minimum amount of solids-not-fat, and of 76 per cent. of the minimum amount of fat." It was found that the vendor had bought both milk and separated milk, and that he had just come out of a yard where water was easily obtained. Before the prosecution was heard I was asked to calculate the composition of the sample in terms of average milk, separated milk, and added water. Birmingham average milk, for a number of years, has varied little from 8·5 per cent. of solids-not-fat, and 3·5 per cent. of fat. Separated milk contains about 0·2 per cent. of fat and 9·0 per cent. of solids-not-fat. The composition of the diluted mixture was calculated from the following equations:—(i) $0{\cdot}085m+0{\cdot}09s=5{\cdot}9$; (ii) $0{\cdot}035m+0{\cdot}002s=0{\cdot}7$; (iii) $m+s+w=100$; where m indicated the percentage of average milk (17·2), s indicated the percentage of separated milk (49·2), and w indicated the percentage of added water (33·6). The solution of simultaneous equations is tedious, and I think a graphical method gives the composition more readily.

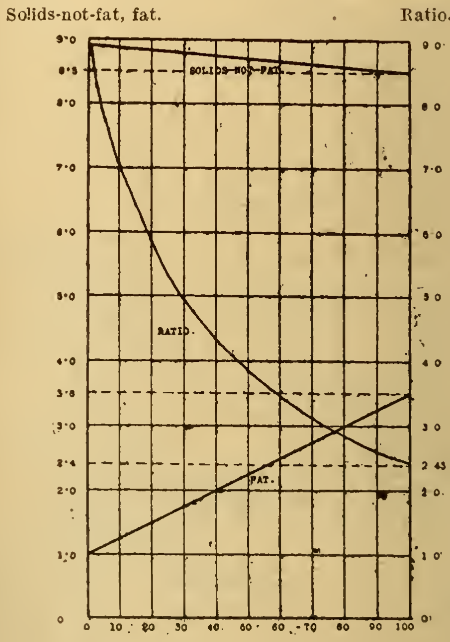
CURVE I.—Separated Milk.



Percentages of average milk, the remainder being separated milk.

In curve I, the straight lines represent the percentages of solids-not-fat and of fat respectively, and the curve shows the results of dividing the former by the latter. The curve rises from 2·43 (8·5÷3·5) to 45·0 (9·0÷0·2). The percentage composition is read on the scale to the left, and the ratios on the scale to the right of the curve. Division of the solids-not-fat (5·9 per cent.) of the above sample by the fat (0·7 per cent.) gives the ratio 8·43. This point, measured on the vertical scale on the right, was read on the bottom scale to indicate that average milk and separated milk were present in the diluted sample in the proportion of 26 to 74. The corresponding point above on the solids-not-fat line was 8·87. This figure indicates that a mixture of 26 parts of average milk with 76 parts of separated milk should contain 8·87 per cent. of solids-not-fat if no water had been added. As only 5·9 per cent. of solids-not-fat was found in the sample, the proportion of milk (average and separated together) present was 66·6 per cent. (8·87 : 100 = 5·9 : 66·6), the remaining 33·4 per cent. being added water. Further, as 74 per cent. of the mixed milks (apart from added water) was separated milk, the diluted milk as sold contained 49·3 per cent. of separated milk (100 : 74 : : 66·6 : 49·3), the remaining 17·3 per cent. being average milk. These results are practically identical with those obtained from the simultaneous equations.

CURVE II.—Skimmed Milk.



Percentages of average milk, the remainder being skimmed milk.

Curve II may be used if it is required to state the composition of the adulterated sample in terms of *skimmed* milk, average milk, and added water, with the assumption that skimmed milk contains 8·9 per cent. of solids-not-fat and 1·0 per cent. of fat. Using the ratio before obtained (8·43), the curve indicates that 2 per cent. of average milk and 98 per cent. of skimmed milk was present, and that the solids-not-fat of such a mixture should be 8·89 per cent. Calculation in the same manner as before indicates 66·4 per cent. of mixed milk (apart from added water) was present (8·89 : 100 : : 5·9 : 66·4) with 33·6 per cent. of added water. Also, that 65·1 per cent. of the diluted sample was skimmed milk (100 : 98 : : 66·4 : 65·1), the remaining 1·3 per cent. being average milk, or that the sample practically had the composition of a mixture of two parts of skimmed milk with one of water.

In the following table the solids-not-fat and the ratio obtained by dividing the solids-not-fat by the fat are given for each 5 per cent., on the assumption that average milk is mixed with either separated milk or skimmed milk.

Percentage of average milk.	Separated milk.		Skimmed milk.	
	Ratio.	Solids-not-fat.	Ratio.	Solids-not-fat.
100	2·43	8·50	2·43	8·50
95	2·59	8·52	2·53	8·52
90	2·70	8·54	2·61	8·53
85	2·84	8·57	2·73	8·55
80	3·03	8·59	2·85	8·58
75	3·23	8·62	2·97	8·59
70	3·43	8·64	3·12	8·62
65	3·69	8·67	3·27	8·63
60	3·98	8·69	3·43	8·65
55	4·38	8·72	3·65	8·67
50	4·73	8·74	3·82	8·69
45	5·22	8·77	4·07	8·71
40	5·82	8·79	4·32	8·73
35	6·54	8·83	4·63	8·75
30	7·44	8·85	4·96	8·78
25	8·73	8·88	5·33	8·80
20	10·50	8·90	5·88	8·82
15	13·14	8·93	6·40	8·84
10	16·90	8·95	7·03	8·86
5	23·93	8·98	7·78	8·88
0	45·00	9·00	8·90	8·90

DISCUSSION.

The CHAIRMAN said that in calculating the adulteration of milk, public analysts had only to certify how much a sample was deficient in fat or non-fatty solids, or both of these constituents, and with the limits given in the Milk Regulations of the Board of Agriculture that was a very simple matter. Skilful adulteration of the same sample with small quantities of separated milk and water was now very regularly practised, and where it was desirable to state the amounts of these two additions he thought the author's method afforded a ready means of making the calculation. The particular sample which had induced the author to work out his method, was the worst case of milk adulteration that had ever come under his (the speaker's) notice.

Mr. F. R. O'SHAUGHNESSY said that once curves such as these had been plotted, they saved a lot of troublesome calculation. These calculations would, however, be valid only on the assumption that the original unadulterated milks were normal and genuine. For the great majority of cases, however, one would be quite justified in applying these rules. If the added water contained much matter in solution the calculation would be upset. The composition of the ash would serve as a valuable check on the operation.

WORKS ORGANISATION.

BY H. STANLEY GARRY.

The term Organisation, according to one definition, means "the arrangement and disposition of component parts intended to act as a compound body." Certain typical examples of organisation are constantly held up as the embodiment of success, while failure after failure is attributed to inefficient organisation. In order to clear up any obscurity at the outset, therefore, I have chosen the definition given above. The popular mind appears to confuse machinery and arrangement with the forces to which these give expression, and ascribes success and failure to organisation or the lack of it, instead of recognising that organisation is but the outward and visible expression of an inward and invisible force. This force may be defined as "dominant idea," and organisation as the machinery through which it finds expression. The examples of the "dominant idea" which most readily occur to our minds are associated with the United States, whence, of late years, most of the comparisons to the disparagement of British industries have come. The American steel industry is perhaps the most striking case in point, and its success, judging from the wealth of its promoters, is beyond question. The conditions under which this industry achieved success were cumulative in effect: An expansive market protected by tariff discrimination; an average quality of product; and the dominant idea presenting itself as output—output at a minimum of productive cost and a minimum of expense. The increased profits are thus primarily due to output alone of a comparatively simple staple product, and the increase of output is secured by machine-made precision, labour-saving appliances, monotonous regularity, and automatic production, while initiative is restricted save in the one direction of quantity. Average product and a large output have been the dominant ideas of many other industries which have been organised on the same lines. Not all have been successful; the limit of an average quality of product varies, and though tariffs have accentuated the opportunities, there have been, and are, failures due not to lack of organisation, but to the limits of the market. This same dominant idea of large output and average product may be found in the cash chemist who makes his way by the multiplication of branches and by purchasing power. Again, we may have a dominant idea in pure competition, in which our success lies wholly in competitive excellence. There are also good and bad examples of the dominant idea, just as there are good and bad expressions of these in the form of organisation. Further, there may be a strong dominant idea carrying a weak organisation, just as there may be a strong organisation carrying a weak dominant idea. One may select a dominant idea, and proceed to evolve the organisation which is to give it expression; such an organisation will naturally divide itself into commercial and works or factory organisation.

In some cases, certain expressions of dominant ideas start the commercial organisation, and later complement it with that of production. In such a case the works organisation is either a part or the whole. Some dominant ideas have been evolved with a productive expression, leaving the distributive expression to follow. The main point is that, in order to obtain a successful outcome of works organisation, one must, in the first instance, determine not only what is the general dominant idea, but the extent and area of expression to which works organisation is to be committed.

The first great principle of productive efficiency is that of productive cost, and the second is that of quality of product. A railway organisation may have to depend on passenger, goods, and mineral traffic, in different degrees. In works one may have to deal with a single product, but more often with three or more. The establishment of the works organisation must provide, in the first place, for the recording of costs, and this is best done departmentally. Cost systems imply multiplicity of detail, often at the expense of a broader survey of results. The following table gives the departmental cost of a product the total of which reaches £24·49 per ton, and the grouping of which represents actual results obtained in practice. Here is a definite basis for determining productive efficiency. In the case of a new installation it should provide the standard basis on which the works organisation should be built up or evolved. The form embraces the principal questions affecting our works organisation (*see* p. 606).

Raw material.—Under this heading are:—Purchasing power; carriage inwards (value of raw material is taken delivered at the works), quality, constituent value, and price.

Wages.—Under this heading come all the opportunities for various classes of labour troubles. By the departmental separation of this item one can test efficiency by dividing labour between process and handling. By taking the tonnage of material dealt with, the average price per ton should afford a comparison with other data.

Interest on plant.—This item is placed next to wages, because in most chemical industries the wages and interest on plant items are somewhat of the nature of convertible terms. There wages may be high and interest charges low, or wages low and interest high. In the table a wages cost of £2·43 is shown, as against a charge for interest on plant of £1·07 per ton. The wages cost of £2·43 represents £1·11 for process and £1·32 for handling and transporting materials and affords grounds for deciding how far it is practicable and prudent to supersede manual

Cost Summary.

	Processes.						Total.
	A.	B.	C.	D.	E.	F.	
	£ per ton.	£ per ton.	£ per ton.	£ per ton.	£ per ton.	£ per ton.	£ per ton.
Wages process	0·34	0·09	0·19	0·22	0·14	0·13	1·11
handling	0·38	0·14	0·13	*nil*	0·30	0·37	1·32
Total	0·72	0·23	0·32	0·22	0·44	0·50	2·43
Interest on plant	0·28	0·10	0·09	0·09	0·04	0·47	1·07
Repair	0·23	0·09	0·12	0·08	0·10	0·16	0·78
Depreciation	0·52	0·06	0·09	0·12	0·08	0·24	1·11
Lighting	0·17	0·04	0·04	0·03	0·03	0·06	0·37
Heating	0·58	—	0·87	0·56	0·10	0·24	2·35
Power	0·78	0·10	0·05	0·19	—	0·35	1·47
Process materials	1·25	1·54	—	0·07	—	—	2·86
Other expenses	0·11	0·04	—	—	0·03	—	0·18
	4·64	2·20	1·58	1·36	0·82	2·02	12·62
Raw Material							11·87
					£ per ton.		
Direct cost—Materials and wages					17·16		
Indirect cost—Heating, power, lighting					4·19		
Direct expense—Repairs and other expenses					0·96		
Indirect expense—Depreciation and interest					2·18		
					£24·49		£24·49

labour by mechanical appliances. Next come depreciation charges, £1·11 per ton; repairs, £0·78 per ton, and further the provision of the necessary power plant to take into consideration as cost. The power cost alone is £1·47 per ton, and a comparison of the power cost and the wages, handling cost in the several processes, shows that there is a certain ratio between these two items. The figures indicate that this question of manual labour and mechanical appliances requires to be considered apart from the question of economy. There are some industries in which the handling cost is periodic. When the railway engineering department ballasts from a train one is struck by the number of men engaged. So it is with many industries; it would be costly to provide mechanical appliances for processes which require them only upon occasion, while manual labour can be utilised elsewhere in the interval.

One question which I have already referred to is that of the output effect on cost. The form here given will show what economies to effect if, owing to a deficiency in the supply of raw material, one had to face a decrease of say 10 per cent. in output. It is equally useful in the converse case. Convenience, therefore, decides whether mechanical appliances or manual labour are to be used, unless there is a possibility of increase of output by the adoption of labour-saving appliances. For instance, in a certain forge increase of boiler pressure implies increased output by increasing the speed of the machinery.

Rent and establishment charges.—No rent, rates, taxes, or water and sewage expenses are included in this costing, because, although forming a true item of cost per ton (in the case in point it amounted to just over £1 per ton), circumstances differ so greatly as to necessitate this being treated as a special item. From the point of view of works organisation, however, their influence on cost is very considerable. A certain amount of the shifting of industries from one locality to another is always going on; of this perhaps the greater portion is the removal of industries from inland centres to the seaports. Not only have established industries this tendency, but it is becoming more marked as years go on in the case of the establishment of new industries and new installations of established industries. The tendency is towards tidal waters, and it may be worth while, perhaps, to compare their advantages with those of inland sites. On locality depend the fortunes of a factory not only in respect of annual charges, but also on their permanency when once incurred. Three main factors are involved in this question of locality, *viz.*, inward charges on raw material, rate of labour, and outward charges on finished products. The first and last, dependent as they are both to some extent on railways and other transport, are, nevertheless, somewhat antagonistic. A large industry rarely draws raw material from and sends finished products to the same spot. If it does, it may be regarded as specially favoured. One should be quite clear whence the raw material is to be derived, whether seaborne or inland. When the former predominates, wharfage for unloading direct into the works is desirable. The dominating factor, however, is the proportion which raw material bears in bulk to finished product. In some industries there are by-products which are only marketable in certain districts, in other cases the proximity to coal is an important factor. In very few industries does time play an important part in the obtaining of raw material. It is in the first place essential, therefore, that there should be an account to show the movements of raw material and finished product. As a rule, the nearer the raw material, the further are the destinations of the finished products. Too many industries have been started without regard to these factors, and only later, during periods of diminished prices, have they been fully appreciated. Locality, from the point of view of inward and outward traffic, is a question of transport charges only, the time factor being of little moment. Germany has paid much attention to this matter, and has largely developed water carriage, particularly in the case of heavy chemical industries. This question of water carriage affects the inland districts very unfavourably in England as compared with Germany. A railway rate of 10s. per ton on an intake of 100 tons weekly makes a considerable difference in the cost of production of an industry, as against another which possesses a wharf. If we take further an industry which produces, say, 1 ton of finished product for 6 tons of raw material, the difference of £3 per ton in carriage charges means a considerable percentage addition to the price of the finished product. With regard to distribution of product, the advantages of the port as against the inland centre are under some circumstances additional to that in the case of raw material. It is possible to ship by coasting vessels at considerable advantage in rates, inclusive of breaking bulk. On the other hand, the growing tendency against carrying stock operates to the advantage of the inland centre in the time necessary to give delivery, and this is certainly a set-off, although it may be mitigated by the keeping of stock at suitable centres.

Broadly speaking, therefore, we come to the conclusion that the locality of the seaport carries certain advantages over the inland centre in the present position of transport arrangements, and this appears to be borne out by the recent development of chemical industries, not only on the Manchester Ship Canal, but at the Humber and the Tees.

The third main factor, *viz.*, labour, is not so important a factor in chemical industries as in other groups. Any chemical directory shows this, and it is a fair assumption that labour would be obtainable.

Other considerations, however, affecting the question of locality in the order of their importance are coal, water and sewage facilities, and these items will affect efficiency of production by their cost and convenience.

For coal, the advantages of a seaport are considerable, but a land centre which might be satisfactory from other points of view might do as well. The land centre has the advantage in respect of water supply, while the seaport has it in respect of sewage disposal. Water and sewage are practically rivals; where there is a good water supply from a river, sewage disposal will probably be a difficulty. To sum up:—The seaport has the advantages of raw material, if seaborne, partial distribution of finished product and export facilities, cheap coal, and sewage facilities; the land centre implies economical distribution of products, water supply, and may imply very cheap coal.

Siding connections.—Siding connections, arrangements for dispatch of goods, railway charges, including siding and terminal charges, come under this head. Chemical industries seldom have absolute competition at their doors, unless they seek it, in which case a scale of rates will be already in force; but in settling on a new area, it is well to get this question of railway charges determined beforehand, and, if possible, on competitive lines. As regards siding connections and their effect on handling as well as on general plan, the main question is whether the works are to be alongside the siding or head on to it. On the whole, the end-on service is more economical and efficient, both in respect of delivery of materials to the various departments inwards, and in the time taken to unload, reweigh, and refill trucks outwards. There has been very considerable development lately in gravitation sidings. In the Nottingham district all new collieries are so arranged that the railway company delivers the empties past the loading stages up the gravitation sidings, whence the trucks run down to their appointed stations for filling and so on to the pick-up siding. Where possible this device should be adopted, as the time saved in loading is very considerable.

The provision of steam power admits of economy in the future. The importance of this matter has been recognised in certain modern combinations, and a special department created to take charge of it. By the gradual elimination of inefficient methods a general all round efficiency has been secured, principally owing to the results obtained in one works being available for general reference.

Stock and stores keeping is of itself not costly, but may well be put on a sound accounting basis. While card index systems and daily reports are good, the effect of visual conception is comparatively better. The rent charge for separate premises for both stock and stores is well covered by the saving in time and labour and by absence of dead stock.

Repairs and maintenance.—The provision of an efficient staff for carrying out repairs and renewals is susceptible of varied treatment, according to locality and means available. It may be good policy to isolate the plant from outsiders for process reasons, and to keep an efficient staff to deal with it. At the same time, the danger of leakage in this direction is generally exaggerated, and it undoubtedly entails greater cost of wages and materials for repairs. The best system appears to be to deal with all repairs by the factory staff, and to call in outside assistance for renewals. The question of repair stock, however, in chemical industries has an influence on output. By their very nature the plant and machinery in chemical works are liable to accident, and although the repair expense involved in keeping duplicate parts is heavy and is objectionable on account of dead stock, the convenience in case of breakdown and the avoidance of loss of output is much greater.

In conclusion, the question of works organization is not an end in itself, but a factor in expressing the force of a dominant idea. The general dominant idea, once determined, should find its full expression in the works organization.

Success does not depend on business systems and card cabinets, nor on perfection in bookkeeping or cost accounting. It is not expensive plant or labour-saving appliances; these are good in their place. These are but servants, and should not be allowed to pose as principals.

Discussion.

The Chairman said that in comparing the enormous output of iron per furnace in America with that of this country, it must be remembered that the American ores were considerably richer than those of this country, and an important factor in these enormous yields was the much smaller amount of unproductive material passing through the American furnace. As regards industries removing to the coast, probably no centre had suffered more from that cause than the Midlands, and the galvanized iron trade supplied an illustration in point. That industry was largely an export trade, and works situated in this centre frequently drew their supplies of steel and spelter from South Wales. It was not at all surprising that a migration took place to that or some other seaboard whereby carriage on the raw material and finished goods was saved.

Mr. E. P. Page said that some cost systems were unreliable, and processes or improvements were sometimes condemned because the cost was apparently too high. It was essential that the chemist who worked out a process should see that it was fairly treated in the matter of prime costing. Prime cost, generally speaking, was the first consideration from the manufacturer's point of view. In the table of statistics he noticed that all the charges were based on a rate per ton. That was all right where a works turned out a fairly even class of product, but where the goods produced differed materially—if, to state an extreme case, a works made heavy machinery and watch springs—it was not possible to allocate on a common basis such charges as "depreciation," "rent," "rates," etc.

Mr. F. R. O'Shaughnessy said that the pollution of streams was a matter which had a bearing, sometimes significant, on the item of expenditure, so far as industrial firms were concerned. He took it that waste products were included in the term "sewage." In his capacity (at the Drainage Board) he had often to investigate such matters. It was a difficult problem. On the one hand there might be an industrial business, the profits of which were small comparatively. If a drastic standard of purification of the waste products were insisted upon, it might mean ruin to that industry. If local authorities became too exacting, as sometimes they were, it meant ultimately their own self-destruction, for they would drive many of the industries out of the neighbourhood.

Mr. E. C. Rossitter, commenting on Mr. Garry's table of costs, thought it would be better if the individual items, such as "direct cost, material, and wages" were placed next one another. It would thus be unnecessary to refer to three separate places in the table when making out the cost per ton due to them. Raw material was brought out rather strongly. If there were any alteration in its price it would be an easy matter to estimate what the alteration in the cost of producing the product would be. For the same reason he thought "process materials" should be brought together.

Mr. E. A. Lewis insisted that the subject of works organisation ought to receive more attention from chemists than it had received hitherto. In the copper trade, in which prices varied considerably, it was necessary that the manufacturer should know the cost to a small fraction of a penny per pound—if it were copper or brass tube—so that they might quote on enquiries. In the case of large orders it was in his judgment better to buy the raw metal required for the particular order than purchase it as it was required in the works, because the price might vary. It was unfortunate for this country that the canals were owned practically by the railways. In Germany the cost of freightage was only about one-third what it was in this country. It was said that the greater the output the cheaper was the cost per ton. He desired to know if that referred to the size of the furnaces or to the number of them. In regard to costing, the fewer the books kept the better. In the metallurgical department, a simple system of prime cost was essential.

Mr. S. **Garry**, in reply, held that it was essential that every man concerned in a manufacturing business should take a broad and comprehensive view of the business and the reasons for its existence. In particular it was essential that the chemist should not confine his interest and attention to his special work, but should know all the points which might be influenced by or through that work. One of the most important points in manufacturing was that of cost, and the influence of the work of the chemist on cost was a very considerable one. With regard to the difficulties of works sewage in chemical industries, they should bear in mind that Local Authorities were made for the manufacturers, and not the manufacturer for Local Authorities. He had purposely dealt with the subject of the paper on a general basis. If they thoroughly grasped the basis idea round which their works organization was to group, the details would readily follow. For instance, the question of fixing establishment charges would involve a whole evening to itself. The first step however was to know the actual gross cost. If a manufacturer went into the market with this knowledge at hand he could tell just what price he could afford to take and just what price would be better left alone. In a great many cases the question of establishment charges would not be the point at issue, but at what figure the direct cost would be covered. Unless this was known, it mattered little what the establishment charges were. When the manufacturer knew what it cost to get the goods there he could readily tell what he could get over this figure for his establishment charges. A man must, however, know his rock-bottom cost, or he might readily find himself on the wrong side in his quotations, especially if his cost was a fluctuating one.

London Section.

Meeting held at Burlington House on Monday, June 1, 1908.

DR. J. LEWKOWITSCH IN THE CHAIR.

The **Chairman** referred in appreciative terms to the loss which the Society and the section had suffered in the death of Sir John Evans, a former President of the Society.

THE AUTOLYSATOR. AN APPARATUS FOR THE AUTOMATIC DETERMINATION OF CARBON DIOXIDE.

BY CHARLES A. KEANE, M.SC., PH.D., AND HARRY BURROWS, A.R.C.S., PH.D.

The importance and economic value of the fullest possible control of the combustion of fuel, has led within recent years to the construction of a variety of forms of apparatus for the automatic analysis of furnace gases.

To obtain a reliable criterion of the course of a combustion it is well known that so-called "average samples," even when a constant method of suction is used for drawing the sample, are unsatisfactory, as variations in composition that may occur during the period of sampling are not detected; to gauge the effect of stoking or of any special method of combustion adopted, the only satisfactory plan of analysis is to take a series of separate samples at successive short intervals. The work thus involved is considerable and the advantages offered by any form of automatic apparatus for this purpose, as a labour-saving appliance needs no comment. The chief essentials for such apparatus are a sufficient degree of accuracy for technical work, responsiveness to variations in composition of the gases examined and applicability to use in works.

The forms of apparatus hitherto introduced for the automatic analysis of furnace gases are based upon the determination of the contained carbon dioxide. They may be divided into those in which the determination is effected by means of the specific gravity of the gases and those in which the contained carbon dioxide is removed by absorption. The former include the Lux gas balance (¹), Arndts' "Oekonometer" (²) and similar apparatus devised by Pfeiffer (³), Siegert (⁴), and Krell. Since the specific gravity of furnace gases is not only dependent upon the proportion of carbon dioxide present, but also upon that of the contained water vapour and unburnt gases, and is, moreover, variable with the pressure, results based upon this method of determination can only be regarded as approximate and are not sufficiently accurate or reliable to substitute the ordinary analytical methods.

The forms of apparatus in which the carbon dioxide is absorbed are more reliable, as their method of working is based upon the removal of the specific constituent, the percentage of which is required to be known. The forms of apparatus based upon this principle include the "Ados" or "Sarco" apparatus (⁵), the Simmance-Abady "Combustion Recorder" (⁶), the apparatus of C. Jung (⁷), that of H. J. Westover (⁸), that of W. H. Porter (⁹), the Uehling-Steinbardt "Gas Composimeter," and the "Autolysator" of Strache, Johoda, and Genzken (¹⁰).

Of these the Ados and Simmance-Abady Combustion Recorder are the best known in this country. Both depend upon the absorption of the carbon dioxide by means of a solution of potassium hydroxide and the subsequent recording of the decrease in volume effected by the absorption, whereby an intermittent estimation of the carbon dioxide in the furnace gases is effected at successive short intervals.

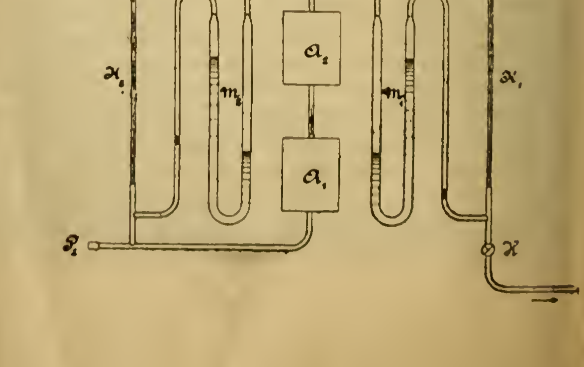
In the "Autolysator" the absorption is effected by means of soda-lime and the pressure of the gas before and after the absorption measured by differential manometers. A continuous record of the proportion of carbon dioxide is thus obtained. This difference in the principle adopted introduces some advantages and as the apparatus is not yet much known here a description of its construction and of our experience with it may be of interest.

Description of the Autolysator.—The gas to be analysed is drawn by water suction of constant pressure through two similar capillary tubes each of which is connected with a manometer. A constant flow of gas is thus obtained through the two tubes and provided no absorbent be interposed the two manometer readings will necessarily be the same. By interposing an absorbent, however, between the two capillaries, a means is introduced for determining the presence of an absorbable gas by virtue of the difference in pressure that will arise and be indicated on the manometer, provided the flow of gas be so regulated that a constant volume passes through the apparatus.

For the practical carrying out of this comparison the apparatus is arranged in the manner shown in Fig. 1.

K_1 and K_2 are capillary tubes of glass, of identical bore and length; K_1 is connected with manometer, M_1, and K_2 with manometer M_2. The absorption vessels, A_1 and A_2, are interposed, as shown, between the capillary

Fig. 1.



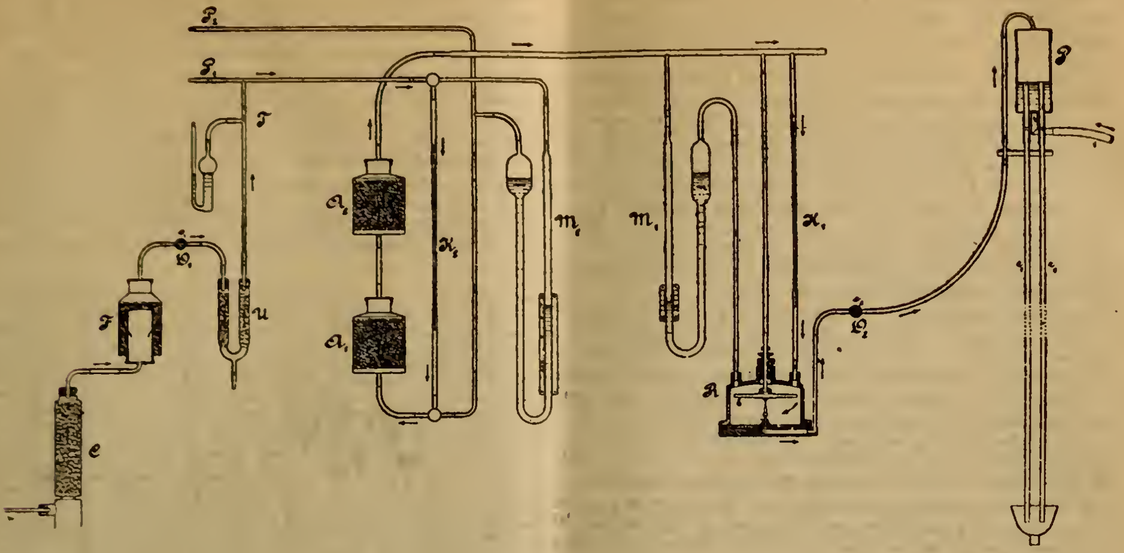


Fig 2.

tubes. The volume of gas passing through these tubes is regulated by means of an adjustable regulator at H, shown in more detail at R (Fig. 2). This consists of a cast iron box provided inside with a bellows made of thin flexible metal; the bellows is in communication internally with the gas after absorption, and is attached to a small solid cone, J, provided with a universal joint which works in a seal which controls the outlet of the gas to the pump. By means of an adjustable screw, B, the bellows can be raised or lowered and the aperture for the exit of the gas thus regulated; the rate of flow of the exit gases after absorption is thus fully under control. Thus regulated the gas is drawn through the apparatus by means of a constant-level water pump, P.

The gas to be analysed is drawn in at E (Fig. 1) through the capillary, K_2, and the pressure recorded on the attached manometer, M_2. If no absorbable gas be present the position of this manometer is recorded as the zero of the attached scale, the manometric difference being solely determined by the difference of pressure of the gas before and after passing through the capillary tube. This condition is then exactly identical with that recorded in the manometer, M_1, and both will stand at the zero point together, as the same volume of gas is drawn through both capillaries in a unit of time. In presence of an absorbable constituent, *e.g.*, carbon dioxide, which is subsequently removed, a difference of pressure will be recorded in M_2 dependent upon the quantity of gas removed, as this is determined by the relative volumes of gas which pass through the two capillaries in a unit of time. If, therefore, an absorbable constituent be removed before the gas enters K_1 a proportionally greater quantity of gas must be drawn through the capillary, K_2, in a unit of time, as the flow through K_1 is always constant. This difference is recorded on the scale of K_2 and thus gives the percentage of carbon dioxide in the gas. After leaving K_2 the gas passes into the absorbing vessels, A_1 and A_2, which are charged with soda-lime, and is there freed from carbon dioxide. From A_2 the gas passes through the capillary, K_1, and the regulator, R, to the pump, P.

Further details of the apparatus are shown in Fig. 2. C is a drying tower loosely packed with coke and calcium chloride; F is a filter-box filled with glass powder and fitted with a perforated glass cylinder so as to break up the current of gas as completely as possible in order to retain the last portions of dust and dirt. The gas then passes to the 3-way tap, D_1, which can be put into communication either with the gas supply or with the outside air. U is a drying tube one limb of which is filled with glass wool and the other with coarse calcium chloride. A safety tube is attached at F. The tap, D_2, is a 3-way tap which can be opened either to the outside air or to the apparatus, so that the communication with the pump is readily made or broken.

The tubes, P_1 and P_2, are in circuit with the manometer, M_2, and lead to a recorder (Fig. 3) on which the readings of M_2 are continuously registered.

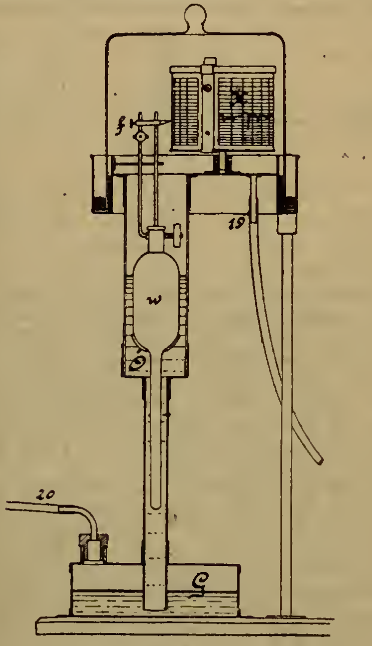


Fig 3.

The recording is dependent upon the movement of the float, *W*, which is free to move up and down in the cylinder, O; this opens into a metal box, G, which is partly filled with water to the required level. A pen, *f*, is attached to the upper end of the float which records on the revolving drum, *x*, and the whole is enclosed in a bell-jar provided with a mercury seal. P_1 (Fig. 2), communicates with tube, 20 (Fig. 3), so that the pressure on the water in G is the same as that of the gas before passing through the capillary tube; P_2 communicates with tube 19, and thus the pressure in the bell-jar is equal to that of the gas after passing through the capillary tube.

The manometric difference in M_2 is thus reproduced on either side of the float, *w*, and by this means a continuous record of the percentage of carbon dioxide is obtained on the drum.

To adjust the instrument for use it is first necessary to bring both manometers to the zero point by drawing air through the apparatus. To effect this, D_2 is connected with the pump, the water turned on, and D_1 opened to the air. When the liquids have taken a constant position the regulator, R, is adjusted so that the difference of level on each of the two manometers is about 25 cm. and the moveable scales adjusted exactly to the zero on each. The apparatus is then ready to be attached to the gas supply, which is effected without disturbance by simply turning the tap, D_1.

It is most important that the water pressure should be constant, as it was found unless this condition is observed small variations in water pressure such as arise by the turning on or off of taps on the same supply made it impossible to obtain consistent readings. This is readily secured by supplying the water from a small tank provided with a ball-cock. A fall of two metres is required for drawing the sample of gas.

Experimental results.—A series of tests were first made on a laboratory scale by drawing the products of combustion from a gas-furnace and comparing the records, at intervals, with actual gas-volumetric determinations. The maximum error under these conditions in no instance exceeded 0·5 per cent., and with two exceptions was within 0·2 per cent., as is shown in the following results; the intervals between the several tests varied from half an hour to one hour and a quarter:—

Duration of test.	Recorded percentage of carbon dioxide on Autolysator.	Analytical determination.
I.—2 hours	5·8	6·0
	6·0	6·0
	6·0	6·0
II.—2½ hours	5·5	6·0
	6·0	6·0
	6·5	6·8
	7·0	6·8
III.—6 hours.........	10·0	10·0
	10 0	10·2
	10·0	10·2
	10·4	10·6
	11·5	10·6

The records of the autolysator are accordingly in satisfactory agreement with the analytical results. The apparatus responded most efficiently and rapidly to changes in the percentage of carbon dioxide in the gases and the advantages of a continuous record were clearly indicated. To test whether the absorption was complete the exit gases from the autolysator were passed through a previously weighed soda-lime tube, when no increase in weight was observed.

The favourable conditions of a laboratory test for an apparatus of this character are however very different from those which obtain in works practice, such as the examination of the furnace gases from boilers, producer-gas, etc., for which purpose the instrument is more especially designed. Through the kindness of Mr. Bailey, chief engineer to the City of London Electric Lighting Company, and with the helpful co-operation of Mr. O. L. Peard and Mr. C. G. Cutbush, we have been able to make a series of tests with the furnace gases from the boilers at the central generating station of the Company, and thus to compare the preliminary indications of the applicability of the autolysator as shown by the laboratory tests, with the requirements of practical working. These tests were made on a hand-fed boiler, the samples drawn at the damper and the apparatus placed at a distance of about 30 feet from the boiler. As far as our tests have gone no dirt or hydrocarbon vapours are carried into the capillary tubes, which would of course interfere with the records of the instrument. The chief difficulty we have encountered has been to maintain a sufficient and constant suction from the flues so as to secure a true sample of the gas in the apparatus. With a water-pressure of 2 metres the pull was found to be insufficient in most cases, working at the distance from the furnace to which we were restricted and the variations in the draught of the furnace rendered the apparatus less reliable than under the laboratory conditions of work. To secure a more constant and reliable suction the apparatus was coupled with an "Ados" apparatus, an arrangement which had the further advantage of contrasting the readings of the two instruments. Under these conditions the curves shown in Fig. 4 were obtained on which the variations in the percentage of carbon dioxide during the test and the duration of the experiment are recorded. The readings in both cases agreed with those obtained by the "Ados," which recorded at intervals of five minutes.

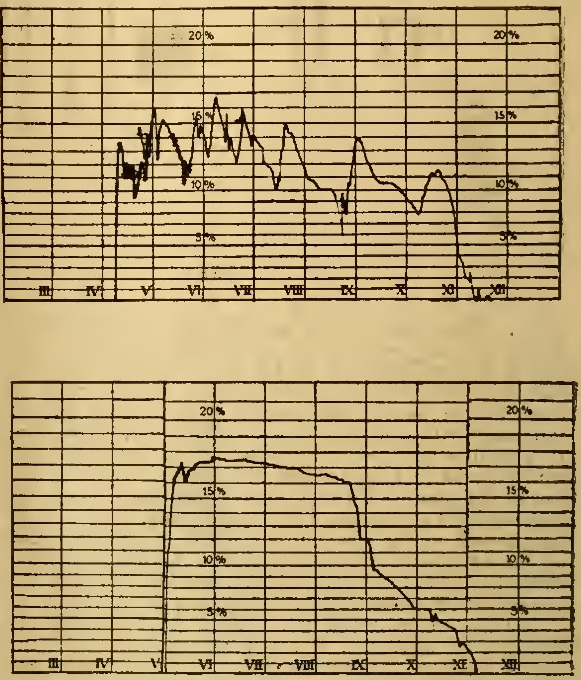


Fig. 4.

The satisfactory drawing of the sample for a continuous test where there is a varying and considerable draught to overcome is all important, and the tests we have made up to the present indicate that some modification of the apparatus in this respect is desirable. We have tried increasing the water pressure in various ways, and are of the opinion that this difficulty will be best met by so arranging the suction that a branch of the sample instead of the whole sample is conveyed to the autolysator, a plan which we now propose to adopt.

In this connection the life of the soda-lime is also an important consideration. When the gases are drawn through at a rate of 20 litres per hour, the speed recommended for continuous tests, it is said to require renewal every twenty-four hours in the case of gases containing 10 per cent. of carbon dioxide. Our tests indicate a somewhat shorter period before saturation is reached. With gases containing 15 per cent. of carbon dioxide and drawing 40 litres per hour the absorption began to slacken after 5—6 hours. This is probably as much due to the formation of channels in the soda-lime as to its becoming saturated, but the incompleteness of the absorption after this period is certainly marked. If it be borne in mind that this corresponds to an absorption of about 24 litres of carbon dioxide, this limitation is not surprising.

From reports we have received from Messrs. Favre & Co., to whom we are indebted for the loan of the autolysator, we should state however that the satisfactory working of the apparatus has been established in the automatic determination of the carbon dioxide in producer-gas employed for heating gas retorts and in the manufacture of water gas.

Compared with other forms of automatic apparatus for the estimation of carbon dioxide, the continuity of the record and its marked responsiveness to changes in composition are distinctly advantageous and its accuracy under favourable conditions of working should render it useful in several directions apart from the testing of flue gases. For the latter purpose the accumulation of further independent experience must establish its comparative value with other forms of apparatus. The cost of the soda-lime and the conditions of its renewal will naturally be weighed against that of the potassium hydroxide solutions used in other apparatus and which requires renewal only at considerably longer intervals Also the cost of water used for the suction may be an economic factor of some importance.

The introduction of automatic analytical apparatus during the past few years marks a new and important advance in the methods for the control of the conditions of working in chemical industries. They have hitherto been concerned essentially as a guide and check on the efficiency of combustion of fuel and of its calorific value, and in this application they have undoubtedly proved efficacious apart from what may be regarded as their moral influence on the stoker.

As yet automatic analysis is quite in its infancy and the engineer rather than the chemist has hitherto been chiefly concerned with its use. It holds out the possibility, however, of important applications both in many chemical industries and in methods of investigation to which it has not yet been adapted, and from this standpoint merits the best attention of chemists. Our own inquiries have been initiated with the object of applying the method to the automatic testing of the composition of illuminating and heating gases by the analysis of their products of combustion, a problem we have now under investigation and on which we hope to report to the Society on a future occasion.

Discussion.

The Chairman pointed out that automatic registration was in extensive use not only in the United States of America but also in this country. Members who attended the last annual meeting in Manchester had occasion to observe this in the pottery works at Clifton, where automatic registration was carried on by Mr. Burton. The advantages of the apparatus shown would lie in the fact that it could be put into the boiler-house, so that the fireman could read the results himself. A serious objection was, however, that every four or five hours the soda lime would have to be renewed. The assertion made by the makers of the apparatus that the soda lime lasted a long time with producer gas had very limited value, as such gas contained only about 5½ per cent. of carbon dioxide, but even with that amount difficulties would soon arise. It occurred to him that it might be possible to put one or two more soda lime boxes in and have a by-pass, so that the boxes could be changed over as soon as the absorption began to fall off. He also inquired as to the cost of the apparatus.

Mr. J. F. Briggs asked what influence variations in temperature had on the apparatus, either in the temperature of the gases or of the surrounding atmosphere by radiation, because it might make a difference if the recording instrument was nearer the boiler than the rest of the apparatus.

Mr. G. N. Huntly said the apparatus marked a distinct advance, inasmuch as it gave an instantaneous determination of carbon dioxide, whereas the recording instruments in current use were semi-integrating, averaging the samples every five or ten minutes. Further simplifications seemed necessary for practical use in the boiler-house: the engineer wanted something to correspond with the pressure gauge, with a definite working line for the stoker. The autolysator was a step in that direction because it gave a column of liquid which the man could be told to keep at a certain height; but the apparatus seemed designed rather for a chemist than a stoker. The capillary tubes did not seem to be jacketed, although a difference of temperature between the two tubes would cause pure air to record an apparent percentage of carbon dioxide. The rapid saturation of the soda lime, referred to by the authors, was a very serious difficulty; no engineer would use an instrument which required attention every four or five hours, but this difficulty could doubtless be circumvented. A practical instrument of this nature should run for a week without attention.

Sir Frederic Nathan said he had had an Ados recorder installed in his factory for some time, and he was much struck with the simplicity of the autolysator as compared with it. The Ados did not give a continuous record but the pen went up and down, and if the tops of the strokes were joined a smooth curve resulted, without those ups and downs as on the record of the autolysator, showing that with the Ados a continuous record was not obtained as with the autolysator. The Ados had the advantage that if you started it on the Monday morning, it would work without any attention for the rest of the week, apart from putting on a fresh paper every 24 hours, unless it went wrong, which he was sorry to say it often did. With the instrument described there was the distinct objection that the soda lime had to be renewed at frequent intervals, requiring skilled attention, as an instrument of this sort could not be left to an ordinary stoker to manipulate. With the Ados the stoker was told that his record must not go beyond a certain line on the chart. If one explained to the stoker what the instrument was supposed to do, he took a great deal of interest in seeing that the conditions necessary to proper working of his boilers were kept up, and in that way you did tend to reduce the coal bill.

Dr. R. Lessing asked if it had been ascertained that the composition of the gas remained unaltered after its passage through the capillary tubes. When taking water gas or producer gas from a gas conduit and drawing it with slight suction only through very narrow capillaries, the hydrogen might, through its smaller internal friction, pass more freely than the carbon monoxide and carbon dioxide. The proportion of hydrogen to carbon dioxide would then be increased, which would considerably affect the composition and consequently the differential pressure of the manometers.

Mr. J. S. S. Brame asked if the records which had been shown were obtained with mechanical or hand firing. Did the apex points of the curves correspond with the time of firing?

Dr. Keane said the records were obtained with hand firing in each case.

Mr. W. C. Hancock said the supplying of more or less continuous records tended not only to methods of economy, but of better control in various manufacturing operations. In the case of flue gases the mere record of carbon dioxide, as a check on the completeness of combustion, was not complete. An instrument was wanted which would give the other constituents. It might be possible to lengthen the life of the soda lime by introducing horizontal baffle plates with cross holes, in order to prevent the channeling of the lime in particular places. With regard to producer gas, there was a great opening for these instruments. The advantage of getting the percentage of carbon dioxide as a record of the way in which the producers were working, was very great. Naturally, the carbon dioxide varied with different types of plant, but as a general rule it might be taken as a very fair guide as to the efficiency of a producer plant, working under more or less established conditions. Recently he had been told that the Simmance-Abady instrument worked very satisfactorily, but when used with producer gas, the clogging of the tubes with tarry matter or fine dust cause some difficulty and some modification would be necessary before these instruments could be used systematically in works. Another large field for the use of these automatic recorders would be in the case of ceramic firing. In these it was necessary first to maintain the temperature required to mature the ware, and in the next place to secure the proper condition of the kiln atmosphere. The prevalence, even for a short time, of reducing conditions would not only affect the colour of ordinary unglazed ware, but in the case of glazed ware would be much more detrimental. Several attempts had been made to introduce producer gas for ceramic firing, but one obstacle to its use seemed to be that reducing conditions might occur, without any visible change in the kiln atmosphere, which, in the case of direct coal firing, would be detected at once by the formation of smoke in the kiln.

Dr. **Burrows**, in reply, said he thought the difficulties which had been referred to would be overcome with further experience with and modification of the apparatus, especially in regard to the analysis of gases rich in carbon dioxide. With reference to volume alterations of the gas caused by variations of temperature, that was controlled by the self-adjusting regulator, since it was set to allow a definite volume of gas to pass through it in unit of time, the only temperature effect would be upon the metal parts of the regulator, which would have to be considerable to affect the working. The viscosity of the liquid employed in the manometers could only affect the sensitiveness of the instrument, and the changes in the composition of the gas would have to be very rapid to cause any considerable error. The cost of the apparatus was about £25.

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(1) *Cf.* Lux and Precht. Fischer's Jahresber., 1893, 39, 1205.
(2) D.R.P. 70,829, 125,470, 129,163.
(3) D.R.P. 78,612.
(4) Verein deuts. Ing., 1888, 32, 1090; 1893, 37, 595.
(5) Ger. Pat. 160,288; Z. angew Chem., 1905, 18, 1231.
(6) Eng. Pat. 18,680, 1906.
(7) Chem. Zeit, 1905, 29, 445
(8) U.S. Pat. 833,274, 1906; this J., 1907, 26, 115.
(9) Eng. Pat. 9540, 1906; this J., 1907, 26, 280.
(10) Z. Chem. Apparatenkunde, 1907, 2, 57.

THE DETERMINATION OF ORCINOL IN ORCHELLA "WEED."

BY HENRY EDGAR WATT, D.SC., A.I.C.

In the early part of 1907, four samples of orchella "weed" were received at the Imperial Institute from the Seychelles, in order that the amounts of colour-yielding substance which they contained might be determined. Orchella weed, which is the name commonly given to the lichen *Roccella tinctoria*, is also called commercially, in common with other species of the same genus, Angola weed, Canary weed, etc., according to the supposed place of origin. When subjected to ammoniacal fermentation, it yields the colouring matter which is the essential constituent of the products known as archil, cudbear, and litmus; other lichens, such as the different species of *Lecanora*, *Variolaria*, etc., share this property, and are also used as sources of the same materials. This colouring matter is produced from orcinol, a substance which sometimes occurs free in lichens, but more usually in combination as erythrin, $C_{20}H_{22}O_{10}+1\frac{1}{2}H_2O$—an ether-derivative of di-orsellinic acid and erythrol (Beilstein., 2, 1752)—in which condition it occurs in orchella weed.

A great deal of work on the proximate constituents of lichens has been carried out by Hesse and by Zopf, details of which appear in papers published by these workers in the *Berichte*, *J. prakt. Chem.*, *Annalen*, and *Centralblatt*, but in regard to the actual estimation of the colour-producing constituent, information is very limited, the only published processes being those of Stenhouse (J. prakt. Chem., **45**, 180) and Reymann (Ber., 1875, **8**, 790). Reymann prepared mixtures of orcinol, erythrol, calcium chloride, and burnt sugar; to a solution of these he added a known excess of bromine in order to precipitate the tribromo compound of orcinol, and he then titrated the excess of bromine, whence he calculated the amount absorbed, and from that, the orcinol present. In view of the fact that he does not appear to have made any experiments with lichens, and also that orcinol does not usually exist in the free state, it was not considered desirable to proceed on the lines suggested by him. In Stenhouse's process, 10 grms. of the powdered lichen are extracted with a 5 per cent solution of sodium hydroxide as quickly as possible, the strained or filtered solution is then titrated with a standard solution of sodium hypochlorite. Each drop of the hypochlorite produces a blood-red coloration, which changes to yellow in the course of a few seconds. The addition is continued cautiously as long as this reaction is produced. The hypochlorite solution must be freshly prepared and standardised against pure orcinol or a lichen of known orcinol content. In practice a 5 per cent. solution of sodium hydroxide was found to be too strong, as it produced a semi-gelatinous solution, difficult to filter or strain. A 1 per cent. solution was therefore employed. On titrating this alkaline extract of the lichen with sodium hypochlorite, the blood-red coloration was found to be not entirely fugitive, as mentioned by Stenhouse, but, on the contrary, disappeared less quickly and less entirely as the end-point was approached, the result being that, owing to increase in colour, the completion of the reaction could not be accurately observed. The process was next modified by adding an excess of sodium hypochlorite solution to the alkaline extract of the lichen and titrating back with a decinormal solution of arsenious acid. The colour reaction was instantaneous, but as the result of a series of experiments, it was found that the amount of hypochlorite solution used was greatly increased when allowed to remain in contact with the lichen solution for some time, the quantity even increasing after the whole had stood for 24 hours. It thus appeared that, in addition to the instantaneous colour reaction, a very slow secondary reaction proceeded. The following method was therefore devised for measuring the instantaneous reaction only:—2 grms. of the powdered lichen were mixed in a mortar with an equal weight of sodium carbonate—in a solution of which erythrin is just as soluble as in a solution of sodium hydroxide, and which possesses the advantage of yielding a cleaner extract—water was then gradually added until the whole measured 100 c.c. The mixture was allowed to stand, with frequent stirring, for 20 minutes, 50 c.c. (= 1 grm. lichen) were then filtered off, excess of sodium hypochlorite solution added and followed immediately afterwards with an excess of a decinormal solution of arsenious acid. The solution was then titrated back with sodium hypochlorite solution, using drops of acetic starch iodide solution, placed on a porcelain tile, as indicator. A preliminary series of trial experiments was conducted with pure orcinol in order to test the accuracy of the process and the following results were thus obtained:—

(*a*) 1 grm. of orcinol and 1 grm. of sodium carbonate were dissolved in water and made up to 100 c.c. 10 c.c. of this solution required (1) 7·65 c.c., (2) 7·75 c.c. of hypochlorite solution.

(*b*) 1 grm. of orcinol and 2 grms. of sodium carbonate were dissolved in water and made up to 100 c.c. 10 c.c. of this solution required (1) 7·70 c.c., (2) 7·65 c.c. of hypochlorite solution.

(*c*) 2 grms. of orcinol and 1 grm. of sodium carbonate were dissolved in water and made up to 100 c.c. 5 c.c. of this solution required (1) 7·8 c.c., (2) 7·7 c.c. of hypochlorite solution.

(*d*) 2 grms. of orcinol and 2 grms. of sodium carbonate were dissolved in water and made up to 100 c.c. 5 c.c. of this solution required (1) 7·6 c.c., (2) 7·7 c.c. of hypochlorite solution; therefore, 0·1 grm. of orcinol required 7·7 c.c. hypochlorite solution. On titration, 50 c.c. N/10 arsenious acid solution were found to be equivalent to 4·55 c.c. of hypochlorite solution.

The following results were obtained with the four samples of orchella weed from the Seychelles:—

Sample.	Quantity in grms.	Hypochlorite used, c.c.	Orcinol found, per cent.
1	1·0	8·9	11·5
2	1·0	1·24	1·6
3	1·0	6·75	8·8
4	1·0	7·15	9·3

A duplicate set of determinations was carried out in which the time factor was varied, and, as a result, the above values were confirmed, and 20 minutes proved to be an adequate time to allow for maceration of the lichen with sodium carbonate solution.

Yorkshire Section.

Meeting held at Bradford on Monday, Jan. 20, 1908.

F. W. BRANSON, ESQ., F.I.C., IN THE CHAIR.

THE ANALYSIS OF TURPENTINE OILS.

BY F. W. RICHARDSON AND J. LEONARD BOWEN.

Light hydrocarbons appear to be almost the sole adulterants used for commercial turpentines. Pine oils and pinolins, by-products obtained in the manufacture of rosin oil, are as powerful solvents of oils and resins as the best turpentine. As these are largely composed of volatile terpenes, their use for ordinary commercial purposes can scarcely be condemned; for pharmaceutical use their presence in turpentine is objectionable, as they act more powerfully on the skin and cause considerable inflammation. As Valenta has stated, mere shaking of the oil with half its volume of a solution of 6 per cent. of iodine in carbon tetrachloride and subsequent heating in a water bath for one minute will give a dark green colour if pinolins are present.

Polarimetry.—On account of the presence of varying amounts of lævo and dextro-rotatory pinenes in pure turpentines, polarimetric methods are of very little service.

Refractive index.—We find that the Abbé refractometer and, within a certain range, Zeiss's butyrorefractometer give invaluable aid in the analysis of turpentines. Pure turpentines from various sources give refractive indices of 1·470 to 1·473 at 15½° C., while hydrocarbon adulterants yield figures varying from 1·41 to 1·46 at 15½° C.

Specific gravity.—The specific gravity furnishes an indication almost as valuable as the refractive index; but it is not as easily applicable to very small amounts of liquid.

Specific refractivity.—There is no special advantage in using the Lorentz and Lorenz formula $\frac{n^2 - 1}{(n^2 + 2)d}$ over that of Gladstone and Dale, $\frac{n - 1}{d}$, for the specific refractivity factor. (n=refractive index and d=sp. gravity.) Compared with turpentine the lighter hydrocarbons show both lower densities and refractivities, on this account the division of the latter by the former diminishes the difference between the specific refractivities of these two classes of bodies; hence we do not find the specific refractivities of service in the analysis of commercial turpentines.

We obtain:—

—	Specific gravity at 15½° C.	Refractive index at 15½° C.	Specific refractivity.	
			Gladstone formula.	Lorentz formula.
Pure turpentine (average) ..	0·86436	1·47334	0·5476	0·3190
Petroleum ..	0·80192	1·44474	0·5547	0·2824

We have before us two adulterants, A and V, and mixtures of these with a pure turpentine:—

	Specific gravity at 15½° C.	Refractive index at 15½° C.	Specific refractivity.
A. Petrol	0·7447	1·4174	0·5605
V. Petroleum..............	0·82114	1·4565	0·5559
10 per cent. "A" plus 90 per cent. turpentine	0·85237	1·46775	0·5488
27·75 per cent. "V" plus 72·25 per cent. turpentine	0·85237	1·46885	0·5500

It is therefore evident that while these two physical factors enable us to discover the fact, they do not enable us to find the amount of hydrocarbon adulterant with any degree of accuracy. To deal satisfactorily with such mixtures it is necessary to resort to fractionation.

Fractional distillation.—We have tried different forms of apparatus and have got good results with Young's rod and disc still-heads, while the Glinsky form has proved troublesome. By using a flask of about 500 c.c. capacity, and with a side tube, for 100 c.c. of the turpentine we obtain sufficiently good results for ordinary work. The large empty space and even the thermometer stem, fixed a little below the opening into the side tube, serve to condense portions with higher boiling points. Any residue boiling at over 200° C. should be transferred to a very small flask with side tube for final fractionation. We have tried distillation in a current of dry carbon dioxide but have obtained no advantage. The vapours which rise in the ordinary course of procedure speedily and completely drive off all air, and no appreciable amount of oxidation can occur.

The following table shows our results from the distillation of American "Daylight petroleum":—

Temp. ° C.	Volume per cent.	Sp. gr. at 15½° C.	Refractivity at 15½° C.		$\frac{n-1}{d}$.
			Abbé.	Butyrorefr.	
126·7—137·8	2·6	0·7447	1·4174	under 0	0·5605
—149·1	7·2	0·7502	1·419	,,	0·5585
—154·6	3·6	0·7548	1·4211	,,	0·5579
—161·0	3·4	0·7580	1·4229	2·0	0·5579
—165·4	3·0	0·7618	1·4255	4¼	0·5584
—171·1	2·8	0·7652	1·4276	6½	0·5587
—176·7	2·4	0·77135	1·42866	8½	0·5579
—182·2	2·4	0·77236	1·4308	11¼	0·5577
—187·8	2·72	0·7764	1·4333	14½	0·5579
—193·3	3·0	0·7818	1·4363	18¼	0·5579
—198·9	2·0	0·78594	1·4380	20½	0·5578
—204·5	2·8	0·7872	1·4392	22	0·5578
—210·0	2·0	0·79236	1·4414	25	0·5570
—215·6	2·64	0·79599	1·4431	27¼	0·5566
—221·1	2·2	0·79851	1·4441	28·6	0·5560
—226·7	3·8	0·8008	1·4459	31	0·5572
—232·2	1·72	0·80655	1·4483	34¼	0·5556
—237·8	2·64	0·80856	1·4495	36	0·5556
—243·3	3·76	0·8188	1·4514	38½	0·5512
—248·9	0·4	not estimated.	1·4538	42	—
—254·4	1·4	0·82063	1·4559	45	0·5555
—260·0	2·0	0·82114	1·4565	46	0·5559
Over 260 C.	38·72	0·83644	1·4655	59½	0·5565

An American turpentine oil similarly distilled gave the following figures:—

Temp. ° C.	Volume per cent.	Sp. gr. at 15½° C.	Abbé.	Butyrorefr.	$\frac{n-1}{d}$.
157—160	74·4	0·8654	1·4719	69	0·5453
—165·5	19·6	0·8663	1·4739	72½	0·5470
—171·1	2·8	0·8690	1·4765	77	0·5482
—176·7	0·96	—	1·4777	79	—
—182·2	0·40	—	1·4797	82½	—
Over 182° C.	1·84	—	1·5036	—	—
Itself	—	0·86844	1·4728	71	0·5438

The turpentine oil only commenced to distil at 157° C., and between this point and 171·1°, 96·8 per cent. had passed over into the receiver.

90 parts by volume of the turpentine were mixed with 10 parts by volume of the petroleum and the mixture was fractionally distilled:—

Temp. ° C.	Volume per cent.	Sp. gr. at 15½° C.	Abbé.	Butyrorefr.	$\frac{n-1}{d}$.
126·1—149·1	0·24	0·8401	1·4367	18·3	0·5198
—154·6	0·28	0·8506	1·4545	43	0·5352
—161	30·00	0·8590	1·4685	64	0·5453
—165·4	47·60	0·8629	1·4704	67	0·5452
—171·1	8·88	0·8632	1·4717	69	0·5464
—176·7	3·88	0·8636	1·4726	70½	0·5471
—182·2	2·00	0·8654	1·4726	70½	0·5460
—187·8	1·32	0·8649	1·4723	70	0·5460
—193·3	0·80	0·8647	1·4721	69¾	0·5458
—198·9	1·72	0·8639	1·4719	69½	0·5462
Over 198·9	3·28	0·8926	1·4873	96	0·5458
Itself	—	0·8626	1·4873	68	0·5458

It requires little more than a superficial glance to see that the sample is shown by the results of distillation to be adulterated with hydrocarbons. 1·472 is the lowest refractivity for a distillate from genuine turpentine, whereas over 80 per cent. of the distillate had to come over before this figure was reached in the case of the above mixture. The distillates from the petroleum, the turpentine, and the mixture may be briefly summarised :—

—	Percentage distilling under 171·1° C.	Sp. gr. at 15½° C.	Abbé.	Butyro refr.	n—1 / d.
Turpentine	96·8	0·8666	1·4725	70·1	0·5451
Petroleum.	22·6	0·7551	1·4216	below 0	0·5584
Mixture ..	87·8	—	1·4698	66·1	—

Our calculations in regard to this adulterated article are complex, and are based on the following factors :—

Distillates at ° C.	Refractive indices at 15½° C.			Percentages found.		
	Petroleum.	Turpentine.	Mixture.	Distillates. Turps.	Distillates. Petrol.	Petrol in sample.
126—154	1·418	1·472	1·4403	41·5	58·5	0·31
—161	1·423	1·472	1·4685	93·0	7·0	2·10
—165	1·4255	1·474	1·4704	92·6	7·4	3·53
—171	1·4276	1·4765	1·4717	90·0	10·0	0·89
—198·9	1·4334	1·4780	1·4720	87·0	13·0	1·27
Over 198·9° C.	1·46	1·49	1·4873	91·0	9·0	0·30
					Total	8·40

A curious feature is noticeable in the distillates from 154° to 198·9° :—approximately 10 per cent. of these on the average consists of petroleum. The loss or error of 1·6 per cent. is inconsiderable when the difficulties of the case are remembered.

Samples of petroleum and turpentine differing from the ones used in the mixture just described were mixed in the proportions of 10 per cent. and 90 per cent. respectively. In order to test the method suggested by Vèzes (this J., 1903, 1106), we obtained the distillates in fractions of one-fifth. 100 c.c. of the sample on fractionation gave :—

	Volume per cent.	Temp. ° C.	Refractive index at 15½° C.		Dispersion.
	c.c. a few drops	16—46·11			39·6
A.	2·0	46·1—148·9			
	5·0	148·9—155·5	1·46321		39·7
	5·0	155·5—156·6			
	8·0	156·6—157·2			
B.	20·0	157·2—158·3	1·46935		39·7
C.	20·0	158·3—158·8	1·47041	1·4705	39·3
D.	20·0	158·8—165·5	1·47115		39·3
E.	10·0	165·5—182·2	1·47180	1·4752	39·3
	10·0	residue over 182·2	1·47875		

Vèzes bases his method on the differences of the refractive indices of the distillates obtained in fifths.

Let D represent this difference and *Dd* the difference between the refractivities of E and C :—D=(E minus C) (5th and 3rd distillates). X=percentage of foreign substances. $D = 0{\cdot}0032 + 0{\cdot}0037x$.

Naturally A to C are scarcely affected, while C to E are considerably influenced by resin or rosin oil. The gasoline class of adulterants will naturally affect A and B Petroleum, while affecting all the distillates, will most strongly influence E. With the differences from A to C, Vèzes asserts that the quantity of each adulterant may be found from $\delta - \frac{0{\cdot}0007}{x} = P$, where δ is the observed difference C and A, and x is a factor dependent upon the nature of the adulterant used.

Substance.	x.
Petroleum	0·0002
"White spirit"	0·0080
Light petroleum	0·0025
Benzene	−0·0009
Carbon bisulphide	−0·0046

According to Vèzes, unadulterated turpentine gives for x, nil to 0·001, whilst also the value for D is not greater than 0·0125, and the initial boiling point is not lower than 150° C. To test this method we tried to distil turpentine and petroleum in fifths, but we were not surprised to find ourselves confronted with certain difficulties. 5½ per cent. of residue was left by the turpentine, and we could see that at 200° C. and over, this did not distil, but began to decompose. We were only able to distil 36 per cent. of the petroleum under 205° C. (400° F.) and it appeared that a higher temperature only served to slowly split up the residual hydrocarbons. 100 c.c. of the turpentine gave us :—

	C.c. per cent.	At °C.	Refractive Index at 15½.°C	Differences.
nil.	....	16 –155·5		
20·0	....	155·5–157·0	1·47054	·00054
20·0	....	157·0–158·0	1·47108	
20·0	....	158·0–160·0	1·47147	·00039
20·0	....	160·0–162·0	1·47203	·00056
14·0	....	162·0–165·5	1·47322	(·00119)
6·0	residue over ...	165·5	1·48946	

Instead of a difference of 0 to 0·001 for (C—D), we find a difference of 0·00093 : showing a close agreement, The petroleum (100 c.c.) gave :—

	C.c. per cent.	At °C.	Refractive index at 15½°C.
10·0	....	126·6–155·5	1·43130
10·0	....	155·5–162·7	
10·0	....	162·7–182·2	
6·0	....	182·2–205·0	1·44342
64·0	residue over	205·0	1·46364

The first 20 per cent. deducted from the second 16 per cent. showed a difference in the refractive index of 0·01212. This figure is in strange disagreement with Vèzes' 0·0002. As gasoline is more amenable to this kind of treatment we obtained the following figures :—

C.c. per cent.	At °C.	Refractive index at 15° C.	Differences.
20·0	21·1–37·8	1·36271	·00122
20·0	37·8–46·1	1·36393	
20·0	46·1–54·5	1·37053	·00660
20·0	54·5–69·4	1·37923	·00870
14·0	69·4–93·3	1·39333	·001410
6·0 residue over ...	93·3	1·41803	

The gasoline itself had a refractive index of 1·37664.

Here the differences are so variable that no definite factor is calculable. (C—A)=0·00782 with the gasoline, 0·00093 with turpentine, and 0·02749 with 10 per cent. of gasoline in turpentine. Such results are quite impossible for calculation purposes.

The use of solvents.—The British Pharmacopœia says that oil of turpentine "is soluble in its own volume of glacial acetic acid"; but it omits all reference to temperature. On a cold day glacial acetic acid will dissolve only half as much turpentine as on a warm summer's day: moreover such strong acid, and within a range of 10° C., would fail to detect a large adulteration with petroleum. The most useful strength of acetic acid is represented by a mixture of 99 volumes of the glacial acid with one volume of water. In spite of apparently useful results obtained under certain conditions, we have been obliged to abandon the method on account of its unreliability, even in cases where the turpentine has been made to contain as much as 20 per cent. of petroleum.

The use of acetic acid as a solvent for oils and fats is well known in the application of the Valenta test, which, however, gives results as temperatures demarcating clearness from turbidity. As with fatty oils, so with turpentines, the temperature has an enormous influence upon the solubility in acetic acid. A mixture of 5 c.c. of the turpentine with 3 c.c. of a mixture of 99 vols. of glacial acetic acid and one vol. of water, giving a clear solution at temperatures above 36° C., was heated in a stoppered vial for 2 hours at 99° C.

	Pure turps.	10 per cent. petrol.	Differences.
Turbid at °C.	29½	35	5½
Clear at °C.	30	35½	5½

A mere fraction of a degree made all the difference between turbidity and clearness. As a qualitative method the Valenta test under strict conditions may be of some service.

Alcohol.—Mixtures of alcohol with small amounts of water when shaken with adulterated turpentines give separations no more satisfactory than those obtained with acetic acid.

Chemical methods.

Iodine absorption.—A. McGill compares the Hanus and Hübl methods of obtaining the iodine value in regard to turpentines and their adulterants (this J. 1907, 847). We agree with McGill that the Hübl is preferable to the Hanus method for this class of compounds. However, the circumstances governing the method are not thoroughly understood, and the variations in the same sample are so large that the method is somewhat unreliable for calculation. Nevertheless, as the iodine value (Hübl) of pure turpentine is approximately 370 per cent., while that of petroleum may vary from *nil* to 20 per cent., it is evident that the test is of some service in turpentine analysis. In conjunction with physical data the iodine number is of great value.

Thermal values.—The action of bromine upon turpentine is so violent that one must use some solvent that is miscible with turpentine and petroleum in order to dilute the bromine. 4 per cent. of bromine by volume (about 12 per cent. by weight) was dissolved in carbon tetrachloride. 2 c.c. of the oil were mixed with 2 c.c. of this solution, and the following elevations of temperature were noted :—

Turpentine.	Petrol.	°C.
100	—	26·7
90	10	23·3
80	20	23·1
50	50	22·5

The differences are too small to be of value.

As petroleums gave variable thermal values, we sought for some reagent which would exert no action whatever on saturated hydrocarbons, and even upon such olefines as are usually found in these liquids, while at the same time it should produce an appreciable amount of heat constantly with terpenes. We thought we had found such a substance in antimony trichloride. A thermometer with a specially small and spherical mercury bulb was used. The mixture of the powdered salt with a fluid presented difficulties, and we did not get uniform results until we used a platinum tube charged with mercury as a protecting and conducting medium for heat to the thermometer bulb. 1 grm. of finely powdered antimony trichloride is rapidly weighed and introduced into a stout glass tube (of these tubes a large number ought to be obtained exactly identical in all possible respects). The platinum tube containing mercury and having a delicate thermometer immersed, is then introduced, and by means of a twisting action, the antimony trichloride is caused to form a thin layer in the lower parts of the glass tube. After a few moments the temperature is noted (the whole being packed in a beaker with some non-conducting material). A quantity of the turpentine to be examined is obtained at the same temperature, 2 c.c. are rapidly added, and the increase of temperature noted, a twisting action being maintained during the whole of the experiment to facilitate the action. The increase in temperature in degrees C. is what we designate as the "antimony trichloride value." Tested in this manner petroleums give absolutely no value, whereas a pure turpentine gave 47·3 in four consecutive occasions. Unfortunately for the utility of the test, we have met with an undoubtedly genuine turpentine which gave an antimony trichloride value of only 22·8. Moreover this turpentine gave the same iodine absorption as a sample having an antimony trichloride value of 47·2. It is evident that a turpentine may contain bodies reactive to Hübl's iodine reagent and not to antimony trichloride. A ratio of from 100 to 104 in the iodine absorption cannot account for a ratio of 100 to 207·3 for the antimony trichloride value.

A table showing the influence of the addition of petroleum to turpentine upon the antimony trichloride value is here given :—

Per cent. petroleum.	Sp. gr. at 15½° C.	Refraction.		Antimony trichloride value. °C.
		Abbé.	Butyro.	
nil	0·867995	1·4728	71	47·4
2·5	0·86796	1·4719	69½	46·0
5·0	0·86608	1·4710	68	44·4
10·0	0′86252	1·4697	66	42·1
15·0	0·85932	1·4685	64	39·4
20·0	0·855428	1·46725	62	35·8
25·0	0·8521	1·4659	60	32·5
30·0	0·84892	1·4646	58	28·4
35·0	0·84544	1·4633	56	26·3
40·0	0·841896	1·4619	54	23·9
45·0	0·83832	1·4608	52·3	22·3
50·0	0·8350	1·4595	50·3	18·8
55·0	0·83156	1·4582	48·3	16·1
60·0	0·82842	1·4572	46·9	13·6
65·0	0·8250	1·4559	45	13·3
70·0	0·82128	1·4545	43	12·5
75·0	0·81796	1·4533	41·3	10·0
80·0	0·81484	1·4520	39·5	8·0
85·0	0·81136	1·4510	38	6·4
90·0	0·80908	1·4495	36·1	4·2
95·0	0·80504	1·4483	34·3	2·65
100·0	0·80110	1·4469	32·0	nil.

We have worked out a correction for variations in the temperature with regard to the refractivity of turpentine, petroleum, and mixtures for the Abbé refractometer :— One degree C. increase in temperature over 15½° C. decreases the refractive index by 0·00048 for turpentine, 0·00043 for petroleum, and 0·00045 for mixtures of equal parts.

Polymerisation.—Several methods have been suggested for the conversion of terpenes into their polymers while leaving hydrocarbons unaffected. Strong sulphuric acid appeared to give desirable results : but after close investigation we found that : (1) Pasty masses of polymers holding hydrocarbons in solution were formed. (2) It was impossible to make even a reasonably good separation of any hydrocarbons which have escaped chemical action.

We cannot endorse the results obtained by J. M. McCandless (J. Amer. Chem. Soc., 1904, 981—985), who repurifies by fuming sulphuric acid and steam distillation until the turpentine is eliminated : this point being determined by refractometry.

How the fractional distillation combined with refractometry works out will be evident from the following examples :—

A mixture of turpentine with 10 *per cent. of petroleum.*

Temp. °C.	Volume. per cent.	Sp. gr. at 15½ °C.	Refr. index at 15½ °C.	Hubl iodine value.	Antimony trichloride value.
147–150	0·84	0·85053	1·4636	277·6	—
–160	52·40	0·8618	1·46824	318·9	44·0
–170	34·00	0·8646	1·47074	331·3	45·60
–180	3·00	0·8581	1·47154	280·9	37·8
–190	1·80	0·8558	1·46948	222·5	33·4
–200	1·04	0·8532	1·46788	189·3	23·4
–220	1·60	0·84982	1·46578	11·6	12·3
Residue	5·32	0·88408	1·48228	63·6*	1·3

* High figure due to resinoids.

A mixture of turpentine with 50 per cent. of petroleum.

Temp. °C.	Volume. per cent.	Sp. gr. at 15½° C.	Refr. index at 15½° C.	Hubl iodine value.	Antimony trichloride value.
130–150	2·28	0·8208	1·449575	200·0	23·0
–160	21·36	0·8376	1·456875	247·3	27·2
–170	26·44	0·8494	1·463175	291·3	31·4
–180	14·40	0·8496	1·464275	318·9	29·7
–190	4·40	0·8456	1·463075	214·5	24·3
–200	2·92	0·84007	1·46170	153·4	16·0
–220	3·20	0·83338	1·4590	78·58	4·0
–230	2·40	0·82985	1·4381	35·43	nil.
Residue	22·60	0·8556	1·4714	11·98	nil.

The composition of the turpentine following was unknown to the analyst. 100 c.c. on distillation gave :—

	C.c. per cent.	At ° C.	Refractometry at 15½° C.
(a) ...	20·0	155—159	1·46385
(b) ...	10·0	—163	1·46638
(c) ...	25·0	—166	1·46671
(d) ...	10·0	—168	1·46746
(e) ...	10·0	—177	1·46744
(f)....	10·8	—191	1·46580
(g) ...	1·0	—200	1·46452
*Residue	11·0	over 200	1·46594

* Residue, minus 1·0 c.c. for turpentine non-volatile residue plus 14·23, gave a total of 24·23 per cent. petroleum. The actual amount present was 24·00 per cent.

Calculating, we get from turpentine to 177° C. at 1·472 and petroleum to 177° C. at 1·43. Above 177° C. turpentine at 1·473 and petroleum at 1·44, *e.g.*, distillate (*a*) :—x=per cent. turpentine, y=per cent. petroleum. (1) $x+y=100$. (2) $1{\cdot}472x+1{\cdot}43y=1{\cdot}46385\times100$, hence $x=80{\cdot}5$ per cent. of turpentine and $y=19{\cdot}5$ per cent. of petroleum.

Distillate.		Petroleum.
	Per cent.	On sample.
(a)	19·5	3·90
(b)	13·5	1·35
(c)	12·5	3·12
(d)	15·0	1·50
(e)	21·9	2·19
(f)	14·8	1·60
(g)	57·0	0·57
		14·23

DISCUSSION.

Mr. F. W. **BRANSON** asked if it would not be advantageous to use a double-walled vacuum tube in place of the platinum tube in the antimony trichloride test, in order to secure greater accuracy. The fractionation test would often reveal what nothing else would. By means of the polarimeter he had detected turpentine in rosemary oil, but when the instrument was in the hands of the adulterator the latter could avoid detection.

Mr. T. **FAIRLEY** said that as turpentine was liable to oxidation the boiling point must vary within certain limits. In old turpentine a large proportion of substances of high boiling point was present. He asked if antimony pentachloride would not be better than the trichloride for the heat test, since as a liquid it could be more readily mixed. It would probably be necessary to reduce its violent action, as in the case of bromine, by the addition of some solvent. He believed Mr. Archbutt used bromine in carbon tetrachloride solution and found he could get useful results by limiting to a definite period of time—about half an hour. Where large quantities of the commodity were used it was necessary to have some means of detecting variations in quality. In heat tests the method of mixing was of importance. For instance, by rubbing together vigorously many oils in a large mortar with concentrated sulphuric acid the sulphonic derivative was obtained with very little darkening, without evolution of sulphur dioxide, and the temperature did not rise as in the case where the oil was oxidised and much sulphur dioxide evolved.

Mr. G. W. **SLATTER** said he thought the fractionation test was the most valuable. The antimony trichloride test, judging from the results obtained in the paper, appeared to be useless. He thought the addition of liquids when other than petroleum would add to the difficulty of testing turpentine substitutes.

Mr. H. G. **BENNETT** was rather surprised that Mr. Richardson preferred the Hübl method to the Hanus method for determining iodine values. In his experience temperature affected very slightly determinations made by the latter method. The use of bromine and tetrachloride apparently depended on a time factor and would therefore probably yield a method more empirical than could be desired.

Dr. L. L. **LLOYD** said the antimony trichloride test might be affected by the position of the double bond in the structural formula for turpentine. There would be a difference between the double bond in the nucleus and that in the side chain. Turpentines from different sources contained different terpenes and therefore the method would have to be tested with pure terpenes. He did not think the nitric acid test was a convenient one, and it was necessary to dilute the terpene before testing.

Mr. J. H. **WRIGHT** asked if the terpenes were not a case of isomerism. He had tested twice distilled turpentine by the polymerisation process and could never get more than 19 per cent. from mixtures which he had made up containing 20 per cent. of turpentine. He did not see how any one process could be used alone, but taking the specific gravity, Hübl's iodine absorption, and refractive indices for comparison seemed to be the only way of arriving at the truth.

Mr. **RICHARDSON**, in reply, said he had thought of a double walled vacuum tube in the antimony trichloride test, but it was scarcely worth while, since the iodine values of two turpentines might be the same whilst the antimony trichloride test gave entirely different numbers for each. With regard to the method used for obtaining the iodine value, McGill said that Hübl's method was preferable for turpentine, and he found it worked well for the class of adulterant used. Young's still-head was the best for fractional distillation. It was simple and easily cleaned, but an ordinary distilling flask was good enough for rough work. He had tried the nitric acid process and did not recommend it. He had got over the difficulty of fumes by dissolving the turpentine in glacial acetic acid and pouring it down a funnel into a special apparatus, but could not get good results. The nitric acid oxidised both the turpentine and petroleum, and nitroterpenes were formed which dissolved some of the petrol. He had only been able to get 8 or 9 per cent. from mixtures containing 20 per cent. of petroleum. He did not recommend the polymerisation process with sulphuric acid, since the polymerised bodies appeared to dissolve unpolymerised bodies. The terpenes were isomerides and possibly some of these compounds had peculiar characteristics depending on the nature of their side chains. If other liquids were added to turpentine the difficulty of detection would depend on their nature. Such an addition as that of methylated spirit or wood naphtha would be easily removed by water and use of a centrifuge.

Obituary.

JOHN EVANS.

PRESIDENT SOCIETY OF CHEMICAL INDUSTRY.
1892–1893.

Sir JOHN EVANS, K.C.B., F.R.S., was born in 1823, at Britwell Court, Buckinghamshire. He was educated by his father, the Rev. Dr. Arthur Benoni Evans, sometime headmaster of the Grammar School, at Market Bosworth, in Leicestershire. Later he was sent to Germany to study the language as a preparation for his business career. As a result of this varied training, he became an accomplished classical scholar, distinguished antiquary, and an eminent man of science, but he was not destined for an academic career. Through the family connections of his mother, John

Evans became associated early in life with the firm of John Dickenson and Co., paper manufacturers, of Nash Mills, near Hemel Hempstead, in Hertfordshire, and at the residence adjoining the works he settled as a young man, and there he lived for more than fifty years at an address which became almost a household word with several generations of scholars, antiquaries, and men of science in all parts of the world. Nevertheless, he was a business man from first to last, and his capacity for business, both public and private, was of a very high order indeed. Several years ago he retired from the daily work and routine of his firm, though retaining a keen interest in its concerns, and some share in its supervision. For many years before his death, Sir John Evans had been President of the Paper Manufacturers' Association. The first work he published, entitled "Coins of the Ancient Britons," appeared in 1864, and a supplement was added in 1890. But science, especially geology, and the anthropological researches associated with it, always shared with archæology, supreme place in Evans's favour. The relation of geological structure to water supply formed a subject which after careful study and investigation, he made his own. He was one of the first geologists in this country to appreciate the importance of the discovery of flint implements and its bearing on the prehistoric condition of man. In 1860 he contributed a paper, "Flint Implements in the Drift," to *Archæologia*, and a second in 1862. On this subject he became one of the highest living authorities. In 1872 he published a monumental work on "The Ancient Stone Implements, Weapons, and Ornaments of Great Britain," a second edition appearing in 1897, and in 1881 the series was completed by the publication of "The Ancient Bronze Implements, Weapons, and Ornaments of Great Britain and Ireland." In 1874 he became President of the Geological Society, after being elected a Fellow in 1857. He was early elected a Fellow of the Royal Society, in which he held the office of Treasurer for twenty years, from 1878 to 1898, and of Vice-President, during a portion of that period. From 1885 to 1892, Sir J. Evans was President of the Society of Antiquaries, a position making him an *ex-officio* trustee of the British Museum, and later he became a permanent trustee. From 1877 to 1879 he acted as President of the Anthropological Institute. Sir John was created a K.C.B. in 1892 and in 1897 to 1898 he was President of the British Association. He has also been chairman of the Society of Arts, and was for several years President of the Egypt Exploration Fund, in which he took a very active interest. He was the author of very numerous papers contributed to *Archæologia*, the organ of the Society of Antiquaries, and to the *Numismatic Chronicle*, of which he was one of the editors for nearly fifty years. Sir John Evans was High Sheriff of the county of Hertford in 1881, and for several years he occupied the posts of chairman of quarter sessions, and chairman of the County Council. Sir John Evans died on May 31st, after a brief illness, at his residence, Britwell, near Berkhampstead, in his 85th year.

Journal and Patent Literature.

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I.—PLANT, APPARATUS, AND MACHINERY.

Patents.

Annealing, heating, or melting oxidisable materials without causing oxidation thereof. V. Stobie, Sheffield. Eng. Pat. 10,185, May 2, 1907.

"A method," is claimed, "of heating, without oxidising, oxidisable materials, consisting of operating any furnace having controlled gas and air supplies passing into the heating chamber, in such wise that the said chamber shall be filled with combustible gases, which, together with the material being treated therein, are raised to and maintained at any desired temperature by the burning of air, which enters the chamber, whilst the gas supply is maintained in great excess over the air supply."—W. H. C.

Cleaning or washing smoke; Apparatus for ——, for evaporating or cooling liquid, or for use as a condenser. J. Black and A. H. and H. Lennox, Newcastle-on-Tyne. Eng. Pat. 14,675, June 25, 1907.

The apparatus consists of a rectangular chamber, divided into compartments by a vertical and several horizontal partitions. These do not extend completely across the chamber, but are so arranged that the compartments form a continuous series of communicating chambers, through which the smoke or gas passes in a zig-zag course. Jets of liquid are arranged at either end of each compartment, to wash the smoke, or to be evaporated by the hot gas.
—W. H. C.

Filter element for collecting dust and condensing fumes. L. B. Fiechter, Basle, Switzerland. Eng. Pat. 28,635, Dec. 30, 1907. Under Int. Conv., March 21, 1907.

The filter is formed by winding one or more threads of fibre or asbestos round a rectangular or oval frame or spool, formed of two end pieces connected by rods or bars.
—W. H. C.

Filter. E. J. Sweetland, Goldfield, Nev. U.S. Pat. 887,285, May 12, 1908.

Circular frames have one hollow ear at the top and bottom, and two on each side, and are assembled together as in the ordinary filter-press. A curved perforated pipe connects the upper conduit formed by the top ears, with the interior of each frame, which contains a filtering device. The filtering device is in communication with one of the side conduits, the other side conduit having nozzles for discharging into the chamber below.—J. W. H.

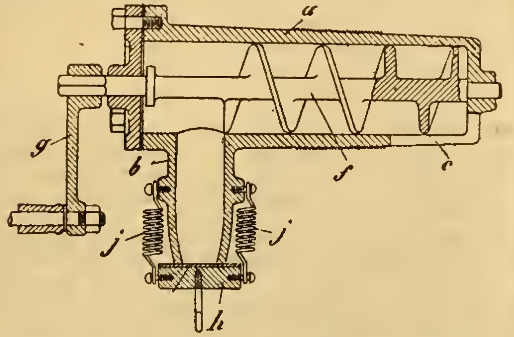
Filter element. C. Sellenscheidt, Berlin. U.S. Pat. 887,349, May 12, 1908.

Each element of a filter-press consists of a main frame carrying auxiliary frames having grids consisting of a network of wires in tension. The auxiliary frames are secured to the main frame, and a coating of an elastic material, such as rubber, is used to make all joints tight.
—J. W. H.

Separation of solids from liquids. H. T. Durant, Bulawayo, Rhodesia. Eng. Pat. 15,350, July 3, 1907.

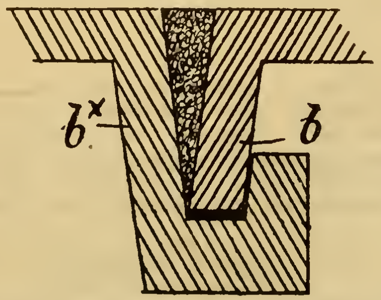
A number of hollow filter-plates, covered with filter-cloth, are vertically suspended, parallel to one another and at suitable intervals, within a closed vessel, which terminates below in a cone. The mud to be filtered, is forced, under pressure, into the vessel, and the liquid passes through the cloth into the interior of the plates, from which it flows away by pipes, which pass through the side of the vessel. The solids deposited on the surface of the filters are continuously removed by wire scrapers, which are caused to pass to and fro across the surface, by reciprocating gearing. The detached solids fall into the bottom of the cone and are continuously elevated and discharged through a valved opening, in the side of the cone, by a vertical screw elevator.—W. H. C.

Spigot for drawing off viscous liquids [*tar, syrup, etc.*]. P. Jörgensen, Aarhus, Denmark. Eng. Pat. 15,807, July 9, 1907.



The spigot, *a*, is closed at both ends and is provided with a spiral screw, *f*, rotated by the handle, *g*, which serves to cause the flow of the viscous liquid. The liquid enters through the aperture formed at *c*, and is discharged through the side tube, *b*. When not in use, the opening of *b*, is closed by a disc, *h*, which is pressed against the end of the tube, *b*, by the springs, *j*, *j*.—W. H. C.

Drying-floors. T., J. R., and H. N. Torrance, Bristol. Eng. Pat. 28,012, Dec. 19, 1907.



The drying-floor is formed of a number of rectangular plates, each of which has flanges projecting downwards on all its four sides. The flanges on two adjacent sides of each plate have the form shown at *b*, in the figure, and those on the two opposite sides the form shown at *b*×. These flanges interlock as shown, and the space between them is filled with a suitable packing material.—W. H. C.

Drying in vacuum Apparatus for ——. E. Passburg, Berlin. U. S. Pat. 888,257, May 19, 1908.

See Eng. Pat. 3432 of 1906; this J., 1906, 802.—T. F. B.

Extracting apparatus. J. E. Porter, Syracuse, and A. L. Clark, New York, Assignors to the Just Mining and Extraction Co., New York. U.S. Pat. 887,268, May 12, 1908.

The apparatus consists of a tank provided with heating coils and fitted with a porous bottom, composed of some mineral substance, and capable of withstanding the air pressure or suction applied to it. Porous cylinders of the same material are arranged so that they can be raised or lowered within the tank; through these also, a current of air can be forced or drawn.—C. A. W.

Rotary kiln. C. Ellis, White Plains, N.Y. U.S. Pat. 887,318, May 12, 1908.

In gas-heated rotary kilns, the heating gas is supplied by a burner having high and low pressure air supplies, one within the other, and means for heating this air.—J. W. H.

Centrifugal fans or drums; Distribution of liquids in ——. P. Kestner, Lille, France. U.S. Pat. 888,092, May 19, 1908.

See Eng. Pat. 17,784 of 1907; this J., 1908, 436.—T. F. B.

Distilling and rectifying apparatus. R. Austerlitz. Ger. Pat. 195,185, Nov. 3, 1906.

The partitions in the rectifying column are movable and interchangeable. The tray or plate portion of each partition is provided near the edges with slits, so that the condensed liquid flows downwards from each partition in the form of a fine rain. Each "circulation-ring" is connected with the one below by an overflow tube, movable up and down, in such a manner that, in general, the liquid does not flow through this tube, but passes in the form of a fine rain through the slits mentioned.—A. S.

II.—FUEL, GAS, AND LIGHT.

Bacteria as agents in the oxidation of amorphous carbon. M. C. Potter. Proc. Roy. Soc., 1908, **80**, **B**, 239—259.

Experiments on carbonaceous substances such as charcoal, lampblack, coal, and peat have conclusively established the fact that by exposure to the air, a slow oxidation of amorphous carbon takes place through the agency of bacteria, carbon dioxide being given off. The amount increases in proportion to the rise of temperature, and the gas ceases to be evolved at a supravital temperature. In order to guard against extraneous influences, three methods were employed:—(1). A stream of air, freed from all traces of carbon dioxide by passing it through caustic soda solution and baryta water, was led through a flask containing the carbonaceous material, and the effluent gas passed through baryta water, in which the presence of absorbed carbon dioxide was subsequently tested for by titration with oxalic and hydrochloric acids. (2). The rise of temperature due to bacterial oxidation was determined by means of a thermopile and galvanometer. (3). In the case of charcoal the presence of calcium carbonate in the flasks containing bacteria was detected. Before performing the experiments, the charcoal was sterilised by heating to a white heat in absence of oxygen, and the research flasks were cleaned by means of nitric acid vapour and steam from distilled water. The bacterium used was obtained from garden soil, and by cultivation in presence of sterilised charcoal, a pure culture of a *Diplococcus* (diam. 1μ) was obtained. In the case of charcoal, no carbon dioxide could be detected in the effluent gases until after 1—2 weeks, but subsequently an average of 7—8 mgrms. per week was obtained. The non-appearance of carbon dioxide at first, is due to its absorption by lime present in the charcoal. Under perfectly dry conditions, such as preclude the possibility of bacterial life, there is no evolution of carbon dioxide. A distinct rise of temperature occurs through the action of the bacteria, and can be measured in various ways. This heat must be taken into account in connection with the oxidation and spontaneous combustion of coal; it may have a dangerous effect on explosive gases. The oxidising action of bacteria is largely responsible for the disintegration of coal and the high percentage of depreciation which it undergoes during storage, and these organisms form an invaluable agency in assisting the circulation of carbon and rendering it available for plant nutrition without the intervention of direct combustion.—E. F. A.

Petrol testing. G. H. Baillie. Engineer, May 22, 1908, 540.

The author points out that the true standard of a good fuel for internal-combustion engines is the readiness with which it evaporates, and that the ideal fuel should all vaporise in its passage along the induction pipe from the jet to the inlet valve. The apparatus designed by the author for testing the volatility of a fuel, consists of a graduated tube terminating below in a stop-cock, and above in a large bulb, with an opening to the air. Near the bottom of the tube a side tube is introduced, and connected to a foot-bellows. The tube is filled with the fuel to be tested, and the quantity read off on the scale. On working the bellows, each stroke drives the fuel into the bulb and thoroughly mixes it with air. The opening of the bulb is protected in such a way that no fuel can be carried off mechanically with the air. The height of the fuel remaining in the tube is read off after, say, each 10 strokes, until the whole of the petrol has been evaporated. The temperature of the apparatus is maintained constant by surrounding the tube with a water-bath. The amount of air used in evaporating a given quantity of the fuel, whilst not giving a measure of the quality of the fuel, is of value in comparing a new fuel with older petrols.—W. S.

Carbon monoxide; Elimination of —— from coal gas. L. Vignon. Compt. rend., 1908, **146**, 1033—1035.

The author has tested the efficiency of three methods for removing carbon monoxide from coal gas. (1). By passing the gas over reduced nickel at 250° C. (after removal of benzene and sulphur compounds), the whole of the carbon monoxide is converted into methane; and, in fact, it is even possible, in this way, to eliminate carbon monoxide from a mixture of coal gas with about 20 per cent. of water-gas. (2). When coal gas (deprived of benzene) is passed over heated iron oxide, more or less of the carbon monoxide, according to the conditions, is converted into carbon dioxide. (3). Practically all the carbon monoxide is removed by means of cuprous chloride solution.—F. Sodn.

Patents.

Briquettes; Method of making —— for building and metallurgical purposes, for heating, etc. A. Hof. Fr. Pat. 385,665, Dec. 28, 1907.

The material to be agglomerated into briquettes, is first dried by heating, and is then, whilst still hot, treated with a "solvent," *e.g.*, oil, alkali solutions, or resinates, which penetrates the particles. The mass is then mixed with an agglomerant, *e.g.*, asphaltum, pitch, or colophony, and moulded into briquettes.—A. G. L.

Bituminous coal; Process for the treatment of —— to render it smokeless, and for the recovery of by-products. W. Dixon, Glasgow. Eng. Pat. 10,804, May 9, 1907.

It is claimed that those constituents in the coal, which cause the production of smoke, are removed by treatment with steam in externally heated retorts. To non-coking or small coal may be added a quantity of tar to give it the necessary coking property. Ammonia and other by-products may be more easily recovered by the addition to the coal of certain salts such as sodium or potassium chloride or nitrate, or of an alkali hydroxide.—W. S.

Coke; Process of desulphurising. E. L. Stoner, Scottdale, Pa. U.S. Pat. 887,145, May 12, 1908.

The coke is subjected to the action of highly heated chlorinating gases at the close of the burning process, and the fire is then quenched to wash out the remaining soluble salts.—A. T. L.

Fumes and gases; Apparatus for condensing ——. G. C. Richards, Berkeley, Cal., Assignor to Richards Gas and Fume Condenser Co., Oakland, Cal. U.S. Pat. 888,119, May 19, 1908.

An ordinary smoke stack carries a bend on its top and is continued horizontally for discharge into a tank. At the bend a water jet is arranged to promote the draught, and near the tank a depression is made, from which the liquor formed is run off.—J. W. H.

Gases and vapours; Apparatus for generating —— by the direct contact of combustion gases and water. B. Dosek, Bohemia. Eng. Pat. 16,315, July 16, 1907.

Liquid or solid fuel is burned by means of compressed air, and the products of combustion are injected into the water of a steam boiler. The gases produced are retained by the boiler until required for use in driving steam engines.—J. W. H.

Gas and coke; Manufacture of ——. J. Hansford, Portland, and W. P. Gibbons, London. Eng. Pat. 23,202, Oct. 21, 1907.

A fuel very suitable for domestic use is produced by coking a mixture of coal and peat. The proportions may vary. Coal 3 or 4 parts, peat 1 part, makes a good domestic fuel. Coal 5 parts, peat 2 parts, makes a softer coke. The coal and peat are previously broken up but not pulverised. Gas can be produced at the same time, without any alteration in the method of procedure usually adopted.—J. W. H.

Coke and gas; Apparatus for the manufacture of ——. J. Armstrong, London. U.S. Pat. 888,136, May 19, 1908.

See Eng. Pat. 1642 of 1906; this J., 1906, 840.—T. F. B.

Gas producer. C. J. Atkinson, Milwaukee, Wis. U.S. Pat. 887,300, May 12, 1908.

The producer comprises a cylindrical combustion chamber having at its lower end a bosh of inverted conical shape, beneath which is arranged a circular fuel-supporting table with a central conical portion projecting upwards into the neck of the bosh. The table can be moved up and down to discharge ashes outwardly over its edge. —A. T. L.

Gas producer and method of making producer gas. E. P. Snowden, St. Joseph, Mo. U.S. Pats. 887,860 and 887,861, May 19, 1908.

(1). The gases from the upper part of the producer are withdrawn through openings in its wall and returned centrally, together with air and steam, by means of a steam jet, to the bottom of the producer. (2). The fuel in the producer is maintained in two zones, into one of which the oxygen-bearing agent is introduced. The resulting gas is carried through the other zone, whereby carbon monoxide is formed, and the condensable products converted into a fixed gas.—J. W. H.

Gas; Process of producing ——. G. J. Weber, Kansas City, Mo. U.S. Pat. 887,989, May 19, 1908.

The exhaust gases from a gas engine are mixed with air, and forced back again through the fuel of the producer; the resulting gas is mixed with a further portion of exhaust gases and steam, and used over again in the gas engine. —J. W. H.

Gas producer; Method of maintaining a constant or approximately constant temperature in a ——. E. Capitaine, Reisholz, Germany. U.S. Pat. 888,421, May 19, 1908.

See Fr. Pat. 353,085 of 1905; this J., 1905, 961.—T. F. B.

Gas producers. A. du Thil. Fr. Pat. 385,778, April 27, 1907.

The producer, which is suitable for all kinds of fuel, is of light construction, and can be used for traction. The fuel is supported on a conical grate mounted on a central bearing and receiving a combined rotating and oscillating motion from two eccentric spur-wheels gearing with teeth on the under side of its periphery. A conical bell beneath the feeding hopper directs the raw fuel towards the sides of the producer chamber, leaving an inverted conical depression in the surface of the fuel beneath the bell. Air, heated in a casing around the producer, is mixed with steam generated in an annular boiler in the casing, and the mixture, after passing through a regenerator, is led into the conical

bell and passes downwards through the fuel; the gas escapes past the lower edge of the refractory lining into an annular chamber behind the lining, and thence to the steam and air superheater. The fuel above the combustion zone undergoes distillation, and all tarry vapours are destroyed; steam is introduced below the grate, and passes upwards through the fuel bed, below the combustion zone, to prevent the formation of clinker.
—A. T. L.

Gas producer. E. Maillet. Fr. Pat. 385,764, Dec. 30, 1907.

The gas producer is of the suction type and is provided with means for automatically regulating the water supply in proportion to the amount of gas drawn in by the engine. The water is delivered to the vaporising device from one arm of a U-tube open to the atmosphere, the other arm being connected at its lower end to a constant-level water-supply tank, and at its upper end to the gas space of the scrubber. Normally the water is at the same level in both arms of the U-tube and in the tank, but when the gas pressure is reduced during the admission stroke of the engine, water is drawn into the U-tube from the tank, past a check-valve, and afterwards flows by gravity, past a second check valve, into the open arm of the U-tube. The water thus delivered is heated in a long U-tube in the gas main, between the producer and the scrubber, and the hot water is partially vaporised in a U-tube arranged within a depending gas outlet passage in the upper part of the producer, above the level of the fire; the vaporisation is completed, and the steam superheated, in a double coil at the back of the refractory lining of the producer, and in two circular passages in an inverted conical casting which supports the lining. The steam issues through small orifices in the casting, and mixes with the air passing up through the incandescent fuel.—A. T. L.

Gas washing or purifying apparatus. H. W. Williams, Abertillery. Eng. Pat. 572, Jan. 9, 1908.

The scrubber is composed of a superposed series of short columns of water retained by shelves with upstanding ledges. These ledges form the rims of circular apertures, each of which is covered by a cap, the sides of which project downwards and surround the ledges. The apertures are made progressively smaller in the direction of flow of the gas, in order to compensate for the decreased volume of the gas due to cooling. The apparatus may be modified so that the gas is adapted to ascend or descend, as it bubbles through the succession of short columns of water, and filters through the corresponding succession of screens composed of dropping water.—W. S.

Filaments for incandescent gas lamp mantles. R. Laigle, Paris. Eng. Pat. 3785, Feb. 19, 1908. Under Int. Conv., Oct. 11, 1907.

See Fr. Pat. 382,749 of 1907; this J., 1908, 216.—T. F. B.

Filaments for incandescent mantles. R. Laigle, Paris. Eng. Pat. 9622, May 4, 1908. Addition to Eng. Pat. 3785 of 1908 (see Fr. Pat. 382,749 of 1907; this J., 1908, 216).

This process of making filaments for incandescence mantles is characterised by the use of a soap such as ammonium oleate, and a purified agglutinant such as gum arabic, together with an organic oxidising material. These substances are incorporated with the mixture of oxides, composed of alumina (precipitated), 3 parts; beryllium oxide, 2 parts; silica or ammonium silicate, 1 part; thorium oxide, 92·8 parts; and cerium oxide, 1·2 parts. The organic oxidising material serves the purpose of completing the combustion of the carbon on calcination.—W. S.

Refractory electrical conductors; Manufacture of —— suitable for electric lamps, furnaces, and the like. British Thomson-Houston Co., Ltd., London. From Gen. Electric Co., Schenectady, U.S.A. Eng. Pat. 15,451, July 4, 1907.

This claim relates to a process whereby refractory electrical conductors, suitable for use in electric lamps, furnaces, etc., are made by mixing a refractory material such as tungsten, molybdenum, boron, tantalum, graphite, etc., with a binder composed of an alloy of bismuth, cadmium, and mercury, the conductor being then shaped and heated to such a temperature that the binding material is driven out and the refractory material sintered. (See Eng. Pats. 18,487 and 18,749 of 1906; this J., 1907, 816, 1002).
—W. S.

Incandescent filaments; Manufacture of ——. G. Auger, Paris. Eng. Pat. 8746, April 21, 1908.

The filament immediately after being squirted, is allowed to fall through a conical oxy-hydrogen flame formed by means of a ring burner.—J. W. H.

Gases; Automatic analysis and recording of ——. Eng. Pat. 26,924. *See* XXIII.

Combustible gases; Determining the calorific power of ——. Fr. Pat. 385,726. *See* XXIII.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM AND MINERAL WAXES.

Petrol testing. G. H. Baillie. *See* II.

Petroleum discovery in Spain. U.S. Cons. Rep., May, 1908. [T.R.]

The U.S. Consul at Seville reports that a little over three years ago, in making improvements in the canal at Villamartin, the presence of petroleum was discovered and a well was opened. At a short depth a lime rock was struck, which when broken by dynamite laid bare a large mass of ozokerite. In March, 1907, a new well was begun and petroleum was met with at the depth of 8 meters. At 14 meters' depth the quantity of gas which issued from the well was so great that drilling was relinquished in favour of boring. At 74 meters large quantities of gas came to the surface, which gradually increased with the depth until a pressure of 80 pounds was reached. As soon as safety appliances had been set up petroleum rich in benzine and lighter oils welled up in quantity.

Patents.

Pyroligneous substances; Process and means for the direct extraction of ——. A. Pages, E. Camus, and R. P. Duchemin, Paris. Eng. Pat. 10,775, May 8, 1907. Under Int. Conv., May 10, 1906.

See Fr. Pat. 375,314 of 1906; this J., 1907, 920.—T. F. B.

Tars or pitches; Treatment of —— in order to render them more suitable for industrial purposes. W. J. Malden, Surbiton, and A. Malden, Twickenham. Eng. Pat. 12,230, May 27, 1907.

See Fr. Pat. 373,775 of 1907; this J., 1907, 817.—T. F. B.

Stearine-pitch; Utilisation of —— as a waterproofing and insulating material. M. Dupré and S. Icard. Fr. Pat. 385,805, Dec. 23, 1907.

The residue obtained on the distillation of "stearine" may be employed for waterproofing paper, fabrics, and the like. It can be applied directly or after being dissolved in a volatile liquid, and other substances, such as tar, resins, magnesium carbonate, talc, graphite, etc., may be added to it in order to form a coating material. Stearine-pitch is also useful as an insulating material in electrical apparatus.—W. P. S.

Tarry wood-vinegar; Distillation of —— and evaporation of tarry acetate solutions. F. H. Meyer. Ger. Pat. 193,382, Aug. 11, 1904.

The invention consists essentially in the application of the multiple-effect system to the distillation of crude wood vinegar and the evaporation of acetate solutions.—A. S.

IV.—COLOURING MATTERS AND DYESTUFFS.

Quinonoids. XV. Wurster's colour salts. R. Willstätter and J. Piccard. Ber., 1908, 41, 1458—1475.

The authors have investigated more fully the nature of quinonoid and quinone-imide dyestuffs by an examination of the properties and constitution of Wurster's colour salts, which were prepared by the oxidation of alkyl-*p*-phenylenediamines. Wurster (Ber., 1905, 35, 2495) obtained unstable red and blue dyestuffs from aminodimethylaniline and tetramethylphenylenediamine. The red colour salt was obtained by the authors as greenish-black crystals melting at 146—147° C. with decomposition, and giving a Magenta-coloured solution. It was prepared by the slow addition of 1 atomic proportion of bromine to dimethylphenylenediamine dissolved in carbon tetrachloride, or still better, in glacial acetic acid. The product was washed with glacial acetic acid and with ether, and recrystallised from methyl alcohol. It was soluble in cold water and with difficulty in cold alcohol. Analysis proved the substance to be a semi-quinonoid compound, termed *meri*-quinonedimethyldi-imonium bromide: $Br(CH_3)_2N : C_6H_4 : NH_2Br + (CH_3)_2N.C_6H_4.NH_2$. Dilute mineral acids decolorised the solution, neutralisation restoring the colour again. Dilute alkalis destroyed the compound completely. Sulphurous acid, stannous chloride, and iron chloride decolorised the red solution. By treatment with an additional atom of bromine, Wurster's Red was converted into the colourless *holo*-quinonoid salt, and with potassium iodide, a black crystalline iodide was formed. With thiosulphates the two bromine atoms were replaced by thiosulphuric acid residues. The colourless unstable *holo*-quinonoid derivative of aminodimethylaniline was prepared and isolated as the nitrate by the oxidation of dimethylphenylenediamine with nitrous gases. The gas was led into 0·5 grm. of the dimethyl base, dissolved in 50 c.c. of alcohol and 2·5 c.c. of 40 per cent. nitric acid, and cooled with a mixture of ice and calcium chloride. The precipitated green *meri*-quinonoid salt became colourless as the stream of gas was continued. The light yellow crystalline deposit was removed and washed with alcohol and ether, as soon as a drop of the suspended liquid gave no coloration with water. It agreed on analysis, with the formula: $NO_3.(CH_3)_2N : C_6H_4 : NH,HNO_3$. This *asymm*-quinonedimethyldi-imonium nitrate burned with intumescence and dissolved in water to a colourless solution. It was converted into Wurster's Red, *i.e.*, to the *meri*-quinonoid salt, on partial reduction by boiling with alcohol or on addition of the leuco-base. On addition of tetramethylphenylenediamine salt to this quinonoid nitrate, a blue coloration was produced. The oxidation product of tetramethylphenylendiamine, known as Wurster's Blue, was prepared as the well crystallised sulphate. 1 grm. of the diamine was dissolved in 10 c.c. of 30 per cent. sulphuric acid and 50 c.c. of alcohol, and nitrous gases were led into the solution, the latter being cooled. On washing the precipitate with alcohol and ether, it was obtained in the form of dark green to violet prismatic crystals. Dilute solutions in water were pure blue, whilst concentrated solutions were violet to red. According to analysis the compound contains 1 quinonoid molecule combined with 2 molecules of diamine: $C_6H_4[N(CH_3)_2SO_4H]_2 + 2C_6H_4[N(CH_3)_2]_2 + H_2SO_4$. By further oxidation with nitrous gases a more stable salt was formed, which proved on analysis to be a two-thirds quinonoid sulphate:

$$2C_6H_4[N(CH_3)_2.SO_4H]_2 + C_6H_4[N(CH_3)_2]_2 + H_2SO_4.$$

The authors conclude that the weakly coloured and colourless components, which go to produce these dyestuffs, are combined in a state of dynamical equilibrium. This state, in which the partly quinonoid condition of the compound is spread over the whole molecule, is expressed by the name *meri*-quinonoid. Special methods of analysis for these quinone-imonium salts are used, *viz.*:—I. Colorimetric methods: *a.* Determination of the maximum coloration produced by a constant quantity of the diamine salt with varying quantities of bromine; *b.* Estimation of the quantity of Wurster's salt by comparing colorimetrically with an excess of leuco-base combined with 1 atom of bromine. II. Volumetric method: By reduction with stannous chloride. For this purpose the substance is dissolved in 25 c.c. of 2*N* hydrochloric acid, which makes the decolorisation at the end of the reaction more distinct. Tetramethylphenylenediamine also serves to indicate very sharply the end of the reaction.—W. S.

Tetramethyldiaminodiphenylcarbinol; Constitution of the compounds of —— with some methylene derivatives. R. Fosse. Compt. rend., 1908, 146, 1039—1042.

The author draws the conclusion that, in neutral or alkaline media, the tetramethyldiaminodiphenylcarbinylmethylenic compounds are not to be regarded as being linked together by an oxygen atom. Ethyl tetramethyldiaminodiphenylcarbinylacetylacetate is linked by a carbon atom thus: $[(CH_3)_2N.C_6H_4]_2CH.CH(CO.CH_3).CO_2.C_2H_5$, as it possesses a ketonic group. The corresponding benzoylacetate has a similar constitution. The constitution of tetramethyldiaminodiphenylcarbinylacetylacetone is: $[(CH_3)_2N.C_6H_4]_2CH.CH(CO.CH_3)_2$, and the corresponding benzoylacetone has a similar formula. Tetramethyldiaminodiphenylcarbinylmalonic acid has the constitution, $[(CH_3)_2N.C_6H_4]_2CH.CH(CO_2H)_2$. When any of these compounds is treated with dimethylamine in presence of acetic acid, the molecule is broken, the leuco base of Crystal Violet being formed, together with methylenic compounds.—J. C. C.

Tritanecarboxylic acids. H. v. Liebig. Ber., 1908, 41, 1645—1648.

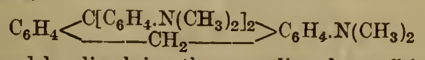
Benzilic acid condenses with resorcinol and other phenols when heated for 1½—2 hours to 180—200° C., to form the lactone of the corresponding hydroxytritanic acid (tritane = triphenylmethane: tritanic acid = triphenylmethanecarboxylic acid) from which the respective hydroxycarboxylic acid can readily be prepared. The yield of the lactone (in the case of resorcinol) is quantitative, and the method is therefore superior to those in which sulphuric acid or stannous chloride is used as condensing agent. Phenol and benzilic acid yield 80—90 per cent. of *p*-hydroxytritanic acid (formed on boiling the melt with sodium carbonate solution) and 10—20 per cent. of the lactone of *o*-hydroxytritanic acid. The following phenols were also similarly condensed with benzilic acid: *o*-, *m*-, and *p*-cresol, thymol, quinol, catechol, guaiacol, orcinol, and pyrogallol.—J. C. C.

Triphenylmethane dyestuffs; Some o-benzylated ——. A. Guyot and P. Pignet. Compt. rend., 1908, 146, 1043—1045.

The authors show that when the benzyl group is in the ortho position to the methane carbon atom in triphenylmethane dyestuffs, the effect is to render the dyestuffs fast to alkalis to about the same degree as obtains when the sulphonic acid group is in the same position. Tetramethyldiamino-*o*-dimethylaminobenzyltriphenylcarbinol,

$$(CH_3)_2N.C_6H_4.CH_2.C_6H_4.C(OH)[C_6H_4.N(CH_3)_2]_2,$$

is prepared by heating for 1 hour to 100° C., 14 grms. of tetramethyldiamino-*o*-benzoylbenzylbenzene dissolved in 20 grms. of dimethylaniline with 15 grms. of phosphorus oxychloride and 5 grms. of dimethylaniline. The dyestuff is isolated by means of the zinc chloride double salt. 2 : 13 : 13′-Hexamethyltriamino-9 : 9-diphenyldihydroanthracene,



$$C_6H_4{<}\begin{matrix}C[C_6H_4.N(CH_3)_2]_2\\ \text{——}CH_2\text{——}\end{matrix}{>}C_6H_4.N(CH_3)_2$$

is obtained by dissolving the preceding dyestuff in concentrated sulphuric acid. It is a white crystalline powder, melting at 175° C., and soluble in dilute mineral acids.
—J. C. C.

Disazo-compounds of benzylethyl-m-aminophenol; Primary ——. C. Bülow and T. Sproesser. Ber., 1908, 41, 1684—1692.

Benzylethyl-*m*-aminophenol,

$$C_6H_5.CH_2(C_2H_5)N.C_6H_4.OH$$

unites with two molecules of the same or of different diazo-salts. The first molecule is combined in faintly acid solution and attaches itself to the carbon atom in the para position to the amino-group. The second molecule is combined in alkaline solution and occupies the para position to the hydroxyl group. None of the dyestuffs prepared have any technical value.—J. C. C.

Aminophenylarsinic acid; An isomeric ——. A. Berthem. Ber., 1908, **41**, 1655—1657.

Nitrophenylarsinic acid (20 grms.) is dissolved in 140 c.c. of 25 per cent. ammonia, the solution saturated with hydrogen sulphide, and heated for 12 hours, using a reflux condenser. After adding 50 c.c. of ammonia the process is repeated, and the whole evaporated to dryness on the water-bath. The powdered residue is twice extracted with dilute hydrochloric acid (0·3—0·5 per cent.), finally with stronger acid, and the united extracts diluted to 1 litre. After adding 140 c.c. of 10 *N*-caustic soda, the solution is heated to boiling, and copper sulphate solution dropped in until a filtered sample gives no lead sulphide on boiling with a drop of lead acetate. The copper sulphide is filtered off, the filtrate neutralised, and zinc acetate added, whereby zinc aminophenylarsinate is precipitated. The free acid is obtained by boiling the zinc salt with 275 c.c. of water and 160 c.c. of 10 per cent. sodium carbonate solution, concentrating the filtrate and neutralising with concentrated hydrochloric acid. On acidifying with 13·5 c.c. of glacial acetic acid, the aminophenylarsinic acid (probably the *m*-compound) separates as a faintly reddish crystalline powder: yield, 65 per cent. of the theory. The acid may also be obtained by reducing the nitro-acid with sodium amalgam in methyl alcoholic solution. The new acid is more sparingly soluble than the corresponding *p*-acid and crystallises from water in colourless prisms melting at 214° C. When diazotised, it combines with the ordinary dyestuff-components to form azo-dyestuffs, which owing to the presence of the arsenic acid group, are easily soluble in sodium carbonate solution.—J. C. C.

Glaucohydroellagic acid. M. Nierenstein. Ber., 1908, **41**, 1649—1650.

The substance obtained by reducing ellagic acid with sodium amalgam, hitherto called glaucohydroellagic acid, is really pentahydroxydiphenylmethylolide, $C_6H_2(OH)_3.CO.O.C_6H_3(OH)_2$ (see this J., 1905, 899, 1087).—J. C. C.

Erythrosin silver salt; A blue ——. Lüppo-Cramer. *See* XXI.

Coal tar dyestuffs in Turkey. Bd. of Trade J., June 11, 1908. [T.R.]

H.M. Consul at Constantinople reports that coal tar dyes, alizarin as well as aniline, are being found unsatisfactory as regards durability, and that Turkish dyers are reverting to the use of the old natural dyestuffs. The importation of cochineal, for instance, is said to be increasing again, 60 tons annually being now imported into Constantinople alone. The manufacturers of Turkey carpets in the Smyrna district have formed themselves into a syndicate. They have factories at Smyrna, Sivas, Panderma and Sparta and numerous agencies all over Asia Minor: they supply their own wool, which they dye themselves. The syndicate has offices in London. Any British firm desirous of introducing British dyestuffs into Turkey should communicate directly with this syndicate.

Patents.

Colouring matters of the anthracene series; Manufacture of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 10,770, May 8, 1907.

See Tenth Addition to Fr. Pat. 349,531 of 1904; this J., 1907, 1083.—T. F. B.

Vat [anthracene] dyestuff; Process for preparing an orange ——. Badische Anilin und Soda Fabrik. Ger. Pat. 192,436, Oct. 28, 1906.

2-Methyl-1.2′-dianthraquinonylamine is treated with an alkali, preferably in presence of an oxidising agent. The anthraquinonyl derivative is obtained by condensing 2-chloroanthraquinone with 1-amino-2-methylanthraquinone.—T. F. B.

Azo dyestuff; Mordant ——, and process of making same. K. Schnitzspahn, Offenbach-on-the-Maine, Assignor to Chem. Fabrik. Griesheim-Elektron, Frankfort-on-the-Maine, Germany. U.S. Pat. 887,348, May 12, 1908.

New mordant monoazo-dyestuffs are obtained by combining the diazo-compounds of *o*-aminophenols of the general formula, $C_6H_2XY(OH).NH_2$, where X and Y denote the atoms or groups, H, CH_3, Cl, NO_2, CO_2H, SO_3H, $NH.CO.CH_3$, with heteronuclear aryl-*a*-naphthylamine-*β*-sulphonic acids. The sodium salts are brownish-black powders dissolving in concentrated sulphuric acid with a violet to blue, and in water with a brownish-red to violet colour. Wool is dyed from an acid bath in red to violet shades, which become violet to black on chroming. —J. C. C.

Vat dyestuff; Red halogen ——, and process of making same. G. Engi, Assignor to Soc. Chem. Ind. in Basle, Basel, Switzerland. U.S. Pat. 887,609, May 12, 1908.

Salicylthioacetic acid (1 mol.) is boiled with a halogenated isatin (1 mol.) in presence of a condensing agent capable of transforming the salicylthioacetic acid into 3-oxy-1-thionaphthene, which then reacts with the isatin. The red vat dyestuffs produced give a dirty brown solution in concentrated sulphuric acid, and furnish bright yellow vats, from which unmordanted cotton is dyed in red shades, fast to washing, light, and chlorine.—J. C. C.

Triphenylmethane dyestuff; Red ——, and process of making. F. Funcke, Assignor to Soc. Chem. Ind. in Basle, Basel, Switzerland. U.S. Pat. 887,620, May 12, 1908.

o-Chlorobenzaldehyde (1 mol.) is condensed with *o*-cresotinic acid (2 mols.) in presence of sulphuric acid, and the resulting leuco-compound is oxidised with nitrous acid in concentrated sulphuric acid solution. The dyestuff is a red powder giving a yellowish-red solution in water and a reddish-orange solution in concentrated sulphuric acid. It dyes wool from an acid bath in red shades, which become greenish-blue on chroming. The dyeings are fast to washing and chlorine.—J. C. C.

Monobromoindigo; Process of making ——. G. Engi, Assignor to Society of Chemical Industry in Basle, Switzerland. U.S. Pat. 888,230, May 19, 1908.

See Addition of March 18, 1907, to Fr. Pat. 375,514 of 1907; this J., 1907, 961.—T. F. B.

Vat dyestuffs; Production of yellowish-orange —— dyeing in the same manner as Indigo. Ges. f. Chem. Ind. in Basel. Fr. Pat. 385,768, Mar. 28, 1907.

When 2-amino-3-chloro(or bromo)-anthraquinone is treated with acid condensing agents such as antimony pentachloride, in presence of an indifferent solvent, a new dyestuff is obtained, which on treatment with alkaline reducing agents, such as caustic soda and sodium hydrosulphite, furnishes an intense blue solution dyeing cotton the same colour. This, on exposure to the air or to an oxidising agent, such as sodium hypochlorite, is converted into a yellowish-orange shade, which is fast to washing, light, and chlorine. Example: 5 parts of 2-amino-3-chloroanthraquinone are heated with 15 parts of antimony pentachloride and 100 parts of nitrobenzene on an oil bath to 180° C., for half an hour. On cooling, the dyestuff crystallises in small orange needles, which are filtered off and washed with alcohol. It gives an orange colour with concentrated sulphuric acid.—J. C. C.

Vat dyestuffs; Production of blue —— dyeing in the same manner as Indigo. Ges. f. Chem. Ind. in Basel. Fr. Pat. 385,772, Mar. 29, 1907.

When 2-amino-3-chloro(or bromo)-anthraquinone is fused with caustic alkalis, with or without the addition of oxidising agents, or treated with acid oxidising agents, a dyestuff is obtained which, with alkaline reducing agents, gives a blue solution dyeing cotton in blue shades fast to washing and light. The dyestuff produced by the latter method is fast to chlorine, but that obtained by alkaline fusion turns green when treated with dilute sodium hypochlorite solution. Example 1: 5 parts of 2-amino-3-chloroanthraquinone are boiled with 200 parts of glacial acetic acid and 15 parts of lead peroxide, using a reflux condenser. After 1½ hours, the product is filtered, washed, and boiled with dilute hydrochloric acid to remove lead. The residual dyestuff is digested with 400 parts of water, 10 parts of 30 per cent. caustic soda solution, and 10 parts of sodium hydrosulphite for some time at the ordinary temperature. In this way impurities are dissolved, and the pure dyestuff is then filtered off. It is a deep blue powder giving a yellowish-brown solution in concentrated sulphuric acid and a blue solution in nitrobenzene, aniline, or quinoline. Example 2: 10 parts of 2-amino-3-chloroanthraquinone are added to 70 parts of caustic potash at 220° C., and the mass maintained at this temperature for 15—30 minutes. After cooling and treating with water, the dyestuff is treated with caustic soda and sodium hydrosulphite at 50—60° C. The purified dyestuff crystallises on cooling. It gives blue shades on cotton, fast to washing and light, but turning green with sodium hypochlorite solution.—J. C. C.

Vat [thioindigo] dyestuff; Process for preparing a violet ——. Ges. f. Chem. Ind. in Basel. Ger. Pat. 190,293, July 17, 1906. Addition to Ger. Pat. 187,586, Nov. 5, 1905.

A fast violet vat dyestuff is obtained by condensing 3-oxy-1-thionaphthene with α-thioisatin, hydrogen sulphide being split off in the process.—T. F. B.

Disazo dyestuff; Blue ——. C. Ris and E. Haager, Assignors to C. Jäger, Dusseldorf-Derendorf, Germany. U.S. Pat. 888,036, May 19, 1908.

See Fr. Pat. 383,747 of 1907; this J., 1908, 442.—T. F. B.

Dyestuffs of the anthracene series; Process for preparing green to blue ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 191,731, March 1, 1903. Addition to Ger. Pat. 172,464, March 1, 1903 (this J., 1907, 313).

p-Aminohydroxy- or *p*-aminomethoxy-anthraquinones are condensed with sulphonic or carboxylic acids of primary aromatic amines, in presence of stannous acetate.—T. F. B.

o-Hydroxyazo dyestuffs; Process for preparing ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 193,724, Oct. 31, 1906.

The diazo compounds of the sulphonic or carboxylic acids of *o*-aminohydroxy compounds are combined with 3-oxy-1-thionaphthene or its -2-carboxylic acid, or their halogen-, alkyloxy-, or alkylthio-derivatives. The dyestuffs produce orange to Bordeaux-red shades on wool from acid baths, converted to violet by treatment with copper salts.—T. F. B.

1-Arylsulphonic acid-2-amino-4-sulphophenol esters; Preparation of ——. L. Cassella und Co. Ger. Pat. 195,226, Jan. 27, 1906.

2-Nitrophenol-4-sulphonic acid combines readily and quantitatively with arylsulphochlorides in alkaline solution. The products, on reduction, form the corresponding aminosulphonic acids, which can be diazotised and combined with chromogens, yielding, when the arylsulphonic group is split off, valuable *o*-hydroxyazo dyestuffs.—A. S.

Monoazo dyestuffs; Process for preparing ——. J. Rohner. Ger. Pat. 193,211, Feb. 11, 1906.

The diazo compound of 2.5-dichloroaniline is combined with diethyl-*o*-toluidine or its analogues, or with *p*-substituted sulphonic acids of phenols, cresols, or xylenols. —T. F. B.

o-Nitroamino derivatives of the benzene and naphthalene series; Preparation of ——. F. Ullmann. Ger. Pat. 194,951, March 7, 1906.

Nitro-derivatives of oxyaryl esters of arylsulphonic acids, of the general formula, $NO_2.R.OSO_2R_1$, and containing at least one nitro group in the ortho position to the oxyarylsulphonic group, when treated with ammonia or amines, are readily converted into the corresponding *o*-nitroamino compounds, the oxyarylsulphonic group being replaced by an amino or substituted amino group. For example, 29 parts of the *o*-nitrophenyl ester of *p*-toluenesulphonic acid is heated to 190° C. with 37 parts of aniline, and 9 parts of anhydrous sodium acetate are gradually added. After 15 hours, the product is worked up in the usual manner for the recovery of the o-nitrodiphenylamine formed.—A. S.

Azo dyestuffs containing the cyano-group; Process for preparing ——. M. Lange. Ger. Pats. 189,935 and 191,838, March 20, 1906.

Azo dyestuffs which contain one or more molecules of naphtholdisulphonic acid R are treated with metallic cyanides, in aqueous solution or suspension. The products obtained are generally less soluble in water than the original dyestuffs, and the dyeings produced by them are deeper and faster to washing. They are converted into the corresponding carboxylic acids by heating with alkalis. These carboxylic acids can also be obtained directly by heating the above-mentioned azo dyestuffs with cyanides and alkalis. These dyestuffs produce, as a rule, dyeings of a more yellowish shade than the parent dyestuffs.—T. F. B.

Anthracene derivatives containing nitrogen; Process for preparing ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 194,253, Nov. 13, 1906.

Aminoanthrapyridones are condensed with halogenated anthraquinones, or halogenated anthrapyridones with aminoanthraquinones. The products are of value as dyestuffs or for preparing dyestuffs; for example, the sulphonic acid of the product from 1-hydroxy-4-aminoanthraquinone and bromoanthrapyridone dyes unmordanted wool blue. (See Eng. Pat. 13,686 of 1907; this J., 1908, 71.)—T. F. B.

Dyestuffs for wool; Process for preparing blue ——. Kalle und Co. Ger. Pat. 194,094, Jan. 31, 1907.

α-Naphthylamine-4.6.8-trisulphonic acid is treated with sulphur compounds which have a reducing action (*e.g.*, alkali sulphides, thiosulphates, or hyposulphites, but not sulphites), in presence of alkali, and the resulting product is oxidised.—T. F. B.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

Printing steam Alizarin Reds and Pinks on unprepared cloth. P. Wilhelm. Bull. Soc. Ind. Mulhouse, 1908, 78, 69—79.

In order to produce on unprepared cloth by the addition of sulphoricinoleic acid to the printing colour, an Alizarin Red equal in brilliancy to that obtained on oil-prepared cloth, it is necessary (1), to introduce into the printing colour an acid, which, whilst not preventing development of the red on steaming, is yet capable of preventing premature precipitation of the mordants by the fatty acid, when the latter is present in sufficient amount to give the maximum brilliancy; and (2), to add the sulphoricinoleic acid in such a form that its combination with the bases of the mordants takes place very slowly. The first condition is fulfilled by a mixture of lactic and formic acids, in proportions varying according to the depth of the colour. The presence of these acids tends to prolong the time of steaming necessary for development of the red, but this disadvantage may be obviated by a small addition of sodium acetate. The second condition is fulfilled by the use of sulphoricinoleic acid in the form of an emulsion, in which it is in an extremely fine state of division comparable with that of alizarin in an ordinary Alizarin Red paste. The emulsion is prepared by allowing a mixture of equal parts of tragacanth water and freshly-prepared sulphoricinoleic acid, with the addition of 100 grms. of acetic acid per kilo., to stand for some days. 100 grms. of this mixture are then added to 900 grms. of tragacanth water containing 35 grms. of formic acid; the product remains unaltered for about 3 weeks. The most brilliant red is obtained by adding to the printing colour a quantity of the emulsion corresponding to 65 grms. of sulphoricinoleic acid per 150 grms. of alizarin 20 per cent., but even for the palest pink, at least 18 grms. per kilo. of printing paste must be taken. A typical printing colour (distinguished as "Red A") consists per 1000 parts, of 160 parts of white starch, 150 parts of water, 100 parts of tragacanth water, 50 parts of acetic acid of 6° B., 150 parts of Alizarin GFX 20 per cent., and 25 parts of oleine mixed with 25 parts of stannic sulpholeate. After boiling and cooling, 130 parts of aluminium nitrate of 15° B., 40 parts of stannic oxalate, 75 parts of calcium acetate of 15° B., 22 parts of lactic acid 50 per cent., 60 parts of formic acid 92 per cent., 100 parts of "fat mixture" (above described), and 18 parts of sodium acetate are added.

F. Binder, C. Favre, and A. Scheurer report that it is necessary to follow exactly the receipts given by the author in order to obtain equally good results. The prints are rather more violet in tone than when the same alizarins are printed on oiled cloth. The advantages of a printing method such as that illustrated by "Red A" are: (1), economy, owing to omission of the oil "prepare"; (2), smooth printing; (3), the printing colour keeps well; (4), the whites do not turn so yellow on steaming as with oiled cloth; (5), the possibility of printing a good Aniline Black with the red, the cloth not being alkaline; (6), the fastness to soap is equal to that of the very best steam red. —R. B. B.

Printing a one-colour ground design with a basic dyestuff and excess of tannin and over-printing with an acid dyestuff; Dark and pale effects on raised flannelette obtained by ——. J. Pokorny. Sealed note 1603, Feb. 14, 1906. Bull. Soc Ind. Mulhouse, 1908, 78, 61—64.

Certain acid dyestuffs can be fixed on cotton with the aid of tannin, and the colour withstands the action of a weak chlorine bath, whereas the same colours printed without tannin are removed by light "chemicking." Making use of this property, the material is first printed with a basic dyestuff and excess of tannin, and on this ground is printed an acid colour of the class mentioned, *e.g.*, Scarlet 3R, Cyanine B, etc. After raising, the effect is that of a dark colour on a light ground, and a light "chemick" removes any colour from the white unprinted portions. Certain other acid dyestuffs printed without tannin, on a similar ground, appear to partially prevent the fixation by steaming, of the basic colouring matter, and in this case the effect is produced of a light pattern on a darker ground. The author does not claim to have perfected these processes as he has not yet been able to try a sufficient number of acid dyestuffs.

In a report on the above communication, A. Lau states that a number of acid dyestuffs can be fixed by printing on tannin-mordanted cotton or on a ground of a basic colouring matter printed with tannin; some of these acid dyestuffs, *e.g.*, Scarlet 3R, Orange II.B, contain no basic groups. Orange II.B printed without tannin serves as a partial resist for basic dyestuffs. These methods are not perfected sufficiently to be of practical value.—R. B. B.

Indigo; Employment of Azo Reds [Paranitraniline Red, etc.] in the production of red and white discharge effects on ——. E. Schweitzer and E. Ebersol. Sealed note 1664, Sept. 1, 1906. Bull. Soc. Ind. Mulhouse, 1908, 78, 65—68.

By the ordinary process, which consists in padding the indigo-dyed material with sodium-β-naphtholate and then printing a bichromate discharge, with or without the diazo compound, it is impossible to produce a satisfactory white, owing to the formation of brown insoluble oxidation products of β-naphthol. The naphthol "prepare" may however be dispensed with if the dyed goods are padded in a solution containing per litre about 30 grms. of an acid salt, *e.g.*, aluminium sulphate, sodium bisulphate, or potassium monophosphate, or of an organic acid, preferably lactic acid. The goods are then dried in the air and printed with a bichromate discharge for white, and for red with a colour containing in 1000 parts, 19 parts of β-naphthol, 44 parts of caustic soda of 38° B., 465 parts of gum tragacanth thickening, 55 parts of Turkey-red oil, a mixture of 150 parts of sodium bichromate and 135 parts of caustic soda of 38° B., and 132 parts of nitrosamine. After printing, the discharge is completed as usual in a bath of sulphuric and oxalic acids.

It is further possible to dispense with the acid preparation, substituting for it a treatment with acetic acid vapour after printing. When this method is adopted, the best results are obtained by substituting potassium hydroxide and chromate for the sodium compounds.

In a report on the communication, C. Favre confirms the accuracy of the above conclusions and assigns to the authors priority for the processes described.—R. B. B.

Patents.

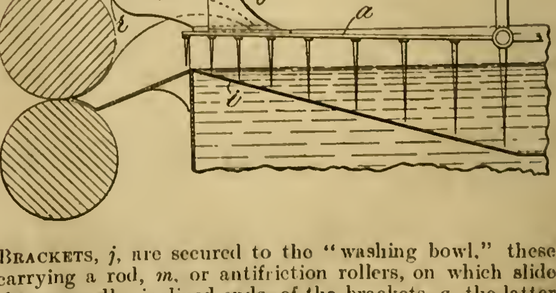
Cellulose products [artificial threads]; Manufacture of ——. Ver. Glanzstoff. Fabr. Akt. Ges., Elberfeld, Germany. Eng. Pat. 27,707, Dec. 16, 1907. Under Int. Conv., Apr. 22, 1907.

A solution of cellulose in cuprammonium is forced out of suitably shaped mouthpieces into concentrated alkaline lye mixed with glucose, saccharose, or analogous substances, which form loosely-combined compounds with bases, the fibres, threads, or films so formed being further treated in the usual manner. A suitable coagulating bath is composed of 32 parts of sodium hydroxide, 8 parts of glucose, and 100 parts of water at a temperature of 60°—70° C. The dried threads remain glossy and transparent and of a green colour, when the soda is removed by washing with water.—J. F. B.

Collodion filaments; Apparatus for the manufacture of ——. V. Planchon, Lyon, France. U.S. Pat. 888,260, May 19, 1908.

See Fr. Pat. 382,718 of 1906; this J., 1908, 221.—T. F. B.

Wool washing and scouring machines. J. Dawson, Rochdale. Eng. Pat. 21,038, Sept. 23, 1907.



Brackets, *j*, are secured to the "washing bowl," these carrying a rod, *m*, or antifriction rollers, on which slide the upwardly inclined ends, of the brackets, *g*, the latter being attached to the pivoted jib frame, *a*. The frame,

with the attached prongs, is thus made to follow the upwardly inclined discharge end, *i*, of the washing bowl, during its forward and backward movement. One or more toothed cams, *o*, may be arranged to act in conjunction with one or more pawls, *p*, carried by the jib frame, thus causing the forward end of the jib frame to be raised in proportion to the rotary movement during the backward movement. The pawl is disengaged by the portion, *r*, of the cam bearing against the underside of the rod, *k*, which also acts as a stay for the brackets, *j*. The ordinary mechanism of a wool-washing machine, for the forward and backward movement, and for the lowering and raising of the main-rake frame, is employed.
—B. N.

Bleaching and scouring of textile vegetable substances; Product and process for the ——. H. F. J. Crepin, Paris. Eng. Pat. 1273, Jan. 18, 1908. Under Int. Conv., Feb. 4, 1907.

SEE Fr. Pat. 384,455 of 1907; this J., 1908, 444.—T. F. B.

Bleaching and degumming of fabrics of cotton, linen, ramie, and other vegetable fibres; Process for ——. A. Vergé. Fr. Pat. 385,365, Mar. 11, 1907.

THE "glucosates of the alkaline-earth metals" are able to saponify fatty substances, forming soluble hydrated soaps. Their solutions can also dissolve the resinous gums and starchy substances occurring in sized fabrics woven from vegetable fibres. These two properties are utilised for preparing such fabrics for the process of bleaching. The material is first washed in cold water, and then immersed for about twenty minutes in a warm solution of calcium glucosate. It is then well washed to remove the free and combined glucosate, and finally bleached in the usual manner. If the fabric is not to be bleached, the treatment is completed by passing the material through a dilute acid bath and then submitting it to a third washing.—P. F. C.

Dyeing machine. J. M. Payne and G. G. Wallace, Girard, Ala., Assignors to E. W. Swift and J. P. Kyle, Columbus, Ga. U.S. Pat. 887,511, May 12, 1908.

A BOILER-SHAPED receptacle consisting of a stationary lower section and a removable upper section is arranged within an open dye-vat. Inside this receptacle is arranged a warper beam, comprising a longitudinally disposed supporting rod, provided at its ends with beam heads which carry a number of yarn holders. The yarn is wrapped around the warper beam, and dye-liquor is circulated through the whole machine.—P. F. C.

Paramine Brown dyeings; Process for shading ——. M. Lummerzheim. Ger. Pat. 192,032, Nov. 7, 1906.

PARAMINE BROWN dyeings, obtained by oxidising *p*-phenylenediamine on the fibre with sodium chlorate, are made more reddish or yellowish in shade either by diazotisation and combination with phenols or amines, or by treatment with diazotised amines.—T. F. B.

Waste liquors from dye-works; Purification of ——. C. A. Preibisch. Ger. Pat. 194,127, May 27, 1906.

THE waste-liquors after being, if necessary, subjected to a preliminary purification process, are passed through filter-beds composed of lignite slack. For example, six filter-tanks are used containing lignite slack of progressively finer states of division. The liquor is caused to flow continuously down through the bed of coarsest material, then rises in a pipe, and flows down through the second bed, and so on, passing through the finest material last. Means are provided for washing the filter-beds with water.—A. S.

Discharging dyed textile fibre and discharging pastes therefor. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 10,542, May 6, 1907.

SEE Fr. Pat. 382,884 of 1907; this J., 1908, 222.—T. F. B.

Indigo dyeings; Discharging —— *by means of hydrosulphites.* R. Haller. Ger. Pat. 194,878, Sept. 8, 1905.

THE dyed goods are printed with a discharge mixture composed of hydrosulphite NF, soap, and a thickening agent, and are then steamed, and the "indigo white" thus produced removed from the fibre by means of boiling water. The indigo white collects on the surface of the water in the form of foam, and can be easily recovered.
—A. S.

Fabrics uninflammable; Process for rendering ——. C. Dubois. Fr. Pat. 385,510, Dec. 23, 1907.

THREE parts of boric acid are added to a boiling solution containing a quantity of sodium tungstate equivalent to 4 parts of tungstic acid. A double salt of boric and tungstic acids is then obtained by crystallisation from the resulting solution. A 7½ per cent. aqueous solution of this substance is prepared, and the fabric to be treated is immersed in it for a few minutes and then dried.
—P. F. C.

Finishing yarns and fabrics; Process for ——. A. Vergé. Fr. Pat. 385,364, Mar. 11, 1907.

A SOLUTION of a sodium or potassium soap is added to an ordinary finishing bath, and the "glucosate of one of the alkaline-earth metals" is added to the mixture. The yarn or fabric is then impregnated with the solution, and is afterwards dried. During the drying process, an insoluble soap is produced upon the fibre by the action of the sodium or potassium soap on the glucosate, and this precipitate permanently fixes the finishing preparation upon the material.—P. F. C.

Fabrics; Drying of —— *by aspiration.* J. Wülfung und Sohn. Fr. Pat. 385,860, Dec. 31, 1907.

FOR drying fabrics after dyeing operations, etc., vacuum drying machines are arranged to travel on rails alongside the vats, and are connected with reservoirs for the liquor by flexible piping.—J. W. H.

Stearine-pitch as waterproofing and insulating material. Fr. Pat. 385,805. *See* III.

VII.—ACIDS, ALKALIS, AND SALTS, AND NON-METALLIC ELEMENTS.

Iodic and bromic acids; Phenomena of oxidation produced by ——. H. Baubigny. Compt. rend., 1908, **146**, 1097—1100.

IT is a commonplace of the text-books that silver bromide in ammoniacal solution is converted by iodic acid into silver iodide, ammonium bromate being at the same time formed. The author shows that in this experiment, the iodic acid reacts on the ammonia, forming ammonium iodide, water, and free nitrogen, and that the silver iodide is produced by reaction between the ammonium iodide and silver bromide. No bromic acid is formed during the reaction, nor is any chloric acid, if silver chloride be substituted for the bromide.—J. T. D.

Ammonium chromate, bichromate, and trichromate; Slow decomposition of —— *by heat.* W. C. Ball. Chem. Soc. Proc., 1908, **24**, 136—137.

WHEN ammonium dichromate is heated at temperatures between 185° and 205° C., it gradually becomes dark brown and finally black, and nitrogen, water, and ammonia are evolved. After heating for several days, the remaining black substance has the approximate percentage composition: chromic oxide, 83·89; active oxygen, 9·00; and water, 6·93. This corresponds fairly well with the formula, $3CrO_2,H_2O$, but the composition is not quite constant. If the heating be interrupted at an intermediate stage, it is found that part of the bichromate has decomposed with production of a black, insoluble substance, nearly half the nitrogen of the decomposed bichromate being contained in it. This black substance also varies in composition, but approximates to the formula, $2CrO_3,Cr_2O_3,2NH_3,H_2O$.

The slow decomposition of ammonium bichromate is therefore partly a dehydration to this insoluble compound containing ammonia, and partly a combustion of the hydrogen of the ammonium to form water, with production of nitrogen. The author has studied quantitatively the decomposition of ammonium chromate and of ammonium trichromate under similar conditions; the substances decompose in a similar manner.

Phosphorus; Action of ammonia on the different modifications of ——. A. Stock. Ber., 1908, 41, 1593—1607.

The phosphorus was heated in sealed tubes with liquid ammonia; after some time the tubes were allowed to cool, and the black deposit which had formed was shaken and rubbed off the walls with the aid of steel bicycle balls which had been placed in the tube before sealing (and which remained unacted upon), and heating was renewed. The black powder so obtained, after drying *in vacuo* and washing with carbon bisulphide, had a specific gravity of 1·99—2·03, and contained 94·4—96·6 per cent. of phosphorus and about 4 per cent. of nitrogen. No sensible quantity of other products was found in the ammonia. On heating the black substance *in vacuo* above 300° C., a small quantity of ammonia was evolved, a small amount of phosphorus nitride was left behind, and a red substance sublimed, which was found to be red phosphorus. This red phosphorus was compared with Hittorf's and with ordinary red phosphorus. The author concludes that all are identical.—J. T. D.

Heavy chemical industries. Times Comm. Suppl., June 12, 1908. [T.R.]

The reports of the various companies engaged in the manufacture of caustic or carbonated alkali and bleaching powder in the United Kingdom for the year 1907 show that the year was one of trade activity, and that the surpluses available for distribution to the shareholders were nearly equal to, and in one case larger than, those of the previous year. The market prices remained steady throughout the year, and the average for the twelve months was £4 10s. per ton for 58 per cent. soda ash and £4 9s. 2d. for 35 per cent. bleaching powder. The following table gives the corresponding averages for the past eight years:—

	Bleaching powder, 35 per cent.	Soda ash, 58 per cent.
	£ s. d.	£ s. d.
1900	6 17 6	4 12 6
1901	6 17 6	4 17 6
1902	6 5 0	4 10 0
1903	4 0 0	4 10 0
1904	4 1 6	4 10 0
1905	4 10 0	4 10 0
1906	4 10 0	4 10 0
1907	4 9 2	4 10 0

The export trade in heavy chemicals in 1907 increased by a small amount as compared with 1906; but the following figures show that the trade is not expanding satisfactorily, and that the figures for the record trade year, 1907, are far below those of the early nineties:—

Exports of alkali and bleaching powder.

Average for years.	Alkali, 58 per cent.	Bleaching powder, 35 per cent.
	Tons.	Tons.
1891—1894	299,100	70,300
1895—1898	248,100	63,100
1899—1902	194,120	56,214
1903—1906	239,060	47,750
1904—1907	254,800	47,449

The United Alkali Company of Liverpool, controlling the majority of the works using the old Le Blanc process of manufacture, earned a net profit of £345,162 for the 12 months ending December 31, 1907, as compared with £393,293 for 1906. Adding £50,246 brought forward from the previous account, a total of £395,408 was available for distribution. The recently acquired copper mines and railways in Spain were stated to be yielding satisfactory results, 170,000 tons of ore having been shipped to this country in 1907.

The larger profits secured by the Castner-Kellner Alkali Company were due, not to any notable increase in prices, but to reduced manufacturing costs, and to the success of their new works at Wallsend-on-Tyne. The reduced manufacturing costs were in part due to the substitution of gas-producers and gas-engines for steam-boilers and steam engines at Weston Point. At Weston Point caustic soda and bleaching powder is made, and at Wallsend-on-Tyne sodium is made by the electrolytic decomposition of fused sodium hydrate. The report for the year ending September 30, 1907, shows a gross profit of £116,754 and a net profit of £107,057, this being the largest yet recorded in the history of the company.

The financial year of Brunner, Mond and Co. closes on March 31. For the year ending March 31, 1908, a net profit of £719,000 was reported. The chairman of the company stated that the profits of 1907 must be looked upon as exceptional, and that it was hardly likely the dividend could be maintained at 12 per cent. for any long period of time.

The Electrolytic Alkali Company own works at Middlewich, where the Hargreaves-Bird diaphragm process for the manufacture of alkali and bleaching powder by aid of electricity is worked. The financial year of the company ends on August 31, so that the last report only covers eight months of 1907. The net profits for the 12 months, after allowing for depreciation and mortgage debenture interest and others standing charges, amounted to £8,212, and adding the amount brought forward, a total of £10,339 was available for distribution.

The activity of the heavy chemical industries is, to a large extent, determined by the internal trade activity of the country. The British export trade in alkali and bleaching powder is small, and is shrinking in amount. The totals for the past year have been 285,620 tons of alkali and 53,864 tons of bleaching powder. In 1891, the year when the United Alkali Company was formed, the export trade of these two commodities amounted in the aggregate to nearly 400,000 tons, and under normal conditions of trade this total ought to have grown *pro rata* with the growth of populations abroad, and to have now been about 500,000 tons per annum.

It is then upon the home trade that the companies manufacturing the heavy chemicals are most dependent for their prosperity, and the prospects for 1908 are not good. The manufactories and industries utilising the heavy chemicals are all suffering from the slackness in trade which is now general, and this is causing a reduction in the demand for caustic or carbonated alkali and for bleaching powder. The new Patent Law, with its clauses relating to the compulsory working of foreign patents in this country, may lead to a small demand for the heavy chemicals in connection with the new colour works now being erected in Cheshire and elsewhere, but the demand is unlikely to prove large. The prospects for the current year for the companies which manufacture only alkalis and bleaching powder are therefore unpromising, and it is unlikely that the profits of the last two years (1906 and 1907) will be attained. But the by-products of the heavy chemical industries are of increasing importance from the profit-making point of view, and possibly one if not more of the companies may be able to increase its sales and profits in this direction.

Production of bauxite in the United States. U.S. Geol. Survey—Rept. for 1907. [T.R.]

The following table gives the production and value of bauxite from 1900 to 1907, inclusive:—

Year.	Long tons.	Value.
		$.
1900	23,184	89,676
1901	18,905	79,966
1902	27,322	120,314
1903	48,087	171,306
1904	47,661	235,704
1905	48,129	240,292
1906	75,332	368,311
1907	97,776	480,330

Of the total output of the past three years Arkansas has contributed nearly two-thirds, while Georgia and Alabama combined have produced somewhat less than one-third, the small remainder being credited to Tennessee, which, however, promises to be a large producer in the near future.

The following table includes the annual production, imports and consumption, respectively:—

Year.	Production.	Imports.	Consumption.
	Long tons.	Long tons.	Long tons.
1903	48,087	14,889	62,976
1904	47,661	15,374	63,035
1905	48,129	11,726	59,855
1906	75,332	17,809	93,141
1907	97,776	25,066	122,842

The following table shows the world's production of bauxite in 1905 and 1906:—

Country.	1905.		1906.	
	Long tons.	Value. $.	Long tons.	Value. $.
United States	48,129	240,292	75,332	368,311
France	101,378	205,738	115,926	229,952
United Kingdom	7,300	8,880	6,654	13,274
Totals	156,807	454,810	197,912	611,537

The production of metallic aluminium is the most important use of bauxite. Most of the output of the State of Arkansas has been devoted to this purpose, and the production from this State has shown remarkable growth during the past few years.

Most of the Georgia-Alabama product is used in the manufacture of aluminium salts, owing to its relative freedom from oxide of iron. It is also used in the manufacture of artificial abrasives (alundum).

The manufacture of bauxite brick is of recent date. The bricks are of chief value in resisting the corrosive action of molten metal at high temperatures, and hence are applied in basic open-hearth steel furnaces, in furnaces for refining lead, in copper reverberatory furnaces, and in the linings of rotary Portland-cement kilns.

The most recent applications of bauxite brick are in the lining of lead-refining and copper reverberatory furnaces. During the process of lead refining the scum which rises to the surface is composed for the most part of basic oxides which attack the silica in ordinary fire-brick linings. The use of bauxite brick has reduced this tendency with consequent increased life to the furnace lining. Bauxite bricks last five to six times as long as ordinary siliceous fire brick.

Aluminium salts; Production of —— in United States. U.S. Geol. Survey—Rept. for 1907. [T.R.]

In 1907 the production of alum amounted to 10,404 short tons, valued at $361,900, or $34.78 per ton; aluminium sulphate, 106,821 short tons, valued at $2,008,046 or $18.80 per ton. In 1906 the production of alum was 15,613 short tons, valued at $450,125, or $28.83 per ton, and of aluminium sulphate 89,246 short tons, valued at $1,613,050, or $18.07 per ton.

The imports of aluminium sulphate in 1907, which included alumina, aluminium hydrate, alum, alum cake, aluminium sulphate, aluminous cake, and alum in crystals or ground amounted to 1,562 short tons, valued at $35,191. In 1906, the imports amounted to 1,183 short tons, valued at $23,193.

An occurrence of scientific interest is the association of alunite ($K_2O.3Al_2O_3.4SO_3.6H_2O$) and gold in the Goldfield district of Nevada. The composition of the ores and the changes exhibited in the country rock point to hot ascending solutions as the agent which has produced the alunite. On some of the ore dumps the soluble sulphate is present in sufficient quantity to suggest its removal by leaching.

Recent experiments by Gawalowski have proved the possibility of making a carbonate of aluminium. Under a pressure of eight atmospheres there is formed a polycarbonate which is completely soluble. Such pressure is found at moderate depths in the earth's crust, and this fact, together with the well-known power of carbon dioxide to act on the silicates and to convert them into carbonates, may have a possible bearing on the character of the hot spring deposition of bauxite in the Georgia-Alabama-Tennessee field.

Patents.

Oxides of nitrogen; Process and apparatus for the recovery of ——, when mixed with air, by means of water. A. A. Naville, P. A. Guye, and C. E. Guye. Fr. Pat. 385,569, Mar. 20, 1907.

The conversion of nitric oxide into nitric acid is effected better by alternate, than by simultaneous treatment with oxygen and water; for nitrogen peroxide reacts with water according to the equation, $3N_2O_4+2H_2O=4HNO_3+2NO$, whereas the oxidation of nitric oxide, in the presence of water, takes place in accordance with the equation, $3NO+0{\cdot}75O_2+0{\cdot}5H_2O=HNO_3+2NO$. The gases are, therefore, repeatedly subjected to three successive processes: (1), absorption of two-thirds of the combined nitrogen by water, in any known manner, in accordance with the first equation; (2), desiccation of the residual gas by treatment with anhydrous calcium nitrate or other drying agent, or by refrigeration; (3), oxidation of nitric oxide to nitrogen peroxide by spontaneous reaction with the excess of oxygen, or by increase of temperature or pressure, or by use of a catalyst. Oxides of nitrogen present in air to the extent of only 1 per cent. may be almost completely recovered by five repetitions of such treatment, but in each succeeding stage the reactions are slower, and the gases should, therefore, be retained in the apparatus for a longer period. In any part of the apparatus the pressure may, if desired, be maintained above that of the atmosphere.—F. Sodn.

Oxides of nitrogen; Recovery of ——, when mixed with air or inert gases, in the form of concentrated nitric acid. A. A. Naville, P. A. Guye, and C. E. Guye. Fr. Pat. 385,605, Mar. 22, 1907.

Nitrogen peroxide reacts with sulphuric acid according to the equation: $N_2O_4+H_2SO_4=HSO_5N+HNO_3$, but nitrogen trioxide is absorbed without the formation of nitric acid. When recovering oxides of nitrogen as nitric acid, therefore, as soon as the higher oxides of nitrogen have been absorbed, the residual gases, containing nitric oxide, should be removed to an oxidising chamber, in order to convert this oxide, as completely as possible, into the peroxide, which is then made to react with sulphuric acid again. It is proposed to employ a series of towers and chambers, so that short periods of absorption alternate with periods of oxidation, the acid being pumped from the bottom of one tower to the top of the next, and finally passing through a heater, in which the free nitric acid is distilled off, any oxides of nitrogen produced, being returned into the system. The humidity of the gas is so regulated, by preliminary addition of water or by desiccation, that the moisture just corresponds to the amount of nitrogen recoverable as nitric acid, *i.e.*, 1 grm.-mol. of water for every 2 grm.-atoms of combined nitrogen. In this way, after distilling off the nitric acid, the residual acid is again ready for use as an absorbent. Oxidation is effected, either by raising the temperature (not above 200° C.), or by use of a catalyst, or by compression, and an increased pressure is preferably maintained in the whole system. In practice, a series, comprising three absorbers and three oxidisers, is found sufficient to almost completely remove oxides of nitrogen from air containing them in small quantities.—F. Sodn.

Cyanide briquettes; Manufacture of hard ——. J. Y. Johnson, London. From Chem. Fabr. Schlempe, G.m.b.H., Frankfort on Maine, Germany. Eng. Pat. 18,096, Aug. 9, 1907.

Crystals of potassium cyanide and sodium cyanide are formed into briquettes by pressure. The briquettes are then immediately transferred to a chamber in which a high degree of vacuum is maintained, and are heated therein for several hours at a temperature of at least 70° C.—A. G. L.

Chlorinated compounds of lime; Manufacture of ——. H. Schultze, Griesheim, Assignor to Chem. Fabr. Griesheim-Elektron, Frankfort on Maine, Germany. U.S. Pat. 888,122, May 19, 1908.

See Fr. Pat. 370,863 of 1906; this J., 1907, 256.—T. F. B.

Tin compounds [halides]; Preparation of pure ——. E. A. Sperry, Brooklyn, N.Y. U.S. Pat. 887,538, May 12, 1908.

Tin-bearing material is treated with a halogen, at a temperature below the boiling point of anhydrous stannic chloride, and the liquid so produced is separated by distillation. The practically pure anhydrous compound may then be diluted; for example, with water.—F. Sodn.

Zinc chloride; Preparation of ——. G. Carrara. Fr. Pat. 385,448, Dec. 16, 1907. Under Int. Conv., Dec. 20, 1906.

Chlorine is made to react with an intimate mixture of an oxidised zinc-bearing material (such as calamine) and sawdust or other substance containing cellulose, hydrochloric acid being thus generated and reacting *in situ* to form zinc chloride. The process is carried out in an apparatus consisting of twin tubular retorts, of earthenware or cast iron, each of which may be heated alone. They are connected to be used in alternate succession, and are so inclined as, together, to form a St. Andrew's X. Chlorine passes in at the base of one retort, the contents of which have been heated to about 120° C., and this causes a rise of temperature to about 240° C. The products of combustion pass from the upper end of the retort to a receptacle, where the tar is deposited, and thence in at the base of the second retort, where the excess of chlorine is fixed. From this retort, in like manner, the gases pass through a receptacle for tar, and then, by opening an appropriate valve, are led to a coil and receiver, cooled by water, instead of completing the circuit back to the first retort. When the contents of one retort are fully chlorinated, it is recharged, and the chlorine now made to pass into the other retort first. Rather less than the calculated quantity of chlorine is employed, and, towards the end of the reaction, the temperature of the retort concerned is raised to 300° C. The mass obtained is lixiviated with water, and the iron and manganese are oxidised by chlorine and calcium hypochlorite, after which the iron is precipitated by zinc oxide, the other metals being separated by agitation with metallic zinc. The liquid is then evaporated to obtain pure zinc chloride, or electrolysed, so as to recover the chlorine. The advantages claimed are: (1), a separate preparation of hydrochloric acid is avoided; (2), the exothermic character of the reaction ensures a great saving in the energy to be supplied; (3), the loss of chlorine is very small—less than 3 per cent.; (4), useful by-products are obtained.—F. Sodn.

Oxidising agent [containing manganese]; Preparation of an ——. P. Wack. Fr. Pat. 385,471, Dec. 21, 1907.

To a cold saturated solution, containing 1 molecular proportion of manganous sulphate, is added sulphuric acid, so that the concentration of the latter reaches 50—60 per cent. Part of the manganese salt is thus precipitated, and the whole is then agitated with 1 molecular proportion of manganese dioxide, until the solution becomes warm. On cooling, or by the addition of more concentrated sulphuric acid, reddish-brown lustrous crystals of a double salt, of manganous sulphate and a sulphate corresponding to manganese dioxide, separate. This substance is stable in dry air and dissolves in organic acids, such as acetic acid. It is therefore suitable for use in the oxidation of organic bodies, and is, moreover, in a convenient form for transit.—F. Sodn.

Alumina and sodium carbonate; Preparation of ——. J. Verdier. Fr. Pat. 385,479, Dec. 21, 1907.

The aluminate of an alkaline-earth metal, preferably calcium, is first obtained by fusing, in an electric furnace, a mixture of bauxite, alkaline-earth, and carbon, the last in quantity sufficient to reduce the iron oxide and silica present. Instead of the oxide, any salt of the alkaline-earth metal with a volatile acid may be used, and iron oxide or silica may also be added, so that a marketable ferro-silicon is obtained as a by-product. A suitable charge, for instance, consists of 100 kilos. of red bauxite, containing 60 per cent. of alumina, 50 kilos. of lime, 10 kilos. of quartz, and 15 kilos. of anthracite. The insoluble calcium aluminate formed is decomposed by boiling, for some time, with a solution of sodium sulphate, and then the sodium aluminate is decomposed in solution by carbon dioxide, in the usual way. The process gives very pure alumina and a solution of sodium carbonate, which may further be causticised, if desired.—F. Sodn.

Hydrogen peroxide; Method of making——stable in admixture with other substances. M. A. Queisser, Hamburg, Germany. Eng. Pat. 20,906, Sept. 20, 1907.

See Fr. Pat. 381,924 of 1907; this J., 1908, 226.—T. F. B.

Aluminium nitrides; Method of producing ——. O. Serpek, Madulein, Switzerland. U.S. Pat. 888,044, May 19, 1908.

See Fr. Pat. 367,124 of 1906; this J., 1906, 1096.—T.F.B.

VIII.—GLASS, POTTERY, AND ENAMELS.

Enamel-glazes [for iron]; Advances in the preparation of ——. P. Eyer. Chem.-Zeit., 1908, 32, 516—517.

In modern practice the first glaze for the enamelling of sheet iron goods may consist of: quartz 17 parts, felspar 30, borax 46, sodium carbonate 2, sodium silicofluoride 3, potassium nitrate 2, cobalt oxide 0·18, nickel oxide 0·42, and copper oxide 0·03 part, the constituents being melted together and then ground with 7 per cent. of clay. This glaze has the advantage over the old-fashioned glazes, that it is not readily chipped off. In order to render the second or white glaze opaque, cryolite now partly replaces the more expensive tin oxide: bone-ash is not suitable. This glaze may be made from: quartz 10·5 parts, felspar 37·5, borax 18, cryolite 12, and potassium nitrate 0·7 part, melted together and then ground with 8 per cent. of tin oxide and 7 per cent. of clay; sodium silicofluoride and artificial cryolite may be used, instead of the natural cryolite. For enamelling cast iron, a first glaze, similar to that for wrought iron, may be used, if the percentage of carbon is low; but little advance has been made in this direction. The white glaze may be made by melting together: quartz 13·04 parts, felspar 26·08, boric acid 14·40, borax 3, sodium carbonate 4·7, potassium nitrate 4·34, red lead 17·40, calcspar 2, magnesia 2, cryolite 11·04, and fluorspar 0·2 part, and then grinding the melt with 7 per cent. of tin oxide and 7 per cent. of clay.—F. Sodn.

Patents,

Glass furnaces. C. Menzel, Lommatzsch, Saxony. Eng. Pat. 14,417, June 22, 1907. Under Int. Conv., July 25, 1906.

See Fr. Pat. 378,776 of 1907; this J., 1907, 1199.—T. F. B.

Glass-furnace. C. Moche. Fr. Pat. 385,712, Sept. 6, 1907.

The furnace is provided with a number of separate burners. Each burner is fed by means of one gas supply and two air supplies, each independently controlled by dampers. The air flues are so placed that the gas is mixed with air from one flue, before it meets the air from the other, which causes combustion. Thorough mixing of gas and air is ensured by making the mixture traverse zig-zag passages. Both air and gas are preheated, before mixing, by means of the hot products of combustion.—A. G. L.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Clays; Status of carbon, iron, and sulphur in —— during the various stages of burning. E. Orton, jun., and H. H. Staley. Third Report of Committee on Technical Investigation, National Brick Manufacturers' Assoc., U.S.A.

Black-coring.—Carbon in clay tends to burn out. Owing to the presence of water in the clay, or of reducing gases in the kiln, the material often reaches a full red heat without being completely freed from carbon. When this is the case, the residual carbonaceous matter undergoes destructive distillation, with the evolution of volatile gases which ignite, thus raising the temperature of the kiln. After expulsion of volatile matter, the residual carbon is deeply ingrained in the structure of the clay, in the form of coke or charcoal, which can only be removed by oxidation. The successful oxidation by means of air must take place slowly and below 900° C. Oxidation is also brought about by contact with reducible materials such as ferric oxide, manganese sesquioxide, sulphuric or nitric anhydride, etc., at a temperature of approximately 1000° C. Carbon is a possible but rare actual cause of black-coring. *Iron.*—Iron in clays is easily oxidised to ferric oxide in the absence of carbon or sulphur. When these are present, the iron does not oxidise until the greater part of these two substances have first been oxidised, any ferric oxide present acting, in fact, as oxidiser of carbon and sulphur, with the formation of magnetic or ferrous oxide, and even of metallic iron. Once reduced, iron is not readily oxidised again, but tends to combine with silica as vitrification proceeds, giving rise to black or dark coloration of the clay. The black cores of improperly fired clay wares are usually due to this cause. *Sulphur.*—Sulphur, in whatever form, is partly expelled by the mere rise of temperature in burning, but it cannot be wholly or even mainly removed by heat alone. It is, however, oxidised in the same way as carbon, but only after the latter has been removed. At high temperatures sulphur gives rise to gases, owing to oxidation, or double decomposition between silica and sulphates or sulphides, and thus causes swelling in the course of vitrification. In general it may be stated that:—(*a*) Carbon is the first cause of black-coring by preventing the oxidation of iron and sulphur. (*b*) Iron is chiefly responsible for the black coloration, owing to the formation of ferrous silicates. (*c*) Sulphur is the actual cause of swelling.—O. R.

Patents.

Wood of any kind; Process and apparatus for impregnating, colouring, or preserving ——. E. Koepfer, Vienna. Eng. Pat. 11,514, May 16, 1907.

See Fr. Pat. 379,065 of 1907; this J., 1907, 1200.—T. F. B.

Fire resisting composition. W. Wilson, Coatbridge, Lanark. Eng. Pat. 860, Jan. 14, 1908.

Sand, of the same composition as Belgian silver sand, (7 to 8 parts), calcined lime (1 to 1¼ parts) and fireclay (½ part), are ground together in a moistened condition. —B. N.

Artificial marble and artificial sandstone; Process of manufacture of ——. C. Eisentraut. Fr. Pats. 385,603 and 385,604, Mar. 22, 1907.

(1). One to four parts of chalk, lime, powdered glass, emery, or sand are mixed with one part of calcined magnesia, and enough magnesium chloride solution of 25—30° B. to form a semi-liquid mass, which is placed in oiled metal moulds for 12—24 hours. Non-metallic colours may be added. Or else, only 5—10 per cent. of calcined magnesia is used, and the mass is moulded under pressure. (2). Building sand (3—8 parts) is mixed with dry cement or quicklime, or with a mixture of cement and lime (1 part), and enough water to form a semi-liquid mass, which is placed in wooden moulds. After one or two days, the stone is removed, dried, and immersed for 2—10 days in a solution of potassium silicate of 6—15° B. —A. G. L.

Furnace; Continuous —— with movable hearth for burning ceramic and other products. R. Morel d'Arleux. Fr. Pat. 385,741, Mar. 27, 1907.

The movable hearth of the furnace is carried by a metal caisson which floats in water contained in a chamber placed below the furnace itself. By altering the level of the water, the hearth is raised or lowered. The hearth can also be moved horizontally, the various movements being guided by rollers fixed to the caisson. The heat from the furnace is screened from the water by metal bands fastened to the fixed part of the furnace, which bands dip into gutters containing sand; these gutters are fastened to the hearth in the space above the water, and are themselves protected from radiated heat.—A. G. L.

Plaster [of Paris]; Apparatus for burning —— by means of superheated water. Opitz und Kaiser. Fr. Pat. 385,583, Dec. 17, 1907.

The plaster is burnt in a heater containing a number of spiral tubes, through which water superheated in an adjacent furnace circulates. The base of the heater may be heated by the pipes leading from the spirals to the furnace, or else by hot flue gases (at a temperature of 180°—250° C.) from the furnace.—A. G. L.

Silicon or boron carbides; Preparation of articles of ——. Chem.-elekt. Fabr. Prometheus. Ger. Pat. 195,533, Aug. 19, 1906. Addition to Ger. Pat. 173,066.

According to the main patent, articles formed of carbon were embedded in finely-powdered silicon- or boron carbide, and strongly heated until the vapours of silicon or boron evolved from the carbides penetrated, partially or completely, the carbon articles. In the additional patent 183,133, the carbon articles were embedded in a mixture of sand and charcoal or boric acid and charcoal. In order to accelerate the reaction in this case, it is proposed, according to the present patent, to add to the carbon of which the articles are formed, carborundum, quartz sand, other substances rich in silicon, or pure silicon.—A. S.

Magnesium silicates; Preparation of —— from magnesia and silica in the electric furnace. E. von Seemen. Ger. Pat. 194,949, May 4, 1907. Addition to Ger. Pat. 189,320.

Magnesium silicates containing a high percentage of magnesium are obtained by first preparing a magnesium silicate containing up to 70 per cent. of magnesia, by fusing together magnesia and silica in the electric furnace, as in Ger. Pat. 189,320, and then maintaining this silicate, in a fused condition, in contact with a bath of molten iron. In this way, some of the silica is reduced, and products richer in magnesium are obtained. The bath of molten iron is continually renewed by addition of further quantities of the metal.—A. S.

Cement kilns; Heating —— by producer gas. H. L. Doherty, Madison, Wis., Assignor to Combustion Utilities Co., New York. U.S. Pat. 887,316, May 12, 1908.

Producer gas, practically free from hydrogen, is led through a passage, the walls of which are heated externally by a portion of the gas, and is finally burnt, with the addition of air, in a rotary cement kiln. The pre-heating is great enough to produce a flame temperature of 2600° F. —J. W. H.

X.—METALS AND METALLURGY.

Silicon and palladium ; Compounds of ——. P. Lebeau and P. Jolibois. Compt. rend., 1908, **146**, 1028—1031.

Palladium and crystallised silicon, when intimately mixed and heated to 500°—600° C., combine with incandescence. A study of the freezing-point curve for the system, Si—Pd, points to the existence of two compounds, $SiPd_2$ and SiPd. A eutectic, SiPd—Si, solidifying at 825° C., has also been recognised. Microscopic examination confirms these results and shows that the observed phenomenon of recalescence consists in the crystallisation of a supersaturated solution. The compound, SiPd, has been isolated.—F. Sodn.

Electrical resistance of alloys ; Results, for technology, of the present state of knowledge of ——. W. Guertler. Metallurgie, 1908, **5**, 292—296.

The author divides the metals possibly available as materials for electrical conductors or resistances into two groups, those fusible with difficulty (iron, nickel, copper, silver, gold, and platinum) and those readily fusible (magnesium, aluminium, zinc, tin, lead, antimony, and bismuth). A review of the properties of the alloys of these metals with one another (and also with carbon, silicon, phosphorus, etc.) shows that:—1. Search for a new metallic conductor, of conductivity approaching that of copper or silver, must be fruitless. The only possibility is that a conductor might be discovered which, with the least possible diminution of conductivity should exhibit the greatest improvement in mechanical or chemical properties. 2. Alloys for resistances, in which the temperature-coefficient must be as small as possible, can only be found amongst those consisting chiefly of metals of the first group. The field for investigation here, however, is practically unlimited.—J. T. D.

Patents.

Steel ingots ; Treatment of —— for the manufacture of rails and for other purposes. B. Talbot, Middlesborough. Eng. Pat. 12,929, June 4, 1907.

See U.S. Pat. 887,286 of 1908 ; following.—T. F. B.

Steel ingots and the like ; Treating ——. B. Talbot, Middlesborough, England. U.S. Pat. 887,286, May 12, 1908.

Steel castings are hardened on their surfaces by being brought, while their interior is still in a semi-fluid condition, into contact with hardening agents, such as carbon. The internal heat of the casting is utilised for effecting the absorption of the carbon.—J. W. H.

Tungsten and molybdenum, etc. ; Process of alloying —— with iron and steel. P. Kemery, Pittsburg, Pa. U.S. Pat. 887,648, May 12, 1908.

The iron or steel is melted in a bath arranged in a suitable furnace, and, if necessary, refined. The temperature having been raised slightly above that necessary for casting, the rare metal, in powdered form and consisting of tungsten, molybdenum, or vanadium, is introduced in a fusible envelope into the bath, while the latter is still in the furnace. The metal having melted, the whole is cast in the usual manner.—C. A. W.

Ore roasting and sintering processes. A. S. Dwight and R. L. Lloyd, New York. Eng. Pat. 17,344, July 29, 1907. Under Int. Conv., July 30, 1906.

See U.S. Pat. 882,518 of 1908 ; this J., 1908, 409.—T. F. B.

Ores ; Method of preparing —— for use in the manufacture of steel. E. B. Clark, Assignor to American Sintering Co., Chicago. U.S. Pat. 887,379, May 12, 1908.

The finely-divided ore is allowed to pass down a cylindrical kiln which is slightly inclined to the horizontal, and capable of rotation. In this way the heat reduces the particles to a semi-plastic condition, and small lumps are obtained. These are subsequently compressed into larger lumps or blocks.—C. A. W.

Furnace ; Metallurgical ——. W. S. Dempsey, New York. U.S. Pat. 887,777, May 19, 1908.

The melting chamber is provided with a series of tuyères, each of which has an air valve and a slagging spout. Each spout is partly closed by a plug, which can be destroyed by heat.—A. G. L.

Smelting ore ; Art of ——. A. Steinbart, Pittsburg, Pa., Assignor to G. L. Collard, Clairton, Pa. U.S. Pat. 887,974, May 19, 1908.

Air is compressed, and cooled by the action of a cooling medium having a normal temperature above 32° F. In this way the moisture content of the air is reduced before the air is forced into the furnace.—A. G. L.

Furnace ; Assay ——. U.S. Pat. 887,057. *See* XXIII.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(*A.*)—ELECTRO-CHEMISTRY.

Iron nickel-peroxide accumulator ; Behaviour of the electrolyte in the ——. F. Foerster. Z. Elektrochem., 1908, **14**, 285—292.

The equation representing the reactions during charge and discharge of this accumulator is $Fe + Ni_2O_3,1.2H_2O + 1.8H_2O \rightleftarrows Fe(OH)_2 + 2Ni(OH)_2[+2F]$. Experiment shews, in accordance with this, that during discharge, the potassium hydroxide electrolyte increases in concentration, through fixation of water by the active substance, and that during charging, this water is again liberated, and the concentration of the electrolyte diminished. Between 1 and 2 molecules of water are withdrawn during discharge for each unit of electricity traversing the circuit. This withdrawal and replacement of water is probably the chief cause of the variation in concentration of the electrolyte. The E.M.F. of the cell diminishes as the concentration of the electrolyte increases, as theory would indicate ; the amount of this alteration is the same as that calculated from the lessening of maximum vapour pressure of the electrolyte caused by its altered concentration.—J. T. D.

Patents.

Insulating electric cable trenches ; Pitch product for ——, and for use for other purposes. T. Marriott, Kingston-on-Thames. Eng. Pat. 10,699, May 8, 1907.

Petroleum pitch, obtained by arresting the distillation of crude petroleum when 34 to 36 per cent. of the volatile constituents have been removed, is mixed whilst hot with about 3 to 4½ per cent. of kaolin.—B. N.

Electrode for electric furnaces. E. F. Price and F. J. Tone, Niagara Falls, N.Y. U.S. Pat. 887,123, May 12, 1908.

Graphite, electrically prepared, is mixed with some hydrocarbon binding agent, the mass being shaped into the form desired. The whole is then heated in an inert atmosphere to a temperature sufficient to coke the binder. —C. A. W.

Accumulators ; Product for the charging of ——. F. F. Bourdil. Fr. Pat. 385,707, March 26, 1907.

A pulverulent or granular material, such as kieselguhr, is mixed with a material, capable of forming a jelly, such as gelatinous silica, both substances being unattacked by the electrolyte. The product is plastic and porous, resists shocks, and is capable of retaining the active material on the whole depth of the plate. The kieselguhr is first soaked in sulphuric acid, in order to completely fill the pores, and afterwards mixed with potassium silicate, also soaked in acid, in convenient proportions for the production of a jelly.—B. N.

Nickel compound; Preparation of the active —— contained in the nickel electrode described in Ger. Pat. 159,393 (*this J.*, 1905, 739). M. Roloff and H. Wehrlin. Ger. Pat. 192,675, Nov. 25, 1906. Addition to Ger. Pat. 159,393 (*loc. cit.*).

Instead of the silver salt recommended in the chief patent, a small quantity of a persulphate or hypochlorite is used as catalyst, and may be added to the nickel solution before precipitation with alkali, or it may be formed during the electrolysis, in which case the desired black nickel compound is deposited. Or, nickel hydroxide may be converted into the black compound by digestion with a solution of one of the salts mentioned. The amount of persulphate or hypochlorite required is about 0·01 mol. proportion for one atomic proportion of nickel.—A. S.

Ferrosilicon anodes. R. Krause. Ger. Pat. 195,518, Feb. 2, 1907.

Claim is made for the use of anodes of ferrosilicon containing from 80 to 95 per cent. of silicon, in the electrolysis of solutions of copper and zinc sulphates. These anodes are not attacked provided the electrolyte does not contain more than 6 per cent. of free sulphuric acid.—A. S.

Electrolysing drum for continuous work; Metallic ——. H. Sackur. Ger. Pat. 194,528, July 29, 1906.

In order to prevent the accumulation of anode-mud, a chamber is provided for the anode on one or both sides of the drum. The chamber is lined with the material of which the anode is formed, and is provided with slits, so that it is continuously rinsed by the electrolyte.—A. S.

Refractory electrical conductors. Eng. Pat. 15,451. *See* II.

Stearine-pitch as waterproofing and insulating material. Fr. Pat. 385,805. *See* III.

(*B.*)—ELECTRO-METALLURGY.

Patents.

Furnace; Electric ——. B. Igevsky. Eng. Pat. 5301, March 5, 1907.

The furnace comprises a hollow body having a lining of a material which is electrically conductive only at a high temperature. Several electrodes are embedded in the walls of the furnace, adjoining the lining, and means are provided for conducting the electric current to and through the electrodes and lining. The latter is thus heated, and rendered capable of heating the charge by radiation.—B. N.

Combined electric induction and open-hearth furnace for making steel.] Metallurgical processes and apparatus for use in connection therewith. S. Z. de Ferranti, Grindleford, Derby. Eng. Pat. 8255, April 9, 1907.

The molten iron on the hearth of a Siemens furnace is converted into steel by circulating and further heating the metal by means of a shifting magnetic field. The magnetic field is formed by means of vertical cores, which may be connected together, and which pass through the furnace, narrow channels being formed around them, through which the metal is circulated at a high speed; the cores may be wound with coils placed both above and below the hearth, in which case a heating effect only is obtained if electric currents are sent through both sets of coils. Or else, the cores may simply be placed below the hearth near the walls, and a central tap-hole may be provided for the slag, which collects in the saucer-like depression formed by the rotating metal; or else the slag may be siphoned off. The furnace may also be provided with a series of nozzles, from which gases, ore, or flux can be blown on to the surface of the metal. The coils used for winding consist of hollow tubes twisted or bundled together, water being circulated through the tubes. During the process, any reagent, alloy, etc., may be added to the metal as usual. Two or more furnaces may also be used in conjunction.—A. G. L.

Zinc; Electro-deposition of ——. H. Paweck, Vienna. Eng. Pat. 8562, April 12, 1907.

Zinc is deposited electrolytically from a bath containing one or more salts of the metal, with or without the addition of conductive salts or other substances. The liquid is maintained neutral, or preferably slightly acid, by intermittent and continuous regeneration, and contains 250 grms. of zinc salt per litre of water, or more, up to the point of saturation. The continuous regeneration of acid is effected by the addition of substances which yield hydrogen ions in aqueous solution, so that these need only be added at long intervals. Substances, such as boric or phosphoric acid and the like, may also be added, these being ionised to a smaller degree. These compounds act as a reserve, and come into action on the exhaustion of the hydrogen ions in the substance used for continuous regeneration.—B. N.

Metals; Electro-deposition of ——. S. O. Cowper-Coles, London. Eng. Pat. 27,385, Dec. 11, 1907.

The invention relates to apparatus for the electro-deposition of metals, of the kind in which the cathode is in the form of a vertical cylinder adapted to be rotated in an annular vat, by means of a driving shaft passing up through the central space. The driving shaft is made in two parts, adapted to be engaged together, the cathode being attached to the upper part, whilst the lower part carries a sleeve which dips into a fixed cup containing mercury, into which the terminal of the electric circuit also dips. The cathode is connected to the shaft by means of a disc, which engages with studs on the shaft and is secured by cotters.—B. N.

Copper; Method of and apparatus for rendering electrolytic —— homogeneous. M. A. J. Jullien and E. L. Dessolle, Levallois-Perret, France. Eng. Pat. 12,563, May 30, 1907. Under Int. Conv., May 31, 1906.

See Fr. Pat. 369,746 of 1906; this J., 1907, 210.—T. F. B.

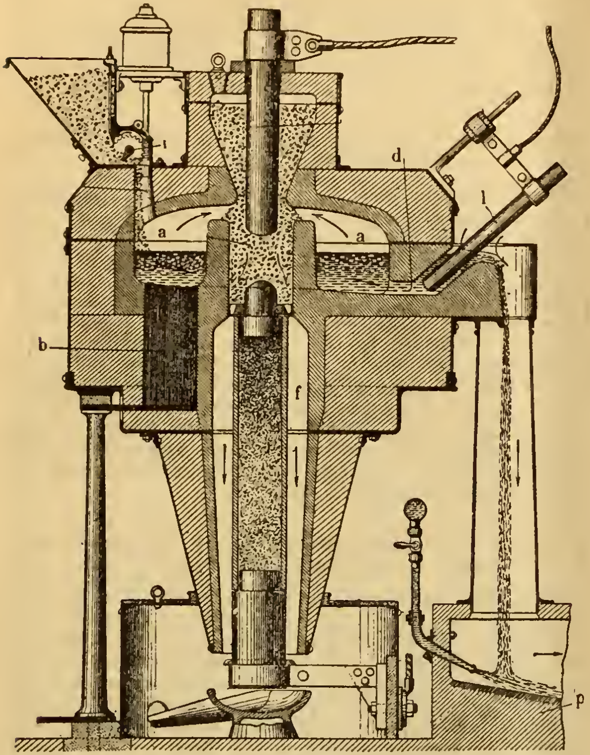
Nickel; Process of recovering —— from silicious ores. A. Chalas, Philadelphia, Pa. U.S. Pat. 887,735, May 12, 1908.

The ferriferous ore is smelted, and the resulting alloy of iron and nickel cast into anodes. These anodes are dissolved electrolytically, the electrolyte being caused to circulate through a body of nickelic hydroxide; in this way the dissolved iron is precipitated, and the nickel left in solution, from which it can afterwards be recovered. The hydroxide precipitating agent is prepared by electrolytically dissolving iron-nickel anodes in a solution of an alkali salt and peroxidising the nickelous hydroxide so obtained.—C. A. W.

Electrolytic process. F. Desbrière. Fr. Pat. 385,494, March 18, 1907.

It has been found that a metal when deposited electrolytically on a cathode which has been previously rendered radio-active, does not adhere to the latter, and can thus be easily removed. This discovery is applied in the reproduction of engraved plates or other similar objects, the latter being first rendered radio-active, and then employed, in a suitable electrolytic bath, as cathode. The radio-activity manifests itself as a lasting positive charge on the cathode.—B. N.

Zinc ; Electric furnace for the continuous extraction of —— from its ores. E. F. Cote and P. R. Pierron. First Addition, dated Sept. 25, 1907, to Fr. Pat. 385,018, Feb. 22, 1907 (see Eng. Pat. 5100 of 1907 ; this J., 1908, 342).



The crucible is in the form of an annular channel, *a*, three electrodes, *b*, being set 120° apart, and permitting of the employment of a tri-phase or other type of current. One electrode, shown in section at *b*, is immediately below the charging orifice, and opposite to the tapping hole, *d*, for the escape of sulphide of iron. The entrance of air is avoided, and the formation of sulphurous gases and zinc oxide is thus prevented, whilst the condensation of the zinc is carried out, as described in the main patent, in the condenser, *f*.—B. N.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

Ethyl-ester value ; The —— : a new constant for the detection of cocoanut oil. J. Hanuš and L. Štekl. Z. Untersuch. Nahr. Genussm., 1908, 15, 577—587.

In a previous communication (this J., 1907, 102) a method was described of differentiating cocoanut oil from butter fat by conversion of the fatty acids of the fat into their ethyl esters. The new constant thus obtained, which the authors term the "ethyl ester value," gives the number of c.c. of $N/10$ potassium hydroxide solution required to saponify the esters in 100 c.c. of the aqueous distillate from 5 grms. of the fat after esterification. It is determined essentially in the same way as previously described (*loc. cit.*), except that it is now directed that the distillation shall be finished within 25 minutes, and that the esters shall be subsequently saponified with 40 c.c. of $N/2$ alcoholic potassium hydroxide solution. The esters in the aqueous distillate from cocoanut oil were separated into those of caprylic, capric, and lauric acids, those of caprylic and lauric acids predominating. In the case of butter fat the same esters were separated, but in different ratio, that of caprylic acid predominating, and that of lauric acid being the smallest in quantity. The ethyl ester value of cocoanut oil was the highest of those of all the fats examined, exceeding 40, whilst that of butter fat came next with 7 to 14. All other fats examined gave values of less than 3. A small proportion of cocoanut oil in cacao butter or margarine may thus readily be detected, but in the case of butter the normal variations of the value are too wide to permit the detection of less than 15 per cent. of cocoanut oil.—C. A. M.

Cacao butter ; Unsaponifiable constituents of ——. H. Matthes and O. Rohdich. Ber., 1908, **41**, 1591—1592.

The authors have previously (this J., 1908, 168) described two phytosterols, which were separated from one another and from a hydrocarbon accompanying them in cacao butter, by fractional crystallisation. These may be obtained more easily and in a purer condition by Windaus' method of treating the crude phytosteryl acetate with a solution of bromine in glacial acetic acid, reducing the brominated compound, and saponifying the product. In this way the phytosteryl acetate tetrabromide yielded a second phytosterol melting at 162°—163° C. (former m.pt. 146° C.), whilst from the phytosteryl acetate dibromide, a phytosterol (m.pt. 139° C. ; formerly 135°—136° C.) was obtained. Both had the same crystalline form, and gave the same colour reactions as the compounds already described. The fat extracted from cacao husks also yielded both phytosterols, in addition to a small quantity of yellow, unsaturated liquid with an odour recalling that of hyacinths.—C. A. M.

Acetylene tetrachloride [tetrachlorethane] and its derivatives ; Some properties of ——. Konsortium für elektrochem. Ind. *See* XX.

Olive leaves and bark ; Constituents of ——. F. B. Power and F. Tutin. *See* XX.

Patents.

Oil from oil seeds ; Process and apparatus for expressing ——. A. Austerlitz, Györ, Hungary. Eng. Pat. 10,860, May 9, 1907.

See Fr. Pat. 381,350 of 1907 ; this J., 1908, 131.—T.F.B.

Fat separator. F. Otte. Ger. Pat. 192,988, Dec. 1, 1906.

The liquid containing the fat is introduced into a closed vessel through a pipe which passes through the side, near the top, and reaches downwards below the level of the water on the bottom of the vessel, opening below a hood, the bottom of which is also below the level of the water. The upper part of the pipe is provided with a side pipe, through which any vapour, entrained by the liquid, escapes into the upper part of the closed vessel. The fat which separates, floats to the surface of the water within the hood, and is withdrawn through a pipe, without again coming into contact with the vapour.—A. S.

Soap or washing compound. J. B. Irving, Ballinluig, Perthshire. Eng. Pat. 10,689, May 8, 1907.

The compound is prepared by mixing together a dry, powdered alkali and fatty acids, a quantity of resin being also added if desired. The mixing is carried out at a temperature not above 80° F. The following proportions of the ingredients may be used :—(1), Fatty acids ("olein"), 60 parts, and crystallised sodium carbonate, 40 parts ; (2), fatty acids, 65 parts ; rosin, 10 parts ; and pearl ash, 25 parts.—W. P. S.

Stearine-pitch as waterproofing and insulating material. Fr. Pat. 385,805. *See* III.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(*B.*)—RESINS, VARNISHES.

Venice turpentine; Detection of ordinary turpentine in ——. E. Walbum. Ark. Pharm. Kemi., 1908, 105; Pharm. Zeit., 1908, **53**, 371.

Ten grms. of the turpentine are dissolved in 30 c.c. of ether; the solution is maintained at a constant temperature of 20·5° C. for 10 minutes in a water bath, then 8 c.c. of $N/_2$ ammonia solution, previously brought to the same temperature, are added, and the mixture is well agitated. Pure Venice turpentine, under these conditions, sets to a jelly in 11 minutes; in the presence of from 2 to 10 per cent. of ordinary turpentine, the gelatinisation takes place only after from 12·7 to 26·8 minutes.—J. O. B.

Patents.

Varnish colours; Process for the manufacture of ——. F. M. Winter. Fr. Pat. 385,484, Dec. 21, 1907.

Varnish colours are made by fixing a colouring matter on an aluminium silicate prepared by a precipitation process. Example.—A solution of 60 kilos. of aluminium sulphate in 1000 litres of water is treated with a 10 per cent. solution of sodium carbonate, containing 20 kilos. of the anhydrous salt, and 75 kilos. of sodium silicate solution of 40° B. A 10 per cent. solution of 75 kilos. of sodium sulphate is then added, followed by a solution of the colouring matter, *e.g.*, 60 kilos. of "Orange II." dissolved in 3000 litres of water, and finally by a 10 per cent. solution of 220 kilos. of barium chloride.—A. S.

Wax-like material; Manufacture of —— *from the gum-resin of the asphodel.* C. Badoil. Fr. Pat. 385,553, Dec. 24, 1907.

Asphodel tubers are cooked, pressed, and the residue treated in a closed vessel with "steam at a pressure of 4 kilos.," the condensed water being used repeatedly until sufficiently charged with the asphodel gum-resin, which is soluble in hot water. The crude gum-resin thus extracted is claimed as a vegetable wax-like material —A. S.

(*C.*)—INDIA-RUBBER, &c.

India-rubber; Presence of oxydases in ——, *with a theory in regard to their function in the latex.* D. Spence. Bio.-Chem. J., 1908, 3, 165—181.

The gradual darkening in colour, which takes place in freshly prepared samples of raw rubber, has long been associated with the presence of an oxydase. No experimental evidence, however, has hitherto been brought forward to support this view, although oxydases have been shown to occur in the latex tubes of many plants and in almost all gums. The dialysed aqueous extract of raw Para rubber is found by the author to contain a powerful peroxydase, which is devoid of activity in the absence of hydrogen peroxide. When purified, by precipitation with absolute alcohol, solution in 40 per cent. alcohol, and reprecipitation, the peroxydase dissolves slowly in water; its activity is destroyed by the addition of potassium cyanide, sodium fluoride, or mercuric chloride, and in the presence of mineral acids and alkalis. It is remarkably stable towards heat; the thermal optimum is about 55° C. It contains much nitrogen, but does not give the biuret coloration. Ammonia and pyrrol fumes are evolved in quantity on fusion with potassium hydroxide; the peroxydase gives a slight reduction with Fehling's solution and the characteristic coloration for pentoses with phloroglucinol and hydrochloric acid. Of importance is the very marked reaction for iron, only given, however, when the activity of the enzyme is destroyed. The presence of an oxygenase along with the peroxydase in the insoluble constituent of Para rubber was sought for without success, but such was demonstrated to be present in fresh latex which therefore contains the full oxydase complement (oxygenase and peroxydase). A rubber free from protein matter was prepared from Funtumia latex by diluting it with many times its own volume of water in a separating funnel. The caoutchouc globules coalesced to form fine spongy flakes, which rose to the surface. The aqueous liquid was drawn off, the flakes shaken several times in succession with fresh quantities of water, and then worked up into a solid rubber clot by washing with alcohol or by pressure. The snow-white rubber thus obtained was free from protein and did not darken in the slightest on keeping. It is suggested that caoutchouc is probably a reserve foodstuff for the plant, and that as circumstances demand, the oxydases break it down into simpler products or build it up from these—probably from the pentoses as Harries suggests.— E. F. A.

Guayule rubber in Mexico. Bd. of Trade J., June 11, 1908. [T.R.]

An American expert who has been studying the industry reports that there are only about 400,000 tons of guayule now in existence in Mexico. The scarcity has become so marked that the most remote districts are now being searched for the plant, and the Bolson de Mapimi district is being thoroughly gone over, and the guayule gathered and delivered under contract to the Continental Rubber Company of Mexico. This district, lying between the Sierra Mojada and Torreon, is practically the last remaining one where there is guayule in any quantity, and the remainder of the 400,000 tons has long since been purchased by various extracting companies at from £2 10s. to £7 10s. per ton. The purchases at the lower prices were made before the landowners realised the value of the shrub or were aware of the improbability of the plant reproducing itself in a short time. It is a practical certainty, according to the expert, that with the consumption of the existing supply, the industry will go into decay.

It had been hoped that experiments would be made by persons interested in the production, planting of seed, and joining it with some kindred plant to accelerate its growth, so that a period of but four or five years would be necessary for the plant to reach the proper size for extraction. This, it is said, could be effected by grafting the guayule upon some kindred plant, the roots of which would furnish the tops with a greater flow of sap and consequently result in more rapid growth, but this has not, to the expert's knowledge, yet been attempted, although, in his opinion, it is the only hope for the future of this industry.

Patents.

Plastic and elastic substances; Production of ——. L. Stange, Aix-la-Chapelle, Germany. Eng. Pat. 3480, Feb 12, 1907.

210 parts of a hot solution of gelatin of 65 per cent. strength are emulsified at 55° C. with a mixture of 20 parts of aniline oil and 20—80 parts of castor oil or other suitable oil. The resulting emulsion is agitated with a mixture of 20 parts of 40 per cent. formaldehyde solution and 20 parts of glycerin of 31° B. The proportions of the different ingredients may be varied, and various other substances (filling materials and colouring matters, etc.) may be added.—A. S.

Vulcanised rubber; Machines for reducing —— *to powder.* T. Gare, New Brighton. Eng. Pat. 8976, April 18, 1907.

The invention consists essentially in the use of rotating rasp or grater-like surfaces (discs or cylinders) for grinding vulcanised rubber to powder. Various forms of apparatus for carrying out the invention are described.—A. S.

Caoutchouc; Process for the regeneration of ——. Basler Chem. Fabr., Basle, Switzerland. Eng. Pat. 4714, March 2, 1908. Under Int. Conv., March 4, 1907.

Waste rubber, vulcanised or not, is cut in small pieces, and heated at 100° C. or above, with an ether of the aliphatic or cyclic series boiling above 100° C., the mixture being kept well stirred. From the resulting solution the caoutchouc is separated by any of the usual methods. For example, 1 part of rubber is heated with 2 parts of commercial di-isoamyl ether for 3 hours at 120°—130° C. The solution is diluted with a further quantity of the isoamyl ether, filtered, the ether distilled off, finally under reduced pressure, and the residue heated with alcohol, separated from the latter, and dried. Other ethers which have proved suitable as caoutchouc solvents are anisol, β-naphthol ether, guaiacol, benzyl ethers, xylyl ethers, phenol ethers, borneol ethyl ether, etc.—A. S.

" *Visco-plastic materials* " ; *Manufacture of —— intended especially for covering pneumatic tyres.* L. C. G. Lesage and Comp. Gén. des Pneumatiques " Increvable." Fr. Pat. 385,381, March 13, 1907.

In the preparation of elastic materials by the action of formaldehyde, tannin, chromium salts, or other hardening agents on mixtures with a base of gelatin, ossein, or cellulose, claim is made for suspending the hardening agent, in the state of vapour or spray, in a volume of air, in order to ensure its intimate contact with the mixture with which it is to be incorporated.—A. S.

Rubber ; Process and apparatus for the extraction of ——. F. Boutroux and V. de Brugada Vila. Fr. Pat. 385,190, Dec. 19, 1907.

Rubber is extracted from the bark, roots, branches, and leaves of rubber-yielding plants, either in the green or dried state, by a process partly chemical and partly mechanical. The different portions of the plant are first decorticated, then subjected to a beating process, by which the latex is expressed ; at the same time a coagulating agent is supplied to the mass. The resulting mixture of liquid and coalgulated rubber is extracted with a rubber solvent.—H. G. B.

XIV.—TANNING, LEATHER, GLUE, SIZE.

Gelatose [hydrolysed gelatin] as a colloidiser. R. E. Liesegang. Z. Chem. Ind. Kolloide, 1908, **2**, 307.

The colloidising power of gelatin jellies for silver chromate is increased in an extraordinary degree by mixing gelatose with the jellies. The crystallisation of potassium bichromate and other salts from layers of gelatin on drying may be prevented by replacing a portion of the gelatin by gelatose. This observation led the author to make experiments on the freezing of gelatose solutions. A solution of 20 grms. of gelatin in 100 c.c. of water was boiled for several days until its gelatinising power was completely lost ; it was then subjected to a temperature of —10° C. for a whole day without the separation of ice. When layers of gelatin containing a crystallisable salt are allowed to dry, the form of the crystals remains after they have been removed by washing. But in the case of layers containing a little gelatose and a large proportion of a salt (strontium nitrate), the gelatose is broken away on drying, and adheres to the crystals of salt.—J. F. B.

Glaucohydroellagic acid. M. Nierenstein. *See* IV.

Patents.

Tanning matters, alcohol, and cellulose ; Process for extraction of —— from wood. E. W. Tillberg. Fr. Pat. 385,279, Dec. 3, 1907. Under Int. Conv., Aug. 5, 1907.

The wood shavings are treated first with boiling water, either at ordinary pressure or under a pressure of two atmospheres, and afterwards in the same vats with dilute acids—either organic or inorganic—at a pressure of eight atmospheres, in which case the extracted matter is used for the manufacture of alcohol. The residue is chiefly cellulose, and is prepared for paper making by the usual methods.—H. G. B.

Tanning materials ; Extraction apparatus for finely-divided —— A. Diehl, sen. Ger. Pat. 192,618, Sept. 4, 1906.

The apparatus consists of a rotating vessel divided by two partitions, formed of rods of triangular cross-section, into three compartments, *viz.*, two outer infusion (heating) chambers, with an extraction chamber in the middle. The two infusion chambers communicate by way of a series of channels, formed by rods of triangular cross-section. The rods forming the partitions between the infusion chambers and the extraction chamber, have their broad sides turned inwards, so that liquid can flow more readily into the extraction chamber from the infusion chambers than *vice versa.* The tanning material is introduced into the extraction chamber, and the extracting liquid is introduced through the central hollow shaft, on which the whole vessel rotates.—A. S.

Sizing material ; Preparation of —— from zinc oleate. A. Plöger. Ger. Pat. 194,726, May 2, 1906.

A saponifiable oil, preferably linseed oil (1 kilo.), is boiled with zinc oxide (50—200 grms.) for ½ hour at 180° C., so as to obtain a thick mass, which is rendered soluble in water by boiling with alkali (5 per cent. of sodium carbonate), with if necessary, addition of some rosin (10 per cent.). One part of the product is then mixed with 2 parts of " amidulin," an adhesive substance prepared by boiling starch flour with 6 times its weight of water.—A. S.

XV.—MANURES, &c.

Phosphoric acid ; The ammonia-soluble —— of the soil. G. S. Fraps. Amer Chem. J., 1908, **39**, 579—586.

The phosphoric acid of the soil left after treatment with dilute hydrochloric acid is partly soluble in ammonia. That portion of the so-called *humus-phosphoric acid* associated with the clay is probably not in solution. The soluble portion, of inorganic origin, derived chiefly from iron and aluminium phosphates is of lower agricultural importance. The phosphoric acid associated with the organic matter may be regarded as a reserve store, of value according to the rate at which it decomposes. The distribution of the ammonia-soluble phosphoric acid in the soil is easily determined as follows : The clay is precipitated by the addition of a solution containing ½ grm. of ammonium sulphate in 100 c.c. of water. After filtering off the precipitate and washing it several times with the ammonium sulphate solution, the organic matter is precipitated by making the liquid slightly acid. Phosphoric acid is determined in the two precipitates, whilst that in solution is estimated by difference, the total phosphoric acid being determined in the original solution.
—W. S.

Calcium cyanamide ; Efficacy of —— under different manuring conditions. I. Namba and C. Kanomata. Bull. Coll. Agric., Tokio, 1908, **7**, 631—634.

Calcium cyanamide yields a better result in conjunction with superphosphate than with a neutral phosphate, doubtless due to the former mixture being more nearly neutral than the latter. Unlike sodium nitrate, calcium cyanamide does not depress the availability of bone dust ; it resembles ammonium sulphate in this respect.—E. F. A.

Gypsum as a manure. T. Takeuchi. Bull. Coll. Agric., Tokio, 1908, **7**, 583—597.

Gypsum is a very valuable addition to manure when sodium nitrate has been applied, as this tends to gradually pass into sodium carbonate, which interacts with the gypsum to form sodium sulphate and calcium carbonate. In general, gypsum is of value when there is any alkaline reaction produced in the soil. Gypsum, however, depresses the yield with an acidic manure such as superphosphate or ammonium phosphate. Gypsum has also

a favourable effect in neutralising the injurious action that a relative excess of magnesia can exert on plants. This is very marked in the case of spinach, where a moderate dose of *magnesia alba* depresses the yield considerably, and lime in the form of carbonate almost entirely destroys the crop, but lime in the form of gypsum restores it to the productive state of the original soil.
—E. F. A.

Rice-straw; Composition of ——. T. Takeuchi. *See* XVIIIA.

PATENTS.

Fertiliser; Process of making a ——. E. Collett, Notodden, Norway. U.S. Pat. 888,145, May 19, 1908.

See Fr. Pat. 356,077 of 1905; this J., 1905, 1315.—T. F. B.

Insecticide-fertiliser. F. G. Dokkenwadel, Coshocton, Ohio. U.S. Pat. 888,148, May 19, 1908.

The fertiliser consists of "cellulose material" mixed with nitrates (sodium nitrate), potash (potassium sulphate), and phosphates. The mass is impregnated with crude carbolic acid, to which kerosene may be added.—A. G. L.

Fertilisers, filtering materials, and the like; Production of ——. J. Brightmore, Tideswell. U.S. Pat. 888,304, May 19, 1908.

See Eng. Pat. 15,922 of 1906; this J., 1907, 1248.—T. F. B.

XVI.—SUGAR, STARCH, GUM, &c.

Starch; Properties of —— *in connection with its colloidal structure.* E. Fouard. Compt. rend., 1908, **146**, 978—981. (Compare this J., 1908, 238, also Maquenne, this J., 1908, 291.)

The true solution of soluble starch obtained by filtering through a collodion membrane a pseudo-solution of de-mineralised and partially hydrated starch, has been further studied. Cryoscopic determinations give no depression of the freezing point, so the lowest possible molecular weight must be at least 15,000. Freezing causes a slight opalescence in the solution preliminary to the granular transformation. Ultra-microscopic examination places the solution intermediate in position between the mineral colloids of insoluble elements and the perfectly dissociated salt solutions. The same 5 per cent. pseudo-solution has been filtered through a number of collodions differing in their content of alcohol so as to have a less compact texture. The filtered extract contains increasing proportions (from 1·518 to 2·365 per cent.) of starch of an increasing specific rotatory power ($[\alpha]_D$ = from 183° 15′ to 191° 50′) showing the membrane to act as an analyser and the solution to contain molecules of different magnitude, each characterised by a special rotatory power. The state of the perfect solution is altered by careful evaporation in vacuum and dilution to the original volume. Water not only acts as a solvent, but is the essential factor of the reaction modifying the state of the pure starch. The electrical conductivity of this starch solution slowly increases from a value of $73·4 \times 10^{-6}$ up to a constant maximum of $226·7 \times 10^{-6}$ during the granular transformation. The solution also shows a very slight acidity, corresponding to traces of a completely dissociated acid phosphate. The increase in conductivity corresponds to the progressive liberation of the granular masses of starch and the mineral ions.—E. F. A.

PATENTS.

Beetroot juice for sugar-making; Purification of ——. H. Steffens. Fr. Pat. 385,639, Dec. 27, 1907.

The juice is treated with about 1 per cent. of calcium oxide (quicklime), this quantity being calculated on the weight of the beetroots from which the juice was obtained, and heated to a temperature of 70° C. Air, or ozonised air, is then blown through the juice for 15 minutes, or less, until the precipitate becomes dark in colour, when the juice is at once treated with carbon dioxide. The latter is passed in until the alkalinity of the juice corresponds with about 0·08 per cent. of calcium oxide. The precipitate is removed by filtration, and the juice is once more treated with calcium oxide, aerated, carbonated, and filtered. The precipitates obtained are readily filtered and washed.—W. P. S.

Waste liquors from sugar manufacture; Evaporation of —— *under reduced pressure.* A. Gräntzdörffer. Ger. Pat. 192,513, Dec. 2, 1906.

The evaporator is provided at the bottom with inlet pipes for the liquor and for water, a heating coil, and just above the latter, an agitator. In the upper portion of the evaporator is a hollow boss, from which tubes radiate, these tubes opening just above the level of the liquor; a pipe leads from the boss to a safety-receptacle, which is connected to the pump. A second suction pipe leads from the cover of the vessel, and this is used at the beginning of the evaporation if the liquor foams strongly. When the foaming subsides, the set of radial suction pipes is put into operation.—A. S.

Drying apparatus to be used more particularly for drying starch and starchy products. C. B. Duryea, Cardinal, Canada. Eng. Pat. 24,951, Nov. 11, 1907.

The invention relates to apparatus of the type in which the material to be dried is placed on superposed trays in a drying kiln, and is dried by a current of hot air. According to the present patent, slots are formed in the floor of the kiln and, at different heights, in the side walls, and by a suitable arrangement of supply and return pipes and of valves operated by means of a cam wheel, it is possible to reverse automatically, at intervals, the direction of flow of the hot air through the kiln. Thus the hot air alternately enters through the slots in the floor and leaves through the slots in the walls, and *vice versa*, and in this way, numerous eddy currents are set up within the kiln, and more intimate contact of the hot air and the material being dried is effected. In order to render the flow of air through the different openings as uniform as possible, the pipes leading to the slots are tapered as they approach thereto, and shutters are provided for varying the size of the slots.—A. S.

Drying apparatus [for starch and starchy products]. C. B. Duryea, Cardinal, Canada. U.S. Pat. 887,317, May 12, 1908.

See Eng. Pat. 24,951 of 1907; preceding.—T. F. B.

Starch manufacture; Pressing the residues from ——. Sudenburger Maschinenfabr. und Eisengiesserei Akt.-Ges. Ger. Pat. 192,102, Jan. 12, 1907.

The press-table is formed by a grating, on which rests a removable finely perforated copper plate. The grating is fixed, by means of set-screws, across the top of a trough, into which the expressed liquid falls. The pressing is effected by means of a pivoted stamp, which is operated by a crank, and when raised, leaves a wedge-shaped space above the copper plate. The material is fed into the wide end of this wedge-shaped space from a feed-roller, the periphery of which carries four curved radial arms, forming four separate compartments. Each time the stamp is raised, the feeding roller moves through an angle of 90°. An endless chain, operated by the radial arms on the feeding roller, passes over the press-table, and moves forward the pressed material in the form of a band or ribbon, which when it leaves the press-table, slides down an inclined plane on to a screw-conveyor.—A. S.

Raffinose; Hydrolysis of ——. Ger. Pat. 195,072. *See* XVII.

XVII.—BREWING, WINES, SPIRITS, &c.

Disaccharides; Application of Barfoed's reagent to show hydrolysis of —— by enzymes. H. E. Roaf. Bio-Chem. J., 1908, **3**, 182—184.

As lactose and maltose reduce cupric hydroxide in alkaline solution both before and after hydrolysis, in order to prove hydrolysis by enzymes it is necessary to make a quantitative estimation of the reducing power in two solutions. This may be avoided by using Barfoed's reagent (copper acetate in acetic acid solution), which is unchanged by disaccharides but reduced by monosaccharides, and the application of which has recently been carefully investigated by Hinkel and Sherman (this J., 1908, 84). To demonstrate the presence of lactase and maltase, the author proceeds as follows:—1 c.c. of the solution containing the enzyme and disaccharide is added to 5 c.c. of the copper acetate reagent, and the solution heated in the boiling water bath for 3 minutes. Reduction indicates the presence of a monosaccharide, that is hydrolysis, no hydrolysis being observed in control solutions containing boiled enzyme.—E. F. A.

Yeasts; Investigations on top-fermentation pitching ——, and on the pure cultures isolated from them. F. Schönfeld and H. Rossman. Woch. f. Brau., 1908, **25**, 281—286. (Compare Rommel, this J., 1908, 462).

Further investigations were made on top-fermentation pitching yeasts from breweries in which the fermentation is effected at distinctly low temperatures, viz., 9—12° C. (48—54° F.). These yeasts, which in some cases consist of mixtures of top- and bottom-fermentation yeasts, and also the pure cultures derived from them, exhibit the general characteristics given previously (*loc. cit.*) for top-fermentation yeasts. These characteristics seem to be well established, as the yeasts examined, 22 in number, were obtained from different breweries making widely different types of beer and using, some a low, and some a high, temperature for fermentation. It is evident that top yeasts, when continuously used for fermentation at low temperatures, undergo no change by which they, or the single-cell cultures isolated from them, lose their characteristic property of top-fermentation. —T. H. P.

Yeast and fermentation; Importance of calcium salts in brewing water to ——. F. Hayduck and K. Schücking. Woch. f. Brau., 1908, **25**, 241—244, 253—258, 265—270, 277—281, 297—300.

The results of a large number of experiments with different yeasts and worts prepared by various methods lead to the following conclusions:—The variations of: (1), the lime-content of the wort with that of the brewing water; or of (2), the lime-content of the yeast with that of the wort, follow no regular law. Except in extreme cases, the course of fermentation and the character of the yeast do not depend on the absolute lime-content of the wort and yeast, but are influenced by the nature of the calcium salt in the brewing water. Each calcium salt has its specific action, which is favourable to the yeast and fermentation in the case of calcium carbonate and unfavourable in the case of the sulphate. The work of other investigators in this connection is discussed. —T. H. P.

Acetaldehyde; Formation and decomposition of —— by yeasts. A. Trillat and Sauton. Compt. rend., 1908, **146**, 996—999.

After preliminary experiments with several beer- and wine-yeasts, the further work was performed with pressed bakers' yeast. It was found that yeasts are able to oxidise ethyl alcohol to acetaldehyde in considerable quantity, but the aldehyde rapidly disappears again if steps are not taken to isolate it at once. A large quantity of yeast was agitated with alcohol in such a manner that it constantly came in contact with the air for 6 hours. The yeast was at once separated by filtration, and the aldehyde isolated by distillation. The oxidation of alcohol to aldehyde in presence of yeast yields larger quantities than such methods as using platinum black, animal charcoal, etc. A yeast adapts itself more and more to the oxidation the more often it is used. Living yeast also causes the aldehyde to disappear very rapidly. The results do not apply to other alcohols. The oxidising action of yeast appears to be specific and not the same as the so-called contact reactions. The rapid disappearance of aldehyde following its formation, explains the contradictory results obtained in the analysis of fermented liquors and notably in wines attacked by micro-organisms. The results also afford an explanation of the formation of aldehyde in quantity in the alcohol obtained in the manufacture of yeast by the aeration process.—E. F. A.

Beer; Susceptibility of —— to chill, and to production of albumin-turbidity by metals. H. Keil. Woch. f. Brau., 1908, **25**, 246—248.

Pilsener beers are far more sensitive to chill and to the action of metals than those of a darker type, a fact which the author attributes to the different procedure in the malting and mashing processes in the two cases. Dark beers are usually made by the old three-mash process from well-grown malt, whilst for the paler beers, a shorter mashing process and malt not so well-grown are generally employed. Directions for both malting and mashing are given, by means of which beers which remain perfectly bright when chilled may be prepared. As regards the turbidity produced by the action of metals, this only seems to occur when the cleaning of the pipes and vessels, with which the beer comes into contact, has been so thorough as to remove the protecting layer of beer-scale from the metal.—T. H. P.

Beers; Sensitiveness of —— to chill. H. Keil. Woch. für Brau., 1908, **25**, 320—321.

In certain seasons the tendency to the production of turbidity due to chill is more prevalent than in others; this would seem to indicate that the cause may lie to some extent in the barley itself. The author has not been able to observe any connection between the protein contents of the malt and the sensitiveness to chill of the beers prepared therefrom. He has studied the influence of the different methods of malting and mashing. Dark beers, which have been brewed from long-grown malts by the slow mashing process, show very little liability to chill-turbidity; pale beers brewed by the same mashing process from long-grown malts are extremely sensitive. Although the mashing process is the same in both cases, the malts are very different. In the case of the dark malts, owing to the high temperature of curing, the proteolytic action which takes place during the slow mashing process is only small, but in the case of low-cured pale malts the proteolytic changes during mashing are considerable. Beers brewed from pale malts cured at higher temperatures are less liable to chill-turbidity. Also, when the high-temperature, quick mashing process is adopted (temperatures below 62·5° C. being avoided), proteolytic action is largely restricted, and the beers are less liable to become cloudy on chilling. A combination of high-temperature curing and high-temperature mashing, with pale malts, gives the most resistant beers. The author has confirmed Schönfeld's observation that beers which have already been stored at fairly warm temperatures are more liable to chill-hazes than beers which have never been subjected to higher temperatures. The differences observed between the different beers are not so much in the final intensity of the turbidity formed after prolonged chilling, as in the rapidity with which the turbidity appears during cold storage. Theoretically, short-grown, high-cured pale malts, provided they are sufficiently modified, should yield the most resistant beers, especially if brewed by the quick, high-temperature mashing process, but such malts are rarely met with. The hardness of the brewing water may possibly play a part in determining the sensitiveness of the beer; probably waters rich in gypsum would increase the tendency to turbidity. A low fermentation temperature appears to be conducive to sensitiveness towards chill, probably because the multiplication of the yeast is restricted, and the cleansing of the beer is less complete.—J. F. B.

Sarcinæ; Rapid method for detection of ——. M. Raux. Woch. für Brau., 1908, **25**, 321—322.

The culture liquid used consists of incompletely fermented beer prepared from a 10 per cent. wort, to which is added about twice its volume of concentrated yeast-water. The cultures are developed at a temperature of 25° C. in an ordinary sterilised flask of 15 c.c. capacity, and are protected from access of air by means of a paraffined cork. After 2—3 days, traces of sarcinæ invisible to the naked eye may be detected, at the same time wild yeasts appear with the sarcinæ. The development of the sarcinæ takes the form of colonies in intimate association with the yeast cells, so that a symbiosis of the two kinds of organisms appears probable; the sarcinæ would appear to derive nutrition from the protein matters excreted by the yeast. The development of the sarcinæ, other conditions being the same, is more rapid if an unhopped, incompletely fermented wort, very rich in nitrogen, be employed; the beer obtained from this is kept at a temperature of 43° C., so that fermentation ceases, and autolysis of the yeast takes place.—J. F. B.

Citric acid in wine; Detection of ——. G. Favrel. Ann. Chim. analyt., 1908, **13**, 177—179.

The method proposed is based on the formation of acetonedicarboxylic acid when citric acid is heated with concentrated sulphuric acid. 100 c.c. of the wine are evaporated to dryness, the residue is dissolved in 7 c.c. of boiling water, 35 c.c. of 95 per cent. alcohol are added, the mixture is placed aside for 30 minutes, and filtered. The filtrate is treated with 0·4 grm. of calcium acetate dissolved in 5 c.c. of water, and the precipitated calcium citrate is collected on a filter. When dry, the calcium citrate is transferred to a dry test-tube, 3 c.c. of sulphuric acid (sp. gr. 1·84) previously heated to 100° C. are added, and the whole is kept at a temperature of 80°—90° C. for 2 minutes. The solution is then cooled, diluted with 3 times its volume of water, again cooled, and shaken with 10 c.c. of alcohol-free ether. The ethereal extract is filtered, and evaporated, when characteristic crystals of acetonedicarboxylic acid separate out if citric acid was present in the wine. The crystals are soluble in water, and the solution gives a violet-red coloration with ferric chloride, which is discharged on the addition of a mineral acid. The reaction is not influenced by the presence of other organic acids, such as formic, acetic, propionic, butyric, tartaric, malic, succinic, lactic, or oxalic acids in the wine or other liquid under examination, but salicylic acid, if present, must be removed previously by extracting the wine with ether, after acidifying with hydrochloric acid. The test will detect 0·05 grm. of citric acid in 1 litre of wine.—W. P. S.

Tartaric acid; Determination of —— *volumetrically in tartar and lees.* E. Pozzi-Escot. *See* XXIII.

Patents.

Water for whisky distillation and for other brewing purposes; Plant for treatment of ——. A. Smith, Knockando, N.B. Eng. Pat. 16,291, July 16, 1907.

The water is first passed through a filter which may be either a gravitation or a vacuum filter. It is then pumped through a heater which consists of a closed tank, in which is arranged horizontally a coil of pipes, through which the water passes. Steam, which may be exhaust steam, is admitted to the tank, and is caused to impinge on the coil of pipes containing the water to be heated. The heated water then passes out at the top of the heater and goes to the mash-tun, whilst the water condensed from the steam in the heater-tank is collected in a reservoir for returning to the boilers.—J. F. B.

Rectifying of alcoholic liquid. E. Guillaume, Paris. U.S. Pat. 887,793, May 19, 1908.

See Eng. Pat. 5794 of 1902; this J., 1903, 223.—T. F. B.

Soy; Apparatus for brewing ——. T. Suzuki, Sunamura, Japan. U.S. Pat. 888,204, May 19, 1908.

The apparatus consists of a closed vessel provided with a central cylinder; a piston is fitted in the latter, and valves in the piston allow the soy to pass in an upward direction only, as the piston is moved up and down. The soy is thus caused to circulate through the cylinder and outer part of the vessel. Means are provided for working the piston, and the temperature of the soy is controlled by means of a coil placed in the space between the cylinder and the wall of the vessel.—W. P. S.

Beer-wort; Process and apparatus for filtering ——. H. Breker. Fr. Pat. 385,574, July 19, 1907.

In the filtering vessel described, the false, perforated bottom is supported at a greater height than usual above the actual bottom of the vessel; the liquid is drawn off laterally through pipes situated in the space between the two bottoms, and an arrangement is provided over the opening of each pipe, so that the liquid cannot directly enter from above, thus allowing of the subsidence to the bottom of the vessel of all particles in suspension, whence they are removed through other openings. An indicator shows the level of the liquid in the vessel, and either gives warning when the vessel is empty, or automatically closes the openings of the pipes.—W. P. S.

Raffinose and products containing the same; Enzymatic hydrolysis of ——. M. Gollmert. Ger. Pat. 195,072, Aug. 5, 1906.

By the action of certain enzymes, such as emulsin or kephir-lactase, raffinose is converted into sucrose and galactose. This action can be applied to the preparation of sucrose and galactose from raffinose; to increasing the sweetening power of the syrup prepared from the residual molasses obtained in de-saccharification processes; and to rendering raffinose fermentable by top-fermentation yeasts.—A. S.

Beer containing lactic acid; Preparation of ——. K. Scholvien. Ger. Pat. 193,913, Dec. 22, 1906.

Beer wort is acidified by means of lactic acid bacteria in the usual manner, and is then rapidly cooled and sown with bottom-fermentation yeast. At the low temperature the lactic bacteria are unable to compete effectively against the yeast, and no lactic acid or only a very small quantity, is further produced. By working in this way, the volatile and non-volatile products, including aromatic substances, produced by the lactic fermentation, are not altered or expelled. A suitable lactic acid bacterium is *Bac. Delbrucki.*—A. S.

Beer yeast; Rendering —— *suitable for baking purposes.* Ger. Pat. 194,443. *See* XVIII*A*.

Barley; Denaturing ——. Ger Pat. 194,644. *See* XVIII*A*.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, AND DISINFECTANTS.

(*A.*)—FOODS.

Cocoa beans; The quantity of soluble silica in ——. H. Matthes and O. Rohdich. Z. öffentl. Chem., 1908, **14**, 166—169.

The amount of soluble silica yielded by a sample of cocoa has been recommended by Matthes and Müller (Z. Unters. Nahr. Genussm., 1906, 12, 94) as an indication of the presence, or absence, of added husk in the sample. The authors find, however, as the result of the examination of 20 specimens of cocoa beans of different origin, that the amount of soluble silica varies from 0·02 to 0·88 per cent., and, consequently, the datum is of no use for the positive detection of added husk in cocoa.—W. P. S.

Rice-straw; Composition of ——. T. Takeuchi. Bull. Coll. Agric., Tokio, 1908, 7, 619—621.

Straw from rice plants when the seed production was poor, was found to be somewhat richer in protein, fat, and carbohydrate than straw from plants giving a good yield of grains, as shown by the following analyses —

	Straw from favourable harvest.	Straw from poor harvest.
Hygroscopic water	12·31	9·85
Dry matter	87·69	90·12
Total nitrogen	0·97	1·48
Crude protein	6·05	8·82
Crude fat	1·36	1·65
Crude fibre..............	31·16	28·72
Crude ash...............	11·42	12·35
Silica	5·39	6·13
Dextrose	2·25	3·28
Sucrose	0·79	0·96
Starch and hemicelluloses.	14·86	18·75
Pentosans	14·28	16·55

The percentage of silica in rice straw is 6·15, whilst straw from wheat contains 2·12, from barley 2·73, from oats 3·36, and from maize 1·54 per cent. of silica.—E. F. A.

Ethyl ester value; The —— : a new constant for the detection of cocoanut oil. J. Hanus and L. Stekl. *See* XII.

Cacao butter; Unsaponifiable constituents of ——. H. Matthes and O. Rohdich. *See* XII.

Patents.

Yolk emulsion to be used in the production of edible fats, butter substitutes, and the like; Process for preparing ——. M. Riegel, Berlin. Eng. Pat. 12,095, May 24, 1907.

See Fr. Pat. 378,281 of 1907; this J., 1907, 1156.—T. F. B.

Emulsifying and homogenising milk and other liquids; Method of ——, *and apparatus therefor.* J. V. M. Risberg, Sodertelje, Sweden. Eng. Pat. 25,890, Nov. 22, 1907. Under Int. Conv., Nov. 26, 1906.

See Fr. Pat. 384,310 of 1907; this J., 1908, 465.—T. F. B.

(1). *Milk; Process of producing dried* ——. (2). *Milk; Process of condensing* ——. (3). *Evaporating apparatus [for milk, etc.].* J. A. Just, Syracuse, N.Y. U.S. Pats. 888,016, 888,017, and 888,018, May 19, 1908.

(1). The milk is fed continuously, in the form of a thin layer, on to the centre of a rapidly rotating horizontal disc. This disc is mounted in a closed, heated chamber from which the air is exhausted. The supply of milk is regulated according to the size of the chamber, so that the fine particles of milk, thrown from the edge of the disc, are dried before they fall to the bottom of the chamber. (2). The process consists in supplying a stream of the milk on to a rapidly rotating surface, so that the layer of milk leaves the circumference of the surface in a fog-like, homogeneous condition. (3). The apparatus consists of a vacuum chamber provided with a heating device; a pair of flat discs are mounted close together on a central shaft in the chamber, and means are provided for rotating the shaft rapidly. The liquid to be evaporated is supplied between the discs at or near their centre.—W. P. S.

Liquids [milk]; Apparatus for concentrating ——. A. Gaulin. First Addition, dated Feb. 27, 1907, to Fr. Pat. 374,457, Jan. 24, 1907 (this J., 1907, 774).

Calcium carbonate, phosphate, and caseinate are employed for neutralising the acidity of milk before concentrating the latter in the apparatus described in the original specification.—W. P. S.

Beer yeast; Process for rendering —— suitable for baking purposes. F. Sarnighausen. Ger. Pat. 194,443, Aug. 19, 1906.

Waste brewer's yeast is washed several times with cold water, and after separating the wash-water as completely as possible, treated with four times its quantity of warm water, so that the mixture contains 40—42 per cent. of yeast. This mixture is vigorously aërated for 6—8 minutes, the warm water separated, and the yeast washed twice with cold water. After again separating the wash-water, the yeast is treated with a dilute solution of tartaric acid, so that the mixture has an acidity of 0·7—0·8 c.c. of $N/_1$ acid per 20 c.c. After aërating gently during half an hour, the yeast is pressed. It is stated to be quite stable and free from bitterness.—A. S.

Barley; Method of denaturing ——. J. Martin. Ger. Pat. 194,644, Dec. 20, 1905.

In order to render barley unsuitable for mashing and for the preparation of malt products, without injuring its suitability as a fodder, it is infected with suitable organisms, for example, by spraying it with wine or beer which has undergone lactic or acetic fermentation.—A. S.

(*B.*)—SANITATION; WATER PURIFICATION.

Underground water supplies to the Thames basin; Some observations upon the ——. C. Beadle. J. Soc. Arts, 1908, 56, 655—668.

A discussion of the subject under the headings:—(1). Visible depletion. (2). Available supplies. (3). To what extent supplies have been drawn upon. (4). Future supplies and requirements.

Manganese sulphate; Removal of —— from water, by means of zeolites. H. Lührig and W. Becker. Chem.-Zeit., 1908, 32, 514—516 and 531—532.

Experiments have been carried out on the efficiency of the method, proposed by Gans and others, for removing manganese sulphate from water by means of artificial or natural zeolites (this J., 1907, 481 and 711). Similar results are obtained with the natural and artificial substances, but the latter are the more active. A given quantity of manganese sulphate is most effectively removed from solution, if this is dilute and is made to filter slowly through a bed of the silicate. The presence of the salts of other bases in solution is unfavourable to the absorption of manganese. By subsequent treatment of the silicate with solutions of salts, such as ammonium chloride, in order to revivify it, the whole of the absorbed manganese is not removed, but it is found to be present partly as hydrated peroxide, which, on the large scale, tends to the obstruction of the filter beds.—F. Sodn.

Nitrates; Limitations of the copper-zinc couple method in determining ——. J. E. Purvis and R. M. Courtauld. Proc. Cambridge Phil. Soc., 1908, 14, 441—446.

The results of a number of experiments are recorded, the investigation being carried out with the object of ascertaining to what extent the presence of albuminous matters interferes with the determination of nitrates in sewage, etc., by the copper-zinc couple method. The determinations were made on solutions containing known amounts of nitrates, albumin, peptone, and blood serum, and on sewage free from nitrates. It appears from the figures given, that a small amount of ammonia was formed in the solutions containing no nitrate, and was, consequently, produced by the disintegration of the albuminous compounds. The effect of the couple when acting in solutions containing both nitrates and albuminous matters was variable; in some instances the amount of ammonia produced was greater than would be due to the reduction of the nitrates alone, and in others less. It would seem that the couple does not always complete the reduction of the nitrate or of the albuminous matter before acting on the other. The experiments, therefore, suggest some doubts as to the accuracy of this method for determining nitrates in waters heavily charged with organic nitrogenous matters.—W. P. S.

Patents.

Refuse ; Processes and furnaces for the combustion of ——. A. Fried, Barmen, Germany. Eng. Pat. 10,712, May 8, 1907.

The furnace consists of two combustion chambers, provided with ash-pits, and into which the refuse is introduced from the top. The air supply is regulated so that carbon monoxide is the principal gas produced, and the gases are conducted from the top of the furnace into a chamber where they are mixed with hot air. The refuse is only burnt in one of the combustion chambers at a time, the heated ashes in the other being used to heat the air supplied to the mixing chamber. In the latter the gases and air are burnt, and the heat generated is employed for heating a tubular boiler. A transverse wall or bridge, placed across the mixing chamber, serves as a means of storing heat and as igniter for the gases when once the furnace is running regularly. Instead of the transverse wall, a hanging wall may be built in front of the boiler. Means are provided for removing soot and fine ashes from all parts of the furnace.—W. P. S.

Sewage, etc. ; Apparatus for the biological purification of ——. J. J. E. Douzal. Fr. Pat. 385,573, March 21, 1907.

The apparatus consists of two parts, an anaerobic chamber and an aerobic or oxidising chamber. The sewage is admitted to the former, which is a closed tank, through a central pipe passing through the top. A serpentine pipe reaching from the bottom to nearly the top of the tank serves as the outlet for the sewage, and by surrounding the central pipe, acts as a coarse screen for the inflowing sewage. The sewage, after being in the closed tank for the necessary period of time, is delivered from the top of the serpentine into a small tank situated at the top of the second chamber ; the top of this tank is provided with a filter. The sewage passes upwards through this filter into another small tank having a filter at its bottom, and thence flows over inclined open channels to the bottom of the chamber, where it is sprinkled over a filter bed. The effluent is collected at the bottom of the chamber and conducted away. The two chambers may be superposed or situated side by side.—W. P. S.

(*C.*)—DISINFECTANTS.

Insecticides and fungicides. New forms of kerosene emulsions. F. T. Shutt. Canadian Dept. Agric., Annual Report on Exper. Farms, 1906, 181—182.

Ordinary flour was found to be a very satisfactory emulsifying agent for use in mixtures of coal tar oil and water, 8 oz. of flour being capable of holding 1 quart of the oil in perfect suspension in 2 galls. of water. In preparing the emulsions, the flour is mixed with the oil, and the mixture is then churned with the water. The following washes are serviceable to fruit-growers :—(1). Copper sulphate (bluestone), 4 lb. ; flour, 8 lb. ; kerosene, 4 galls. ; water, 36 galls. (2). Sodium hydroxide, 8 lb. ; flour, 8 lb. ; kerosene, 4 galls. ; water, 36 galls. (3). Copper sulphate, 4 lb. ; lime, 4 lb. ; kerosene, 4 galls. ; water, 36 galls. (4). Copper sulphate, lime, flour, of each 4 lb. ; kerosene, 4 galls. ; water, 36 galls.—W. P. S.

Patents.

Disinfectant ; A solid, soluble ——. P. Dame. Fr. Pat. 385,706, March 26, 1907.

The disinfectant consists of a mixture of an alkali hypochlorite, preferably sodium hypochlorite, and anhydrous sodium carbonate. About equal parts of each are used, but this proportion may be varied, and other anhydrous salts, such as sodium sulphate, sodium phosphate, magnesium sulphate, borax, or alum, can be used in place of sodium carbonate.—W. P. S.

Insecticide-fertiliser. U.S. Pat. 888,148. *See* XV.

XIX.—PAPER, PASTEBOARD, &c.

Book papers ; Preservation of —— *in public libraries.* W. Herzberg. Mitt. K. Materialprüfungsamt, 1908, 26, 105—137.

The author has examined 435 samples of paper supplied by the Berlin University Library and taken chiefly from treatises and periodicals devoted to the arts and sciences. Such books partake of the nature of permanent records of importance, and it might be expected that, in comparison with the cost of the book, the small difference between the cost of a good paper and a bad paper would not be considered. The standard paper considered satisfactory for publications of this importance is that specified in the list of Prussian " normal " papers as " class 8a," a pure rag paper, with mechanical properties corresponding with the " strength-class 4 " ; for works of subordinate importance, paper of " class 8b," composed of any non-lignified fibres, but of the same strength-class, would be admissible. The work of the author has been to ascertain what proportion of the papers in actual use conform with these standards, and thus have a reasonable prospect of surviving for any length of time under the conditions of use in a reference library. Considering first the fibre composition of the papers, and excluding books printed before the second half of the 19th century, the author has been able to compare the results with those of a similar investigation made 20 years ago by A. Martens. The figures are given in the following table :—

Year.	No. of samples tested.	Percentage of samples belonging to Fibre-Class.		
		I.	III.	IV.
1887.....	123	2	33	60
1907.....	419	9	70	21

Class I. = pure rag ; Class III. = any non-lignified fibres ; Class IV. = any fibres whatever, including mechanical wood fibres.

Thus there has been a distinct improvement in the direction of excluding the extremely perishable mechanical wood fibre from valuable publications. But the author's tests of the mechanical properties, which could only be made in full on 246 samples, showed an extremely unsatisfactory state of things. Only 1·6 per cent. of the papers tested, fulfilled all the specifications of " strength-class 4." About one-third of the samples showed a sufficiently high breaking-length or breaking-stretch, but only 18 per cent. were up to the standard in both respects. The quality of resistance to repeated creasing showed the worst results, only 1·8 per cent. of the samples reaching the standard specified for class 4. Yet this quality is probably one of the most important factors in the durability of a paper when used in the form of a book. The author states most emphatically that a specification based on composition alone is not sufficient to ensure a durable book paper, in fact some of the worst examples cited refer to papers composed mainly or entirely of rag fibres. The quality of the raw material and its suitable treatment in the process of manufacture are really of more importance. These can only be ensured by a strength specification. The author asks for a commission representing the various interests, with a view to legislation, making it compulsory that all copies of printed matter deposited in or purchased by the public libraries should be printed on papers of the " normal " class 8a or class 8b. In the case of treatises, valuable books, etc., class 8a, a pure rag paper, should be used ; in the case of periodical literature a general regulation for the use of rag papers would cause too heavy a demand, and paper of class 8b would be permissible. If necessary, special "library copies" would have to be printed to conform with these regulations.—J. F. B.

PATENTS.

Paper, cardboard, etc., in band form; Method and apparatus for marbling ——. H. Metzger, Aschaffenburg-Damm, Germany. Eng. Pat. 426, Jan. 7, 1908.

WATER is caused to flow in a very shallow stream along a trough, the inclination of which can be adjusted to regulate the speed of flow. The marbling colours are sprinkled or injected into this shallow stream of water before it reaches the paper. The formation of patterns may be effected by hand or by means of transversely movable rakes and fixed combs, placed across the channel between the colour supply and the paper under treatment. The paper, in the form of a continuous band, passes under a roller which brings it into contact with the surface of the stream of marbling water, but without actually immersing it. Thus the paper picks up the colours from the surface of the water, but is not appreciably wetted; the colours, therefore, do not run off. The paper carrying the colours passes upwards, and is treated with a suitable fluid by means of a spray, for the purpose of fixing the colours, and is finally dried. The water from which the colour has been removed, runs away at the end of the trough into an inclined discharge channel.—J. F. B.

Celluloid; Manufacture of a non-inflammable substitute for ——. L. L. Béthisy, Villeneuve la Garenne, and L. F. Fouchard and E. Vignes, Paris. Eng. Pat. 11,397, May 15, 1907. Under Int. Conv., July 12, 1906.

SEE Fr. Pat. 368,004 of 1906; this J., 1906, 1231.—T. F. B.

Stearine-pitch as waterproofing and insulating material. Fr. Pat. 385,805. *See* III.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

Strychnine alkaloids. 1st communication. Oxidation of strychnine and brucine by a new method. H. Leuchs. Ber., 1908, **41**, 1711—1720.

ANHYDROUS brucine was dissolved in acetone, cooled to 0° C., and powdered potassium permanganate added gradually. When the oxidation was complete, the precipitate was collected, washed with acetone, and extracted with water. The aqueous extract was acidified, and shaken with chloroform, when brucinonic acid, $C_{23}H_{24}O_8N_2$, was obtained in a yield of 20—23 per cent. By using less permanganate in the oxidation, dihydrobrucinonic acid, $C_{23}H_{26}O_8N_2$, was produced. Brucinonic acid crystallises from water in small colourless prisms which contain water and melt at 178°—183° C. (corr.). When dried at 105° C. or crystallised from alcohol, it melts with decomposition at 266° C. (corr.). When dissolved in the calculated amount of $N/10$ sodium hydroxide, it has $[\alpha]_D = -47{\cdot}6°$ to $-48{\cdot}5°$. The monoethyl ester melts at 130°—132° C. when crystallised from alcohol or benzene, and at 161°—163° C. when crystallised from glacial acetic acid. Dihydrobrucinonic acid is soluble with difficulty in most solvents. It melts with decomposition at 315° C. (corr.), and has $[\alpha]_D = -14{\cdot}6°$ to $-14{\cdot}8°$ when dissolved to the extent of about 17 per cent. in sodium hydroxide solution.

Powdered strychnine was shaken in a bottle with acetone, and portions of finely powdered permanganate added from time to time. The precipitate was treated in the same way as that described for the oxidation of brucine. There was a yield of about 15—18 per cent. of strychninonic acid, $C_{21}H_{20}O_6N_2$, and a small yield of the very much less soluble dihydrostrychninonic acid, $C_{21}H_{22}O_6N_2$. Strychninonic acid is monobasic, and crystallises from water in shortened prisms containing two molecules of the solvent. When dissolved in the requisite amount of $N/10$ sodium hydroxide, it has $[\alpha]_D = -43{\cdot}3°$. It melts with decomposition at 265°—267° C. (corr.). Dihydrostrychninonic acid, when dissolved in alkali and precipitated with an acid, forms small colourless rectangular tablets. It melts at 315° C. (corr.) with decomposition, and has $[\alpha]_D = +4{\cdot}3°$ in sodium hydroxide solution.—F. SHDN.

Arbutin from quinol (hydroquinone); Distinction of ——. P. Lemaire. Ann. Chim. analyt., 1908, **13**, 105—107.

ARBUTIN, the glucoside occurring in bearberry leaves (*Arctostaphylos uva ursi*) and whortleberry leaves (*Vaccinium vitis idaea*), only reduces Fehling's solution after it has been hydrolysed by the action of a dilute acid or a ferment, whilst quinol reduces this reagent directly. A 1 per cent. solution of arbutin reduces ammoniacal silver nitrate solution on boiling, and gives a precipitate when heated with sodium hypobromite solution; in the case of quinol these two reactions take place in the cold. Ferric chloride gives a slate-blue coloration with arbutin and a yellowish-brown with quinol, a blackish crystalline precipitate forming subsequently. A brownish-black coloration is obtained when arbutin is added to sulphuric acid containing a little formaldehyde. When boiled with mercuric sulphate solution, arbutin yields a light yellow, and quinol a yellowish-brown coloration; in both cases a precipitate forms on cooling the mixture. Sodium hydroxide effects no immediate change of colour when added to arbutin solution, but quinol solution becomes brown. An alkaline arbutin solution, when treated with sodium peroxide, gives a yellowish coloration, whilst in the case of quinol the mixture becomes reddish-brown in colour.—W. P. S.

Sakuranin, a new glucoside from the bark of Prunus pseudo-cerasus, var. sieboldi. Y. Asahina. J. Pharm. Soc. Jap., 1908, 213; Apoth.-Zeit., 1908, **33**, 326.

A NEW glucoside, *sakuranin*, $C_{22}H_{24}O_{18}$, forming white needles, m. pt. 210—212° C., has been isolated from the bark of *Prunus pseudo-cerasus*, var. *sieboldi*. It has a bitter taste, is readily dissolved in dilute alcohol, less soluble in strong alcohol and in water, and insoluble in ether. The alcoholic solution is coloured yellow by ferric chloride. It is hydrolysed by acids into dextrose and *sakuranetin*, $C_{16}H_{14}O_6$. The latter forms white needles, m. pt. 150° C., and contains a methoxyl group; it affords phloroglucinol, acetic acid, and *p*-hydroxybenzoic acid when fused with potassium hydroxide.—J. O. B.

Olive leaves; Constituents of ——. F. P. Power and F. Tutin. Chem. Soc. Trans., 1908, **93**, 891—904.

THE air-dried olive leaves, when treated by percolation with boiling alcohol, yielded 30 per cent. of their weight of extracted matter, of which nearly 63 per cent. was soluble in cold water, whilst a further 8·7 per cent. could be dissolved with boiling water. The portion of the alcoholic extract soluble in cold water, contained a large quantity of a sugar yielding *d*-phenylglucosazone, together with tannic matter, brown amorphous products, and an amount of *d*-mannitol equivalent to about 3·4 per cent. of the weight of leaves employed. The portion of the alcoholic extract soluble in boiling water but separating on cooling, consisted of amorphous resins. The material insoluble in water was found to contain small quantities of hentriacontane, $C_{31}H_{64}$ (m. pt. 68—69° C.), and pentatriacontane, $C_{35}H_{72}$ (m. pt. 74·5° C.), a small quantity of a mixture of fatty acids, and a new monocarboxylic acid, $C_{22}H_{45}COOH$ (m. pt. 68—69° C.). It yielded also three crystalline alcohols, which appear to be hydroxyphytosterols, namely, *oleasterol*, $C_{20}H_{34}O$ (m. pt. 174° C.), *olestranol*, $C_{25}H_{42}O_2$ (m. pt. 217—218° C.), and *homo-olestranol*, $C_{27}H_{46}O_2$ (m. pt. 210° C.). A new colourless crystalline substance, *oleanol*, $C_{31}H_{48}O(OH)_2.H_2O$ (m. pt. 303—304° C.) was obtained, one of the hydroxy groups of which possesses phenolic properties. With sodium ethoxide and methyl iodide, it yields a *monomethyloleanol* (m. pt. 194—195° C.), which on acetylation gives *acetylmethyloleanol* (m. pt. 215·5° C.). *Diacetyloleanol*, melting at 208° C. with decomposition, yields *monoacetyloleanol* (m. pt. 258° C.), on heating with aqueous alcohol.—W. S.

Olive bark; Constituents of ——. F. B. Power and F. Tutin. Chem. Soc. Trans., 1908, **93**, 904—917.

On percolation with hot alcohol, the air-dried olive bark yielded about 30 per cent. of its weight of extracted material, of which 61·5 per cent. was soluble in cold water, and 32·3 per cent. was soluble in boiling water, but separated on cooling. The portion of the alcoholic extract soluble in cold water, contained an amount of *d*-mannitol equivalent to nearly 1·9 per cent. of the dried bark, together with tannic matter, viscid brown products, and a sugar which yielded *d*-phenylglucosazone. It contained also a small quantity of a new crystalline phenolic substance, *olenitol*, $C_{14}H_{10}O_6$ (m. pt. 265° C.), dilute solutions of which show a blue fluorescence. *Acetyl-olenitol* melts at 130° C. The portion of the alcoholic extract soluble in hot water, consisted mostly of brown resinous products, some yielding dextrose on hydrolysis. The substances insoluble in water consisted chiefly of new monocarboxylic acids which crystallised from ethyl acetate in small leaflets, and possessed the following compositions and properties: (1). $C_{34}H_{67}CO_2H$ (m. pt. 69—70° C.), yields an ethyl ester melting at 63° C.; (2), $C_{24}H_{45}.CO_2H$ (m. pt. 79° C.), yields an ethyl ester melting at 66·5° C.; (3), $C_{34}H_{69}CO_2H$ (m. pt. 92° C.), yields an ethyl ester melting at 87° C.; (4), $C_{29}H_{67}CO_2H$ (m. pt. 84° C.), yields an ethyl ester melting at 75° C. A substance, probably a tertiary alcohol, $C_{35}H_{68}O$ (m. pt. 70° C.) was also obtained, as also a small amount of pentatriacontane, a phytosterol, $C_{27}H_{46}O$ (m. pt. 136° C.), and a small quantity of a substance, $C_{23}H_{38}O_2(OH)_2$, the ethyl ester of which is identical with *ipuranol* which has recently been isolated by Power and Rogerson from *Ipomœa purpurea*. Three substances only, *d*-mannitol, sugar, and pentatriacontane, are common to both the bark and leaves of the olive plant.—W. S.

Essential oils; Constituents of ——. *Elemicin, a high-boiling constituent of elemi oil, and the replacement of alkyloxy groups in the benzene nucleus by hydrogen.* F. W. Semmler. Ber., 1908, **41**, 1768—1775.

A high-boiling fraction of elemi oil was examined, which had the following constants: sp. gr. 1·031 at 20° C., $n_D = 1·51880$, $a_D = +1°$ in a 100 mm. tube. After several distillations over sodium, it was fractionated, and although the principal constituent, *elemicin*, was not isolated, a fraction was obtained which boiled at 155°—156° C. at 10 mm., and had the sp. gr. 1·036 at 20° C., with $n_D = 1·54193$ and $a_D = -1°$ in a 100 mm. tube. The oil after distillation over sodium, yielded trimethylgallic acid on oxidation with permanganate. Trimethylgallic acid when reduced with sodium and alcohol, loses two methoxy groups and is converted into *m*-methoxybenzoic acid.—F. Shdn.

Essential oils. H. Haensel. Chem. Zentr., 1908, **1**, 1837—1838.

Acaroid resin oil was obtained from the resin in a yield of 0·33 per cent. It is reddish-brown, and has an odour resembling that of tolu- and Peru balsams. The oil is optically inactive, and has the sp. gr. 0·9600 at 20° C., acid value, 4·7; ester value, 37·5. It contains 1·94 per cent. of cinnamic acid, and on shaking with dilute sodium hydroxide solution, yields 7·6 per cent. of a yellowish resin insoluble in benzene and light petroleum spirit. It also contains an ester of cinnamic acid and styrol. A recently distilled specimen of *oil of birch leaves* (yield 0·04 per cent.) was of a yellowish colour, and was solid at ordinary temperatures. It had the sp. gr. 0·8683 at 80° C., acid value, 30; ester value, 81. A paraffin hydrocarbon, crystallising in leaflets from hot alcohol, and melting at 49·5—50° C., was isolated from it. A sample of terpeneless *coriander oil* had the sp. gr. 0·8786 at 15° C., $a_D = +9·50°$; ester value, 13·3. *Cubebs oil* (yield 11·8 per cent.) had the sp. gr. 0·941 and $a_D = -13·55°$. *Guaiacum resin oil.* On distillation with superheated steam, guaiacum resin yielded 0·03 per cent. of a dark brown oil of aromatic odour. The oil is not completely soluble in 96 per cent. alcohol; it has the sp. gr. 0·9417 at 15° C., acid value, 77; ester value, 13·8. *Oil of ground-ivy* was obtained from the dried plant in a yield of 0·064 per cent. It is dark brown in colour, has a very penetrating odour, and contains solid particles at the ordinary temperature. It contains neither aldehydes nor ketones, and has the sp. gr. 0·9296 at 21° C., acid value, 0; ester value, 111. *Laurel-leaf oil* (yield, 2·32 per cent.) had the sp. gr. 0·9361, and $a_D = -15·95°$. It contains *l*-pinene and probably also phellandrene. *Celandine oil* was obtained from the dried plant in a yield of 0·013 per cent. It has a brown colour, is solid at 30° C., and has the sp. gr. 0·9374 at 40° C. *Frankincense oil* has the sp. gr. 0·8810 at 17·5° C., $a_D = +22·08°$, acid value, 2; ester value, 15·5. It contains an alcohol, *olibanol* ($C_{26}H_{44}O$), which is a yellow viscous oil boiling at 205°—212° at 17 mm., sp. gr. 0·9570 at 20° C., $a_D = -65·05°$. The oil also contains formic acid.—A. S.

Manila elemi; The terpenes obtained from the resin ——. A. M. Clover. Amer. Chem. J., 1908, **39**, 613—650.

The resin of Manila elemi is found to become more viscous as the volatile elemi oil, usually obtained by steam distillation of the resin, is removed. For the present investigation it was found desirable to distil the resin in a vacuum varying from 8 to 15 mm. pressure; no decomposition of the resin was found thereby to take place. In the first fraction (A), between 125 and 150° C., the elemi oil was obtained in yields of from 10 to 25 per cent. The second distillate (B) was taken up to 210° C., and the third (C) up to 250° C. Of the 21 samples of resin examined, 10 of the terpene oils, obtained as fraction A, gave pure dextrolimonene. Nine of the remaining oils, including all but two optically inactive ones, contained more or less phellandrene. Three of these 9 oils were dextrorotatory, and showed an initial boiling point lower than that of phellandrene; they contained probably unidentified terpenes of the limonene series. Of the six oils containing phellandrene, one was lævorotatory. The others were dextrorotatory, but showed great variation in rotation. Judging from their boiling points, they consisted of practically pure phellandrene, the presence of small quantities of lævolimonene accounting for the differences of rotation. The two remaining samples of resin gave almost optically inactive oils, which were found to consist of terpinene and terpinolene. The phellandrene was found in all cases to be the *a*-product, which was identified by isolating the *a*-nitrite as described by Schreiner (this J., 1901, 927) and Wallach (Annalen, 1905, **340**, 1). It was found that on standing, phellandrene deposits small quantities of colourless hexagonal crystals, soluble in alcohol and ethyl acetate, sparingly soluble in ether and chloroform, and which on analysis answer to the formula for a dihydroxy-phellandrene. The high-boiling oil, contained in distillates B and C of the resin, was found in most cases to consist of a product boiling between 167 and 170° C. at 35 mm. pressure. When the different samples of this oil are arranged in the order of their specific gravities, the indices of refraction and the viscosities are found to vary in the same proportions. These regularities suggest that the products consist of a mixture of two substances in varying proportions, probably a sesquiterpene alcohol and a dioxy-derivative of a terpene. The analysis of one of these products, which differed somewhat largely from the rest in properties, agreed with the formula, $C_{15}H_{26}O$. The almost colourless pleasant smelling oil after three months' standing, became solid on scratching the inside of the bottle. It is soluble in all organic solvents and separates as an oil from dilute alcohol, refusing to crystallise. The crystalline residue termed *amyrin* was obtained from two samples of Manila elemi, from one of which had been isolated pure limonene, and from the other pure phellandrene. In neither case could a body of constant and sharp melting point be obtained; the products behaved as mixtures.—W. S.

Citral; Determination of —— *in oil of lemon.* P. Bruylants. Ann. Chim. analyt., 1908, **13**, 91—97.

On adding citral or other aldehyde to a 3 per cent. solution of defibrinated blood which has been treated with ammonium sulphide, a brown solution is obtained which shows a characteristic absorption spectrum. At first two bands are seen, and, after a time, a third band appears between the other two. The appearance of this band is directly related to the quantity of aldehyde present, that is, the sooner it appears, the greater the quantity of aldehyde in the solution under examination, and the phenomenon may be used as a means of determining citral in oil of lemon. As great attention is required in observing the exact length of time between making the mixture and the appearance of the middle band, it is better for two observers to work together, one working on the oil of lemon and the other on an alcoholic solution of citral of known strength, which serves as a comparison. The ammonium sulphide used is prepared by saturating ammonia (sp. gr. 0·94) with hydrogen sulphide, then adding rather more than an equal volume of ammonia, and exposing the solution to light for a few days. Freshly prepared ammonium sulphide, neutral ammonium sulphide, or ammonium hydrogen sulphide cannot be used. Alcoholic solutions are prepared containing 20 per cent. of the oil under examination, and of an oil containing a known quantity, say 5 per cent., of citral. Nine c.c. of the blood solution and 1 c.c. of ammonium sulphide are placed in each of two test-tubes; one operator then runs into one tube 0·15 c.c. of the solution of the oil under examination, while the other adds the same volume of the solution of the standard oil to the other test-tube, and the contents of the two tubes are shaken, commencing at the same moment, for 30 seconds. Portions of the lower parts of the mixtures are then transferred to suitable tubes and observed in the spectroscope. If the appearance of the middle band is noted at the same moment in the two tubes, the two solutions of oil contain the same amount of citral. If such be not the case, smaller or larger quantities of the solution of the sample oil are treated in the above-mentioned manner, and compared with the control, until the band appears at the same time in both tests.—W. P. S.

Cyclo-octane and cycloheptane; Contribution to the knowledge of —— III. R. Willstätter and T. Kametaka. Ber., 1908, **41**, 1480—1486.

When cycloheptane is passed together with hydrogen, over finely-divided nickel at 235° C., it is slowly converted into a substance, probably consisting in the main, of hexahydrotoluene. Cyclo-octane is more easily reduced, the main product being dimethylcyclohexane. If cycloheptane, C_7H_{14}, be passed with hydrogen only twice over the nickel at 235° C., it is converted to a large extent into an isomeric compound, which is no longer crystalline, and has an odour, not like that of camphor, but resembling that of benzene. Cyclo-octane, C_8H_{16}, is isomerised in like manner at a temperature of 205°—210° C. Bicyclo-octane when passed once with hydrogen over nickel at 200° to 205° C., is reduced, being changed into a mixture of hydrocarbons having the same boiling point and density as the isomerisation product of cyclo-octane. It is probable that cyclo-octane is formed first, but is not stable under the conditions of the reduction. (See also this J., 1905, 687, and Ber., 1907, **40**, 957.)—C. A. M.

Reduction of unsaturated alcohols, acids and esters by means of platinum and hydrogen at ordinary temperatures. [Extension of the method of Sabatier and Senderens.] I. R. Willstätter and E. W. Mayer. Ber., 1908, **41**, 1475—1480.

The authors have studied various reductions obtained by methods essentially the same as those of Sabatier and Senderens (this J., 1901, 978; 1902, 504, 566, 1070, 1157; 1903, 1012; 1904, 341, 654). The ethyl ester of oleic acid was converted quantitatively into the ester of stearic acid (*cf.* Fokin, this J., 1906, 935; 1907, 169, 1139). With regard to the reduction of olefines the method is only of importance when substances that volatilise with difficulty are in question. From phytene the saturated hydrocarbon, phytane, $C_{20}H_{42}$, was obtained. Oleic alcohol, prepared by the method of Bouveault and Blanc (this J., 1904, 798) was rapidly reduced in the presence of platinum black, yielding octadecyl alcohol (m. pt. 57°—58° C.), whilst erucyl alcohol, $C_{22}H_{44}O$, yielded a saturated alcohol, $C_{22}H_{46}O$, corresponding to behenic acid. Geraniol was reduced with more difficulty, and only after several days' treatment with hydrogen was there obtained a mixture of about 60 per cent. of a saturated hydrocarbon, $C_{10}H_{22}$, with about 40 per cent. of a saturated alcohol, $C_{10}H_{22}O$. The former (2·6-dimethyloctane) was a colourless, mobile liquid, distilling between 156·5° and 158° C. under a pressure of 724 mm., and having a specific gravity at 0°/4° C. of 0·741. It was regarded as probably identical with a hydrocarbon obtained by Reformatzsky from Bulgarian rose oil. The alcohol had a pleasant odour, and boiled at 118° C. under a pressure of 15 mm. Phytol was slowly reduced, giving a good yield of dihydrophytol ($C_{20}H_{42}O$), a colourless oily liquid, boiling at 201·5° to 202° C. under a pressure of 9·5 mm., and having a specific gravity of 0·894 at 0°/4° C. Phytane, the above-mentioned hydrocarbon, was formed as a by-product. Benzoic acid in ethereal solution was slowly reduced, the product consisting of impure hexahydrobenzoic acid, $C_7H_{12}O_2$, and unaltered benzoic acid, which were separated by fractional solution in petroleum spirit of low boiling point.—C. A. M.

Benzilic acid; Preparation of ——. H. v. Liebig. Ber. 1908, **41**, 1644—1645.

Benzilic acid free from benzoic acid is easily prepared in large quantities as follows: 100 grms. of potassium hydroxide and 200 grms. of water are introduced into a flask containing 100 grms. of benzil, and after solution is complete, 200 grms. of alcohol are added. The mixture is boiled on a water-bath for not longer than 10 minutes, and the contents are then poured into a beaker. After some hours standing, the crystals are separated on a hardened filter, washed with alcohol, and then well stirred in 150 to 200 grms. of cold alcohol, contained in a wooden vessel. The crystals are filtered off, dissolved in 1 to 2 litres of water, and the filtered solution made up to 2 litres. The solution is heated to boiling, and dilute boiling sulphuric acid added. Benzilic acid separates out, partly as needles and partly in the amorphous state, in yields of 90 to 95 per cent. and may be directly used for condensation purposes. It is best recrystallised from boiling benzene. The 3 to 5 per cent. of benzilic acid still remaining in the alcoholic filtrate are recovered by distilling off the greater part of the alcohol, whereupon more crystals separate.—W. S.

Methane; Mixed trihalogen derivatives of ——. V. Auger. Compt. rend., 1908, **146**, 1037—1039.

The author has prepared the compounds, HCI_2Cl, HCI_2Br and $HCIBr_2$. Chloroiodoform, HCI_2Cl, is obtained along with iodochloroform, $HCICl_2$, by distilling a mixture of iodoform (1100 grms.) and mercuric chloride (700 grms.) under a pressure of 100 mm. On fractionating the distillate (670 grms.) under 30 mm. pressure, 235 grms. of iodochloroform and 323 grms. of chloroiodoform are obtained. Iodochloroform boils at 40° C. at 30 mm. and 131° C. at 760 mm. Its sp. gr. is 2·41 at 0° C. Chloroiodoform is a colourless liquid which crystallises at —4° C.; its sp. gr. at 0° C. is 3·17, and it boils at 88° C. at 30 mm. and, with decomposition, at about 200° C. at 760 mm. It is very unstable in air or light, iodine being liberated. Iodobromoform, $HCIBr_2$, is obtained by distilling a mixture of equal parts of iodoform and mercuric bromide under 150 mm. pressure. The product, on fractionation, yields pure iodobromoform, which crystallises from light petroleum in white tables melting at 22·5° C. and boiling at 101—104° C. at 50 mm. and 91° C. at 42 mm. It is stable to light in the solid state, but its solutions are very unstable in presence of air. Bromoiodoform, HCI_2Br, is prepared by gradually adding a solution of bromine (40 grms.) in carbon tetrachloride (80 grms.) to a mixture of iodoform (135 grms.) and carbon tetrachloride (80 grms.) at 0° C. After each addition the temperature is allowed to rise to 15° C. After standing for 12 hours, the iodine which has separated, is removed by sodium sulphite solution, the carbon tetrachloride distilled off, and the residue fractionally crystallised from light petroleum. Yellow hexagonal crystals of bromoiodoform are obtained which melt at 60° C. and boil at 110° C. at 25 mm. The substance is very stable to light when solid, but is extremely unstable in solution.—J. C. C.

Acetylene tetrachloride [tetrachlorethane] and its derivatives ; Some properties of ——. Konsortium für elektrochem. Ind. G.m.b.H. Chem.-Zeit., 1908, **32**, 529—530.

TRICHLORETHYLENE, when heated with strong alkalis, is gradually converted into dichloracetylene, but it is stable towards weak alkalis (lime, sodium carbonate, soap), even in boiling solution. Under the conditions of use in the factory, the narcotic effects of trichlorethylene and tetrachlorethane are less than those of carbon tetrachloride. Tetrachlorethane, when pure, may be steam distilled without decomposition. The corrosive action of this substance and of pentachlorethane on iron is less than that of carbon tetrachloride under the same conditions. (See also this J., 1908, 344).—F. SODN.

Ytterbium ; Decomposition of ——. C. Auer v. Welsbach. Monats. f. Chem., 1908, **29**, 181—227.

BY the repeated fractional crystallisation of the double salt of ytterbium oxalate with ammonium oxalate, the author has succeeded in establishing that ytterbium consists of at least two constituent elements, for which the names *cassiopeïum* (Cp) and *aldebaranium* (Ad) are proposed. A study of the spark spectra of the various fractions shows that the former becomes concentrated in the mother liquors and the latter in the less soluble double salt. In order to avoid supersaturation, and effect a more complete separation, the mother liquor was allowed to remain in contact with the crystals for about eight days. By refractionating the less soluble portions, some erbium and thulium were removed in the first fractions, and then fractions were obtained, which, in the visible part of the spectrum, showed the lines of aldebaranium, free from those of cassiopeïum, though a photographic study of the ultra-violet spectrum showed certain lines common to the two elements. The spark spectra of aldebaranium and cassiopeïum together constitute the ordinary ytterbium spectrum. Chemically these new elements resemble ytterbium, and the similarity has prevented their separation by chemical means. They form sesquioxides, stable at a red heat, and the corresponding salts are colourless. The atomic weight of cassiopeïum is found to be 174·23 and that of aldebaranium, 172·9. Spectroscopic evidence makes it possible that a third element exists in ytterbium, which tends to separate in the middle fractions. Comparative tables of the wave-lengths of the spectra of ytterbium, cassiopeïum, and aldebaranium, and also reproductions of the spectra themselves, are given in the paper.—F. SODN.

Thorium oxyfluoride and fluoride. E. Chauvenet. Compt. rend., 1908, **146**, 973—974.

THORIUM OXYFLUORIDE, $ThOF_2$, is obtained as a colourless insoluble amorphous powder on heating the hydrate of thorium fluoride at 800° C., in a platinum tube, in a current of dry hydrogen fluoride. With sulphuric acid it liberates hydrogen fluoride. It is also formed on heating thorium fluosilicate, containing some water, in a current of hydrogen. Thorium fluoride, ThF_4, may be prepared as an amorphous substance by the action of anhydrous hydrogen fluoride on thorium chloride or bromide, preferably the latter, in which case the conversion takes but a few minutes at 350—400° C.—E. F. A.

Mercuric zinc cyanide. A correction. W. R. Dunstan. Chem. Soc. Proc., 1908, **24**, 135.

IN a paper published in 1892 (this J., 1892, 367), the author described the results of an investigation of the "antiseptic cyanide" which had been introduced into surgery by Lord Lister. The conclusion was arrived at that the substance was an unstable double mercuric zinc cyanide, for which the formula proposed was $Zn_4Hg(CN)_{10}$, and this was stated to correspond with 40·65 per cent. of mercuric cyanide. This is a miscalculation, as the formula actually requires 35 per cent. of mercuric cyanide, and must therefore be rejected. The formula which most nearly corresponds with the maximum percentage of mercuric cyanide found, namely, 38·5, and which is also in accordance with the curves plotted from numerous experimental data, is $Zn(CN)_2,\frac{1}{3}Hg(CN)_2$, which requires 41·6 per cent. of mercuric cyanide. The salt, prepared as described, may therefore be regarded as a trizincic monomercuric octocyanide of the formula $Zn_3Hg(CN)_8$, which, as shown, inevitably suffers some decomposition by the water present during its precipitation.

Tartaric acid ; Determination of —— volumetrically in tartar and lees. E. Pozzi-Escot. *See* XXIII.

Camphor and camphor oil trade of Formosa. Bd. of Trade J., June 4, 1908. [T.R.]

H.M. CONSUL at Tamsui reports that the total exports of camphor from Formosa in 1907 amounted to 4,121,566 lb., of which 2,452,933 lb. was sent to Havre, London and Hamburg, 1,635,300 lb. to America, and 33,333 lb. to Madras. Thus no camphor was ultimately destined for Japan. It is reported that there was a large increase in the camphor manufactured by the Camphor Monopoly in 1907 as compared with 1906, the figures being 5,388,918 lb. as against 4,040,838 lb., an increase of 1,347,979 lb. Hitherto the contract for the export of camphor from Japan and Formosa has been held by a British firm, but from April, 1908, this was to be discontinued, the Japanese Government intending to enter the foreign markets direct or through the intermediary of one of the leading Japanese firms. By the latest returns the production of camphor oil has nearly doubled in 1907, being 6,710,390 lb. as against 3,610,645 lb. in 1906. Hitherto all the camphor oil has been shipped to Kobe to be converted into refined camphor, but in the fiscal year commencing April, 1908, a sum of about £14,000 was to appear in the estimates to meet the expense of erecting a refinery in Taihoku, the capital of Formosa, and in future the camphor will undergo the necessary process there. It is said that a new method of distillation has been discovered, and that by this method as well as by the saving of expense in transport, a considerable economy will be effected.

PATENTS.

Camphene ; Manufacture of ——. R. E. Ellis, London. From Chem. Fabr. vorm. Sandoz, Basle, Switzerland. Eng. Pat. 10,783, May 8, 1907.

PINENE hydrochloride is converted into camphene by heating with alkali or alkaline-earth hydroxides and an alkali or alkaline-earth salt of a sulphonic acid of the benzene or naphthalene series. The mixture is heated in an autoclave to 160°—170° C. for 12 to 20 hours. The addition of the sulphonate is found to accelerate the conversion by alkali. As an example of the process, the following mixture may be heated :—173 parts of pinene hydrochloride, 250 parts of sodium *p*-toluenesulphonate, 215 parts of 33 per cent. soda lye, and 180 parts of water. —T. F. B.

Phenols and formaldehyde ; Manufacture of condensation products from ——. W. E. Lake, London. From K. A. Lingner, Dresden, Germany. Eng. Pat. 1330, Jan. 20, 1908.

CONDENSATION products of formaldehyde and phenols are made by causing formaldehyde to act on the phenols dissolved in or mixed with resins or resin acids, without a further solvent. For instance, 1 kilo. of rosin is dissolved in 1 kilo. of crude cresol and 1 kilo. of 40 per cent. aqueous formaldehyde is added. The mixture is heated to 100° C., and 300 grms. of hydrochloric acid of 20° B. are gradually added whilst stirring. The temperature of 100° C. is maintained until the mass has become sticky and a portion becomes hard and solid when brought into water. After cooling, the mass is separated from any liquid which may be present, pulverised, and washed with water.—J. F. B.

Cascara sagrada [Rhamnus purshiana]; Process for obtaining the active constituent of the bark of ——. Ges. für. Chem. Ind. in Basel, Switzerland. Eng. Pat. 1617, Jan. 23, 1908. Under Int. Conv., Aug. 23, 1907.

In order to obtain the active principle of the bark of *Cascara sagrada*, now recognised as a new glucoside, aqueous or alcoholic extracts of the bark are mixed with lead acetate and basic lead acetate so long as a precipitate is formed. This precipitate contains the inactive and valueless constituents of the extract, amounting to about 70 per cent. It is filtered off and washed repeatedly with water; the filtrate and washings are treated with excess of basic lead acetate and ammonia, whereby the active principle is quantitatively precipitated. This precipitate is washed and suspended in water, the lead is separated by means of hydrogen sulphide, and the solution is evaporated *in vacuo*.—J. F. B.

Arsenoarylglycine. P. Ehrlich and A. Bertheim, Frankfort on Maine, Assignors to Farbwerke vorm. Meister, Lucius, und Brüning, Hoechst on Maine, Germany. U.S. Pat. 888,321, May 19, 1908.

Arsenoarylglycines, of the formula

$CO_2H.CH_2.NH(4).R.(1)As:As(1).R.(4)NH.CH_2.CO_2H$,

are reddish-brown powders, insoluble in water, alcohol, and ether, and soluble in sodium hydroxide or sodium carbonate solutions. The sodium salts are yellow powders, and the glycines are precipitated from solutions of these salts by the addition of dilute acids. The properties of arsenophenylglycine correspond with those described above.—F. Shdn.

Oxidation [of organic substances]; Process for rendering —— more complete. F. Fritzsche and Co. and Verona Chemical Co. Fr. Pat. 385,700, Dec. 30, 1907.

In the preparation of aldehydes or ketones (vanillin, heliotropin, camphor) by oxidation processes, better yields are stated to be obtained by working in presence of sulphanilic acid or analogous aminosulphonic acids or their salts.—A. S.

Tobacco stems; Apparatus for the treatment of —— for the recovery of useful constituents. The Kentucky Tobacco Product Co. Fr. Pat. 385,837, Dec. 31, 1907.

Nicotine and other useful constituents of tobacco stems and leaves can be withdrawn by passing steam at ordinary pressure, or superheated steam, through the material, which should be previously heated so as to avoid condensation. Apparatus for this purpose is described.
—F. Shdn.

Thymol and its derivatives; Preparation of condensation products of ——. Krewel und Co., G.m.b.H. Ger. Pat. 194,810, June 28, 1905.

The finely-powdered fruits of Embelia species or the barks of Albizzia species are freed from fat by treatment with light petroleum spirit at 20°—25° C., and then extracted with alcohol, to which a small quantity of alkali may be added. The alcoholic extract is mixed, in the proportion of 3 : 1, with thymol or dithymol, or their salicyl derivatives, and the mixture, with the addition of one of the common condensing agents, heated for 3 hours under a reflux condenser. The products are of medicinal value.
—A. S.

Dimenthyldimethylene ether; Process for preparing ——. K. A. Lingner. Ger. Pat. 189,331, Feb. 6, 1906.

By the action of symmetrical dihalogenated dimethylethers on the metal derivatives of menthol, dimenthyldimethyl ether, $(C_{10}H_{19}.O.CH_2)_2O$, is obtained.—T. F. B.

Urethane of m-amino-p-ethoxybenzoic acid; Process for preparing the ——. Act.-Ges. f. Anilinfabr. Ger. Pat. 189,838, April 7, 1906.

The urethane of *m*-amino-*p*-ethoxybenzoic acid is obtained by the action of ethyl chlorocarbonate on *m*-amino-*p*-ethoxybenzoic acid: this latter compound is prepared by oxidation of *m*-acetamino-*p*-cresol ether, and subsequently removing the acetyl group.—T. F. B.

Narcotinesulphonic acid and acetylnarcotine; Process for preparing a ——. Knoll und Co. Ger. Pats. 188,054 and 188,055, May 3, 1906.

Narcotinesulphonic acid is obtained by the action of sulphuric acid and acetic anhydride on narcotine, at temperatures not exceeding 30° C. If the temperature of the reaction is increased, the product is acetylnarcotine.—T. F. B.

Aponarceine; Process for preparing ——. Knoll und Co. Ger. Pat. 187,138, April 21, 1906.

Narceine may be converted into aponarceine by treatment with condensing agents, such as mineral acids, inorganic or organic acid chlorides, or organic anhydrides.
—T. F. B.

Alkamine esters of salicylic acid; Process for preparing ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 188,571, May 29, 1906.

Salicylic acid alkamine esters may be prepared by any one of the following methods: (1), Esterification of salicylic acid with alkamines; (2), decomposition of salicylic esters of chlorhydrins with alkamines; (3), decomposition of salicylides with alkamines. The products are stated to possess anæsthetic properties in addition to those of salicylic acid.—T. F. B.

Aminocinnamic acid alkamine esters; Process for preparing ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 187,593, May 13, 1906.

Aminocinnamic acid alkamine esters may be obtained as follows: (1) Reduction of nitrocinnamic acid alkamine esters; (2), decomposition of aminocinnamic acid or its esters with alkamines; (3) treatment of aminocinnamic esters of halogen-substituted alcohols with secondary amines. The products possess anæsthetic properties.
—T. F. B.

Nuclein rich in iron; Preparation of —— from yeast. A. Ascoli. Ger. Pat. 194,950, June 6, 1906.

The alkaline liquid obtained by the action of caustic soda solution on yeast, is treated with ferric chloride, filtered, and the still strongly alkaline filtrate treated with concentrated hydrochloric acid and ferric chloride. The precipitate formed is collected on a filter, washed with water, and dried on a porous plate. A grey, amorphous powder, insoluble in water, and of therapeutic value, is thus obtained, which contains phosphorus equivalent to 8·7 per cent. of phosphoric anhydride, and iron equivalent to 12 per cent. of ferric oxide.—A. S.

Bismuth cholate; Process for preparing ——. E. Wörner, Ger. Pat. 191,385, Sept. 26, 1906.

Basic bismuth salts are heated with solutions of salts of cholic acid.—T. F. B.

Compounds of gallic acid and albuminoids; Process for preparing —— E. Wörner. Ger. Pat. 189,334, Sept. 30, 1906.

Alkaline solutions of albuminoid compounds are mixed with animal galls, and the gallic acid-albumin compounds precipitated by means of dilute acids.—T. F. B.

Methylenecitrylcresotinic acids ; Process for preparing ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 193,114, Oct. 20, 1906. Addition to Ger. Pat. 185,800, March 23, 1906.

Methylenecitrylcresotinic acids, which are stated to possess valuable therapeutic properties, are obtained by the action of the dichloride of methylenecitric acid on the cresotinic acids.—T. F. B.

Morphine ; Process for preparing the bromoalkylates of ——. J. D. Riedel, A.-G. Ger. Pat. 191,088, Dec. 5, 1906. Addition to Ger. Pat. 165,898, June 9, 1904.

Bromoalkylates of morphine may be obtained by decomposing the chloroalkylates with soluble bromine salts or with hydrobromic acid. This process is of value, in that it utilises the morphine chloromethylate formed as a by-product in the production of codeine from morphine by means of methyl chloride and alkali.—T. F. B.

Silver compounds containing organically combined silver ; Process for preparing stable ——, soluble in water. A. Busch. Ger. Pat. 193,740, Dec. 13, 1906.

The addition-compound of hexamethylenetetramine and silver nitrate is dissolved in an albumose solution, and the solution thus obtained is either precipitated by alcohol or evaporated to dryness *in vacuo*, in the dark. The products are of medicinal value.—T. F. B.

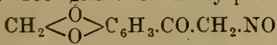
Eugenol esters of o- and m-aminobenzoic acids ; Process for preparing the ——. J. D. Riedel A.-G. Ger. Pat. 189,333, Jan. 16, 1907.

The eugenol esters of *o*- and *m*-nitrobenzoic acids are reduced to the amino-compounds, which are of value as anæsthetics.—T. F. B.

2.4.6.-Trioxypyrimidine and its 5-mono and dialkyl derivatives ; Process for preparing ——. C. F. Boehringer und Soehne. Ger. Pat. 193,447, Feb. 14, 1907.

Malonic acid derivatives of the general formula, $NH_2.CO.NH.CO.CR_1R_2.COOR_3$ (R_1 and R_2 are hydrogen or alkyl ; R_3 is alkyl), are converted into pyrimidine derivatives by treatment with alkalis in presence or absence of water.—T. F. B.

ω-Nitroacetocatechol ; Preparation of ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 195,814, May 12, 1907.

ω-Nitroacetocatechol is obtained by the action of aluminium chloride on its alkyl or alkylene ethers. Example : 100 grms. of finely-powdered ω-nitroacetopiperone,  $CH_2{<}^{O}_{O}{>}C_6H_3.CO.CH_2.NO_2$, are mixed with 1 litre of benzene or toluene, and 60 grms. of aluminium chloride added, with agitation. After continued agitation for 24 hours, the mixture is heated for 3 hours on the water-bath, hydrochloric acid being evolved. The product is then cooled, and the benzene or toluene drained off. The residue is stirred with 600 c.c. of 10—12 per cent. hydrochloric acid, the acid separated after 1 hour, and the unaltered nitroacetopiperone again treated with hydrochloric acid. The acid solution is treated with alkali until "Congo" paper is only faintly coloured blue, then filtered, and the nitroacetocatechol extracted from the filtrate with ether. The product is purified by washing with ether and crystallisation from water. It forms a raw material for the preparation of substances of therapeutic value.—A. S.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Erythrosin silver salt ; A blue ——. Lüppo-Cramer. Z. Chem. Ind. Kolloide, 1908, 2, 325—326.

The silver salts of the dyestuffs of the eosin class may be obtained in the form of colloidal solutions by double decomposition, either in presence of a protecting colloid, such as gelatin, or by working with dilute solutions and avoiding an excess of silver salt. In the case of erythrosin, the colloidal solution of its silver salt differs from the solution of the sodium salt by its very much more intense colour and its bluer shade. Like the colloidal silver haloids, the colloidal solution of the silver erythrosin salt can be made to undergo a process of "ripening." This takes place rapidly on warming or in the course of a few days at the ordinary temperature. The "ripened" solution deposits an extremely fine sediment which has a pure blue colour by transmitted light. The blue erythrosin silver compound is best prepared in presence of a silver haloid by dissolving 1 grm. of erythrosin in 400 c.c. of water, adding 7·1 c.c. of a 10 per cent. solution of potassium bromide and then 12 c.c. of a 10 per cent. silver nitrate solution. No precipitate is formed at first, but the blue deposit begins to separate in 2—3 days. The colloidal solutions of the silver salts of the other dyestuffs of the eosin class do not undergo this change.—J. F. B.

Gelatose [hydrolysed gelatin] as a colloidaliser. R. E. Liesegang. *See* XIV.

Patent.

Toning silver prints ; Processes of ——. A. Traube, Charlottenburg, Germany. Eng. Pat. 10,258, May 2, 1907.

See Fr. Pat. 376,051 of 1907 ; this J., 1907, 1029.—T. F. B.

XXII.—EXPLOSIVES, MATCHES, &c.

Patents.

Composition for the cleaning and lubricating of gun and rifle barrels. King's Norton Metal Co., Ltd., T. A. Bayliss, H. M. Smith and H. W. Brownsdon, London. Eng. Pat. 17,910, Aug. 7, 1907.

One part by weight of mercury or mercurous oxide or an amalgam containing one per cent. of sodium or potassium, is mixed intimately with two parts of vaseline or other lubricant, to which a small quantity of caustic soda or other alkali may have previously been added. —A. G. L.

Firearms ; Means of preventing flame at the mouths of ——. L. Villa. Fr. Pat. 385,769, Mar. 28, 1907.

With the object of rendering manufactured powder flameless, it is proposed to add to such powder either in cartridge or in bulk, sticks or lozenges of a friable mixture of say 25 per cent. of magnesium hydroxide and 75 per cent. of paraffin, in the proportion of from 3 to 10 per cent. of the weight of powder.—J. W. G.

XXIII.—ANALYTICAL CHEMISTRY.

APPARATUS.

Patents.

Gases ; Apparatus for automatic and continuous analysis and recording of ——. W. S. Hubbard, Leicester. Eng. Pat. 26,924, Dec. 5, 1907.

The gas to be analysed (*e.g.*, from a boiler flue) is alternately supplied to and withdrawn from, a pair of measuring vessels, by the rise and fall of water in their enclosing chamber. On leaving the first measuring vessel, the gas passes to a vessel wherein it is treated with a suitable absorbent, and the residual gas next passes to a second measuring vessel. Slide-valves, actuated by a float in an overflow vessel, control the movement of the water in the chamber and the gas in the two vessels, and their connecting parts, the absorbing vessel, and the measuring bell. The latter is suspended on a balanced lever which records on a chart, by its vertical movement, the amount of residual unabsorbed gas.—J. W. H.

Combustible gases ; Method and apparatus for determining the calorific power of ——. P. Lemoult and Soc. Anon. les Etabl. Poulenc Frères. Fr. Pat. 385,726, Dec. 3, 1907.

The method proposed consists in burning the gas in presence of an alkaline solution, and measuring the contraction of volume and the oxygen consumed. From these data the proportions of hydrogen, carbon monoxide, methane, etc., in the gas can be calculated, and hence the calorific power. The apparatus proposed is a simple one and allows the determination to be rapidly carried out on the spot with an error of 1 per cent. or less. It consists of a modified U-tube, one limb of which is plain and open and is used for pressure adjustments and the introduction of absorbents and oxygen. The other limb is closed at the top by a three-way tap, above which is a cup, and at the bottom by a tap of the ordinary kind. Three superposed bulbs are blown along it, the two upper ones being close together. The uppermost one has a capacity of 17—20 c.c. It is furnished with a platinum spiral or electrodes. The two lower ones are from 30 to 35 c.c. capacity. The intermediate tubing is graduated to $\frac{1}{10}$ or $\frac{1}{5}$ c.c. The estimation of the gaseous constituents is carried out in the usual way.
—J. W. G.

Furnace, Assay ——. L. Baudendistle, Denver, Colo. U.S. Pat. 887,057, May 12, 1908.

The muffle within the furnace is supported at the ends and partly on a transverse pipe mounted in the outer casing. This pipe is turned upwards at its two extremities and, at these points, communicates with two smaller pipes. Through one of these tubes an adjustable supply of some cooling medium can be passed, the other being used as an exhaust.—C. A. W.

INORGANIC—QUALITATIVE.

Silver ; A new test for ——. A. W. Gregory. Chem. Soc. Proc., 1908, **24**, 125.

When a solution of a silver salt is added to a mixture of 20 c.c. of aqueous ammonium salicylate (20 grms. of salicylic acid neutralised with ammonia, a slight excess of the latter added, and the solution made up to 1 litre) and 20 c.c. of ammonium persulphate solution (50 grms. in 1 litre) an intense brown colour is produced. By this reaction, 0·01 mgrm. of silver can be detected. As lead does not give this reaction, silver may be tested for in presence of this element ; 1·1 mgrm. of silver may be detected in this manner in the presence of 0·2 grm. of lead. The brown substance formed in this reaction does not contain silver, and it is probable that the silver salt acts as a catalyst, since on boiling a solution of ammonium salicylate with ammonium persulphate, a similar brown colour is produced.

Metals and liquids ; Differences of contact potential between ——. L. Bloch. Compt. rend., 1908, **146**, 1017—1018.

The author has measured the differences of contact potential between a disc of oxidised zinc and various aqueous solutions. He finds : (1). The apparent potential difference between metal and liquid is smaller for alkaline solutions than for water, and smaller for water than for acid solutions. Solutions of salts differ little from pure water in the effects observed. (2). This potential difference varies always in the same sense in passing from a normal solution of caustic soda to a normal solution of sulphuric acid. (3). The greatest variations are observed in passing from pure water to very dilute solutions. The method gives, therefore, a means of detecting small traces of acids and alkalis, too small to respond to colour tests.
—F. Sodn.

INORGANIC—QUANTITATIVE.

Tungstic acid ; Determination and separation of —— by means of chlorine and sulphur chloride. F. Bourion. Compt. rend., 1908, **146**, 1102—1104.

The substance, contained in a porcelain or silica boat, is heated in a glass tube in a stream of chlorine which has passed, after being purified and dried, over sulphur chloride, so as to carry with it a small (not too considerable) percentage of this substance. The gases pass through absorbing tubes containing water, and the temperature of the boat, after being kept for 45 minutes at 180°—190° C., and again for 45 minutes at 220°—250°, is slowly raised to 500° C. After cooling, the boat is removed, and the residue examined as may be necessary ; the tube is washed out with water and ammonia, the washings mixed with the liquid from the absorbing tubes, concentrated, treated with nitric acid to destroy ammonium salts and oxidise sulphur compounds, evaporated to dryness, and the residue taken up with ammonium nitrate solution (containing if necessary a little hydrochloric acid). The tungstic acid remaining is collected on a filter and weighed. In this way the author has got good results from sodium tungstate, silicotungstic acid, ytterbium silicotungstate, wolfram, scheelite, and mixtures of tungstic acid and silica.—J. T. D.

Thallium from silver ; Quantitative separation of ——. J. F. Spencer and M. Le Pla. Chem. Soc. Trans., 1908, **93**, 858—861.

The mixture of silver and thallium salts is treated in the presence of about 50 c.c. of water with a rapid current of chlorine for about 10 minutes, whereby the silver is precipitated as chloride and the thallous salt completely oxidised to a thallic salt, which remains in solution. The liquid is boiled to expel excess of chlorine, and filtered through a Gooch crucible, the precipitate of silver chloride being washed and weighed in the usual way. The filtrate and washings are concentrated to about 150 c.c., and treated with a current of sulphur dioxide for 10 minutes, or better with a few c.c. of liquid sulphur dioxide, the liquid being then boiled to expel excess of sulphur dioxide. An excess of a 20 per cent. solution of potassium iodide is added, and the mixture again boiled for two minutes. The precipitated thallous iodide is collected in a Gooch crucible, washed with a 1 per cent. solution of potassium iodide, and then with 80 per cent. alcohol, dried at 140° C., and weighed.

It is found that whereas 3·86 grms. of thallous chloride dissolve in a litre of water at 25° C., 21·84 grms. are soluble in a litre of a 5 *N*-solution of potassium carbonate.
—W. S.

Nitrates ; Limitations of the copper-zinc couple method in determining ——. J. E. Purvis and R. M. Courtauld. *See* XVIII*B*.

ORGANIC—QUALITATIVE.

Ethyl ester value ; The —— : a new constant for the detection of cocoanut oil. J. Hanus and L. Stekl. *See* XII.

Venice turpentine ; Detection of ordinary turpentine in ——. E. Walbum. *See* XIII*B*.

Citric acid in wine ; Detection of ——. G. Favrel. *See* XVII.

Arbutin from quinol ; Distinction of ——. P. Lemaire. *See* XX.

ORGANIC—QUANTITATIVE.

Tartaric acid ; Determination of —— volumetrically in tartar and lees. E. Pozzi-Escot. Compt. rend., 1908, **146**, 1031—1032.

One grm. of the substance is treated with an excess of a boiling solution of sodium or potassium carbonate and made up to 100 c.c. 25 c.c. of the resulting solution, which contains all the tartaric acid, is acidulated with an excess of hydrochloric acid, boiled to expel carbon dioxide, and made alkaline with ammonia. 40 c.c. of a decinormal solution of barium bromide in strong alcohol are then added and about 75 c.c. of alcohol. The mixture is shaken and filtered (preferably through a Gooch crucible), and the precipitated barium tartrate washed with small portions of alcohol. To the filtrate a little water is added, and an excess of ammonium oxalate, to precipitate the excess of barium as oxalate, and this is filtered off and washed with ammoniacal water. By means of $N/10$ potassium permanganate solution, the amount of oxalic acid in the precipitate is then determined, and from this the weight of barium required to precipitate the tartaric acid is readily calculated, and hence, by proportion, the weight of this acid in the original solution.—F. Sodn.

Citral; Determination of —— in oil of lemon. P. Bruylants. *See* XX.

XXIV.—SCIENTIFIC & TECHNICAL NOTES.

Ozone; Origin of atmospheric —— and causes of the variation of carbonic acid in the air. H. Henriet and M. Bonyssy. Compt. rend., 1908, **146**, 977—978.

Daily estimations show that when the amount of ozone in the atmosphere increases, the carbonic acid decreases, and *vice versa*, whatever the direction of the wind. Since the lowering of the carbon dioxide below the normal can only be due to an influx of air from high altitudes, it follows that the ozone comes from these regions. The proportion of ozone is a maximum with west and south-west winds, at a minimum with an east wind; on the contrary the carbonic acid is a maximum with east and north-east and a minimum with south-west winds. West and south-west winds accordingly bring down to the earth the air from high altitudes. Rain likewise brings down to lower regions the air from high altitudes; after rain there is an increase in the percentage of ozone and a decrease in that of carbonic acid. Solar radiation has no influence on the amount of carbonic acid, but it increases that of ozone and acts therefore to form this gas. Fogs or mists temporarily cause an increase in the amount of carbonic acid due to the cessation of the upward current and non-diffusion of the gases, rich in carbonic acid, liberated by the soil. It is concluded that ozone is formed from oxygen at high altitudes by the action of the ultra-violet solar radiations. Ozone is brought to the strata of the atmosphere immediately next the earth, partly by the winds and partly by rain. In clear weather the solar radiations produce ozone even in the lowest strata of the atmosphere. All variations in the amount of carbonic acid below the normal are due to the influx of air from high altitudes; variations above the normal are due to local phenomena such as the presence of towns, animals, fires, etc.—E. F. A.

Diazonium bromides; A new method of preparing ——. F. D. Chattaway. Chem. Soc. Trans., 1908, **93**, 958—961.

Diazonium bromides are very easily prepared by the action of primary aromatic hydrazines upon the corresponding diazonium perbromides, which are readily obtained in the solid state by adding bromine to aqueous solutions of diazonium salts. The finely powdered perbromide is suspended in absolute alcohol or acetic acid, and the calculated quantity of the corresponding hydrazine, dissolved in the same solvent, added, the mixture being cooled. The diazonium bromide separates as a crystalline powder, or can be precipitated by the addition of ether.—W. S.

Trade Report.

Imports and Exports at Prices of 1900. *Tables showing for each of the years* 1900–1907, *the estimated value of the Imports and Exports of the United Kingdom at the prices prevailing in* 1900, *with an Introductory Memorandum.* [Cd. 4115.] Price 2½d.

This return, which has been prepared in the Commercial, Labour and Statistical Department of the Board of Trade, is issued in continuation and extension of that issued last year (Cd. 3446, 1907) in which a detailed comparison was made in respect of each year since 1900 between the values of the various groups of imports and exports as actually declared and the estimated values of such groups based on the average values obtaining in 1900. The object of this series of returns is to eliminate as far as possible the effect of the fluctuation of prices, and so secure a basis for a closer comparison between the volume of imports and exports in each year.

The following table summarises the results of this investigation :—

Year.	Imports.		Exports of Produce and Manufactures of the United Kingdom.		Exports of Foreign and Colonial Merchandise.	
	Values as declared.	Estimated Values at prices of 1900.	Values as declared.	Estimated Values at prices of 1900.	Values as declared.	Estimated Values at prices of 1900.
	£	£	£	£	£	£
1900	523,075,000	523,075,000	291,192,000	291,192,000	63,182,000	63,182,000
1901	521,990,000	538,932,000	280,022,000	294,041,000	67,842,000	69,028,000
1902	528,391,000	551,635,000	283,424,000	312,159,000	65,815,000	67,617,000
1903	542,600,000	558,388,000	290,800,000	320,504,000	69,574,000	69,946,000
1904	551,039,000	563,726,000	300,711,000	327,449,000	70,304,000	69,340,000
1905	565,020,000	573,762,000	329,817,000	359,890,000	77,780,000	74,761,000
1906	607,888,000	588,806,000	375,575,000	386,917,000	85,102,000	75,319,000
1907	645,904,000	599,592,000	426,205,000	416,973,000	91,972,000	79,182,000

Mines and Quarries: General Report and Statistics for 1907. *Part I. District Statistics.* [Cd. 4105.] Price 7d.

This return, which forms the first part of the General Report on Mines and Quarries for 1907, contains statistics of the number of persons employed, the output of minerals, and of accidents at mines and quarries in the United Kingdom, arranged according to the inspection districts. The total output of the undermentioned minerals in the United Kingdom, in 1907, as compared with 1906, was as follows :—

——	1906.	1907.
	Tons.	Tons.
Coal	251,067,628	267,830,962
Iron ore	15,500,406	15,731,604
Clays and shale	15,291,352	14,827,895
Limestone (other than chalk)	12,758,588	12,509,142
Igneous rocks	6,165,750	5,674,470
Sandstone	5,261,150	5,012,053
Chalk	4,749,310	4,779,387

New Books.

THE MANUFACTURE OF VARNISHES, AND KINDRED INDUSTRIES. Based on and including the "Drying Oils and Varnishes" of Ach. Livache. By JOHN GEDDES McINTOSH. Second and greatly enlarged English edition, in three volumes. Vol. I. OIL CRUSHING, REFINING AND BOILING. THE MANUFACTURE OF LINOLEUM, PRINTING AND LITHOGRAPHIC INKS, AND INDIARUBBER SUBSTITUTES. Scott, Greenwood and Co., 8, Broadway, Ludgate Hill, London, E.C. 1904. Price 10s. 6d. D. van Nostrand Co., 23, Murray Street, New York.

8vo volume, containing 145 pages of subject matter, and the alphabetical index. There are 29 illustrations. The entire subject is treated under the following heads :—I. Oil crushing and refining. II. Oil boiling—theoretical and practical. III. Linoleum manufacture. IV. Printing ink manufacture. V. Rubber substitutes. VI. Manufacture of driers. VII. Detection of adulteration in linseed and other drying oils, by chemical, physical and organoleptic methods.

VOL. II. VARNISH MATERIALS AND OIL VARNISH MAKING. Scott, Greenwood and Son, 8, Broadway, Ludgate Hill, London, E.C. 1908. Price 10s. 6d.

8vo. volume, similar to the last, containing 202 pages of subject matter, with 70 illustrations, and the alphabetical index. The entire subject is subdivided as follows :—I. Amber and amber oil varnishes. II. Asphaltum, coal-tar pitch, bone-pitch, stearine-pitch, india-rubber, gutta-percha, paraffin wax. III. Copal. IV. Resins. V. Oil varnish making. VI. Copal oil varnishes. Kauri copal varnishes. VII. Rosin oil varnishes. Brunswick black. Super-black Japan. VIII. Testing varnish. Utilising residues. IX. Utilisation of varnish-makers' waste products.

KOLLOIDES SILBER UND DIE PHOTOHALOIDE. Von Carey Lea. In deutscher Uebersetzung mit Anmerkungen neu herausgegeben. Von Dr. LÜPPO-CRAMER. Theodor Steinkopff's Verlag. Dresden. 1908. Price M.4.

SMALL 8vo volume with frontispiece, preface, biographic notice of Carey Lea and 147 pages of subject matter, which are arranged under the following heads :—PART I. Red and purple silver chloride, bromide and iodide. On the latent photographic image, and heliochromic effects, etc. PART II. Identity of the silver photo-salts with the substance of the invisible photographic image. Silver photochloride by means of sodium hypophosphite, etc. On compounds of silver chloride with other metallic chlorides. Allotropic forms of silver.

KOLLOIDCHEMIE UND PHOTOGRAPHIE. Von Dr. LÜPPO-CRAMER. Theodor Steinkopff's Verlag, Dresden. 1908, Price M.5.

SMALL 8vo volume, containing preface, and 152 pages of subject matter, with 6 illustrations, and an alphabetical name index. The subject matter is subdivided and classified as follows :—I. Brief introduction to the chemistry of colloids. II. Special use of colloidal chemistry in connection with photography.

WATER-ANALYSIS. A Practical Treatise on the Examination of Potable Water. By J. ALFRED WANKLYN, M.R.C.S., etc. Revised by W. J. COOPER. With memoir and portrait of the author. Eleventh Edition. Kegan Paul, Trench, Trübner and Co., Ltd., Dryden House, Gerrard Street, W. 1907. Price 3s. 7d.

12MO volume, containing frontispiece portrait of the late J. Alfred Wanklyn, Reviser's note, Author's "Last warning and advice to chemists working the ammonia process," preface, memoir of the Author by W. J. Cooper, 236 pages of subject matter, and the alphabetical index. The subject matter, which is illustrated, is subdivided into three parts. PART I. WATER ANALYSIS FOR GENERAL SANITARY PURPOSES. (i.) Collection of samples of water. (ii.) Specific gravity and total solid residue left on evaporation to dryness. (iii.) Chlorine. (iv.) Organic matter, "Free and albuminoid ammonia." (v.) The moist combustion process. (vi.) Poisonous metals. (vii.) Drawing up of reports. (viii.) Verification. PART II. SPECIAL ANALYSIS, &c. (i.) Specific gravity of natural waters. (ii.) Carbonic acid in natural waters. (iii.) The water-residue; insoluble solids; soluble solids; degree of alkalinity. (iv.) Hardness. (v.) General quantitative analysis of the water-residue. Statement of results. (vi.) Gases and vapours dissolved by water. (vii.) Table waters. (viii.) Purification of water. (ix.) Urine and sewage. PART III. EXAMPLES OF COMPLETE MINERAL ANALYSIS. (i.) Water supply to London and to Manchester, etc. (ii.) Appendix. (iii.) Letter from Royal Commission on water supply. (iv.) Testimonials. (v.) List of original papers.

DECORATION OF METAL, WOOD, GLASS, ETC. A Book for Manufacturers, Mechanics, Painters, Decorators, and all Workmen in the Fancy Trades. Edited by H. C. STANDAGE. First Edition. John Wiley and Sons, New York, U.S. America. 1908. Price 8s. 6d. net. Chapman and Hall, Limited, London.

12MO volume, containing 220 pages of subject matter, and an alphabetical index. A collection of recipes.

DIE GASERZEUGER UND GASFEUERUNGEN. Von ERNST SCHMATOLLA. Second Edition. Dr. Max Jaenecke, Verlagsbuchhandlung. 1908. Price M.3.

SMALL 8vo volume, containing 162 pages of subject matter, with 133 illustrations and an alphabetical index. The subject matter is classified according to the following scheme :—I. The chemical raw materials and compounds used in connection with gas-producers and gas-firing. II. Comparison of the generator gas-firing with the ordinary grate-firing. III. Gas-producers in general. IV. Varieties of gas-producer. V. Power gas-generators for crude fuels. VI. Water-gas and water-gas producers. VII. The construction of gas-generators. VIII. Combustion of generator-gas. IX. Gas-firing and gas furnaces.

PATENTS, DESIGNS, AND TRADE MARKS. TWENTY-FIFTH REPORT OF THE COMPTROLLER-GENERAL. 156. Price 3d.

THIS report deals with the work of the Patent Office during the year 1907. The number of applications for patents and for registration of designs and trade marks during that year, as compared with the two preceding years, is shown by the following table :—

—	1905.	1906.	1907.
Patents—			
Applications	27,578	30,030	29,040
Specifications—			
Provisional	19,863	21,025	19,630
Complete	18,806	18,243	18,893
Sealed................	14,786	14,707	16,272
Designs—			
Applications	23,938	22,001	24,928
Registered	23,138	21,212	24,039
Trade Marks —			
Applications	10,521	11,414	10,796
Registered	4,261	4,731	6,255

The surplus of income over expenditure during 1907 was £124,158 12s. The Comptroller gives a summary of the Patents and Designs Act, 1907, and states that a notice pointing out the effect of the amendments has been sent out to nearly 70,000 patentees in this country. A note describes the method that has been adopted for checking applications for speculative patents based only on chemical theories, the Comptroller being empowered to ask for typical samples and specimens of the alleged inventions.

Patent List.

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

Applications.

11,851. Semper. Producing as high temperature as possible in rotary kilns heated by gas.* June 1.

12,077. Tarver, and Coulson and Co., Ltd. Apparatus for washing, separating, or concentrating minerals or substances of different specific gravities. June 3.

12,081. Barry. Magnetic separation of materials. June 3.

12,252. Furowicz. Centrifugal mixing apparatus.* June 5.

12,408. Ruthenburg. Furnaces.* June 9.

12,565. Humphrey. Method and apparatus for compressing air or gases. June 11.

12,750. Carrick and Pattison. Agitating and separating mixtures of solid matter and liquids.* June 13.

Complete Specifications Accepted.

12,781 (1907). Planckh. Distilling and boiling apparatus. June 11.

13,179 (1907). Reimann. Heat insulating coverings for pipes, etc. June 17.

13,357 (1907). Macherski and Kopersky. Improving or refining liquids. June 17.

15,164 (1907). Halket. Evaporators, distillers, etc. June 17.

15,172 (1907). Black and Lennox. Apparatus for cleaning or washing smoke or gases. June 11.

25,405 (1907). Lake (Aktiebolaget Separator). Drums of centrifugal separators. June 11.

25,517 (1907). Hildebrandt. Cooling and liquefying gases. June 17.

26,935 and 27,482 (1907). Venter. Process and apparatus for concentrating lyes. June 17.

6414 (1908). Buckingham. *See under* X.

7910 (1908). Siemens Bros. and Co. (Siemens und Halske A.-G.). Pyrometers or thermometers of the thermo-electric or electric resistance type. June 11.

II.—FUEL, GAS, AND LIGHT.

Applications.

12,113. Holgate. Producers for water gas and producer gas. June 4.

12,281. Tangyes, Ltd., and Robson. Gas producers.* June 5.

12,406. Roscoe. Manufacture of fuel. June 9.

12,446. Jabs. Gas generators.* June 9.

12,720. Soc. Franç. d'Incandescence par le Gaz. Manufacture of incandescent electric lamp filaments. [Fr. Appl., July 13, 1907.]* June 13.

Complete Specifications Accepted.

13,190 (1907). Harrison and Hirst. Electrodes for electric arc lamps. June 17.

13,292 (1907). Wright. Coking ovens. June 17.

15,367 (1907). British Thomson-Houston Co. (General Electric Co.). Producing refractory electric conductors particularly metallic filaments. June 17.

21,124 (1907). Marconnet. Gas producing apparatus. June 11.

25,036 (1907). Boult (Taussig). Water-gas apparatus. June 11.

5225 (1908). Allgem. Elektricitäts Ges. Electrodes for arc lamps. June 11.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

Complete Specifications Accepted.

16,969 (1907). Common, and Hull Oil Manufacturing Co. Rendering paraffin oil emulsifiable. June 17.

20,059 (1907). Ridgill. Manufacture of oils and greases for lubricating, etc. June 11.

2399 (1908). Koppers. *See under* VII.

IV.—COLOURING MATTERS AND DYESTUFFS.

Applications.

11,866. Newton (Bayer und Co.). Manufacture of azo-dyestuffs. June 1.

11,867. Newton (Bayer und Co.). Manufacture of a sulphonic acid of Celestine Blue. June 1.

11,878. Johnson (Badische Anilin und Soda Fabrik). *See under* XIII.A.

12,067 Durand, Huguenin et Cie. Manufacture of condensation products of gallocyanines with ammonia. [Ger. Appl., June 3, 1907. Addition to No. 15,138 of 1907.]* June 3.

12,167. Johnson (Badische Anilin und Soda Fabrik). Manufacture of colouring matters of the anthracene series. June 4.

12,264. Johnson (Bahische Anilin und Soda Fabrik). Manufacture of colouring matters of the anthracene series. [Addition to No. 7418 of 1908.] June 5.

12,462. Levinstein, Ltd., and Maron. Red dyestuff obtained from thioindoxyl or thioindoxylcarboxylic acid. June 10.

Complete Specifications Accepted.

16,962 (1907). Newton (Bayer und Co.). Manufacture of dyestuffs of the anthracene series. June 17.

17,960 (1907). Newton (Bayer und Co.). Manufacture of leuco-compounds of the oxazine series. June 11.

18,698 (1907). Newton (Bayer und Co.). Manufacture of azo dyestuffs. June 17.

1334 (1908). Durand, Huguenin et Cie. Manufacture of the leucogallocyanine corresponding with pyrogallol. June 11.

2306 (1908). Durand, Huguenin et Cie. Manufacture of a gallocyanine dyestuff. June 11.

3655 (1908). Chem. Fabr. Griesheim-Elektron. Manufacture of an aminonaphtholdisulphonic acid. June 17.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

Applications.

11,959. Dreaper. Manufacture of artificial silk materials. June 2.

12,036. Prestwich. Treating textile yarns and threads with liquids. [Addition to No. 1042 of 1901.] June 3.

12,253. Guadagni. Machines for producing artificial silk threads. [Ital. Appl., Sept. 28, 1907. Comprised in No. 1265 of 1908.]* June 5.

12,416. Johnson (Badische Anilin und Soda Fabrik). Production of white and coloured resist effects on textile fibre. June 9.

12,455. Hübner. Producing designs or ornamental and colour effects on fabrics. June 10.

12,463. Keith and Wardle. Machines for drying yarn. June 10.

Complete Specifications Accepted.

13,868 (1907). Dreaper. Machinery suitable for the preparation of artificial silk, etc. June 17.

17,780 (1907). Spenle. Apparatus for drying proofed or like fabrics or materials. June 11.

18,936 (1907). Lecoeur. *See under* XIX.

25,801 (1907). Ostersetzer. Colour printing on half-wool fabrics. June 11.

VII.—ACIDS, ALKALIS, AND SALTS.

Applications.

11,864 and 11,865. Newton (Bayer und Co.). Manufacture of alkali hydrosulphites. June 1.

12,071. Zimmermann (Chem. Fabr. auf Actien, vorm. E. Schering). Manufacture of ammonium thiosulphate. June 3.

12,136. Bourdos. Production of metallic compounds from pitchblende. June 4.

12,317. Levy-Mond. Recovery of products from lead fumes or waste metallic solutions or suspensions. June 6.

12,433. Epstein. Treatment of carbonic acid. June 9.

12,449. Diefenbach and Moldenhauer. Manufacture of hydrochloric acid from magnesium chloride. June 9.

12,476. Masson. Resolving alkali chlorides into hydrocholric acid and alkali carbonates, or alkali nitrates into nitric acid and alkali carbonates. June 10.

12,570. Rogers. Production of mica powder. June 11.

12,763. Goldschmidt. Separation and concentration of chlorine. [Ger. Appl., Aug. 5. 1907.]* June 13.

Complete Specifications Accepted.

5314 (1907). Bloxam (Soc. Gen. per la Cianamide). Manufacture of nitrogen compounds from carbides. June 17.

18,417 (1907). Mount. *See under* X.

23,217A (1907). Johnson (Verein Chem. Fabr.). Manufacture of sodium carbonate and hydrogen sulphide from sodium sulphide. June 17.

25,632 (1907). Birkeland. Utilisation of nitrous gases. June 17.

272 (1908). Riiber. Simultaneous production of an alkali salt, a phosphorus-containing manure, and carbonic acid. June 11.

2399 (1908). Koppers. Producing ammonium sulphate from gases of dry distillation of organic substances. June 17.

6655 (1908). Gouthière et Cie. Manufacture of nitrite of soda. June 11.

8012 (1908). Meister, Lucius, und Brüning. Manufacture of alkali formate. June 17.

VIII.—GLASS, POTTERY, AND ENAMELS.

Application.

12,039. Hassall and Coleman. Colour printing for earthenware, china, and similar goods. June 3.

Complete Specifications Accepted.

16,690 (1907). Humphrey. Firing pottery ovens, kilns, or furnaces. June 11.

18,417 (1907). Mount. *See under* X.

22,193 (1907). Lake (Erste Deutsche Blumentopfwerke Ges.). Drying earthenware, etc. June 17.

9563 (1908). Bloxam (Siemens und Halske A.-G.). Manufacture of glass. June 17.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Applications.

12,106. Sykes. Composition for bricks, tiles, stone, cement, etc. June 4.

12,597. Cawley and Moore. Manufacture of a building material. June 12.

Complete Specifications Accepted.

17,562 (1907). Muller. Manufacture of cement. June 11.

28,180 (1907). Bos, and Delastre et Cie. Manufacture of artificial stone blocks. June 11.

7091 (1908). Lake (Sackett Plaster Board Co.). Manufacture of plaster, cement, etc. June 17.

X.—METALS AND METALLURGY.

Applications.

11,996. Hess. Extracting copper from its ores or matt.* June 2.

12,042. Duke. Metallic alloys. June 3.

12,077. Tarver, and Coulson & Co., Ltd. *See under* I.

12,212. Stock. Bessemer converters. June 5.

12,258. Hugot. *See under* XI.

12,322. Boult (Jones). Method of treating iron ore.* June 6.

12,324. Boult (Jones). Making iron and steel.* June 6.

12,342. Holzapfel. Smelting furnaces.* June 6.

12,383. Churchward. Production of alloyed steels. [U.S. Appl., Sept. 18, 1907.]* June 9.

12,403. Hopkins. Apparatus for smelting zinc ore, galvanisers' dross, &c. [Addition to No. 25,099 of 1907.] June 9.

12,452. Lamon and Thomas. Improving the physical properties of metals and alloys.* June 9.

12,494. Finfrock. Aluminium solder.* June 10.

12,510. Cowper-Coles. Coating iron and steel with metal. June 10.

12,511. Cowper-Coles. Annealing iron and steel. June 10.

Complete Specifications Accepted.

13,254 (1907). Snyder. Treatment of ores. June 17.

13,268 (1907). Hoover and Sulman. Ore concentration. June 17.

13,977 (1907). Cowper-Coles. Manufacture of zinc dust. June 17.

18,417 (1907). Mount. Furnaces for melting metals, glass, &c., and for roasting or calcining ores, salt cake, &c., June 11.

21,063 (1907). Sutton, Steele, and Steele. Dry concentration of ores. June 17.

27,489 (1907). Massenez. Manufacture of steel. June 17.

28,207 (1907). Rübel. Manufacture of steel alloys. June 17.

207 (1908). Kuzel. Production of exactly measured alloys. June 17.

3173 (1908). Hiorth. Refining steel. June 11.

6050 (1908). Siemens und Halske A.-G. Hardening tantalum. June 11.

6414 (1908). Buckingham. Filters for separating solutions from ore pulp. June 11.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

11,895. Walton. Manufacture of compositions suitable for electric insulating, &c. June 1.

11,944. Somers and Crowley. Electrolytes for storage batteries. [Comprised in No. 10,078 of 1908.] June 2.

12,161. Jones. Electro-deposition of metals on aluminium. June 4.

12,258. Hugot. Electric furnaces for the manufacture of steel. June 5.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

Complete Specification Accepted.

21,489 (1907). Lake (Rutgerswerke). *See under* XIII*B*.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(*A*.)—Pigments, Paints.

Applications.

11,878. Johnson (Badische Anilin und Soda Fabrik). Manufacture of colouring matter lakes. June 1.

12,517. Liebreich. Manufacture of oil paints.* June 10.

(*B*.)—Resins, Varnishes.

Complete Specification Accepted.

21,489 (1907). Lake (Rutgerswerke A.-G.). Extraction of resins, oils, sulphur, and the like. June 17.

(*C*.)—India-Rubber.

Applications.

11,949. D'Aloè. India-rubber compound. [Appl. in Brazil, Jan. 27, 1908.]* June 2.

12,440. Lewis. Purification of rubber. June 9.

12,504. Lewis. Purification of rubber. June 10.

12,647. Bridgeman, Wardle, and O'Brien. Susbtitute for vulcanite. June 12.

12,648. Bridgeman, Wardle and O'Brien. Substitute for india-rubber. June 12.

XIV.—TANNING, LEATHER, GLUE, SIZE, &c.

Applications.

12,174. Lake (Schuhfabr. Bonndorf Gebr. Kriechle). Manufacture of a leather substitute.* June 4.

12,254. Boult (Internat. Process Tanning Co.). Tanning hides and making leather.* June 5.

Complete Specifications Accepted.

22,382 (1907). Neufeld. Manufacture of elastic chromated glue masses. June 11.

25,528 (1907). Müller. Manufacture of artificial leather. June 17.

1021 (1908). Parkin and Williams. Treatment of bone, ivory, &c. June 17.

XV.—MANURES, &c.

Complete Specification Accepted.

272 (1908). Riiber. *See under* VII.

XVI.—SUGAR, STARCH, GUM, &c.

Complete Specifications Accepted.

25,274 (1907). Newton (Bayer und Co.). Manufacture of soluble starch. June 17.

1353 (1908). Fritsche. Soluble gum. June 17.

XVII.—BREWING, WINES, SPIRITS, &c.

Complete Specifications Accepted.

26,915 (1907). Perelzveich and Rosenbusch. Manufacture of solidified spirit. June 17.

4622 (1908). Kuhn. Manufacture of fermented beverages. June 17.

XVIII.—FOODS; SANITATION, WATER PURIFICATION; AND DISINFECTANTS.

(*A*.)—Foods.

Applications.

12,082. Woosnam (Whetham). Manufacture of foodstuffs. June 3.

12,378. Liversedge. Manufacture of butter and butter substitutes. June 9

12,434 Epstein. Non-alcoholic drinks. June 9.

12,493. Stevenson and Cox. Preservative for foodstuffs. [Addition to No. 14,149 of 1907.] June 10.

12,516. Bergell and Wülfing. Making milk for infants.* June 10.

12,672. Saliter. Drying milk, &c.* June 12.

Complete Specifications Accepted.

14,149 (1907). Stevenson and Cox. Preservative for foodstuffs. June 17.

1528 (1908). Reese. Manufacture of food preparations from cereals. June 17.

2035 (1908). Wimmer. Treatment of coffee. June 17.

(*B*.)—Sanitation; Water Purification.

Applications.

12,263 Shone and Ault. Purifying air polluted by sewage gas, &c.* June 5.

12,711. Pulsford. Water purifying apparatus. June 13.

Complete Specifications Accepted.

24,381 (1907). Allen. Treatment of effluents. June 17.

7365 (1908). Parsons. Purification and utilisation of sewage. June 11.

XIX.—PAPER, PASTEBOARD, &c.

Application.

12,101. Funnell. Machines for coating paper, &c. June 3.

Complete Specifications Accepted.

13,023 (1907). Rouxeville. Substitute for celluloid and the like. June 17.

18,936 (1907). Lecoeur. Manufacture of threads or films of cellulose. June 17.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

Applications.

11,899. Wellcome and Pyman. Manufacture of a tropine derivative. June 1.

12,405. Buer. Obtaining lecithin free from bitter alkalis from seeds of lupines and other podded plants.* June 9.

12,472. Wellcome and Barrowcliff. Manufacture of therapeutic compounds. June 10.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Application.

12,341. Smith. Reagents and processes for toning photographic prints. [Addition to No. 22,218 of 1907.] June 6.

Complete Specifications Accepted.

13,835 (1907). Kelly. Printing out papers and photographic sensitive surfaces for producing positive pictures. June 17.

4745 (1908). Brasseur. Colour photography. June 11.

XXII.—EXPLOSIVES, MATCHES, &c.

Application.

12,188. Anglo-French F. and S., Ltd., and Edwards. Explosives. [Addition to No. 24,025 of 1907.]* June 4.

Complete Specifications Accepted.

23,834 (1907). Bramwell-Smith. Blasting fuses. June 17.

2509 (1908). Claessen. Weather-proof blasting explosives. June 17.

Journal of the Society of Chemical Industry.

No. 13, Vol. XXVII. JULY 15, 1908. No. 13, Vol. XXVII.

Official Notices.

BY-LAWS.

AT THE COUNCIL CHAMBER, WHITEHALL.

The 17th day of June, 1908.

BY THE LORDS OF HIS MAJESTY'S MOST HONOURABLE PRIVY COUNCIL.

WHEREAS there was this day read at the Board certain By-laws made by the Society of Chemical Industry at a General Meeting of the Society held on the 15th day of June, 1908:

And whereas it is provided in the Charter of the Society that By-laws made by the Society shall not commence or have effect until they have been submitted to and allowed by the Lords of the Council:

NOW, THEREFORE, Their Lordships having taken the said By-laws into consideration, are pleased to allow the same, as set forth in the Schedule to this Order.

A. W. Fitzroy.

The Schedule referred to in the foregoing Order will be published in the next number of the Journal.

By Order,

Charles G. Cresswell, Secretary.

ANNUAL GENERAL MEETING.

The Annual General Meeting will be held in the Armstrong College, Newcastle-on-Tyne, on Wednesday, July 22nd, at 10.30 a.m. A programme [and request form were contained in the May 30 number of the Journal. The ticket of membership will be found in this number.

In accordance with the provisions of By-law 18 of the Society of 1881, notice is hereby given that those members whose names are printed in *italics* in the list of Council (see p. 363, April 30th number) will retire from their respective offices at the forthcoming Annual Meeting.

Prof. R. Meldola, F.R.S., has been nominated to the office of President under By-law 8; Dr. J. T. Dunn, Mr. A. R. Ling, Mr. George C. Stone, and Mr. R. C. Woodcock, have been nominated Vice-Presidents under By-law 8; Sir Boverton Redwood has been nominated a Vice-President under By-law 11; and Dr. T. B. Wagner has been nominated a Vice-President under By-law 26. Prof. P. Phillips Bedson and Mr. H. Van der Linde have been nominated Ordinary Members of Council under By-law 26; and Mr. Thomas Tyrer and Dr. Ludwig Mond, F.R.S., have been nominated Hon. Treasurer and Hon. Foreign Secretary respectively under By-law 9.

Prof. W. Hodgson Ellis, Messrs. O. Guttmann and H. Hemingway and Dr. G. G. Henderson have been nominated, under Rule 18, to fill four vacancies among the Ordinary Members of Council. No ballot will be required.

The medal has been awarded to Sir Andrew Noble, Bart., K.C.B., F.R.S., for his researches on explosives.

By order of the Council,

Charles G. Cresswell, Secretary.

Birmingham and Nottingham Sections.

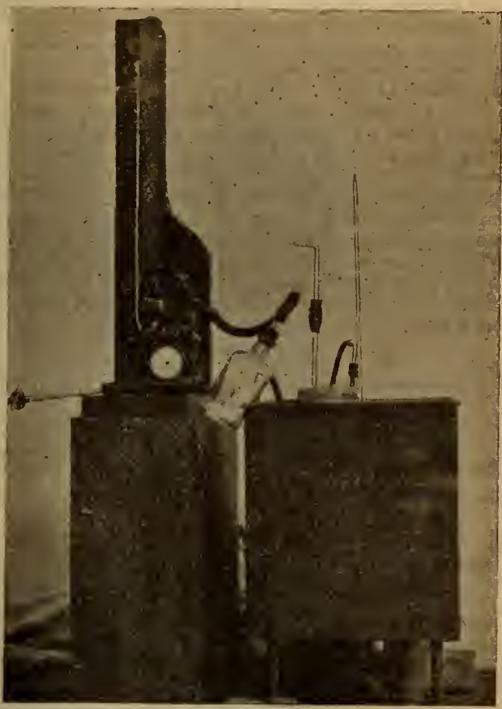
Meeting held at Burton on Thursday, May 7th, 1908.

MR. HARRY SILVESTER IN THE CHAIR.

ESTIMATIONS BY FERMENTATION WITH YEAST.

ARTHUR SLATOR, PH.D., D.SC., F.I.C.

In two papers published in the Transactions of the Chemical Society (1906, **89**, 128; 1908, **93**, 217), I have given an account of some measurements of the rate of alcoholic fermentation by living yeast. The method of investigation is briefly as follows:—A given quantity of yeast and sugar solution is introduced into a glass bottle of about 150 c.c. capacity, fitted with a rubber bung and connected by pressure tubing to a mercury manometer, which can register pressures from a vacuum to about 30 cm. of mercury. The apparatus can be exhausted and kept air-tight by means of a side tube and a stopcock. The construction of the apparatus is shown in the accompanying photograph. The bottle contains twenty or thirty fairly large glass beads to assist in the thorough shaking of the solution. It rests in the thermostat and is taken out at intervals during the experiment and vigorously shaken to overcome supersaturation of the gas in the liquid. The change in pressure registered on the manometer scale is a measure of the amount of fermentation in the given interval of time. The method of investigation has the great advantage that the velocity can be measured when only a small quantity of sugar has been changed to alcohol and carbon dioxide. By considering only these initial velocities, complications due to other reactions which take place simultaneously are to a large extent eliminated. Some of the results obtained may be mentioned, as they are of importance in the latter part of the paper.



The rate of fermentation of dextrose is exactly proportional to the amount of yeast present in the solution. The rate of fermentation of dextrose, lævulose, galactose, and mannose is approximately independent of the concentration of the sugar when the concentrations vary from one grm. to ten grms. per 100 c.c.

Dextrose and lævulose are fermented at the same rate. Brewery yeast ferments sucrose at the same rate as dextrose and lævulose. The fermentation of galactose is brought about only by yeasts which have been grown in the presence of galactose.

The apparatus can be used for other estimations.

The fermentative activity of yeast.—Various methods have been described for measuring the fermentative activity of a given sample of yeast. In almost all cases the carbon dioxide evolved in a given time from a known quantity of yeast and sucrose solution is measured. The amount of gas evolved may be measured volumetrically or by the pressure produced.

Hayduck's apparatus is an example of the first method, whilst C. G. Matthews (Manual of Alcoholic Fermentation, p. 274) uses the pressure of gas produced as an indication of the activity of the yeast. Various fermentation saccharometers have also been constructed and even patented.

The apparatus described in this paper can be used very conveniently for rapidly and accurately estimating the activity of samples of yeast. About 15 grms. of pressed yeast (or an equivalent quantity of samples of liquid yeast) are weighed out in a small flask. The yeast is well mixed with water and made up to 250 c.c. 10 c.c. of the mixture and 50 c.c. of a 5 per cent. sucrose solution are introduced into the bottle of the apparatus and warmed to exactly 30° C. The bottle is connected to the manometer and placed in the thermostat, which is regulated at 30° C. The apparatus is exhausted and readings are taken every five minutes. Some specimens of yeast show a constant activity for several hours after mixing, the activity of others gradually changes. The method is especially applicable to compare yeasts of approximately the same activity, and even in the case of samples which show a gradual change in activity there is no difficulty in comparing one yeast with another.

Where yeast is used in such a manner that the initial activity is of importance, such estimations are evidently of value. The use of yeast for baking purposes is probably such a case.

Table I.

A comparison of the activity of two yeasts.

29·2 *grms. of yeast A.*

Time after mixing.	Reading on scale.	Difference per 5 minutes.
mins.	cm.	
10	3·95	—
15	6·8	2·85
20	9·5	2·7
22	1·0	—
27	3·6	2·6
32	6·2	2·8

Mean .... 2·73

29·5 *grms. of yeast B.*

Time after mixing.	Reading on scale.	Difference per 5 minutes.
mins.	cm.	
10	0·25	—
15	2·5	2·25
20	4·95	2·45
25	7·2	2·35

Mean .... 2·35

Ratio of activities A : B = 1 : 0·85.

Pressed brewers' yeast, and three samples of bakers' yeast gave a ratio of activities 1 : 0·95 : 1·00 : 1·13.

There are on the market various dry preparations of yeast, which are capable of bringing about alcoholic fermentation. The apparatus can be used to estimate the activities of such preparations. 5 grms. of the preparations, and 50 c.c. of sucrose solution are introduced into the bottle and measurements carried out as before. A series of observations must be made as the initial velocities are very irregular. (Trans. Chem. Soc., 1908, **93**, 236.)

The estimation of small quantities of fermentable sugar.—It is evident that the fall in pressure during the time of complete fermentation can be used as a measure of the amount of sugar introduced into the apparatus, and in this way small quantities of fermentable sugars can be estimated. It was found possible to ferment completely 0·1 grm. of dextrose in 20 minutes, and to measure the fall in pressure due to this fermentation. This measurement, after correction for the autofermentation of the yeast, is proportional to the amount of sugar introduced into the bottle of the apparatus. By carrying out two experiments, one with a sugar solution of known concentration, and the other with a solution of unknown strength, the amount of sugar in this latter solution can be estimated. Details of the method are as follows:—A mixture of yeast and water (1 part of pressed yeast to about 4 of water) is kept overnight at 25° C. in order to reduce the autofermentation of the yeast. 25 c.c. of the mixture are placed in the bottle of the apparatus and the rate of autofermentation measured at 30° C. 10 c.c. of a solution containing about 0·1 grm. of dextrose is heated to 30° C. and added to the yeast and water in the apparatus, which is then quickly exhausted. A reading is obtained one minute after mixing the solution, and two or three other readings are taken at intervals of one minute. The amount of fermentation which takes place during the first minute after mixing is taken as one-half the amount which takes place during the second minute and an extrapolated value of the pressure reading at mixing is thus obtained. Readings are also taken 10 minutes and 20 minutes after mixing. By this time the rate of evolution of gas is approximately equal to the original rate of autofermentation showing complete disappearance of the sugar. The fall in pressure during the 20 minutes after mixing can be corrected for autofermentation, and the value thus obtained is a measure of the amount of dextrose in the 10 c.c. used in the experiment. A known quantity of dextrose can thus be compared with an unknown quantity and the latter amount estimated. The estimation of dextrose in a commercial sample of galactose is an example of the method.

Table II.

25 c.c. yeast and water at 30° C.

Time. mins.		Scale reading. cm.
0		1·25
30		3·2
31	0·1 grm. dextrose added	(0·6)
32		1·15
33		2·3
41		14·2
51		15·0

Fall in pressure 31 mins. to 51 mins. 14·4 cm.
Correction for autoferm. .... 1·3 cm.
0·1 grm. dextrose corresponds to .... 13·1 cm.

25 c.c. yeast and water at 30° C.

Time. mins.		Scale reading. cm.
0		1·8
15		3·4
18	1·0 grm. galactose added	(−0·25)
19		0·4
20		1·65
28		11·2
38		13·4
48		14·4

Fall in pressure 18 mins. to 38 mins. 13·65 cm.
Correction for autoferm. .... 2·1 cm.
11·55 cm.

Percentage of dextrose in commercial galactose = 8·8.

THE HEAT TREATMENT OF MUNTZ METAL.

Part II.

BY G. D. BENGOUGH, M.A., AND O. F. HUDSON, B.SC.

The present notes are supplemental to the authors' paper entitled "The Heat Treatment of Copper-Zinc Alloys, Part I. Muntz Metal." (1) In that paper an attempt was made to connect the mechanical tests of Muntz metal with the heat treatment it had undergone and the corresponding microstructure. As the proportions of α and β in any bar depend partly on the time and temperature of annealing, but more especially on the rate of cooling, it is necessary that this rate be clearly defined, if the results are to be of general application and reproducible. The conditions of cooling were so arranged that a fall of about 60° C. took place in 15 minutes in the case of annealings at 550° C. and downwards, and about 75° C. in the case of annealings above 600° C.

Impact tests.—The further work on impact tests with Izod's pendulum machine foreshadowed in our last paper

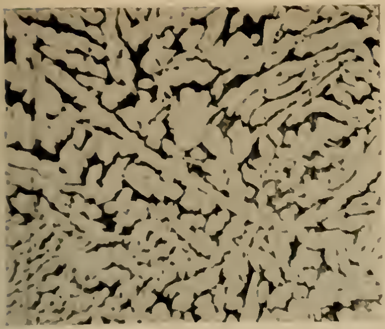


FIG. 4.—As rolled, Trans. Bar C. × 80.

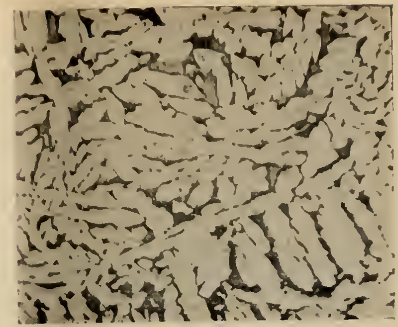


FIG. 5.—As rolled. Longl. Bar C. × 80.

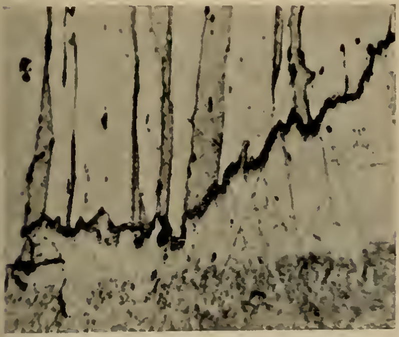


FIG. 6.—Tensile Fracture, Bar C_4. × 200.

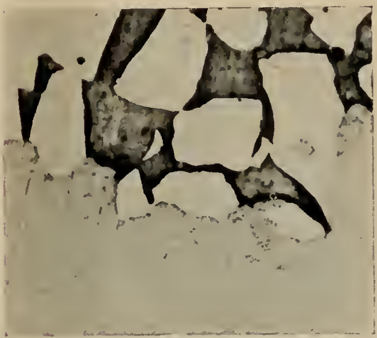


FIG. 7.—Impact Fracture, Bar E_6. × 200.

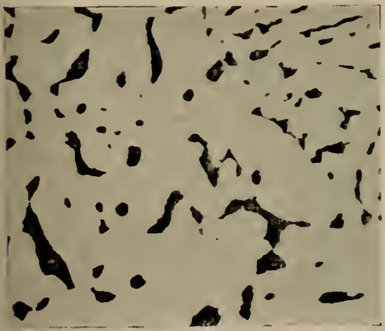


FIG. 8.—7 hrs. at 540°, Bar C_1 × 80.

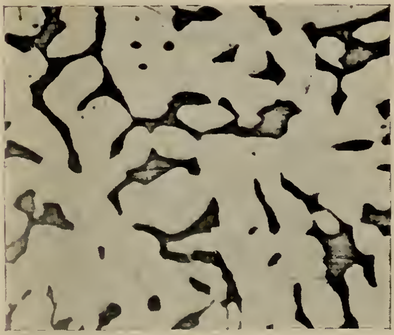


FIG 9.—7 hrs. at 640°, Bar C_2. × 80.

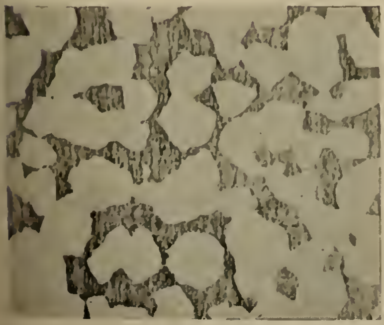


FIG. 10.—7 hrs. at 576°, Bar E_3. × 190.

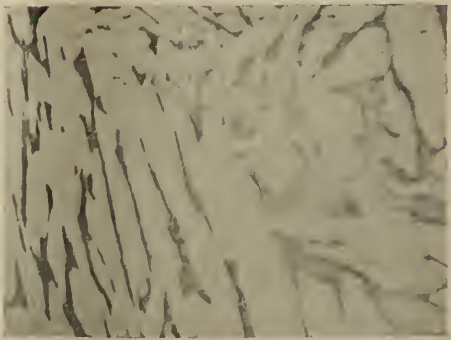


FIG. 11.—Bar C_4, 7 hrs. at 840° C. × 30

Mechanical Tests of the Bars photographed are given in Table I. All are slowly cooled. Illumination vertical.

has been carried out, and the results are given in Tables I. and II. From those given in the column headed V-notch, it will be seen that in several cases there is a discrepancy between pairs of results. Also if the useful properties of an alloy are still considered to be defined by its behaviour in the tensile testing machine, the results given in the table clearly show that the impact test does not discriminate sufficiently sharply between good and inferior material. Bearing in mind, however, that the bar denoted by the letter, E, in the table was hard (*i.e.*, cold) rolled and the bar, C, was soft (*i.e.*, hot) rolled, the impact tests appear to follow the elongation in hard rolled bars, but the maximum stress in the case of soft rolled bars. Impact tests on our original bar (A) are published separately in Table II. We do not consider that too much reliance should be placed on them, as the test pieces were cut from the ends of tensile test pieces after treatment in the testing machine; the straining due to the pressure exerted by the grips may very probably affect the mechanical properties. Impact pieces for bars E and C were cut from the alloy as rolled, and annealed with the tensile test bars. It was thought that U-notched or unnotched bars might give more reliable results than V-notched bars. The experiments, however, did not bear out this idea.

Summing up this portion of our work, we may say that we are of opinion that the Izod impact test is not sufficiently discriminating to give really useful results on this alloy.

TABLE I.

Bar No.	Annealing temperature (7 hours).	Yield Point.	Maximum Stress tons per sq. in.	Elongation, per cent. on 2 in.	Contraction, per cent.	Impact tests. ft. lbs. V notch.	Impact tests. ft. lbs. U notch.	Impact tests. ft. lbs. un-notched.	Percentage of α	Tensile Fracture.	Appearance of test piece after tensile test.
C_0	[as rolled]	—	27·5	47·0	56·4	8·1 7·1 8·3	10·4 10·2	10·6		Silky, cup.	Smooth.
C_1	540° C.	—	23·5	52·5	60·7	7·6 7·95 7·8	7·0 8·3 8·1 6·9		89·0	Sloping.	Smooth, longitudinal furrows.
C_3	540° C.	5·6—7·0	21·2	65·0	58·9	6·2 6·8 6·8	9·1 8·3	11·1 11·4	89·2	Rough, irregular cup.	Roughened.
C_2	640° C.	—	20·9	55·0	56·8	6·8 8·0 6·4	8·4 7·9 8·4	9·9 9·9	82·0	Irregular cup.	Cracked.
C_4	840° C.	5·7—7·2	19·95	72·0	70·8	6·9 6·0 6·2	7·9 9·2 9·1		79·1		Cracked.
E_0	[as rolled]	16·1	29·81	37·0	58·1	4·6 5·7				Cup.	Smooth, somewhat furrowed longitudinally.
E_7	450° C.	14·6 [indefinite]	26·5	48						Cup.	
E_3	575° C.	7·7—9·2	25·7	60·5	61·5	7·9 7·3	9·9 9·7		67·0	Cup.	Smooth furrowed.
E_2	605° C.	7·1—8·1	24·8	57·3	64·5	6·4 6·4	11·2 10·4		67·5	Fairly regular cup.	Furrowed.
E_6	680° C.	7·9	23·6	53·3		4·4 6·4				Irregular.	Cracked.
E_1	695° C.	7·6—10·6	24·1	55·0	56·1	6·7 6·0	10·9 10·9		63·0	Irregular.	Cracked.
E_4	810° C.	9·0 [indefinite]	23·3	50·5		6·2 6·4			67·1	Rough, irregular	Very coarsely furrowed distorted and cracked.
E_5	810° C.	8·0	22·4	53·5		6·4 6·8				Sloping.	Ditto.
B	[as rolled.]	10·5 10·6	28·5 28·3	46 47·5	59·6 60·8	5·5 5·75	9·2 8·35				

TABLE II.

Bar No.	Time and temp. of annealing.	Max. strength tons per sq. in.	Elongation, per cent. on 2 in.	Contraction, per cent.	Impact test ft. lbs. V notch.
	[as rolled.]	30·2	37·7	57·9	4·8 ; 5·25
A_{17}	½ hour, 475° C.	28·0	44·4	53·0	6·55
A_8	½ hour, 725° C.	26·5	54·9	52·0	4·25 ; 6·2
A_{27}	4 hours, 410° C.	26·7	49·7	49·0	5·55
A_8	4 hours, 725° C.	25·8	56·6	52·0	7·8 ; 7·65
A_3	4 hours, 750° C.	24·1	46·2	48·4	9·8 ; 8·8
A_4	4 hours, 810° C.	24·1	55·7	47·8	9·2
A_{15}	7 hours, 410° C.	27·4	48·0	55·0	7·15 ; 5·9
A_{24}	7 hours, 465° C.	24·3	48·0	50·3	8·9
A_{14}	7 hours, 570° C.	23·8	52·5	52·0	7·65
A_{33}	7 hours, 795° C.	23·4	44·0	42·5	5·6
A_{20}	2 days, 450° C.	24·8	45·7	53·0	6·0 ; 6·95
A_{18}	7 days, 335° C.	27·4	45·1	53·0	5·7 ; 6·4
	Cast.				4·45 ; 4·25

Yield Point.—In Table I. the yield points of several bars are given. It will be noticed that the yield point is considerably raised by cold rolling, but in most cases no very definite yield point was observed. Similar phenomena have been noted in the case of other copper alloys, particularly certain copper-aluminium alloys with over 9 per cent. of aluminium (2), and copper-tin alloys rich in copper (3).

Some misapprehension appears to have arisen as to the reasons for adopting a 7-hours annealing for the bars. Under our laboratory conditions, it will be seen, by reference to Fig. 1, that the effect of a short time of annealing, say half an hour, might be masked by the slowness with which the bar took up its temperature. Thus the heating from C to D will have almost as great an effect as the actual annealing which took place over the interval D to E, and in order to obtain half-an-hour's annealing at a temperature D, the bar has been heated for one hour and a half over a temperature interval B to E. This, of course, is a somewhat indefinite heat-treatment. With a seven-hour annealing this indefiniteness is relatively of little importance.

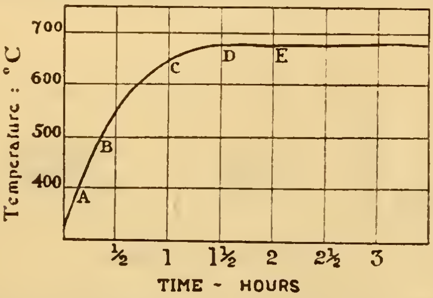
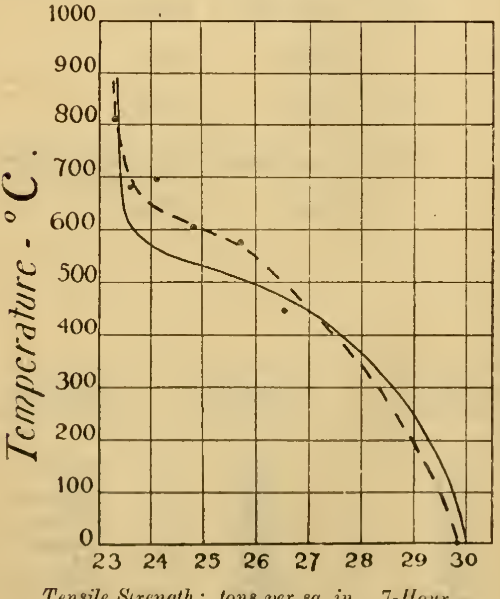


Fig. I.

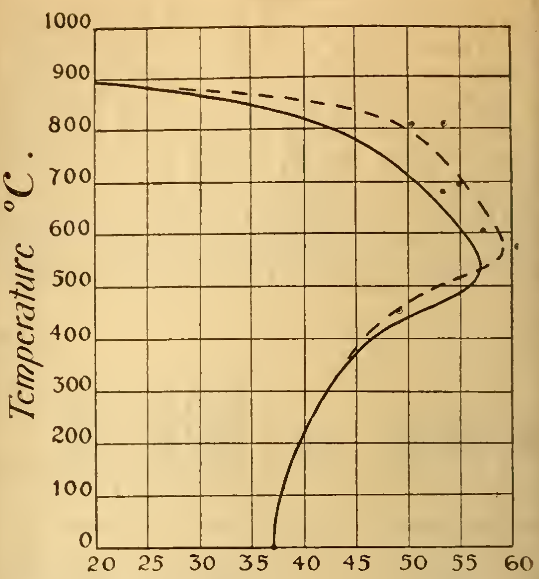
Quantitatively, therefore, the mechanical tests given by us are not directly applicable to works practice, in which the metal does not remain in the annealing furnaces for more than half an hour. The curves representing works annealings (reheatings) will, however, be of the same general shape as ours, but the flexures will be smoothed and raised on the temperature scale (*c.f.* half hour annealings). With the *type* of curve thus fixed it will only be necessary for any worker to make two or three determinations of the mechanical properties of his alloy in order to construct a curve which shall represent quantitatively the effect of annealing at any given temperature. In order to verify the general applicability of the curves already referred to, we obtained a ¾″ round bar (denoted by the letter E) of hard (or cold) rolled yellow metal of Elliott's Metal Co., Selly Oak, Birmingham. The analysis of this alloy closely resembles that of our original bar, and is as follows :—Copper, 60·00 per cent. ; lead, 0·38 per cent. ; iron, 0·17 per cent. ; tin, *nil* ; zinc (by difference), 39·43 per cent. The mechanical tests are given in Table I., and are plotted on curves shown in Figs. 2 and 3.



Tensile Strength: tons per sq. in. 7-Hour Annealings. Bars s.c.

Fig. 2.

Continuous curve : Bar A.
Broken curve : Bar E.
Tests of Bar E only are plotted.



Elongation : per cent. on 2-in. 7-Hour Annealings. Bars s.c.

Fig. 3.

Continuous curve : Bar A.
Broken curve : Bar E.
Tests of Bar E only are plotted.

A third bar (denoted by C), which had not been hard rolled, was obtained and gave tests which are also shown in Table I. The maximum stress of this bar in the rolled state is some 2·5 tons less than that of the hard rolled material, while the elongation is raised from 37 to 47 per cent. No difference can be detected between the longitudinal and transverse sections (Figs. 4 and 5), as no cold work had been put upon the bar. Some of the remarkable results given by this bar are referred to later. On analysis this bar gave :—Copper, 60·30 per cent. ; lead, 0·15 per cent. ; tin, *trace* ; zinc (by difference), 39·55 per cent.

A further attempt was made to determine directly the mechanical properties of β. A bar of pure β was prepared and forged hot and cold. It was comparatively malleable from a red heat down to an almost black heat, but was hard and cracked readily when cold. It will be seen, however, from Fig. 6 that the β appears to be drawn out considerably without showing cracks. Hence under stresses slowly applied, and when embedded in a matrix of α it appears to exhibit some ductility. Another "fracture photograph" which is of interest in this connection is shown in Fig. 7. This confirms our former observation that an impact fracture goes largely through α.

In our previous paper we were inclined to attribute the variation in mechanical properties of the bars partly to the variation in relative proportions of α and β and partly to the type and coarseness of the crystalline structure. Certain observations led us to suspect that the first cause was of less importance than we had originally believed, and it became necessary to clear this matter up. The most promising line of attack appeared to be to determine as accurately as possible the relative proportions of α and β and compare them with the mechanical tests. These determinations were carried out by a method described elsewhere by one of us (⁴). The results are given in Table I., and are remarkable. It will be seen that the proportion of α in all the E bars is nearly constant at about 67 per cent., *i.e.*, the ratio :—Percentage of α : percentage of β = 67 : 33 = 2 (nearly) is constant for all annealing temperatures above about 550° C., and this value is evidently determined by the rate of cooling of the alloy in the furnace, and is but little affected by the time and temperature of annealing. These merely influence the type and coarseness of the crystalline structure. These facts are of fundamental importance, and it becomes necessary to seek an explanation of the curves of mechanical properties along these lines.

We may distinguish four types of structure for slowly cooled bars, and to these we have given the following names :—1. The rolled type (⁵). 2. The island type (see Fig. 8). 3. The network type (⁵). 4. The cast type (⁵). The following table gives the typical mechanical properties and the approximate temperature limits which correspond to these types. This classification is not rigid, and the four types merge gradually one into another ; also in any one type the mechanical properties vary with the coarseness of the structure.

Table III.

Type.	Approximate temperature limits for annealed alloy.	Maximum stress tons per sq. in.	Elongation per cent. on 2 in.	Illustrated in Fig. Nos.
Rolled	0—500° C.	31—27·5	Hard rolled 37—50 Soft ,, 47—65	2 to 8 *loc. cit.*
Island	500—575° C.	Hard rolled 26—24 Soft ,, 26—21	Hard rolled 52—60 Soft ,, 55—65	Fig. 8 this paper.
Network	575—790° C.	Hard rolled 23·5—22·5 Soft ,, ?	Hard rolled 50—57 Soft ,, 65—72	10, 11, 13, 17A *loc. cit.*
Cast	790—895° C.	Hard rolled 23·5—22·5 Soft ,, 21—20	Hard rolled 17—44 Soft ,, ?—72	3, 18, *loc. cit.*

It should be noticed that, for ordinary hard-rolled metal, the rolled type is the type of greatest strength ; the island type is the type of greatest ductility ; the network type is the type of both moderate strength and ductility ; and the cast type is the type of least strength.

Comparison of bars A and E.—The curves of our original bar, now denoted by the letter A, were given in our former paper. The curves for E are now given in Figs. 2 and 3. Bearing in mind that the bars were prepared by different makers by their usual processes, the curves for their mechanical properties are very similar, and may be considered typical. It will be noticed that E keeps its strength rather better at the higher annealing temperatures, at the same time giving better elongations. It does not seem probable that its advantage can be explained on the ground that it has had more work put on it ; it is possible that the explanation must be sought in the initial process of manufacture.

Comparison of hard rolled and soft rolled bars.—Bars E and A were both hard rolled. [Details of the manufacture of A have already been published.] Bar C was an inch square bar, and was not hard rolled, as may be seen by a comparison between the transverse and longitudinal sections as seen under the microscope. A well-marked difference between such sections is exhibited in the case of hard rolled alloys. In the case of bar C, no such difference is observable, as will be seen by reference to Figs 4 and 5. The reason for this appears to be that rolling was stopped at such a high temperature and while the metal was in a soft and plastic state that any crystalline distortion that took place was removed by subsequent recrystallisation.

In view of the difference in mechanical properties between E and C, even after drastic annealing at high temperatures, we were at first inclined to consider whether cold work has any permanent influence on a bar, which influence may persist even after complete recrystallisation. At first sight this did not seem very probable, and we had not sufficient experimental data to enable us to form a definite opinion. Yet the extraordinary mechanical properties of the several samples of the bar C annealed at different temperatures, when compared with those of the hard rolled bars, seemed to point to this conclusion. Tests on C_4 after annealing at 840° C. for seven hours gave the remarkable elongation of 72 per cent. and a maximum stress of 20 tons per sq. in. In fact, its properties resemble those of a high grade annealed 70—30 yellow brass. C_1 and C_3 after annealing for 7 hours at 540° C. gave elongations of 55 and 65 per cent. respectively, with maximum stresses of 21 tons and 22 tons per sq. in., consequently it appeared possible that a bar that has once been stressed cold very severely could only be given its greatest possible ductility, viz., about 70 per cent., by a very prolonged and drastic annealing, much more than 7 hours at 810° C. Also, it is possible that the pressure applied during rolling might retard the $\beta \rightarrow \alpha$ change, and thus give in the cold bar a large percentage of B.

The measurement of the relative proportions of the two constituents, however, has suggested an alternative explanation. It can be seen in Table I. that the proportion of α in the annealed portions of bar C varies from 79 to 89 per cent. It is considerably greater than in the bars of series E. This in itself would lead us to expect a higher ductility and lower strength. In addition it may be noticed from Figs. 8 to 10 that the island type of structure, so characteristic of high ductility, is preserved at higher temperatures in the case of the C bars, and this may very well heighten the effect.

The cause of the increased proportion of α in bar C may perhaps be sought in the fact that the bar was of larger section—one inch square as against three-quarter inch round. This would cause the bar to cool more slowly, since the furnace treatment was precisely similar and the specific heat of quartz-sand (which was used to imbed the bars) is about 0·19 as against about 0.09 for brass. Owing to the slower cooling, a larger proportion of β will change to α, or in other words a closer approximation to equilibrium will be obtained. We have not, however, satisfied ourselves that this explanation is to be adopted to the entire exclusion of that previously suggested. The practical point to be noticed is that the final rate of cooling of the bars is all-important, and should be varied with the section of the bar, if precisely defined mechanical properties are desired.

In conclusion we offer as a summary of our work on Muntz Metal the results given in Table III.; fuller details may be obtained by a study of the various curves.

Also, we would point out that Muntz metal as it comes on to the market, is in a metastable state, and though at ordinary temperatures the reaction velocity is infinitely slow, elevation of temperature will considerably increase that velocity, and the rate of crystalline growth. In order to put the metal on the market in its best possible physical condition particular attention should be paid to its final rate of cooling.

The authors are indebted to Prof. S. M. Dixon for placing at their disposal the testing machines in the Testing Laboratory of Birmingham University. The

tensile tests were made by Mr. F. H. Hummel, M.Sc., and the authors desire to record their appreciation of the interest he so kindly took in this matter.

Discussion.

Mr. **Heathcote** said with regard to the impact test on brass, he had often found the same variation experienced by the authors. In consequence it had been necessary to make always four and often six tests of each sample of the brass.

Mr. W. F. **Reid** stated that a great number of tests on somewhat similar lines had been carried out at the National Physical Laboratory. The Society of Chemical Industry had taken a prominent part in initiating those tests. They investigated alloys in a number of ways. They had the "fatigue" test; then they subjected the alloys to vibration tests in powerful machinery. Now they had a very interesting apparatus, made by Zeiss, by which the surface of metals might be photographed by means of ultraviolet rays. All the rays visible to our eyes are cut off by this process. He believed that some very interesting information was being obtained in this way.

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(1) This J., 1908, 43. In the second paragraph of that section of the paper headed "Microscopic Examination" (p. 52) the sentence, "It will be seen that by preference the fracture goes through the β" should conclude with the letter a instead of β. Also in the next paragraph "The large light areas are a, the black β . . ." should read "The large light areas are β, the black a . . . .", and in the concluding sentence of the same paragraph the term a should be substituted for β.

(2) Carpenter and Edwards, VIIIth Report to the Alloys Research Committee; J. Inst. Mech. Eng., Jan., 1907.

(3) Shepherd and Upton. J. of Phys. Chem., 9, 474.

(4) G. D. Bengough. Proc. Chem. Soc., 1908, 24, 145.

(5) Illustrated in previous paper. This J., 1908, 43.

THE MEASUREMENT OF THE VELOCITY OF WATER THROUGH FILTER MEDIA.

BY WILLIAM CLIFFORD, A.M.I.C.E.

The methods for the measurement of the velocity of water through filter media, to be described, apart from their value to engineers, have a particular significance to chemists, as promising a new line of attack for problems in chemical dynamics.

During recent years a considerable amount of work has been done in determining the "velocity" of chemical changes. The velocity of a chemical change is the amount of substance transformed in unit of time divided by the number of units of time occupied in transformation.(1) The usual method of measuring the velocity is to determine the concentration or the amount of substance involved in the process at different intervals of time, during the progress of the chemical change. A velocity curve is then obtained by plotting the amount of the substance in the system against the time. The slope of the curve at any point represents the velocity of the reaction at that moment. But when a chemical change or transformation is effected by means of a catalytic body or by micro-organisms, the position of which is more or less fixed, another method of measurement becomes possible. The substance to be transformed may be passed continuously over the transforming agent, in which case, the time of contact is the time of transformation, and if the flow be regulated so that the amount of substance transformed in unit time be constant, the necessary and sufficient conditions are present for the determination of the "velocity of reaction," or the rate of transformation. For example, if a dilute solution of sugar could be passed continuously over or through yeast in such a way that the liquid flowing away contained a constant amount of alcohol, the velocity of the transformation could be readily ascertained if the time of passage of the liquid through the yeast could be determined.

The purification of sewage by filtration through the so-called trickling filters or percolation beds is a practical illustration of the method, whereby chemical changes are effected by passing the substance or substances to be transformed, continuously over the transforming agent. The liquid while passing through the filter remains in contact with the medium a certain time, during which the organic matter content of the liquid is greatly diminished. Oxidation takes place, and a liquid eventually flows away almost free from organic matter, and no longer of a noxious character. Now if the flow of the liquid could be so regulated that the amount of organic matter brought into the bed just balanced that lost by oxidation, the time of passage of the liquid through the bed would, with certain precautions, measure the rate of oxidation. There are many difficulties in the way of a complete solution of this problem. Many changes other than oxidation take place and organic matters are often carried out of the bed in suspension. As a first step towards overcoming these difficulties, it was necessary to measure the time occupied by a liquid in passing through the bed.

The velocity of a stream is admittedly exceedingly difficult to measure for the reason that it is constantly changing. Prof. Bovey says: (2) "The velocity of flow varies so much from point to point that it seems almost hopeless to expect that the complicated law of velocity distribution can be expressed in a general formula." Prof. Unwin says: (3) "The ordinary formulæ for the flow of liquid rest on the hypothesis that the variation of the velocity may be neglected and that all the filaments may be treated as having a common velocity equal to the mean velocity. . . . This theory is obviously based on an imperfect hypothesis." (4) "One of the most important conclusions of modern experiments," says Captain Cunningham, "is that the motion of water even when tranquil to the eye is extremely unsteady, so that there is no definite velocity at any point, but the velocity varies everywhere largely from instant to instant." D. F. Henry found that (5) "All water in motion has an intermittent velocity increasing and decreasing according to some undiscovered law."

The motions of fluids are studied in two different ways. In the first, the principles of energy are applied to the whole mass of fluid under consideration, or to portions which, though small, are yet of visible magnitude. (6) "No attempt, however, is made to conceive, much less determine, the movements of the smallest particles of which the fluid may be imagined to be made up." On the other hand, the motions of fluid are determined by mathematical analysis directly from the laws of motion without reference to experience. It completely determines the motion of all the particles of the (ideal) fluid, and not merely that of the fluid as a whole.

(7) The methods for measuring velocity of water may be divided into two general classes—the direct and indirect. The direct methods include all ways of ascertaining the velocity of water, from bodies floating in it, such as surface floats, float rods, double floats, &c. The indirect methods include measurements with the current meter, pressure tubes, pressure plates, &c., by which the velocity of the water is inferred from its impact or its pressure. It will be seen that the so-called direct methods are really indirect, all that is measured being the velocity of a floating body, from which is inferred the velocity of the water.

In what follows an attempt is made not only to conceive, but to determine the forward movement (*i.e.*, the resolved part of the actual velocity parallel to the current axis) of the smallest particles of which a liquid may be imagined to be made up. It may be useful at the outset to state the usual meanings attached to the word "flow" as applied to liquids. Qualitatively, it indicates merely change of position; quantitatively, the change of position of a *volume* of liquid in a certain time. The word is used in both senses in works on hydrology. There is, however, another meaning, which will be referred to as the velocity-flow, as distinct from volume-flow. By velocity-flow is meant the distance between two given cross-sections of the stream divided by the time occupied by one or more particles of a liquid, in passing from one section to another.

When a solid body changes position, the time taken to travel from one position to another is in general easily determined, but with a liquid the case is different, the particles are constantly changing position relative to one another, so that "change of position" may either refer to the change of position of a particle or to the change of position of the centre of gravity of a number of particles. For obvious reasons the change of position of a particle of liquid need not be considered, but the change of position of the centre of gravity of a number of particles is a question to which an answer may be given. The idea or concept of the change of position of the centre of gravity of a number of particles is often utilised in mechanics, but the application in this connection is perhaps somewhat new.

Consider water to be flowing steadily through a tank or trough, and suppose the particles or molecules in a section at any given instant to be recognisable (Fig. 1).

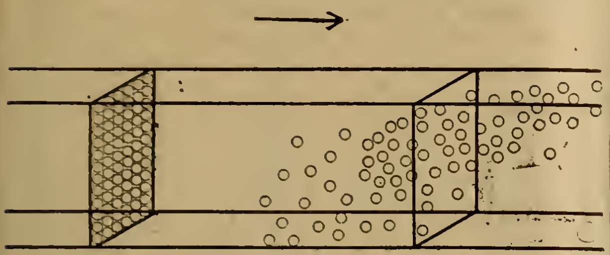


Fig. 1.

Diagram illustrating change of position of molecules.

These particles or molecules have a common centre of gravity, that is, there is one point in space about which the molecules are in equilibrium at that instant. Since the liquid is flowing through the tank, all the recognisable molecules must pass through every section between the one above mentioned and the outlet. After a time the centre of gravity of the particular molecules will be in a section at some distance from the first one, and if the number of these molecules passing through the second section be plotted against the time of passage between the sections, some such curve as that shown in Fig. 2, Curve 1, would be obtained, and the position of the "centroid vertical" (8) would indicate the time when the centre of gravity of the recognisable molecules was in the second section.

A method based upon the above considerations was described by the Author in a recent paper read before the Manchester Section of this Society (this J., 1907, 739). Briefly stated, the method consists in the distribution of a solution of common salt over the medium without interrupting the flow of liquid through the medium. Samples of the effluent are taken at regular intervals, and the amount of chlorine determined. The latter gives the *relative* numbers of molecules of the salt solution in the effluent from time to time, from which data the average time of passage of the whole of the salt solution can be calculated by the centre of gravity theorem.

Another method for obtaining the same result is described in the Massachusetts State Board of Health Report for 1904. It consists in the addition of a solution of common salt (at the ordinary working rate of the bed) until the chlorine in the effluent is constant or nearly so. The time occupied in the process is taken as the time of passage of the liquid through the medium. On comparing the times of passage through the media given in the report above referred to with those obtained by the author, the former were found to be invariably longer than the latter. Further, the interpretation of the Lawrence method did not seem to agree with the conception of the flow of liquids above stated. It was, therefore, decided to make comparative experiments.

For the purpose of comparing the two methods above mentioned, clean sand was chosen, as it could be easily washed free from chloride, and, further, since it held a considerable amount of water, a smaller quantity of the medium was needed than if a larger graded medium had been selected. The sand was dried, and screened through a ½-inch (3 mm.) riddle to remove pebbles, then passed over a 1-25 inch (1.0 mm.) riddle to remove the finer particles and dust. The sand which remained on the finer riddle was used. The vessel to hold the sand consisted of a half Winchester bottle with the bottom cut off, inverted, and a piece of wire gauze placed in the neck. The area of the filter was 7·67 sq. in., the depth 8 inches. The sand was run into the vessel, shaken, washed with tap water, and then with distilled water, until no further trace of chloride could be detected.

The first experiment was made on the lines described by the author, namely :—Distilled water was applied to the surface of the filter by means of a pipette in doses of 25 c.c. every four minutes ; this is equivalent to a dose of 0·92 gallon per sq. yard every four minutes, or an average rate of 334 gallons per sq. yard per day. Several doses (five or six) were added until a steady condition of "flow" was established ; then one dose of a chloride solution was applied, followed at regular intervals by distilled water. The effluent discharged in the four minutes following the application of the chloride solution was collected and numbered as if it had all been collected in the fourth minute ; this was a matter of convenience in recording results. The whole of the effluent during the experiment was thus collected into four-minute average samples. This method of sampling was adopted throughout so that the results are comparable without adjustment. The average times found by calculation are, however, 1·5 minutes longer than if the end of the second minute had been taken as the time of sampling. The application of distilled water was continued until no further trace of chlorine appeared in the effluent.

The second experiment followed the lines of the Lawrence method. This was to ascertain how long the application of a chloride solution, at the same rate as in the previous experiment, should be continued before the chlorine in the effluent became constant and equal to that of the applied liquid. The chloride solution contained 118 parts of chlorine per 100,000. The effluent was sampled as before. After the chlorine in the effluent had become constant a third experiment was begun ; this was to ascertain how long the application of distilled water should be continued before all trace of the chloride disappeared. The rate of application and the method of sampling was similar to that of the other two experiments.

The above experiments were repeated, the order only being slightly varied. The results of the two series are given in the following table.

Table I.—*Showing the combined chlorine in samples of effluent.*

Sample.	1st Series.			2nd Series.		
	One dose of chloride solution.	Chloride solution dis-placing distilled water.	Distilled water dis-placing chloride solution.	One dose of chloride solution.	Chloride solution dis-placing distilled water.	Distilled water dis-placing chloride solution.
Minute.						
4th...	0	0	118·0	0	0	118·0
8th...	0	0	118·0	0	0	118·0
12th..	0	0	118·0	0	0	118·0
16th..	2·0	0	118·0	0·75	0·5	117·5
20th..	18·5	5·5	112·5	14·5	5·3	113·5
24th..	43·5	21·5	96·5	40·0	21·5	101·0
28th..	57·5	42·5	75·5	59·5	44·5	75·0
32nd .	52·0	66·0	52·0	57·2	68·5	52·2
36th..	38·0	84·0	34·0	40·5	85·0	32·0
40th..	26·0	93·0	25·0	27·5	95·5	20·0
44th..	17·0	101·0	17·0	18·5	104·0	12·0
48th..	11·0	107·0	11·0	11·2	109·0	8·5
52nd .	7·5	110·0	8·0	8·0	112·0	5·5
56th..	5·5	114·0	4·0	5·2	114·0	3·5
60th..	3·0	115·0	3·0	3·5	115·0	2·0
64th..	2·0	116·0	2·0	2·25	116·2	1·7
68th..	1·5	117·5	0·5	1·7	117·7	1 5
72nd	1·0	118·0	0	1·2	118·0	1·2
76th..	0·8	118·0	0	0·8	118·0	1·0
80th..	0·6	118·0	0	0·7	118·0	0·7
84th..	trace	118·0	0	0·5	118·0	0·5

The chlorine time curves, numbered I., II. and III., were plotted from the data yielded by the repeat experiments. Curve I. is derived from what may be called the one-dose-chloride method, which is based on the fundamental conception of the motion of the centre of gravity of a number of particles. The time of flow or passage of the water works out to 33·7 minutes and 30·4 minutes, respectively, for the two similar experiments. Curves II. and III. are derived from the Lawrence or displacement method. In the one case, the chloride solutio

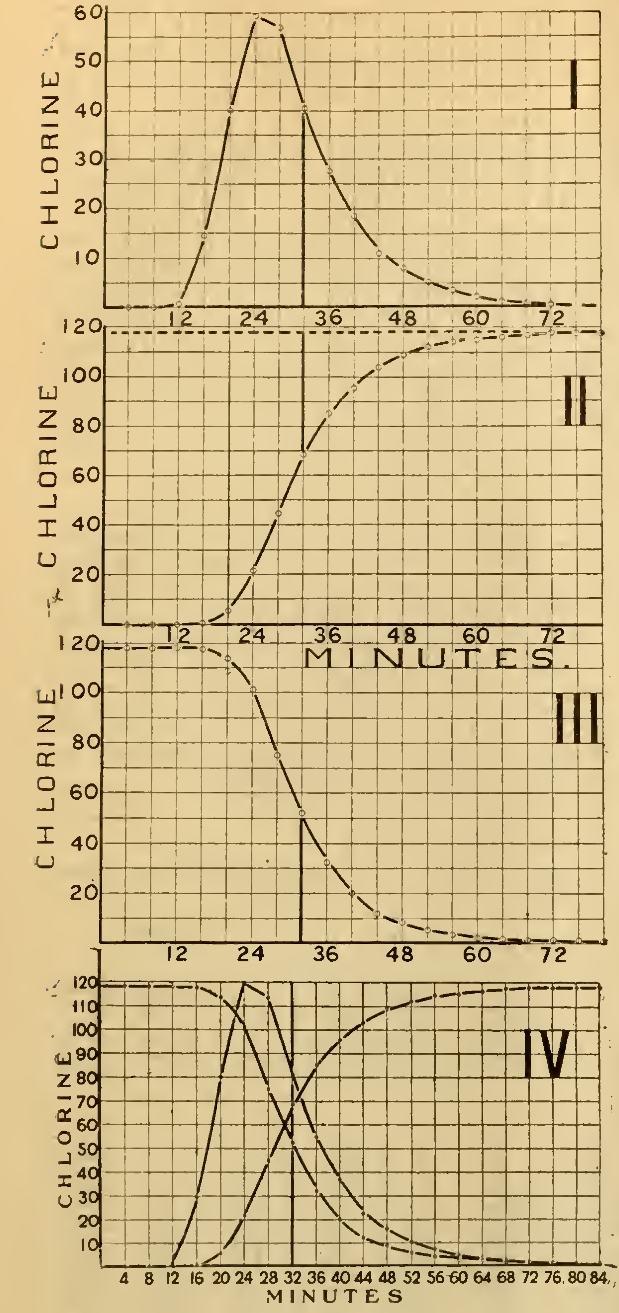
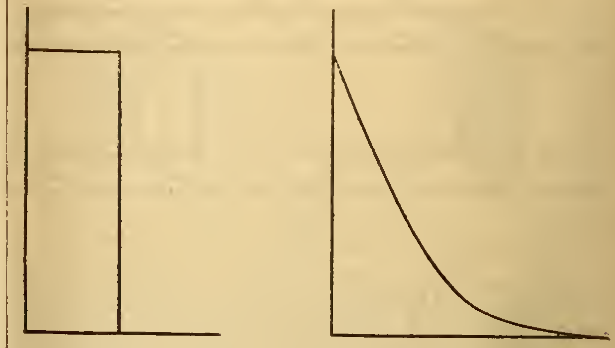


Fig. 2.

displaced distilled water, and in the other distilled water displaced the chloride solution. The time of passage or flow, as previously mentioned, is stated to be that required for the chloride to become constant (curve II.); both curves give the time as 72 minutes, from the start of the experiment, or 52 minutes from the first noticeable variation in the effluent.

It will be interesting to inquire what takes place during experiments such as represented by curves II. and III. In both cases, as above stated, a liquid is displaced from the medium. Now, distilled water is not a measurable substance in the sense used in this paper, but its displacement is measured indirectly by the chlorine in the effluent. Hence, in interpreting curve II. the portion above the curve represents the displacement of the distilled water by the salt solution. On the other hand, when the salt solution is being displaced, the chlorine in the effluent measures the displacement directly, and the lower side of the curve, therefore, represents the displacement (curve III.).

Now, consider two ideal cases of displacement, first, suppose the distilled water not to mix with the salt solution (3rd expt.), but to move bodily through the medium, the positions of the molecules relative to one another being more or less fixed, in this case the chlorine in the effluent would remain constant until the whole of the chloride had been displaced, when the chlorine would suddenly disappear from the effluent, (*i.e.*, there would be a vertical drop in the chlorine curve, as represented in diagrammatic curve V. and the time of passage of the chlorine molecules in the section immediately below the distilled water would be the time from the first addition of distilled water until the disappearance of chlorine from the effluent. Second, suppose the distilled water to mix with the whole of the chloride content of the medium from the beginning; in this case the chlorine in the effluent would decrease from the start, at first rapidly, and then more slowly, in some such way as represented in diagrammatic curve VI. The average time of the passage of all the chlorine molecules in this case would be that corresponding to the position of the centroid vertical of the curve. An examination of curve III. shows that both displacement and mixing have taken place, that, in fact, the curve is made up, with a slight modification of curves V. and VI. Obviously that portion represented by the constant chlorine, is one of displacement, *i.e.*, forward movement through the medium, and we have then only to consider that portion of the curve which is variable, and as has been shown, the centroid vertical gives the average time of this portion. On adding the average time found for the varying portion of the curve to the time during which the chlorine is constant, the sum of the two gives the whole time of displacement, that is, the average time of passage of the whole of the liquid through the medium.



Diagrammatic Curve V.

Diagrammatic Curve VI.

Fig. 3.

Calculated in this way the four sets of data give the time of passage as 32·0, 31·9, 31·7 and 31·9 minutes, respectively. The agreement with the results of the one dose chloride method is apparent. There is, however, further evidence to support the above interpretation of the Lawrence method. The author has elsewhere shown (9) that the time of passage of water through a *medium* is directly proportional to the amount of water in motion in the medium. Now the data from the "displacement" method is sufficient to calculate the amount of liquid held by the sand, or at least that portion taking part in the flow or displacement. The water content, calculated for the four similar experiments, is 188·7 c.c., 191·4 c.c., 191·8 c.c., and 195·5 c.c., respectively mean value, 191·8 c.c. The displacement of this volume at the rate of 25 c.c. every four minutes would take 31·6 minutes, which agrees fairly closely with the results given above. Summing up these results, the time of flow of water through 8 inches of sand, when applied to the surface at the rate of 334 gallons per sq. yard per day, is found to be :—

32·0 minutes :—mean of two determinations by the one dose method.

31·9 minutes :—mean of four determinations by the Lawrence or "displacement" method.

31·6 minutes :—by calculation from the water content data.

Although there is reason to believe that the molecules of different substances have different velocities when in solution, yet it is highly probable that the average forward movement of the molecules of a solute does not differ appreciably from that of the molecules of the solvent.

The method of calculating the amount of salt recovered in the effluents of the one dose chloride method, and the water content from the chlorine in the effluents of the other experiments may perhaps be of interest. If two solutions, each containing a substance in known quantities, be mixed in any proportion, and the amount of the substance in the mixture be determined, the volume of the two liquids mixed can be found.

Let V_i be the volume of a liquid ; C_i, the concentration of substance in solution ; and V_i, be another volume of the same liquid, and C_{ii}, the concentration of the substance of the other liquid.

Then if V_m be the volume of the mixture, and C_m the concentration of the substance in the mixture, we have

$$V_mC_m = V_iC_i + V_{ii}C_{ii} \quad \dots\dots \quad (1)$$

and, assuming the liquids undergo no change of volume on mixing,

$$V_m = V_i + V_{ii}$$

$$(i.e.) \quad V_m - V_i = V_{ii} \quad \dots\dots \quad (2)$$

putting $V_m - V_i$ for V_{ii} in (1)
we have $V_mC_m = V_iC_i + (V_m - V_i)C_{ii}$
or $V_m(C_m - C_{ii}) = V_i(C_i - C_{ii})$

$$(i.e.) \quad V_i = \frac{V_m(C_m - C_{ii})}{C_i - C_{ii}} \quad \dots\dots \quad (3)$$

And since V_m is known V_{ii} can be obtained by difference.

In the experiments described above distilled water was used, so that the concentration of the chlorine was *nil*, (*i.e.*, $C_{ii} = 0$).

The volume of salt solution in any volume of effluent was in the above case given by the equation—

$$V_i = \frac{V_mC_m}{C_i} \quad \dots\dots \quad (4)$$

DISCUSSION.

Mr. F. R. O'SHAUGHNESSY said the method brought forward by Mr. Clifford for the solution of this difficult and interesting problem was a very ingenious one. To those interested in questions dealing with sewage the matter was of considerable importance. The interest attaching to this particular method was in his (the speaker's) opinion largely academic ; for the problem was settled empirically in practice. As in many other practical problems, this was a matter of necessity, owing to the complications introduced by a number of unknown factors when considering the theoretical side of the question. The value of Mr. Clifford's investigation lay in the fact that it helped towards a clearer conception of what was really happening in the percolation bacteria bed. At present, owing to our ignorance on this head and the empirical methods of arriving at practical results, it was hardly surprising to find prominent sewage experts taking widely different views on details of construction of percolation bacteria beds. These differences in view very often meant large differences in the effluent obtained. It was perhaps still more important from the point of view of the man-in-the-street that these differences in opinion affected very appreciably the cost of sewage disposal. An investigation such as that undertaken by Mr. Clifford helped to introduce a greater degree of mathematical certitude into our views on the proper construction of these bacteria beds and in this sense was of considerable value.

Mr. Clifford had experimented with fine sand. If he had also investigated the corresponding phenomena with large-sized media, say ¼ in. to 1½ in. cubes, such as were used very largely in the construction of these beds, his results would have been still more valuable. For he ventured to think that the laws regulating the passage of water through fine sand were quite different from those governing the percolation of water over blocks of appreciable size. In this connection he might mention that Mr. L. F. Mountfort, an engineering colleague of his, and he himself (the speaker) had given this matter much consideration and investigation for some years. Mr. Mountfort had made an elaborate investigation, using direct mechanical methods, and so far as he could gather, the problem did not seem to be quite so simple as Mr. Clifford made it appear. The amount of work to be done was really very great, but he hoped that the results of this work would be brought forward at an early date. He wished to emphasise the value of Mr. Clifford's work, but at the same time to insist that this work by no means covered the whole ground.

Mr. CLIFFORD, in reply, said that the experiments were admittedly on a small scale, but as the main object was the comparison of two methods of measuring the time of percolation, it was hoped, and the results seemed to justify the conclusion, that the accuracy obtainable was sufficient for the purpose. The reason for the use of sand had been given ; comparative experiments were also made with gravel, but as these were not so complete as those with sand, they were omitted. The results, however, so far as they went, were similar to those obtained with sand. The relation of the time of percolation to the construction of bacteria beds has been discussed elsewhere, but it may be stated here that different media (coal, gravel, destructor clinker, etc.) have been investigated in sizes varying from ⅛ in. to 1¼ in. diameter. As was pointed out, the flow of liquid even in an open channel was exceedingly complex, but the flow becomes much more complex when the liquid passes over media as in percolating beds, and far from being a simple matter, the measurement was more difficult than was generally surmised. He was greatly interested to hear that Mr. O'Shaughnessy and his colleague were working at other methods to the same end, and trusted the Birmingham Section of this Society might have an early opportunity of hearing an account of that investigation.

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(1) Chemical Statics and Dynamics. Mellor. p. 5.

(2) Bovey's Hydraulics, p. 257. Second Edition.

(3) Vol. XII., Encyclopedia Brittanica. Art. Hydromechanics.

(4) Proc. Inst. Civil Eng., 71, 7.

(5) J. Franklin Inst., 62, 323.

(6) Cotteril's Mechanics.

(7) Accuracy of Stream Measurements. E. C. Murphy. U.S. Geol. Survey, paper No. 95.

(8) The "centroid vertical" is the vertical line through the centre of gravity of the area of the curve.

(9) Paper to be shortly published in the Proceeding of the Institution of Civil Engineers "On Percolation Beds." W. Clifford.

Canadian Section.

Meeting held at Montreal on Friday, February 28th, 1908.

MR. MILTON L. HERSEY IN THE CHAIR.

MEASUREMENT OF TEMPERATURE FOR INDUSTRIAL PURPOSES.

BY H. T. BARNES, D.SC., F.R.S.C., MACDONALD PROFESSOR OF PHYSICS, MCGILL UNIVERSITY, MONTREAL.

The first effort to record temperature for industrial purposes may be said to have been made by the famous potter, Wedgwood, in 1782. The instrument he devised, which depended on the permanent contraction of clay when subjected to a high temperature, remained the standard for nearly a century.

In 1882 the famous Sèvres pottery employed fusible clay to determine the temperature necessary for their work. This was perfected in 1886 by Seger, who constructed cones of clay of varying composition with fusing points ranging from 600° to 1800° C.

The substances which enter into the composition of these cones are essentially :—Pure quartz sand ; Norwegian felspar ; carbonate of lime ; Zettlitz kaolin, consisting of silica, alumina, oxide of iron, and water. In very fusible cones, oxide of iron, oxide of lead, carbonate of soda, and boric acid are added. The less fusible cones contain calcined alumina. These cones are extensively used to-day and are supplied by number. The less fusible extend from 1 to 38, this latter corresponding to about 1980° C. The more fusible are numbered from 01 to 022, the most fusible being at 590° C.

While these cones are useful for the attainment of any particular temperature in a furnace, they can be no guide in maintaining a steady temperature, and can be successfully used only in such cases where a furnace is carried to the desired point and then allowed to cool off. In ceramic industry they are generally used, and before firing up, a series of cones is introduced, so that the attainment of successive temperatures may be observed by the falling over of the tips of the various cones in order of fusibility.

Other forms of pyrometers, based on the expansion of a gas or on the heat imparted to water, have been devised with a certain degree of success. With the exception of the ordinary air thermometer, which is limited in range, all the commercial instruments are empirical in character. For lower temperatures the mercury in glass thermometers is useful, but whenever such instruments are used for the higher ranges up to 1000° F., they deteriorate rapidly and soon give inaccurate indications. The instruments most generally used for temperatures up to 2600° F., are based on the thermoelectric properties of the metals discovered by Seebeck in 1820, and applied by Becquerel for temperature work in 1830. Le Chatelier made an extended study of the thermoelectric pyrometer and showed that pure platinum, when combined with platinum alloyed with 10 per cent. of iridium or rhodium, could be used up to 2900° F.

These instruments consist of a pair of wires fused together at one end for insertion in the furnace and fastened to copper wires at the cool end. The connection is made to a galvanometer or millivoltmeter, and the temperature is indicated directly on the scale. The correctness of reading depends as much on the cold ends as on the hot end, and hence great care must be exercised to have the wires of the couple sufficiently long to be away from the influence of the furnace. In the case of the Le Chatelier couple this is an expensive matter. To obviate this and also the expense attached to a chance deterioration of the couple from contact with furnace gases or hot metals, Prof. Wm. H. Bristol offers a nickel-iron couple with a patent compensated cold end, which has the advantage of being self-contained, unbreakable, and cheap.

One disadvantage of the thermoelectric pyrometer is in the fact that the reading instrument must be calibrated for a certain length of connecting wires, which when altered change the indications. The instrument is its own battery, and is therefore simpler than many others.

Recording devices are available for the thermoelectric instruments. The galvanometer or millivoltmeter needle, bearing a point or pen, moves across a scale on which it is depressed at regular intervals of time, thus tracing a dotted curve.

The electrical resistance pyrometor is extensively used in England, and depends on the variation of the resistance of a pure metal—such as platinum—with temperature. As originally devised by Siemens with a fine platinum coil, the instrument was not successful, and it was not until Callendar took up the matter in 1887 that it was made practical, not only as an ultimate laboratory standard, but as a commercial instrument. It may be said to be at the present time the most useful instrument for all classes of temperature work. It is limited in its upper range, however, to about 2200° F., beyond which the platinum wire coil volatilises and permanently changes in resistance. The instrument is based on the well-known Wheatstone bridge principle, and requires an external battery. It is very nearly independent of battery voltage, however, and is affected only by currents large enough to heat the fine wire coil. By the introduction of compensating leads, which parallel the leads running from the fine platinum coil to the indicating galvanometer or bridge, and which are connected to the opposite arm of the bridge, the readings are independent of the distance between the fire end and the reading instrument.

The indications are obtained on deflecting galvanometers, or on wire bridges with direct reading scales. A recording device has been obtained by Callendar which is capable of great refinement. It is essentially an automatic Wheatstone bridge. A galvanometer with double contacts operates a right and left hand relay device connected with a differential gear operating the galvanometer contact on a bridge wire. The record is traced on a drum by a pen attached to the galvanometer contact. The relays move the contact always in such a direction as to restore the balance whenever this is upset by a change in the resistance of the platinum coil due to a change in temperature. Telephone indicating instruments have been devised to replace the galvanometer with much success.

Other forms of pyrometers have been devised, based on the ordinary gas thermometer, such as the older form of Bristol instrument. Instruments employing a stream of water flowing through a coil in the furnace have been devised in which the difference in temperature between inflow and outflow gives an indication of the temperature of the furnace. Such an instrument depends entirely on maintaining a perfectly steady flow.

The flow of air through an orifice in the furnace has been utilised, the change in the viscosity of air and size of the orifice giving the necessary variability of flow upon which the temperature indications are based. These instruments depend entirely on an empirical calibration.

In very high temperatures the only satisfactory instruments are the optical pyrometers. These are of two classes: those that depend on colour estimation, such as the Wanner, and those that depend on the measurement of the total radiation, such as the Féry pyrometer. These instruments are coming into very general use and extend in range from a low red heat up to the temperature of the sun itself, 6000° C. For the latter instrument, recording devices are available similar to those used in connection with the thermoelectric pyrometer. The laws of heat radiation are now well known and the instruments based on these are found to give exceedingly satisfactory and reliable indications.

In general it may be said that for very high temperatures, from 2200° F. upwards, the only reliable instrument is the optical pyrometer. For a commercial instrument reading from 2600° F. downwards to about 300° F. or 400° F., the thermoelectric pyrometer, such as the Bristol, is the most serviceable. For work below 500° F. down to the temperature of liquid air, no instrument can compare with the electrical resistance pyrometer. As a standard over the whole range of temperature up to 2200° F., the resistance pyrometer is undoubtedly the best. It is not too much to say that all industrial concerns should provide themselves with one of these to check the indications of other instruments from time to time.

Too much attention cannot be given to an accurate knowledge of temperature conditions in industrial work, since the success of so many processes depends to such a large extent on the attainment of steady heat.

Discussion.

Mr. C. R. **Hazen** said that in furnace work in 1898, he had occasion to use one or two pyrometers of a single and cheap type, which were good when obtained, but which, in the course of a very brief time, became unreliable. There were none that would stand rough wear or continued heating and cooling in the furnace, and continue to register correctly the higher degrees of temperature. How had later developments in the electric instrument succeeded in limiting such errors? Would they now work correctly on high temperatures constantly for twelve or eighteen months?

Dr. A. **Stansfield** said that he had used thermoelectric pyrometers with platinum or platinum-iridium rods, which would be good if they could do away with the rods, and use plain metals, which would stand the required temperatures. On account of the expense of platinum, they were obliged to use very small wires in place of rods, and these wires became worn. He had used the melting point as a calibration point, but the instrument was only of use for experimental work. It was very difficult to get suitable protection tubes. Possibly quartz tubes would do well for this. One disadvantage of the thermo-electric pyrometer was that the physical laws were not nearly so well known as in the resistance pyrometers, so that for temperatures up to 1000° C., the resistance pyrometer was preferable, and for temperatures from 1000 to 1500° C., the thermo-electric pyrometer. The thermo-electric pyrometer could be put in the space of a pea, but the resistance pyrometer could not be put into so small a space. For rough and ready purposes, pyrometers, such as the Bristol, were much cheaper than the platinum, and if they were burnt up in a few times, there was not much loss. They were good up to about 1000° C. For higher temperatures, the only pyrometers which were really satisfactory, were the optical pyrometers, described by the author.

Mr. H. H. **Vaughan** said his company had used one of Dr. Barnes' pyrometers on locomotives, and he believed it was the only one with which anything like accurate results could be obtained. The idea was to find out what was the difference in temperature of the exit gases which passed through the superheater tubes and those which passed through the ordinary tubes. By using the ordinary pyrometer telephone, they were able to get within about 20°; was it not a fact, in measuring temperature in a glowing piece of steel, that the correct temperature could be obtained by the optical pyrometer where any other kind would fail? The Wanner was first used, he believed, in a rail mill for trying to find the temperature of the rail passing through the rolls, and it seemed to give very good results. Pyrometers would also be of use in obtaining the temperature of the iron in the ladle; in order to determine the depth of chill, was the radiation pyrometer an absolute instrument, or would it measure the temperature at the end of the cupola?

Dr. G. P. **Girdwood** asked what were the limits of the spectroscope for the ascertaining of temperature?

Dr. R. F. **Ruttan** asked why resistance pyrometers would not measure very low temperatures?

Mr. I. B. **Lesh** asked if the pouring of the molten metal would effect the reading of the optical or radiation pyrometers? If the pouring were not affected by the scum, would the Féry read instantly, or would it require some time?

Mr. **Norman Holland** asked if the mercury thermometer gave concordance? What caused the variation; was it something inherent in the thermometer itself? He had found that a variation of 50° might occur if the bulb were not cleaned when using the thermometers in liquids.

Dr. H. T. **Barnes**, in reply, said that most pyrometers would not keep to their regular calibration, and that was one advantage in having one with a cheap end, like the Bristol, which could be thrown away after a short while, as the wires deteriorated. The Bristol would not, however, stand a higher temperature than the melting point of iron. Up to about 900° C, the electrical instrument was as reliable as any that can be obtained. Instruments were more likely to be destroyed by being broken than by use. In answer to Mr. Vaughan, no other instrument could give anything like so accurate a reading as the Wanner. Time after time the metal could be brought up to exactly the same temperature with wonderful precision. The heat instruments, like the Féry, had to be calibrated first at lower temperatures; they depended on frequent calibration. The Morse instrument was a very simple one to use. In fact, nearly all these optical instruments were valuable, and were the only ones that could be used above 1600° C. The spectroscope would hardly be as accurate as other instruments. Much greater variations were obtained with this instrument than with any pyrometer.

Slight impurity as an alloy in the platinum of resistance pyrometers produced a large error at low temperatures. Curves for pure metals and alloys were widely different. For reading instantly, the colour instrument was the best. The molten metal pouring from the ladle should be free from scum. The radiation pyrometers were all subject to error, due to absorption in the gases and vapours of the heat and light rays. As to the possible errors of mercury thermometers, the glass had a large co-efficient of expansion and went on contracting for many years. One which he had standardized had been steadily going up. It was accurate only by determining the correction each time. This particular one had gone up two-tenths of a degree; another had gone up three-tenths. The bulb of an ordinary thermometer, left in boiling water for an hour or so, would be affected. A mercury thermometer calibrated by means of a low melting metal, such as aluminium, might give concordant results, and it might not. Jena glass was the best for this purpose; all modern thermometers were made of it. A resistance thermometer would be more accurate.

Liverpool Section.

Meeting held at Liverpool University on Wednesday, April 8th, 1908.

DR. JAMES T. CONROY IN THE CHAIR.

NOTES ON STEAM PRODUCTION.

BY P. M. PRITCHARD.

The more important factors in the economical raising of steam group themselves roughly under the following heads:—Class of fuel, method of firing and design of combustion space, type of boiler, and boiler accessories; but it is difficult to discuss one of these divisions without trenching upon another.

Fuels.—The fuel selling at the lowest price per ton is usually the cheapest per unit of calorific value, but the price of fuel increases out of all proportion to its calorific value. There is, under present conditions, some reason for this in the difficulty of burning poor fuel efficiently, as it is found that, with nearly all systems of firing, the efficiency of a boiler is lower when using a low grade fuel than when a high class fuel is used.

The following figures taken from actual experience illustrate this point: a Stirling Boiler of about 3000 square feet heating surface fitted with Roney Stokers was fired with a poor quality of slack containing about 15 per cent. ash and 7 per cent. moisture, and having an evaporative value of something under 12 lbs. of water from and at 212° F. The efficiency of the boiler with this class of fuel was 56 per cent., and the cost of the fuel was 6s. 6d. per ton delivered.

As an experiment, the same boiler was fired with a high class anthracitic fuel containing 8 per cent. ash, very little moisture, and having an evaporative value of over 14 lbs. of water from and at 212° F. per lb. of fuel. It was found that the efficiency of the boiler was at once raised to 76 per cent., but, owing to the high price of this fuel, the cheaper slack was commercially the most economical.

A number of causes contribute to the low efficiency of poor fuels. Owing to the high percentage of ash and consequently dirty fires, a keener draught is necessary to maintain a good rate of combustion, so that excess air is more easily drawn through any thin places in the fire and a lower carbon dioxide results.

The evil results of leaky brickwork—and nearly all brickwork is more or less leaky—are also emphasised by a heavy draught. Not only does the excess air cause loss by providing a greater weight of gas to carry away heat, but, owing to the lower flame temperature and the greater velocity of the gases, the transmission of heat through the boiler tubes is less rapid, and a higher exit temperature results. Experiments which will be referred to later bear this statement out, although low exit temperatures usually are associated in one's mind with low carbon dioxide. A high percentage of ash not only makes it difficult to burn down the carbon content of the cinders to a low figure, but provides a larger vehicle, so to speak, for carrying away the unburned carbon.

In addition to their variation in calorific value, fuels vary in their physical characteristics in a way which is not shown by the ordinary analysis for fixed carbon, volatile matter, moisture and ash. These characteristics are shown by the way in which the fuels clinker on a grate, and are of special importance when the fuel is for use on a mechanical stoker of the ordinary type. Experience shows that it is almost impossible to burn some fuels on mechanical stokers, owing to the clinker running and burning on to the bars, and this is most marked when the furnace is a brick-lined one with a consequently higher grate temperature. The fused clinker in such a case sticks to the bars, and instead of being carried forward along the grate, chokes the air spaces between the bars and prevents the air for combustion being drawn through them. As a result the bars become overheated, and are very soon destroyed. Probably this can be accounted for by the chemical composition of the ash, but information on this point is somewhat scarce.

A table in the "Chemical and Metallurgical Handbook" gives the melting points and percentages of silica, alumina, ferric oxide, lime and magnesia of various ashes. The analyses are not complete, but it might be inferred from the figures given that the presence of ferric oxide tends to lower the melting point, whilst ashes high in alumina and lime melt at a high temperature.

An analysis of the ashes of some Lancashire slacks is given in the following table, but the results are inconclusive :—

Slack.	SiO_2.	Fe_2O_3.	Al_2O_3.	CaO.	$CaSO_4$.	MgO.	Per cent. ash.
A.	32·15	24·00	25·10	2·18	11·94	3·87	9
B.	30·80	15·34	25·36	6·36	17·10	1·70	10
C.	30·35	27·68	24·27	1·86	11·97	3·70	9
D.	32·20	18·40	23·50	4·32	15·00	5·33	14·5
E.	39·50	15·20	25·45	3·84	12·29	2·58	13·5
F.	16·93	15·60	24·80	12·60	25·10	4·00	10
G.	24·20	27·68	18·07	4·15	22·35	3·50	12

Of these the C slack gives the best results on Vicars Stokers, and D the worst. E, F, and G are intermediate between C and D. B gives a high grate temperature with consequent heavy repairs to brickwork. It is evident that there is room for a considerable amount of work in ascertaining the exact reasons for the varying characteristics of fuel. The usual remedy for the difficulty caused by fusible clinker is to blow steam under and between the bars in order to lower the temperature of the clinker and bars, but this is very wasteful, as it is impossible to check the amount of steam used.

Method of Firing.—Machine firing is more economical than hand firing as regards both fuel and labour, assuming an equal amount of intelligence and care on the part of the fireman in the two cases, but the ordinary mechanical stoker leaves a great deal to be desired in many ways.

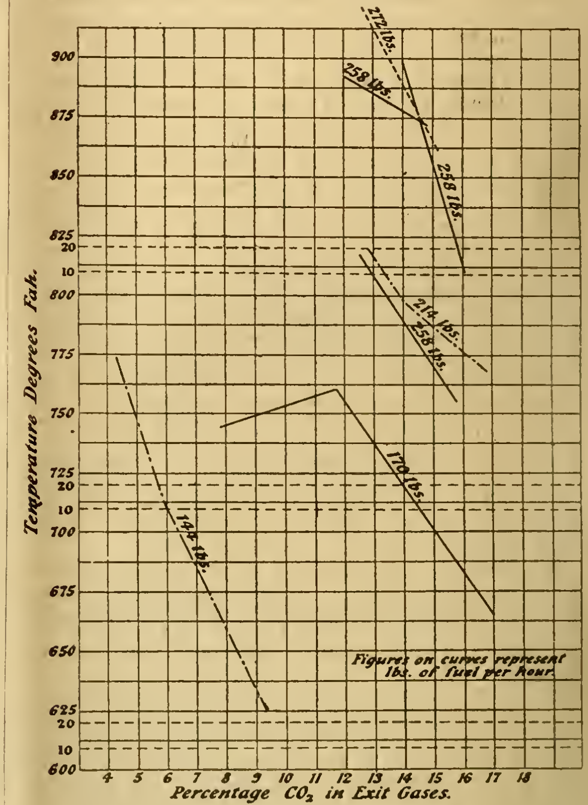
The following qualifications may be laid down as being those of the ideal stoker :—It must, within reason, burn any kind of fuel, burn down the cinders to a low carbon content, give a high flame temperature and a high carbon dioxide, it must not require any steam under the bars, and finally, the repairs must be low.

In the case of most stokers—chain grate, reciprocating bar or stepped grate—the fuel is carried forward as it burns, and should be completely burned just as it reaches the end of the grate, which is a condition quite impossible of fulfilment. The choice therefore lies between heaping up incompletely burned fuel at the end of the grate, with consequent high carbon in the cinders and heavy repairs to the grate bars, or allowing the fuel to burn more or less completely before reaching the end of the grate, with consequent thin fires and even bare bars and low carbon dioxide. The burning of the bars in the first case can be avoided by the use of steam under them, and many makers adopt this method of saving the bars from rapid destruction, but the cost of this remedy is heavy, and may easily account for more than 5 per cent. of the steam raised. From the nature of the case, however, the fire must become thinner as it nears the end of the grate, so that whilst the draught may be insufficient for the thick parts of the fire, it is too great for the thin parts. This condition of affairs gives a lower flame temperature than should be the case by delaying combustion on the one hand, and supplying excess air on the other, and makes it difficult to obtain more than 13 per cent. carbon dioxide continuously, even in the best stokers.

The importance of a high percentage of carbon dioxide for efficient working is recognised in theory, but it is not always remembered that a reduction in carbon dioxide in the exit gases, when due to excess air passing through the grate, is accompanied by a rise in the exit temperature. It is generally difficult to prove this experimentally, but recently an opportunity of doing so with a Schwartzkopff dust fired furnace presented itself.

In the Schwartzkopff system of burning fuel it is easy to maintain a constant rate of combustion, and to vary the carbon dioxide by merely varying the draught (in an ordinary grate varying the draught at once alters the rate of combustion) and as there is no reservoir of fuel in the grate, the effect of varying the carbon dioxide in the exit temperature can be more easily observed than is usually the case.

The results of several experiments are plotted on the accompanying chart, from which it will be seen, that, at all events, for carbon dioxide percentages above, say, 10 per cent , a drop in the amount of carbon dioxide is accompanied by a rise in exit temperature, but it is not quite clear to what extent this holds with a lower percentage of carbon dioxide. This is what might be expected from considerations of temperature difference across the heating surface, and also velocity of the flue gases, the volume of which is increased as the percentage of carbon dioxide is lowered.



Dust firing differs from ordinary mechanical stoking, and is more allied to gas firing than to burning solid fuel. With this method of firing the fuel is brought into such intimate contact with the air that the combustion is very rapid and complete, and a very high flame temperature is obtained. The difficulty in fact is rather to obtain a sufficiently refractory material for the combustion chamber, and it may be necessary to make the combustion chamber of a fairly open design in order to allow some of the radiant heat to strike directly on to the heating surfaces. As there is no grate with this system there is no ironwork to be destroyed by the burning fuel, whilst difficulties with fusible clinker do not exist, and it becomes possible to burn any kind of bituminous fuel.

It is quite possible with dust firing to maintain 15·5 to 16 per cent. of carbon dioxide with no carbon monoxide, as the amount of air used for combustion is regulated entirely by the damper. Against these advantages, of course, must be set the cost of grinding the fuel, which may be taken at about 1s. per ton.

The design of the combustion chamber has an important effect both on the efficiency of the boiler and on the cost of repairs. A large proportion of the heat generated in a boiler furnace can be, and generally is, transferred to the heating surface by radiation, whence it follows that it is desirable to maintain as high a temperature as possible in the combustion chamber in order to make effective use of this radiant heat. Two conflicting requirements are involved here. On the one hand, to obtain a high temperature, firebrick walls are required for the combustion space. On the other hand, in order to make use of the radiant heat, the walls should be part of the heating surface of the boiler. The best ratio of reflecting to absorbing surface in the walls of a combustion chamber can only be determined by actual trial.

These principles are well illustrated by a comparison of the conditions obtained in the partially brick lined grate of a water tube boiler, and the water surrounded grate of a Lancashire or Marine boiler. In the case of the water tube boiler, the grate temperature is so high that repairs on the brick and iron work of the grate are considerable, amounting to perhaps fourpence per ton of fuel fired, and there are cases where the whole grate is only prevented from melting up by blowing in steam both below the bars and between the fire and the combustion arch. In such a case the use of pre-heated air is inadmissible, but in the case of a water surrounded grate, the normal temperature is so low that any method of raising this temperature, such as the use of pre-heated air, is not only admissible, but advantageous.

Type of Boiler.—The two main types of boilers in most general use on land—Lancashire and water tube—may be compared either by assuming an equal cost and comparing the efficiencies, or by assuming equal efficiencies and comparing their costs.

Taking the first case, let us suppose that the boiler plant is of small size, and that say 20,000 lbs. of steam are required per hour. If water tube boilers are decided upon probably three boilers each of 10,000 lb. hourly evaporative capacity will be required, one of which is in reserve. The cost of these boilers with stokers, brickwork, and foundations will be about £3,200, and an evaporation of 9 lbs. water per lb. of coal can be obtained from Lancashire slack containing about 10 to 12 per cent. of ash in a good type of water tube boiler.

For the same amount of money it would be possible to install five 30 × 8 Lancashire boilers, one of which is in reserve, leaving four boilers to raise 20,000 lbs. of steam per hour. When working at this rate the evaporation of the Lancashire boilers will not exceed 8 or perhaps 8½ lbs. of water per lb. of coal. Taking the latter figure, the loss per year of 52 weeks of 168 hours due to using Lancashire boilers would be nearly 800 tons of fuel per year. In the case of a larger plant the percentage of spare plant for the water tube boilers may be reduced to 20 per cent. and the capital cost will be correspondingly reduced.

As regards reliability a good water tube boiler is as reliable as a Lancashire boiler, provided that properly softened water is used. Non-scale forming water should be used in any boiler, but it is essential for the satisfactory working of water tube boilers. The tubes of a water tube boiler will no doubt fail in time, even though softened water is used, from external corrosion if from no other cause, but it very rarely happens in a plant under good supervision that a tube will fail so completely and with so little warning that there is not time to change over to the spare boiler.

The small repairs on water tube boilers are probably a little higher than on Lancashire boilers, but there is this difference, that the small repairs (such as new tubes) of a water tube boiler will maintain it in good working condition almost indefinitely, whilst in the case of Lancashire boilers there comes a time when the working pressure must be reduced, and no reasonable amount of repairs will make them fit for their original pressure.

As regards floor space, the water tube boiler shows a distinct advantage over the Lancashire type. The three boilers previously referred to, viz., of the Stirling type, occupy 900 square feet, whereas the five Lancashire boilers occupy 1870 square feet.

A decided disadvantage of a water tube boiler, where a rapidly varying demand for steam has to be dealt with, is the relatively small volume of water which it contains. Under these circumstances it is more difficult to maintain a constant pressure in a water tube boiler, and there will probably be more loss by blowing off at the safety valve than in a Lancashire boiler.

Absence of smoke may or may not be of importance, depending on the locality of the works, but Lancashire boilers are great offenders in this respect, seeing that a certain proportion of the flame is quenched against the cold flue plates before the carbon has had time to burn up. In the brick-lined grate of a water tube boiler, the temperature is higher and there is more space in which combustion can be completed before the burning gases strike the cold tubes. Thus, a fairly strong case can be made out for water tube boilers of good design, as compared with Lancashire boilers, unless the conditions permit of only one boiler being installed.

Accessories.—Boiler accessories are almost as important, and are certainly as costly as the boilers themselves. Under this heading must be included water softening plant, economisers, superheaters, feed pumps and heaters, and frequently induced draught with air heating and thermal storage drums; but it is not proposed to deal with these apparatus in detail, as each one class would furnish sufficient material for a paper.

Water softening plants are essential for water tube and of advantage for Lancashire boilers. Lime and soda ash are the usual reagents, but there is a choice between lime water or milk of lime. The use of lime water involves more bulky apparatus and less attention than milk of lime, but the attention in either case is very small. The precipitate is removed from the softened water by settlement or filtration or both, but experience shows that filtration, especially when very hard water is being dealt with, is unsatisfactory, and that settlement is to be preferred. Where Lancashire boilers are heavily fired, economisers are a necessity, but economisers may be used wherever flue gases at a temperature of over 500° F. are obtained from a boiler. At these low temperatures, however, a large economiser will be necessary for a given amount of heat transference, and the return on the outlay will be correspondingly less. With a heavily fired 30 × 8 Lancashire boiler a usual number of economiser pipes is 96, giving a heating surface of 960 square feet, which will deliver the water at or about the steam temperature under ordinary conditions of work. It is found necessary to feed the water to the economisers at a temperature of not below 90° F. as, if the water is not heated, condensation of the steam in the flue gases takes place on the economiser tubes, which with the sulphur dioxide in the flue gases sets up rapid corrosion. This preliminary heating can be usually done with exhaust steam from the feed pumps, but if they are electrically driven, a small proportion of the water pumped through the economiser is returned into the feed pump suction.

Superheating of the steam is very general in new plant, and effects important economies in steam consumption. If the superheaters are not controlled as to the amount of superheat, as in the Cruse Superheater, some arrangement must be adopted whereby the flue gases are diverted from the superheaters. If this is not done the temperature of the superheater tubes may be raised to a dangerous point, when the full quantity of steam is not passing through them.

Professor Watkinson, of the Liverpool University, has recently read a paper on "Superheating," before the Liverpool Engineering Society, in which the design of superheaters is dealt with very fully.

The amount of superheat permissible depends altogether on the type of engine used. Old mill engines are working quite satisfactorily with 100° F. superheat, and 80 lbs. steam, although with excessive oil consumption. Makers of high-speed engines do not advocate higher superheat than 150° F., but with drop valve or turbine engines as much as 250° F. may be used, although this involves special construction and probably increased repairs.

The following figures may be of interest as indicating approximately the steam consumption per K.W. hour under various conditions :—

Turbines, large units 150° F. superheat	14	lbs. per K.W. Hr.
Drop valve engines, 350 K.W. 400° F. superheat	14	,, ,, ,,
Small high speed engines, 150 K.W. 150° F. superheat	23	,, ,, ,,
Small high speed engines, 150 K.W. 100° F. superheat	24	,, ,, ,,
Saturated steam	27	,, ,, ,,

Induced draught enables the maximum amount of heat to be taken out of the flue gases, as the heat is no longer required for the production of chimney draught. It is also of value where it is necessary to force the boilers to a high rate of production at times, as in the case of lighting stations.

In connection with fan draught, an arrangement of air heating is sometimes adopted. In this case the air required for combustion is drawn around the tubes of a heater through which pass the hot flue gases. By this means the incoming air can be heated to about 250° F. In addition to the heat saved by this preliminary heating of the air, a higher flame temperature is obtained, and so a more efficient use is made of the heating surface of the boiler. This system is practicable only for water surrounded furnaces, such as Lancashire and Marine Boilers, as the ordinary grate temperature of a brick-lined furnace is already so high that the possible economy of air heating in this case is more than counterbalanced by the increased repairs to the stokers and brickwork.

Thermal storage is not of any very immediate interest to manufacturers, but is used to some extent in power stations which are subject to sudden increases of load. With ordinary equipment an increased demand for steam necessitates quicker delivery of feed water through the economisers (as there is very little reserve of water in water tube boilers), and consequently a lower feed temperature at the very time when the boilers are being driven, and should therefore have the feed water as hot as possible.

In the thermal storage system a large reserve of water at boiler pressure and temperature is carried in drums placed over the boilers from which the boilers can be fed. A usual diameter for these drums is 8 or 9 feet, and the length is usually equal to the width of the boiler. They necessitate very considerable structures to carry them, and have been regarded with a certain amount of suspicion since the explosion of one of these drums at Greenwich. The finding of the official inquiry pointed to defective workmanship, but probably the conditions of work were severe, owing to the possibility of variations of temperature in the contained water and absence of means of circulating the water.

Discussion.

Mr. Eustace Carey said that the Schwartzkopff Coal Dust Firing System had one advantage which Mr. Pritchard had not mentioned, and that was the abatement of the smoke nuisance. Had Mr. Pritchard found that smoke is reduced to a minimum by the Schwartzkopff system ?

Mr. Walter F. Reid said that at St. Louis some years ago important experiments with American coal were carried out on real locomotives, which were put on trestles, and the brake power of the wheels was tested very accurately. The experiments were continued after the close of the exhibition, and the results had since been published. All the power at St. Louis, which was very considerable, was produced by tubular boilers. Undoubtedly there was a difficulty when there was a sudden demand for power, and consequently for steam, if one had only one or two boilers ; but if one had a range of them the difficulty disappeared. It was quite possible to have a reserve of hot water that could be relied upon in case of sudden emergency ; that was the only way to put the tubular boiler on the same level as the Lancashire boiler in this respect. At St. Louis nearly half a million electric lamps had to be lighted in a quarter of an hour, and there was no failure.

So far as he remembered, there was no difficulty with the clinkering on the fire bars. The temperature of combustion was low. With a high temperature of combustion and a fierce draught there was a difficulty, but not if the temperature were kept sufficiently low to prevent the ash from clinkering. The coal used at St. Louis was never touched from the time it was dug in the mine. The shafts were big enough to take railway waggons. The cinders were removed mechanically from the boilers. The coal was mechanically crushed and fed into the grate hoppers. In Great Britain mechanical appliances were not sufficiently used in connection with boilers. For regular combustion the fuel must be uniform in size. The powdering of the fuel was the first thing, the second thing was the combustion of the fuel at a regular temperature ; under these conditions machinery could stoke even better than the British stoker.

Mr. J. B. C. Kershaw thought that although chemists were disposed to pay particular attention to their boilers, engineers as a class were disposed to neglect them, and many members of their Society were engineers. Had the author had any experience of artificial refractory materials for lining furnaces, in place of the ordinary firebrick ? Some time ago they heard a great deal of carborundum and carborundum brick, and a company was said to have been formed at Niagara for the manufacture of carborundum fire-bricks. Had the author had any experience of boiler corrosion due to the use of a too pure water ? He had had water low in lime, and corrosion took place very badly. What cure was there for this type of corrosion ?

Mr. Rawlins understood Mr. Pritchard to say that forced draught had a tendency to overheat the fire bars, and that the admission of steam under the bars, as a preventive of this, was costly. These were, however, the conditions existing in the Meldrum Furnace, which was generally considered to be economical in use.

Mr. W. R. Harrison said the curves as plotted out showed the exit temperatures and the percentages of carbon dioxide for the quantity of fuel used, and he presumed the observations were taken over a certain period. What length of time was devoted to each particular test to make the points by means of which the curves were plotted ?

Mr. F. T. Munton asked whether, in the case of coal dust firing, the increased efficiency would pay the 1s. per ton for grinding the coal. His experience with mechanical stokers had been rather adverse, and his conclusion was that a good fireman in front of the boiler was better than a mechanical stoker. If they got a fuel which fitted the stoker it was all very well. But a set mechanical condition existed with a mechanical stoker, and the fireman could not get the bar in to prick the fire. The fuel had simply to go through as the plungers with which the mechanical stoker is set, forced it, and personally he had come to the conclusion that a good fireman took a lot of beating. The steam introduced underneath the bars for keeping them cool had caused him some trouble with the economisers, because the feed water had on several occasions been cold, and they had had considerable corrosion of the tubes. He thought there was still something to be said in favour of a British workman in front of a boiler.

Mr. Pritchard said, with reference to the absence or otherwise of smoke with dust firing, his experience of dust firing had been chiefly confined to brick-lined furnaces, and in that case it might be said that with ordinary care there was practically no smoke at all. Brick-lined furnaces always tended to reduce smoke, but with dust firing in brick-lined furnaces very little if any smoke was produced.

Thermal storage was quite a usual practice in this country in large stations.

With regard to the life of grate bars, so long as high carbon dioxide was not obtained, there was little difficulty, as at the back of the grate the fire became thin, and cold air was drawn through the bars, which of course prolonged their life. Some few years ago, in the United States, he had inquired of some of the large power stations as to the carbon dioxide usually obtained in flue gases, but no information was available. In some stations in this country the carbon dioxide question was put on one side altogether, owing to the difficulty of obtaining good results and at the same time keeping the grate repairs within reasonable limits.

He had had some experience with carborundum bricks, and he believed they stood fairly well so long as they were not brought in contact with the ash.

He had had very little experience with absolutely pure feed water. His experience had been mostly on the other side. At present he had seven Lancashire and one Stirling boiler under his supervision in which condensed steam was being used almost entirely, but so far they had not given any trouble. The make up feed, which is towns' water, was not softened.

Replying to Mr. Rawlins: at the present moment he could not think of any place where air heating was used. He had seen it used for watertube boilers, but the results did not appear to justify its adoption. Referring to the carbon dioxide chart, each carbon dioxide reading represented about one hour's test. There was perhaps a quarter of an hour between each test. He thought the temperature differences given must be less than they really were, because in the cases shown the high percentage of carbon dioxide tests were taken first, and they had found that the temperature went up as the carbon dioxide dropped. The cost of coal-dust firing was a question which it was impossible to answer off-hand. It entirely depended upon the price of fuel, and whether the size of the installation allowed of the adoption of a grinding plant, and so on. The claim was put forward that hand firing was better than machine firing. It was conceivable that under certain conditions machine firing did not save labour, but if the boilers were of any size, burning, say, 150 tons of fuel per week per boiler, it would be difficult to get a man to stand up to that work.

All the evaporation tests he had made went to show that machine firing was more economical than hand firing, as regards fuel at all events, in spite of other difficulties which might be introduced.

The Meldrum or any other steam-blown grate was economical in that it enabled a cheap fuel to be used, where it *might have been thought* impossible to use it. If a cheap fuel was already in use the possibilities of saving by such a grate were reduced. If by using a cheap fuel some shillings a ton were saved the loss due to using steam under the grate might be neglected.

London Section.

Meeting held at Burlington House on Monday, June 1, 1908.

DR. J. LEWKOWITSCH IN THE CHAIR.

SOME MODERN CHEMICAL PLANT.

BY OSCAR GUTTMANN, M.INST.C.E., F.I.C., F.C.S.

In a paper read by me before the Manchester Section of the Society in 1903 (this J. 1903, 1331) it was stated that the sulphuric acid factory of the future might appear small and different from the present ones, but that it ought to have a high producing capacity, and that all expenses and amortisations would amount to a small quota on the cost of manufacture. Then, as now, the whole struggle between the contact and the chamber systems of sulphuric acid manufacture resolves itself into a question of economy, and, therefore, if the chamber process is to hold its own against the contact process, the producing capacity of a plant of a given size must be improved, and its cost be much lessened. To increase the yield of sulphuric acid monohydrate per pound of sulphur burnt is hardly possible, since this is already very near theory and the cost of an attempt to improve on it would be disproportionate. Mechanical burners, Meyer's round tangential chambers, fans in various places, and atomised water instead of steam, have now become frequent, and several works in this country have altered their plant with good results. In the same paper it was stated that smaller chambers instead of very long ones had become the rule, and now the tendency is to make the height greater than the length and width. A plant was then mentioned with chambers 5·5 metres wide and 9 metres high, the longest chamber in the set being 25 m., whilst the shortest was only 7 m. Meyer's chambers have so far been built with a maximum diameter of 34 ft. and of about the same height. Now a rectangular chamber has been rebuilt which originally was, as usual, 20 ft. high, producing 3·4 kilos. of sulphuric acid per cb. m. (equivalent to 14 cb. f. of chamber space per lb. of sulphur burnt in 24 hours). By giving the new chamber a height of 40 ft. the production has been increased to 4·3 kilos. per cb. m. (11 cb. f. per lb. of sulphur.) This tendency to make the chambers very high has been proved to be a sound one, because the gases, which are generally led in horizontally at the top, travel slowly downwards, forming eddy currents, thus greatly increasing the length of their path and allowing the gas particles to remain in contact with each other for a greater period than if they are allowed to rush horizontally like a solid wedge through a long chamber. At the present moment a chamber is being built, 14·5 m. (about 48 ft.) square, and 24 m. (30 ft.) high, thus practically a tower, having a capacity of 5046 cubic metres (about 178,000 cubic feet). It stands in an iron building of special construction.

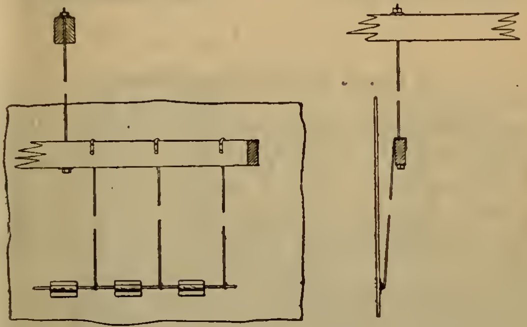


Fig. 1.—Method of Suspending Sides of Lead Chamber.

The chamber mentioned before as having a height of 40 ft. is built in a novel way, as shown in the drawing. Horizontal wooden beams are suspended by means of iron rods, and can be levelled by adjusting the nuts provided. The whole 40 ft. length of 3 mm. (6 lb.) lead is suspended in two places only in the following manner: An iron rod, ½ in. diameter, is laid horizontally against the lead, and held in place by means of straps. A double hook made of ¼ in. round iron, grips the iron rod at one end, whilst the other end is hung on the wooden beam, hammered flat, and nailed down. The arrangement is similar to that frequently used on the Continent for the roofs of chambers. The hooks are spaced about 20 inches apart, so that only about 2 cwt. of lead are supported by each hook, a diameter of ¼ in. being thus ample. There are great advantages in suspending the chamber in this way. The timber and lead construction are simple and cheap. The lead is free to expand, and the hooks being elastic there is no unequal strain, as is generally the case with straps. The side of the chamber hangs down practically like a curtain, and yields even to wind pressure, while it does not buckle. Such a chamber must be housed, as it would scarcely stand in the open, especially if exposed to strong winds.

Volvic lava Glover towers (this J., 1903, 1331) are now made to stand by themselves, but sometimes a thin outer shell (of 3 mm. lead) is added to prevent the escape of fumes. Iron hoops covered with lead hold the lava segments together, and sometimes even these are dispensed with. No wooden structure at all is required, since even reservoirs are dispensed with when automatic feeding apparatus are used. Fig. 2 shows a Glover tower of this kind.

The great care usually bestowed upon the feeding arrangement for Gay Lussac towers has also been found unnecessary when an efficient filling material and auto-

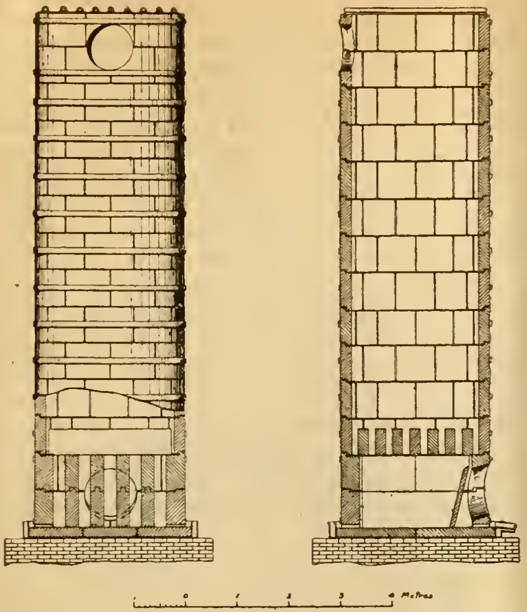


Fig. 2.—Volvic Lava Tower.

matic pumping arrangement are installed, and the greatest possible quantity of Glover acid is fed into them. Thus, it is now a very usual and useful plan to provide a central Gay Lussac tower to catch nitrous gases escaping from as many as eight Gay Lussacs, and these latter are fed with the nitrous vitriol which comes out of the central Gay Lussac tower, and is pumped up to a distribution tank.

In an English works about 12 tons of 49 per cent. pyrites are burnt per day of 24 hours, and at the time of the test the plant was working rather intensely. There is a ball tower 6 feet square filled to the depth of 6 feet with about 8000 hollow balls 4 in. in diameter, and behind it a coke tower 10 ft. 6 in. square, 42 ft. high, and 9 ft. square inside, filled to a depth of 35 ft. with coke. About 12 tons per day of 148° Tw. sulphuric acid are run down the coke tower, and this acid is run down to the ball tower.

	lb.	Calculated as sodium nitrate per cent.	Sulphuric acid grains per cb. ft.
Gas entering ball tower	—	0·65	2·54
Gas leaving ball tower	—	0·35	1·08
Acid run into ball tower	—	1·3	—
Acid coming from ball tower	—	2·8	—
Recovered in ball tower per day	403	—	—
Recovered in coke tower per day	350	—	—

Those who are familiar with the manufacture of nitric acid will know that it was formerly distilled from small pots or cylinders, holding about 4 cwt. of sodium nitrate, and that it took 36 or more hours to work up such a charge. When stills containing up to 20 cwt. charges could be worked up in only 12 hours, the economic progress was by no means small. Until lately, the largest still was of 2½ tons capacity; Fig. 3, however, shows one of several in use, each holding 5 tons, and a similar one is at work with a capacity of 10 tons of sodium nitrate, or 50 times the amount usual 20 years ago. At the same time such factories are nowadays kept scrupulously clean and free from escaping gases.

Formerly wood was charred in heaps in the forests, there being at the time no use for the by-products obtainable in the process, and this method is still used in certain forests in Germany and Austria. Nowadays, however, wood is distilled in iron retorts, and the resulting pyroligneous acid is carefully condensed and worked up for acetic acid, methyl alcohol, and acetone. Such retorts usually have a capacity of 2 cubic metres. In America a system of charring the wood in a number of trolleys placed in a large cylinder has been adopted, about 15 cubic metres being worked up at a time. Mr. Alexander Frankl, general manager of the Clotilde Chemical Works in Nagy Bocskó, in Hungary, has furnished the drawing of a kiln, which works on the principle of the old heap, and yet enables the by-products to be recovered very perfectly can be reproduced. Similar kilns were tried previously by the famous Trebertrocknungsanstalt without much success. The kiln, *a*, is made in brickwork lined with iron plates. The bottom is provided with inclined cast iron plates in order to facilitate discharge. The roof is also covered with iron plates, *c*. The hot gases from fires, *f*, under the kiln traverse a series of vertical pipes, *e*, and the draught and therefore the temperature is regulated by means of conical dampers, *g*. The wood is fed in through openings, *i*; these and the air inlets, *h*, are closed, and as soon as the wood has become incandescent, the fire is drawn, and the process of charring continues without any further external application of heat such as was necessary in the old heap method. If the wood is very wet or a strong liquor is desired, the openings, *i*, are kept open at first, until the blue vapours of pyroligneous acid issue, when they are quickly closed and the process continued as before. Finally the covers, *h*, are opened, and the charcoal raked into sheet iron boxes, or cold air is drawn in through the tubes to cool the charcoal. Such a kiln works up all the waste wood of a large factory, giving a constant stream of liquor about 1½ in. diameter, whilst the uncondensed gases serve to heat all the retorts, boilers, etc., in the place, no other fuel being required. Since then, however, kilns holding 200 cubic metres (about 7000 cb. ft.) of cut wood have been erected, which give about 46,000 litres of liquor (about 10,000 gallons) and 400,000 cubic metres (about 14,000,000 cb. ft.) of uncondensed gas ready for use as a fuel. Surprisingly large quantities are thus worked up automatically.

It has been proposed to use iron containing as much as 10 per cent. of ferro-silicon to make it acid proof. Although such iron is somewhat brittle, it is useful for the smaller

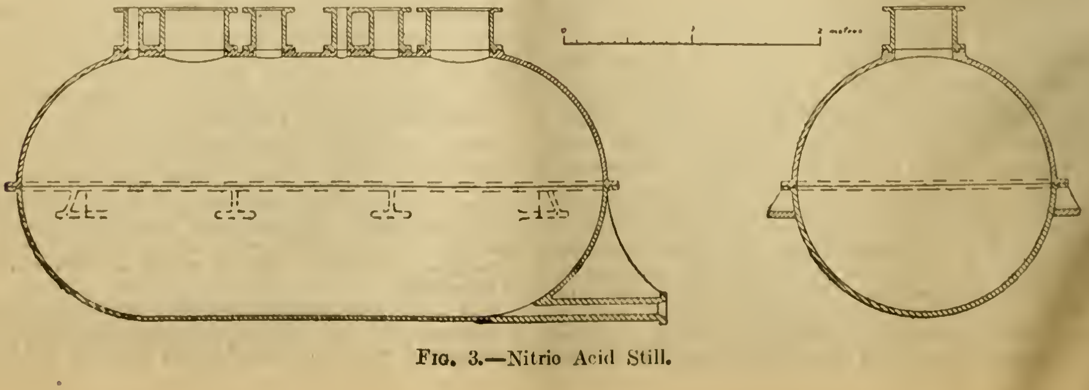


Fig. 3.—Nitric Acid Still.

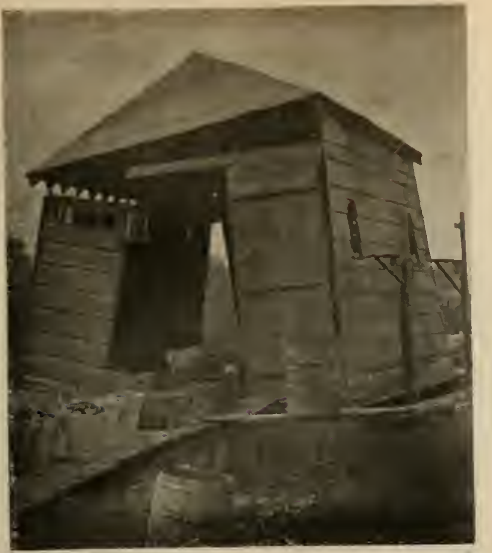


Fig. 1. Explosion in shed, of 30 lbs. semi-manufactured fog signals. Dyer & Robson's factory, East Greenwich, 29 August, 1873.

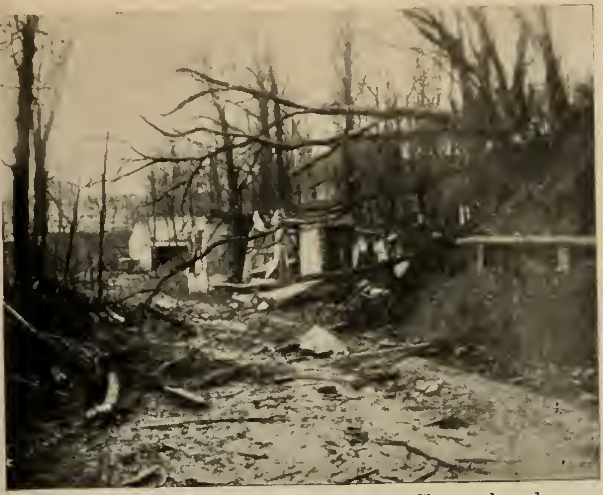


Fig. 2. Roslin, 22 January, 1890, Charcoal and Saltpetre Store.

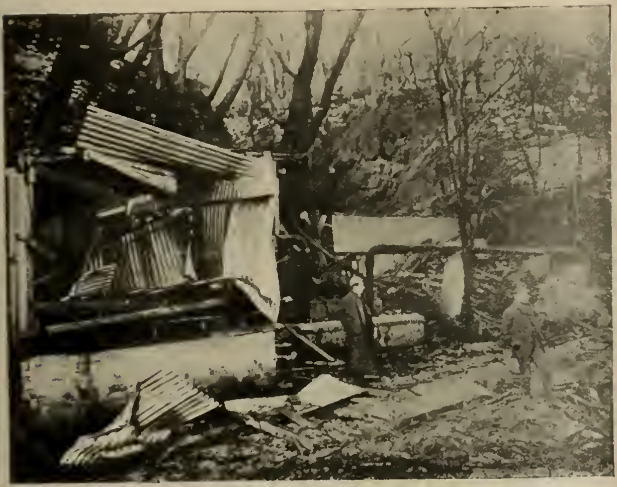


Fig. 3. Roslin, 22 January, 1890, Charcoal Store.

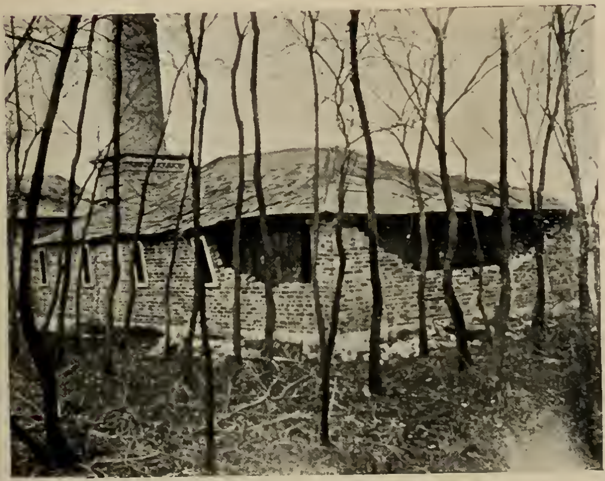


Fig. 4. Hall & Son, Faversham, 21 February, 1879, Stove House No. 57.

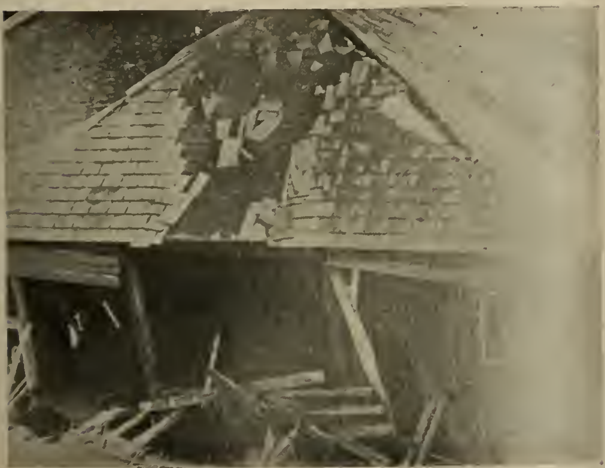


Fig. 5. Hall & Son, Faversham, 21 February, 1879, Corning House No. 62.

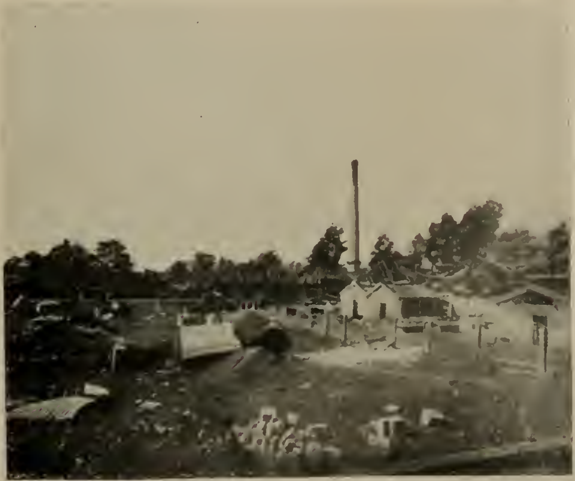


Fig. 6. Guncotton Works, Stowmarket, 11 August, 1871.

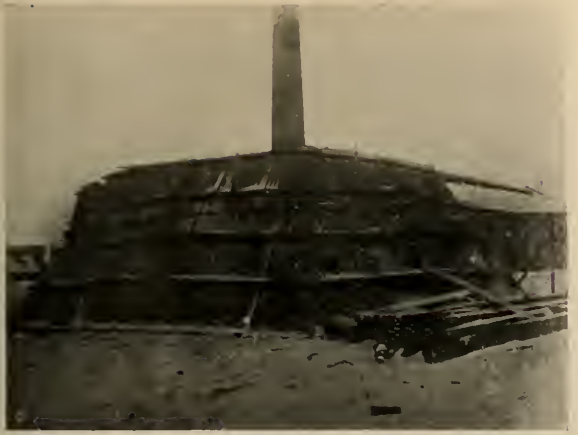


Fig. 7. Laboratory Magazine. Ardeer, 5 January, 1895.

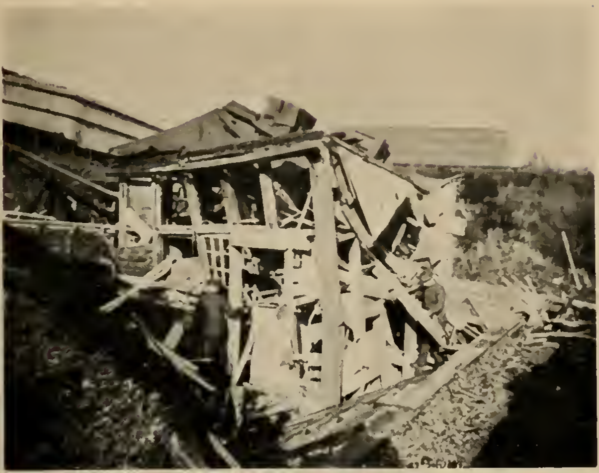


Fig. 8. Nobel Works, Ardeer, 27 February, 1897, B. House.

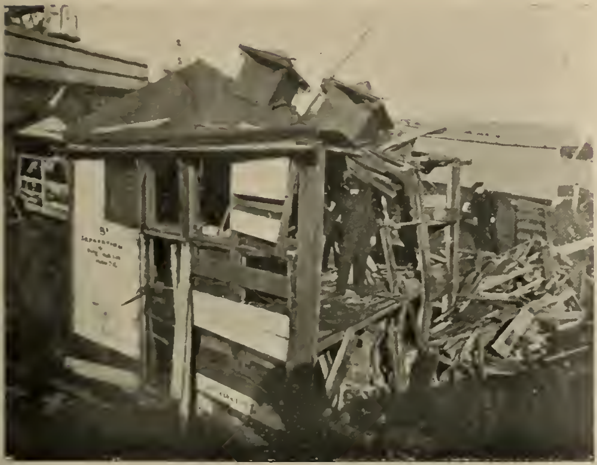


Fig. 9. Nobel Works, Ardeer, 27 February, 1897, B_1 House.

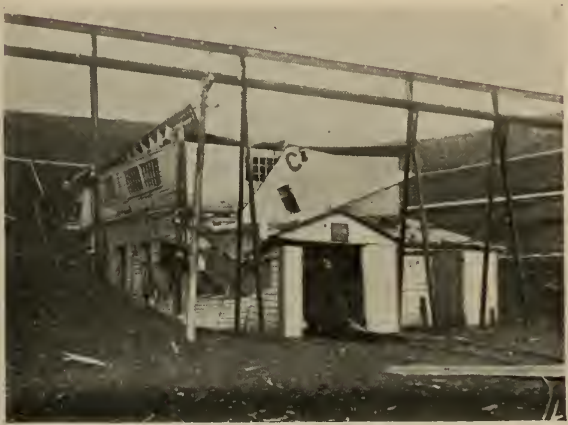


Fig. 11. Nobel Works, Ardeer, 9 January, 1902, C_5 House.

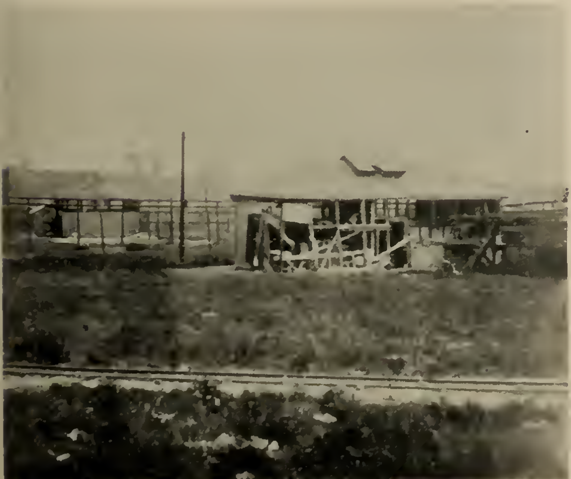


Fig. 12. Waltham Abbey, 7 May, 1894, Wash-water Settling House.

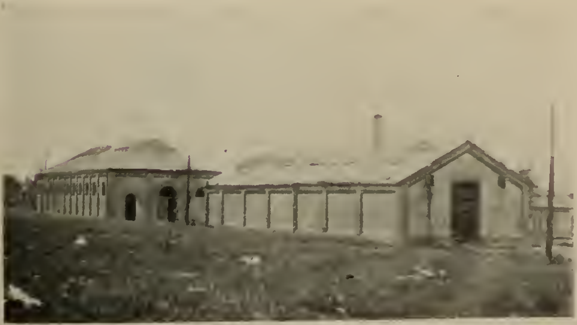


Fig. 13. Waltham Abbey, 7 May, 1894, Cordite Reeling House.

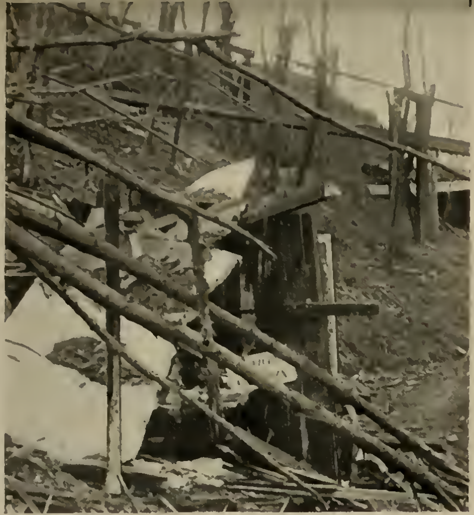


Fig. 14. Nobel Works, Avigliana, 1906, Excise Office.

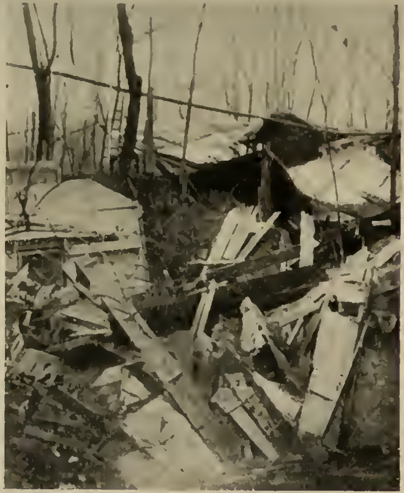


Fig. 16. Nobel Works, Avigliana, 1906, Packing House.

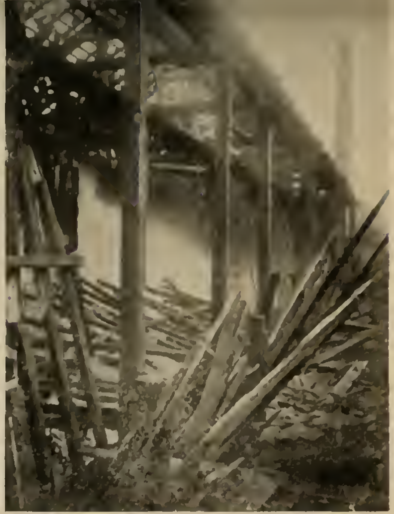


Fig. 18. Nobel Works, Avigliana, 1906, Lead Chambers.

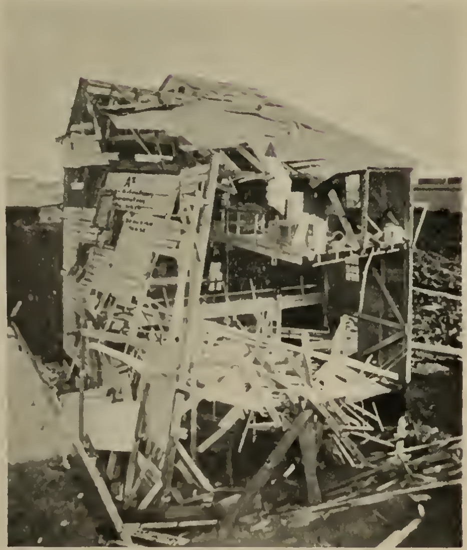


Fig. 10. Nobel Works, Ardeer, 27 February, 1897, A_2 House.

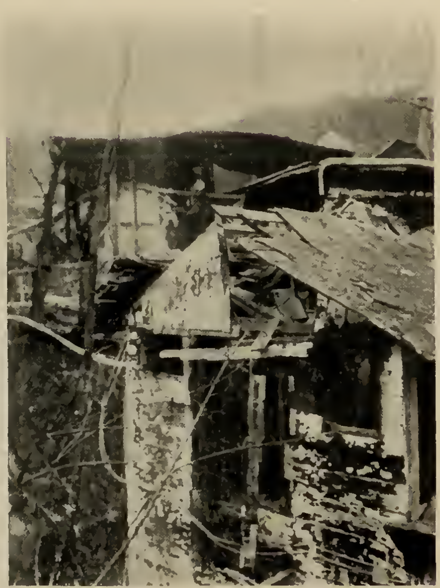


Fig. 15. Nobel Works, Avigliana, 1906, Nitrating House.

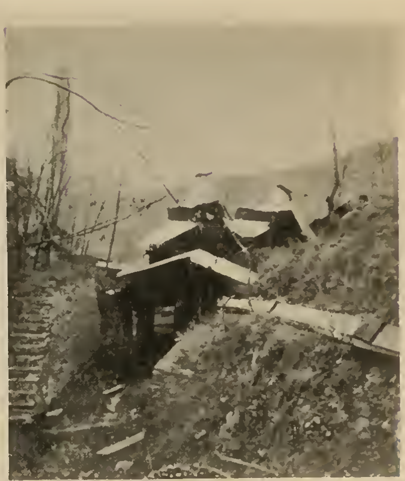
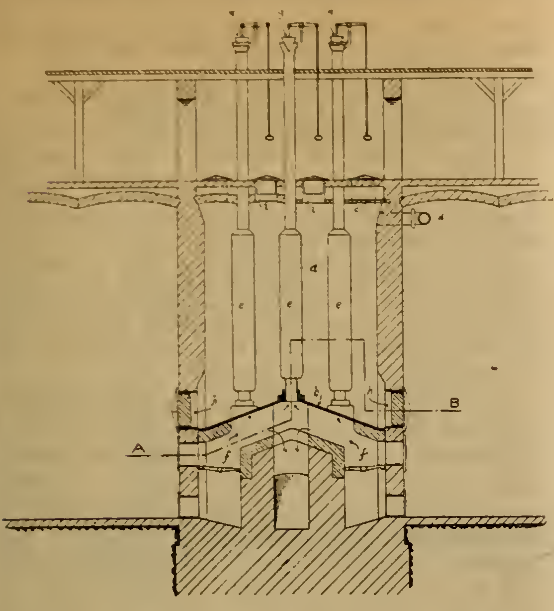


Fig. 17. Nobel Works, Avigliana, 1906, Denitrating House.



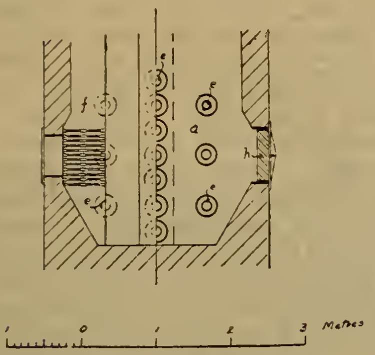


Fig. 4.—Wood Distillation Kiln—Elevation.

Fig. 5. „ „ „ Section through A—B.

castings. Lately it has been found that the addition of 1 per cent. of nickel renders cast iron proof against alkalis, and it will be interesting to watch the use of such iron in this country.

Earthenware fans for drawing off nitrous fumes in explosive works and metal refineries have become the rule, but they were only rarely placed between sulphuric acid chambers, in which the temperature is generally about 80° C. A year or two ago Dr. Plath surrounded such fans by a cast iron shell, and for resistance to heat tested them by running at full speed for three hours, the temperature being gradually raised to 80° C. and kept at this figure for a full hour. The fans behaved splendidly. The method of running and recording these tests was described by Dr. Plath in the Zeits. f. angew. Chemie.

Manufacturers of chemical apparatus are constantly pestered with inquiries for complete plans and estimates without a thought of remuneration for the work entailed. But competition nowadays is so keen that engineering firms keep a special staff for such work, in the hope of thereby securing orders. Some of them go so far as to give plans for whole installations, although their share in them may be one or two accessory machines only, and in this way certain engineering firms have acquried the reputation of specialists for certain plant. Lately a reaction has set in. Engineering firms in Germany, Hungary, and elsewhere are seriously debating upon an agreement to make special charges for such estimates and plans. This will enable them to obtain expert advice, because at present the technical recommendations of certain engineering firms (mostly foreign), although of the highest standing, are often useless and sometimes harmful. A flagrant case was that of a factory in which a machine failed to give the required yield per day. The makers, a well-known firm, thereupon recommended the purchase of two further machines, and advised their use in a certain way as being the latest practice, wth the result that it still took over two days to work up a charge. When the chief engineer of another and still larger firm was called in, he calmly suggested the purchase of a fourth machine. Careful overhauling and adjustment under expert advice produced the startling result of the day's requirements being obtained by one single machine in two hours. The mere possession of some models and the experience gained through erectors of plant does not justify engineering firms in giving advice and making plans of plant. The small manufacturer is likely to suffer from advice given by firms, whose experience does not extend to the processes for which they supply their machinery.

Discussion.

The **Chairman** asked how long did those new and intensively worked chambers lived as compared with the old-fashioned chambers which did not yield so much sulphuric acid per cubic foot of chamber space.

Mr. **Guttmann**, in reply to the Chairman, said the present chamber would not last quite as long as the old-fashioned chamber. It was not meant to last so long, but one gained so much otherwise that it was simply a question of calculation. A chamber of this kind, although it might not last fifty years, as some of the old chambers did, would last for twenty, and that was quite enough; many lasted longer than that.

EXPLOSIONS AND THE BUILDINGS OF EXPLOSIVES WORKS.

BY OSCAR GUTTMANN, M.INST.C.E., F.I.C., F.C.S.

In the history of the construction of buildings for the manufacture of explosives only two distinct periods are known. The first, during which gunpowder was made in dwelling houses or outhouses, that time when the Town Hall of Lübeck was destroyed through the negligence of those " qui pulveres pro bombardis parabant." The other, during which it was considered advisable to house explosive workshops in very light wooden structures, so that no heavy blocks of masonry could fly about and endanger houses and persons in the vicinity.

This latter principle is expressed in the Explosives Act of 1875, which was due to the efforts of the late Sir Vivian Majendie, and it was thereupon adopted by all other countries. It is interesting to note how the various countries sought to attain the same object. Thus, in France buildings are made with strong walls, generally brickwork, on three sides, whilst the fourth consists merely of a glass front. In Great Britain and Austria-Hungary wooden buildings, originally with light felt-covered roofs, and later on, chiefly in the case of magazines, with corrugated iron sides and roofs, were preferred. In Germany the buildings are still of light wooden construction, but the roof is sometimes put on quite loosely, being held by two or four wooden pins only, so that in case of an explosion the roof is simply lifted off and the sides are supposed to remain intact, which, by the way, never happened, except in black-powder houses containing very small charges. In this country, mounds need only exist on those sides which are within a specified distance from a building not so protected, and then they need only reach up to the eaves of the building. In most other countries the mounds must be at least one metre higher than the highest point of the roof, and must surround the building on all sides, even the access to the building being formed by means of a tunnel. It is the rule to maintain a definite distance between each building, in order to minimise damage. This distance is regulated by the quantity of explosive contained in the building, but for practical purposes varies very little, 50 to 52 yards being the average for mounded buildings of high explosive works (except cartridge huts).

There has always been a distinction made between the effect of explosion of low explosives, like black powder, which do not spread far, and those of high explosives, which produce peculiar effects sometimes over considerable distances. Apart from the projection of heavy or burning pieces or a perfect hail of minute metal and wooden particles, buildings sometimes suffered from concussion, and in other cases by an effect comparable to suction, owing to which, for instance, windows frequently fall outwards. Experiments made at Beverloo by the Société anonyme des Poudres et Dynamites, of Arendonck, in conjunction with the Belgian Government, showed clearly how lightly balanced screens placed at regular intervals were alternately thrown inwards and outward. Similarly the German military authorities carried out experiments at Cummersdorf under the supervision of Major Müller and Dr. Wolff, when it was proved that the explosion produced a wave similar to a sound wave, and forming mountains and valleys with alternate crushing and sucking effect. This theory is in full agreement with practical experience. So far, however, the effects of an explosion, which are transmitted through the air, are the only ones considered by legislation, whilst as a matter of fact, other and just as important ones take place and require attention.

The public believe that gunpowder acts upwards while a high explosive like dynamite acts downwards only. As a matter of fact both act equally in all directions. The difference in the effects produced is due to the fact that the explosion takes an appreciable time to be complete in the former case, while in the latter case it is practically instantaneous. Consequently, in the case of a slow explosive, the air has time to be displaced, and its resistance is therefore negligible compared to that of the soil, so that the latter is hardly disturbed. With a high explosive, however, the action is so sudden, that the air acts like a solid resistance permitting the soil to receive its full share of the explosive effect. This powerful shock on the ground is transmitted like any other impulse with an intensity depending upon the nature of the soil and decreasing as the square of the distance. High explosive works are very frequently built on sandy soil, and here more than anywhere, a phenomenon takes place which is best compared to the well-known physical lecture experiment on a series of balls suspended from strings and touching each other; when the ball at one end is struck all the other balls remain perfectly steady except the last one, which flies away. Similarly the shock received by the soil is propagated through it, and shows visible effects on buildings and movable objects on the surface some distance away. Mining men will be reminded of the fact, that an undercharged bore hole may not break the rock, nor even throw out the stemming, yet frequently a piece of solid rock from the mouth of the borehole is thrown to a very great distance.

A great many phenomena observed after an explosion have been put down to suction effect, whilst they are more easily and simply explained by my theory. Some results of the explosion at Dömitz last year have been mentioned in the "Zeitschrift für das gesamte Schiess- und Sprengstoffwesen," March 1st, 1908. Thus the smooth puddle between the wooden sleepers in the tunnels rose up above the levels of the sleepers in consequence of explosions in other buildings. Wooden poles embedded in sand mounds to prevent their slipping were for the same reason shot over a yard out.

It is further frequently observed that an explosion in one building has the effect of lifting up the roof of another one, opening out its sides and allowing the roof to fall back. This cannot be due to suction, because tables, machinery, etc., in the building are lifted up and displaced at the same time. The accompanying photographs illustrate this effect very clearly.[*] More particularly should attention be drawn to photograph No. 1 which shows the effect of an explosion of 30 lb. of semi-manufactured fog signals *inside* a building, to photograph No. 7, where a small quantity exploded in a laboratory magazine and lifted the surrounding mounds in the manner shown, and to various other photographs, where similar effects due to an explosion in *another* building can be seen.

Another and very dangerous effect of an explosion is the projection of heavy or burning wreckage. It is a well-known fact that many buildings are destroyed by flying pieces of machinery, which penetrate the roof, and strike some explosive substance. The disastrous explosion at Avigliana was due to a distant magazine being struck by wreckage from another building wherein a *small* quantity exploded. It is also, unfortunately, a frequent occurrence that burning pieces of timber, roofing felt, and even cartridges of explosive are thrown about, and set fire to other buildings, ultimately exploding them. Thus in an explosion at Ardeer, in 1884, ten girls lost their lives and four were injured through the cartridge huts having been set on fire.

In a paper read at the Institution of Civil Engineers, on Nov. 27th, 1900, I referred to the experiments at Cummersdorf, and reported that a number of German manufacturers of high explosives, under the direction of Mr. C. E. Bichel, had built two magazines in concrete, with an aggregate of fine gravel, and that on exploding therein one and a half tons of gelatine dynamite, nothing was projected beyond a distance of 50 metres. Such magazines have since been made obligatory in Germany. Such concrete made conductive in some way, say by admixture of iron filings, might with advantage be used for buildings of explosive works generally. This idea, in conjunction with the above views upon the effects of explosions, forces upon us the conclusion that the construction of explosive buildings in wood or other light material is wrong in principle, and that concrete similar to that used at Cummersdorf, but with the insertion of a network of iron or expanded metal, should be used; in other words, ferro-concrete made with an aggregate of fine river gravel. Fig. 19 shows a building of this kind. In order to make it cheap and efficient, the roof is constructed, after the manner of wooden protecting screens for guncotton presses, with a flat inner ceiling of ferro-concrete, a layer of sand, and a thin arch of ferro-concrete (in this country arched brick magazines have already been used). A falling piece of wreckage would penetrate the ferro-concrete arch but would be stopped by the sand. The floor is also made of ferro-concrete, and the whole of the armouring being connected to earth, the building practically forms a Faraday's cage, and is absolutely lightning proof, as has been demonstrated by practical experiments on the Karst mountains by General Hess in 1884. Such a building cannot be set on fire, nor would burning wreckage be thrown about in case of explosion, whilst it would retain all small débris, and nothing, not even the iron armouring, will be projected from the building itself to a large distance. Should there be an explosion in another building, the special mound mentioned later on will prevent anything being shot in, as it were, and only such pieces have to be considered as may be thrown into the air and fall down on to the building, say such weighing ½ cwt. and falling from a height of 100 ft. Needless to say, such a building cannot easily open out or throw off its roof, but will form a solid block resisting the shock transmitted through the soil. Mr. Bichel informs me that in an explosion at the Carbonite works at Schlebusch in 1907, he has also found that his concrete magazines acted as one block, which showed no cracks or other damage, although situated only 80 metres from the centre of the explosion. Such a building further possesses the advantages of being warm and dry. Shafting can be readily supported, while the walls and floor can be kept quite clean by painting them over or even rendering them with a layer of cement. The cost is not very great, in fact in many cases a saving will be effected because, on account of the low roof, the mounds will also be lower. This ferro-concrete should further be permitted in the construction of mounds and entrance passages. Tunnels should be avoided wherever possible, as they frequently collapse or catch fire when made of wood. The illustration also shows a mound constructed in ferro-concrete with earth filling, and the economy in material and space over the old system of making mounds will at once be apparent. By using ferro-

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[*] My thanks are due to the Home Office, Col. Sir Frederick Nathan, Nobel's Explosives Co., Ltd., of Ardeer, Dynamite Nobel of Avigliana, and other friends for placing their collections of photographs at my disposal. Only 18 out of 40 shown are reproduced here.

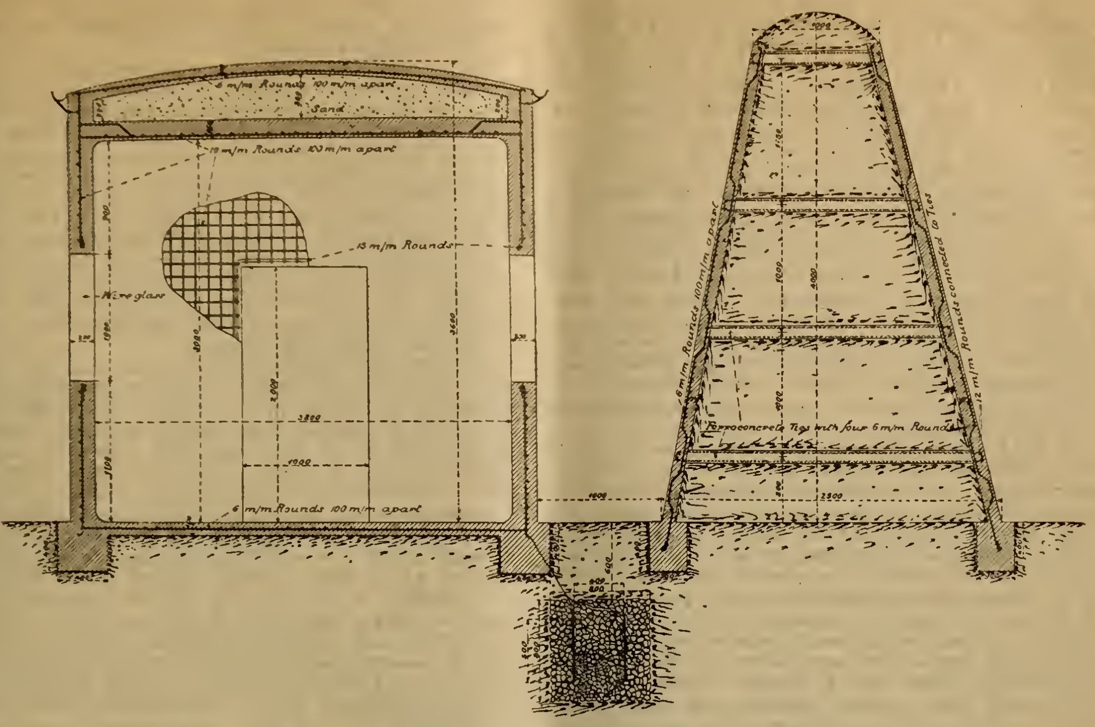
6 m/m Rounds 100 m/m apart
Sand
10 m/m Rounds 100 m/m apart
13 m/m Rounds
Wire glass
900
1900
3020
2,900
3600
3800
1000
1100
6 m/m Rounds 100 m/m apart
1000
6 m/m Rounds 100 m/m apart
12 m/m Rounds connected to Ties
Ferroconcrete Ties with four 6 m/m Rounds
1000
4000
2500

Fig. 19.—Ferro-Concrete Explosives Building and Mound.

concrete the entrance passages can be so arranged that the building is quite invisible from outside.

Ordinary glass windows provided with wire screens should be discarded, as has been done already in Waltham Abbey. The frames are always thrown down and the glass projected about as if there were no wire screen, injuring the workers and rendering the explosive material in the buildings highly dangerous. Wire-glass, invented years ago by Friedrich Siemens of Dresden, is an excellent substitute, since it only cracks like Wedgwood, but does not break. It is unnecessary to preserve large distances between such buildings. An explosion by sympathy is out of the question in the case of the comparatively small quantities contained in manufacturing buildings, and damage by falling wreckage setting fire to a building would also be practically impossible. It might, therefore, be at least considered advisable to allow two buildings to adjoin with a mound intervening, because in this case, as is shown by well-known casualties, the danger is much smaller than when a building is some distance away. This would frequently simplify manufacturing operations, and avoid the conveyance of explosive materials over great distances.

Discussion.

Sir **Fred. Nathan** said these proposals were somewhat novel, and he hesitated to express any opinion as to the desirability of making buildings for explosives manufacture on the principles advocated. He thought there was something in the transmission through earth theory, but was rather inclined to think that the author went a little too far in that direction, and in discarding the suction theory altogether. Possibly the explanation of the phenomena observed in many cases, lay between the two theories.

Dr. **Divers** said that his experience of earthquakes made him concur with the views put forward by Mr. Guttmann and with his interpretation of the photographs which he had shown them. The passage of an earthquake was largely lateral but it had generally the effect of an upward blow upon bodies on the ground. He had been present when the table-cases in a museum jumped on the floor, with the combined result of giving a loud single report, when an earthquake struck the building. The shock of a severe earthquake on a town of Japanese built houses caused the walls of the houses to fall outwards and the roofs to drop vertically to the ground but little damaged, as the result of the upward blow. Viewed from above at some distance away, such a ruined town looked just as though it had sunk into the ground to the level of the eaves of the house-roofs. Strongly built masonry houses stood earthquake shocks wonderfully well, moving with the ground as a whole, although the things within were being shaken about with much noise.

Mr. A. **Marshall** said Mr. Guttmann was quite right in contradicting the prevalent idea that a high explosive acted downwards and a low explosive upwards, but he did not quite agree with the way in which he made the explanation. Mr. Guttmann ascribed the apparent downward effect of explosives to the resistance of the air, but he thought it more correct to ascribe it to the fact that a high explosive acted like a violent blow in all directions, whereas a low explosive, such as gunpowder, acted more as a push in all directions. Naturally, a slow push on to a solid resisting substance like the earth produced little effect, whilst a violent blow, like that produced by dynamite or nitroglycerin, created a great concussion. He thought the air had practically no part in it, and if it took place in a vacuum the same effect would be produced. It was very difficult to say whether the effects of explosions were mostly due to a shock travelling through the air or through the earth; no doubt it was partially due to each. With regard to the construction of buildings, which perhaps was the most practical point, the present system was to a large extent founded on experience with black powder, which when confined produced more violent effects than when it was allowed to expand freely, and it was probably time that this matter was reconsidered.

Captain M. B. **Lloyd** said with regard to the style of buildings recommended by Mr. Guttmann there was an apparent advantage in that form from the lowness of the roof, which required, therefore, a lower mound; but to his thinking the actual height of the roof itself was not so much the matter to be considered as the height of the explosives inside the building. British practice required that the mound should be as high as the eaves, and practically one could not stack explosives in a magazine higher than the eaves, so that Mr. Guttmann, in claiming an advantage that the building was lower and therefore the mound was lower, was merely saying that according to German regulations the mound might be made lower. With regard to the method of construction, while it might be true that these buildings would fly into a large number of small pieces when subjected to a shock from a high explosive, he was not at all convinced that a more moderate explosive such as ordinary or smokeless powder would have the effect of disintegrating the building into such tiny fragments, and possibly with a gunpowder explosion the roof might hurtle through the air as a whole, when it would form a serious projectile. Mr. Guttmann recommended putting the buildings at shorter distances; he thought that the experience of the last 30 years had shown that our English table of distances was a sound one. The number of communicated explosions had been very few in their experience, and one had only to turn to the contrary and disastrous effect experienced at Dömitz last year, when almost an entire factory was demolished by a single explosion, to make one hesitate before diminishing our British distances.

Mr. W. F. **Reid** did not agree with the author that the photographs proved that the force was specially communicated to the roofs of buildings through the ground. Undoubtedly there was in certain cases an action on the ground, and the wooden poles shown in one of the photographs that were driven out of the ground undoubtedly showed that the ground had been moved, but he thought the explanation was very much simpler. He had seen in cases of tornadoes, with no vibration whatever of the ground, exactly similar results which, in that case, must have been caused by the air. In every building there was a number of side openings, and through these openings the air came under great pressure, whereas in the roof there was practically no opening. On the other hand, the roof slanted on one side, or both, and the pressure was therefore less on one side than the other. Thus, when pressure came in from the sides, the roof was raised and fell down again. The transmission of the force of an explosion through the ground was always in the shape of a cone. In making explosions in wells, especially in rather compact formations, it was possible to stand at the top of the well where an explosion took place at a considerable depth and feel nothing at all, and also hardly hear the sound; but at a certain distance from the vertical line, depending on the depth and the compactness of the strata, a very severe shock might be given; and he had known walls fractured in that way at a considerable distance from the explosion. An explosion would produce a cone which would affect the top of the mound, and the position of the explosives rather than that of the building should be considered. Buildings of concrete had been in use a great number of years. In the seventies Mr. Nursey put up concrete magazines, without iron, which undoubtedly added to the strength, but he had a considerably greater weight on the top, and that, perhaps, was even better than relying on the rather dubious tensile strength of embedded steel. It was not found that those magazines were either dry or convenient to work in. In case an explosion happened, the weakest point was round the walls, and the tendency was to powder the walls and raise the roof in a mass. He had known in the case of a building of light construction, fragments projected a mile and a half through an explosion of less than half a ton of nitroglycerin. Such a magazine might contain from 100 up to 500 tons of propelling explosives, and when they considered that a very small fraction of one ton of such an explosive would send a projectile 15 or 20 miles, he thought there was a reasonable doubt about putting heavy substances in the direct line of the force of the explosion. In the case of small quantities, no doubt they could have a magazine or a building which would dominate the force of the explosion, but for considerable quantities he was quite certain that a building of that construction could never control the force, and unless they were made as high as the mounds themselves and very thick, the upper portion must be driven a considerable distance. He noticed among the photographs of the Stowmarket explosion that the factory chimney was not upset at all by the extremely violent explosion, although it was in the middle of the factory. This did not indicate any great disturbance of the ground.

Dr. R. **Robertson** said that whatever might be the ultimate conclusion regarding the relative importance of earth- and air-wave in explosions, one instance at least had come to his notice in which the destructive effect was due to the latter only. It was in the case of a large gas-holder situated about half a mile from the scene of an explosion of considerable violence. The gas-holder was a telescopic one, in three sections and fully extended. The effect was produced only on the top section, which was badly detruded, the internal stays being much twisted, and it was considered by those who saw the gas-holder that, had it been two-thirds full no destructive effect would have been produced. In this case at least the effects produced could be attributed only to the air-wave.

Mr. **Guttmann** thanked Prof. Divers for his lucid and very remarkable comparisons between earthquakes and the effects of explosions. He fully agreed with Prof. Divers, and all the more gladly because no better observer for the purposes of this paper and none with longer experience could be found. In reply to the objections taken to constructing buildings of ferro-concrete, he said it might not be any proof to those who objected, but that sort of construction, so far as concrete alone was concerned, was now the only one permitted in Germany for magazines, some of which were actually licensed up to 30 tons. The objection to this concrete had been that the roof might be thrown bodily into the air, but he was afraid he had not made himself quite clear. It was a special kind of concrete, made with fine river gravel, which on explosion had been proved to fall into dust, nothing being projected to a greater distance than 50 yards, so that with an explosion of smokeless powder—which was very violent and not to be taken so lightly as that of black powder—the effect would simply be to pulverise the whole construction. But he was not so much concerned with the effect in the building. He had seen the effects of many explosions, and investigated one in which over a hundred buildings were down on the ground. The effect of an explosion on the usual type of building was to destroy it and break it up into minute fragments. It was not that heavy pieces of the roof, or the whole roof would fall about, but that heavy pieces of machinery or burning pieces of roofing felt and timber were projected into the air and fell down on to another building. With a regulation light felt roof, or something of that description, one of these pieces would knock a hole through the latter, fall on the explosive inside, and set it off, a thing that happened with surprising rapidity. What was necessary was first to protect the buildings and to prevent flying pieces of machinery or burning pieces falling into them. Since his ideas on this subject had leaked out, one or two people had written articles on the same subject, and he received a paper that morning in which the suction effect was nevertheless described as paramount. He might point out that the slides shown were carefully selected ones of buildings where the effect, according to his view, was one in which suction had no play. He could have selected photographs which undoubtedly showed the effect of explosive waves, but he selected these to elucidate his theory.

In reply to Captain Lloyd, if they stacked explosives 5 ft. high only he should not make the magazine higher than 7 ft., but if they stacked it 10 ft. high they must build higher and make the mound higher. The mound was not so much a protection from pieces flying over the building as against pieces flying into the building, and if the mound were erected according to the Continental practice, nothing could be shot into the building, because the mound stopped it. All they had then to consider was the pieces that flew up into the air and fell down on to it. If they took two buildings and put them side by side, separated by a mound, the pieces of machinery did not absolutely fly vertically up and fall down on to the next building. They flew in a very large parabola, and that was why he suggested building in this way. He might remind them that at the explosion at Waltham Abbey in 1894, a small hut on the other side of a mound had not even a window smashed, and such cases could be multiplied. Contrary to Capt. Lloyd's view, explosions by sympathy in factories are quite unknown, and the effects at Dömitz were not due to one single explosion, but to quite a number of them succeeding each other during a whole morning. Mr. Reid referred to the fact that the chimney at Stowmarket suffered no damage. He had unfortunately seen a number of chimneys which stood in the midst of explosions, and it was a peculiar fact that the column of air inside the chimney protected it from collapse, and, of course, this possessed great strength because of its peculiar construction. In many cases chimneys were badly cracked, although they stood erect, which was quite consistent with the fact that they were shaken from below. With regard to the Home Office table of distances, he might remind them that, as Mr. Marshall said, the distances were based on the experience gained with black powder, and were empirically doubled for dynamite. They happened to be right for the construction of buildings then required, but that would not hold good at the present day. Manufacturers desried to be protected as far as possible against any structural damage and against injury to their employees, and experience in countries which had adopted larger and stronger buildings had proved his view to be correct.

VOLUMETRIC ESTIMATION OF IRON AND CHROMIUM BY MEANS OF TITANOUS CHLORIDE.*

BY S. B. JATAR.

I.—Volumetric Process for the Estimation of Chromium by Titanous Chloride.

Attempts have been made to titrate chromium with titanous chloride, but have been given up, probably for want of a suitable indicator.

Various processes for the estimation of chromium are on record. There are the gravimetric process; the colorimetric process of A. Moulin (Bull. Soc. Chim., **31**, 295), in which acetate of diphenylcarbazide is used; the volumetric methods, among which may be mentioned one which depends on the distillation of chromium as chromyl chloride; the iodometric process; and lastly, one which depends on the quantitative oxidation of ferrous ammonium sulphate by potassium bichromate, the excess of the ferrous salts being subsequently titrated by either standard potassium bichromate or potassium permanganate. The last-named seems to be the one generally used; the others are either inaccurate or too lengthy to be popular. Besides, with the exception of the gravimetric one, all are indirect estimations of chromium, whereas the one to be described is a direct one. The reagent used is titanous chloride. For methods of storing and standardising it see the original papers of E. Knecht (J. Soc. Dyers and Col., **19**, 169; this Journal, 1907, 1165, and 1908, 434).

The Indicator.—The indicator consists of a dilute solution of pure ferrous sulphate (or any pure ferrous salt), to which are added a few drops of potassium thiocyanate; boiled water (free from oxygen) should be used for the solution. The indicator must be freshly prepared, and can be preserved for some time in a test tube with a "cork and tube" arrangement. Instead of using pure ferrous ammonium sulphate, it is better to place a few crystals of ferrous sulphate in a test tube, wash them five or six times with water, and then dissolve them; this should not give a red tinge with the potassium thiocyanate; a drop of this indicator on a "spot plate" brought in contact with a drop of very dilute solution of potassium bichromate gives rise to the formation of ferric thiocyanate, and the solution is coloured intensely red. It is a very delicate test for potassium bichromate, and therefore for chromium. Moreover, it is a direct test for the available oxygen, as the reaction in this case is due to the three atoms of oxygen obtained from the bichromate; hence it becomes still more delicate in terms of oxygen, and can therefore be used as a test for a suitable oxidising compound or for available oxygen from other sources. Traces of hydrogen peroxide can be detected by this indicator. While using the indicator in this method, the presence of nitric acid must be avoided.

One can obtain an idea of the delicacy of the indicator from the following table:—

	In terms of potass. bichromate.	In terms of chromium.	In terms of available oxygen.	
1 in	1,000,000	2,826,000	6,134,000	Very faint reddish tinge.
1 in	500,000	1,413,000	3,067,000	Quite distinct red.
1 in	100,000	280,000	613,000	Red.
1 in	10,000	28,000	61,000	Deeper red.

Methods of titration.—This can be done in three ways:—

(*a*) By the use of the above indicator:—0·2 grm. of pure potassium bichromate were weighed out in a conical flask, dissolved in distilled water, acidified with about 5 c.c. of dilute sulphuric acid and titrated cold with the standard titanous chloride. As the bichromate is reduced, the original orange red solution changes to yellow, then green, and lastly violet. Just after the green colour has disappeared, a drop of the solution, taken by means of a glass rod, is tested with the indicator drop on a spot plate. The red tinge is given so long as any bichromate remains in the solution; when all the bichromate is reduced there is no colour at all, and this marks the end of the titration.

On account of the colour changes in the bichromate solution the titanous chloride can be added to within the last c.c., the indicator being used finally, only three or four drops of the solution are thus necessary. If excess of the reagent is added a drop of the solution will discharge the red colour of some of the first tested drops of the indicator. In fact, a red ferric thiocyanate solution can be used as an indicator, but that will show excess of titanous chloride. The reaction is as follows:—

$$6TiCl_3+K_2Cr_2O_7+14HCl=Cr_2Cl_6+6TiCl_4+2KCl+7H_2O.$$

The value of the titanous chloride in terms of iron being known, it can be easily converted into the terms of dichromate or chromium as required. The factors for conversion of iron into bichromate and chromium being 0·87805 and 0·31067 respectively.

In one experiment, 0·2 grm. of bichromate required (*a*) 85·2 c.c., (*b*) 85·3 c.c. of titanous chloride solution, 1 c.c. of which=0·0023462 grm. of bichromate, 0·0023462×85·25×500=100·0068.

I have tried the method several times with very satisfactory results. It can be used for standardisation of bichromate with titanous chloride, or *vice versa*; exactly 10 or 20 c.c. of the bichromate being titrated as above. I have also used the method for testing the purity of chrome alum, and for the valuation of commercial chromium sulphate.

0·25 grm. of chrome alum was dissolved in a conical flask, the solution acidified with dilute sulphuric acid, and heated to boiling; ammonium persulphate was added gradually, boiling being continued till the salt was oxidised to bichromate, as indicated by the colour change, boiled well to remove the excess of oxygen, cooled, and titrated as above. 0·25 grm. of chrome alum required 29·35 c.c. of titanous chloride solution (1 c.c. = 0·00088783 grm. chromium) = 0·0260578 grm. of chromium, or 10·42 per cent. Theory requires 10·42 per cent. of chromium. The same method is adopted for chromium sulphate, but as the commercial sample contains iron as well, it will be treated with the next process.

The ammonium persulphate breaks up according to the following equation:—$(NH_4)_2S_2O_8+H_2O=2NH_4HSO_4+O$.

(*b*) In this method an excess of pure ferrous ammonium sulphate is added to the acidified solution of a weighed quantity of bichromate which oxidises the ferrous salt quantitatively, the solution changing to green. A few drops of thiocyanate solution are added and the solution is titrated with the titanous chloride, as in the case of a pure ferric salt. Towards the finish the solution assumes a darkish appearance owing to the mixture of the faint red with the green of the chromic salt; addition of a few drops of thiocyanate solution at this stage clears any doubts. After the end reaction the solution becomes quite clear and violet in colour.

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* Taken as read.

(*c*) In the third method, instead of adding an excess of ferrous salt, only a small quantity is added, so that we have in solution potassium bichromate and a ferric salt which represents quantitatively the reduced portion of the dichromate. Now, without adding any thiocyanate, it is titrated with titanous chloride till it assumes a clear violet colour (it goes through the same colour changes as stated in (*a*), showing that all the dichromate is reduced; a few more drops of titanous chloride are added to make sure, only the ferric salt is left in solution. To this a few drops of thiocyanate solution are added, and the solution titrated till the colour disappears.

The solution assumes a clear violet colour. The thiocyanate must not be added at the beginning, as it reduces the bichromate. The volume of titanous chloride used represents the total bichromate in both the above cases.

I prefer the first method and have used it in the above estimations.

II.—VOLUMETRIC ESTIMATION OF IRON AND CHROMIUM IN A MIXTURE.

At present, chromium and iron are separated by precipitation, and then titrated separately, or the chromium estimated in a mixture by one of the above methods, and the iron estimated after separation. B. Glasmann (Zeits. anal. Chem., **34**, 506) has devised a method for this purpose, but it is lengthy.

The principles involved in the present method are these:—

(1) Hydrogen peroxide oxidises chromic salts in alkaline solutions to chromates, these becoming bichromates on acidifying the solutions.

(2) Hydrogen peroxide in acid solutions reduces bichromates to the chromic state, ferric salts being unchanged.

(3) When titrating a mixture of bichromate and a ferric salt, for all practical purposes the dichromate is reduced first, the colour change marking the reduction, the ferric salt being left in solution.

The first one is involved in bringing the iron and chromium in an ore into solution; on the second and the third depends the following process.

The ore was finely ground and passed through muslin; 0·5 grm. was fused with caustic soda or a mixture of caustic soda and sodium peroxide, with subsequent additions of peroxide, in a silver dish over a full Bunsen flame; after cooling the fused mass was extracted with water, the solution was boiled thoroughly to remove all traces of the hydrogen peroxide, carefully acidified with dilute sulphuric acid, and again boiled.

A mixture of a ferric salt and bichromate is thus obtained; a little sediment at the bottom consists of finely divided silver. I prefer to use a silver dish. To remove the last traces of the "melt" from the dish it is necessary to add three of four drops of dilute sulphuric acid, this being afterwards added to the main portion.

The solution thus obtained was made up to 500 c.c. and aliquot portions taken for titrations.

The method was tried several times on mixtures of pure ferric chloride and potassium bichromate. It was also used for analysis of ferro-chrome and chrome iron ores.

The Method.—50 c.c. of a solution of bichromate and a ferric salt are measured into a conical flask. The conditions are the same as they were in the (*c*) of the last process, and therefore the titration is done in exactly the same way. The total volume used indicates the titanous chloride required for bichromate and the ferric sulphate together. A second 50 c.c. of the solution are measured in another conical flask, and hydrogen peroxide is added; the solution goes purple owing to the formation of perchromate; in a few seconds this colour disappears, the solution turning green, showing that the bichromate is reduced to a chromic salt; a little more hydrogen peroxide may be added to ensure complete reduction. The solution is boiled for ten or fifteen minutes to expel the excess of hydrogen peroxide, the solution assuming a violet colour, and is cooled. The conditions are the same as in (*b*), and therefore titrated accordingly. The volume of titanous chloride solution used represents the amount of iron only. This is deducted from the first one (which represents the bichromate and iron combined) and thus amount of bichromate is found.

When the quantity of iron is known to be very small, a larger portion of the solution (100 c.c. or more) is taken for the second titration, and the results adjusted.

For valuation of commercial chromium sulphate the method used for chrome alum was adopted, oxidising the chromic salt with ammonium persulphate. Two lots of 0·25 grm. were dissolved and acidified; to one was added hydrogen peroxide to ensure complete oxidation of the iron, the excess was boiled off, and the solution titrated. The other was treated like the chrome alum. The latter gave the volume for chromium and iron, the former for iron only.

The following were the results:—

	Substance.	Iron gravimetrically.	Iron by titration.	Chromium gravimetrically.	Chromium by titration with bichromate.	Results by the above method. Irou.	Results by the above method. Chromium.
		Grms.	Grms.	Grms.	Grms.	Grms.	Grms.
1	Solutions of ferric salt and bichromate.	0·819	0·818	0·925	0·929	0·819	0·938
2		0·581	—	—	1·003	0·579	1·009
		—	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
3	Chrome iron ore	—	10·59	—	27·74	10·60	27·79
4	Chromium matte	—	24·98	61·467	—	24·96	62·50
5	Ferrochrome	—	35·735	—	—	35·74	62·67

Municipal School of Technology, Manchester.

Journal and Patent Literature.

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I.—PLANT, APPARATUS, AND MACHINERY.

PATENTS.

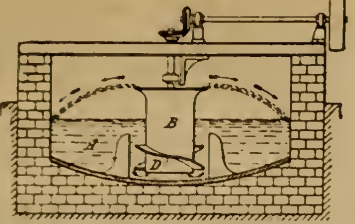
Mixing machines. O. Imray, London. From Meister, Lucius, und Brüning, Hoechst a/Main, Germany. Eng. Pat. 4849, March 3, 1908.

THE inside of a rotating drum, forming the mixer, is provided alternately with helical surfaces and lifting plates having oblique blades. The helical surfaces and oblique blades act on the material in opposite directions and cause it to travel in a closed path. A spout and guide at one end serve the double purpose of receiving and discharging the materials. A screw conveyor which may be rotated in either direction may be used in place of the spout and guide.—J. W. H

Mixing machines; Rotary ——. T. L. Smith, Milwaukee, U.S.A. Eng. Pat. 12,385, May 28, 1907.

SEE Fr. Pat. 379,006 of 1907; this J., 1907, 1200.—T. F. B.

Mixing machinery. H. Skinner, Rosherville, England. U.S. Pat. 888,542, May 26, 1908.



One or more vertical cylinders, B, with a bell mouth above and terminating below just short of the bottom of the tank, are mounted so as to be rotated by vertical shafts and gearing, in the tank, A. The lower end of each cylinder has an internal helix and an external helix, D, with oppositely arranged spirals. The cylinder is driven in such a direction that the outer screw forces the liquid downwards towards the bottom of the cylinder and the inner screw forces it upwards and causes it to be thrown out of the top of the cylinder, in a lateral direction, as shown by the arrows.—W. H. C.

Distilling and boiling apparatus. R. Planckh, Graz-Eggenberg, Austria. Eng. Pat. 12,781, June 3, 1907.

See U.S. Pat. 870,747 of 1907 ; this J., 1907, 1270.—T.F.B.

Distilling apparatus. T. M. U. von Post, Stockholm, Sweden. U.S. Pat. 889,150, May 26, 1908.

A series of retorts are so arranged that they may be successively heated in any predetermined order, and also that any single retort, or group of retorts, may be cut out of the series for cooling, discharging, and recharging, without interfering with the continuity of the rest of the series.—W. H. C.

Distilling apparatus. A. Normand et Cie. Fr. Pat. 386,006, Jan. 7, 1908.

The claim is for the method of fixing the horizontal steam heating coils in a vertical cylindrical distilling or evaporating apparatus. The coils are introduced through an opening closed by a removable cover, bolted to one side of the lower part of the vessel ; they are not, however, fixed to the cover, but to a removable tubular distributing piece, which is connected by pipes with the steam inlet and exhaust openings in the side of the cylinder. The coils are inclined, and have the outlet ends lower than the inlet ends, to facilitate the escape of the condensed water. If desired, the coils may have a horizontal partition between them, to separate the liquid-space of the apparatus into inlet and discharge parts.—W. H. C.

Vacuum evaporators. The Bradford Dyers' Assoc., Ltd., and E. Worsley, Bradford. Eng. Pat. 15,589, July 6, 1907.

A float, connected with an air valve, is placed in either the evaporator or its catch vessel. Upon priming taking place, the level of the liquid is altered, and the float rises and opens the air valve. The vacuum is thus partially destroyed, the priming ceases, and the liquid in the catch vessel returns to the evaporator by a small pipe.—J. W. H.

Evaporation ; Process and apparatus for production of continuous spray in air or vacuum ——. E. Fontenilles et Cie. First Addition, dated Dec. 23, 1907, to Fr. Pat. 371,440, Oct. 22, 1906 (this J., 1907, 308).

In order to prevent the stoppage of the apparatus by the formation of an incrustation of crystals, the latter are continuously removed from the apparatus by a screw or other suitable means. Any liquid which is removed with the crystals, is, after separation of the latter, returned to the evaporator.—W. H. C.

Vacuum multiple-effect evaporating apparatus. S. Godlewski. Ger. Pat. 195,071, March 9, 1906.

The apparatus consists of a vertical chamber divided into compartments by transverse corrugated partitions, over which the liquid to be evaporated is caused to flow, starting at the bottom of the chamber and leaving at the top. The lowest partition is heated by means of steam, and the others are heated by the vapour from the liquid in the compartment below.—A. S.

Wood wool for filtering purposes. H. Ruthenberg, Weissensee, Germany. Eng. Pat. 27,798, Dec. 17, 1907.

See Fr. Pat. 385,035 of 1907 ; this J., 1908, 493.—T. F. B.

Hydro-extractor ; Means for separately collecting different portions of liquid discharged from a ——. F. Hampl, Elbe-Teinitz, Austria. Eng. Pat. 488, Jan. 8, 1908.

The basket of a hydro-extractor is surrounded by a circle of vertical gutters of semi-circular section. These gutters are capable of simultaneous rotation so as to expose either their convex or concave surfaces to the liquids ejected by the basket. When the concave side faces the basket, the liquid runs away through the hollow footstep of the gutters into a special channel. With the gutters in the opposite position, the liquid leaves the apparatus in the ordinary way. In this manner the escaping liquors (mother-liquor and washing water) may be collected separately.—J. W. H.

Classifying solid materials ; Apparatus for ——. R. E. Trottier, Hussein-Dey, Algeria. U.S. Pat. 888,767, May 26, 1908.

See Eng. Pat. 7648 of 1907 ; this J., 1908, 151.—T. F. B.

Dryer. W. Putkowski. Fr. Pat. 386,035, Jan. 8, 1908.

The material to be dried is introduced through a shoot into the upper end of an inclined rotating drum, provided with longitudinal shelves, and divided into two parts by a disc. The first part of the drum is provided with one or more hollow truncated cones, to prevent the partly-dried material from being mixed with the fresh material. The material is moved forward by the motion of the drum, and is finally discharged in a dry state into a chamber at the lower end. Hot combustion gases from a furnace pass through a chamber into the first (upper) portion of the drum. When the gas and material reach the disc, the material passes through openings near the edge into the second (lower) portion of the drum. The greater part of the moisture-laden gas enters the annular space between two tubes, which extend from the disc through the lower portion of the drum, and are provided with a cap to prevent the entry of dust. This gas is aspirated by a fan, and passes into a heat-interchanger. Air is aspirated through the heat-interchanger in the opposite direction, and the hot gas gives up its heat to the air, which is then delivered by the fan into the inner tube passing through the drum, and is discharged through suitable orifices into the upper end of the lower portion of the drum. It then passes over and completes the drying of the materials under treatment and, together with a small portion of the furnace gas that has leaked, with the material, through the openings near the edge of the disc, escapes through a discharge pipe. As the greater portion of the gas from the first part of the dryer is withdrawn by the fan, the material is not kept for a long time in contact with the heavily moisture-laden gas, but the drying is completed by relatively dry air introduced as described through the inner tube.
—W. H. C.

Automatic chemical examination ; Method of ——. L. and C. Steinmüller. Ger Pat. 192,439, July 31, 1906.

Light rays are directed on to or through the substance under examination, these rays then falling on to a material, the electrical conductivity of which varies according to the intensity of the light. Thus, when chemical reaction takes place, *e.g.*, the production of a turbidity in the solution under examination, the variation in the intensity of the light, may be caused in any suitable manner, to induce corresponding variations in the strength of an electric current, and thereby to automatically make a record, or regulate addition of chemicals, etc.—A. S.

Crystallising solutions and saline liquids; Process for cooling —— by blowing in air. Dessauer Zucker-Raffinerie, G. m. b. H. Ger. Pat. 191,341, Nov. 30, 1906.

The air is introduced through a movable piece of flexible tubing fastened on the end of the air-inlet pipe.—A. S.

II.—FUEL, GAS, AND LIGHT.

Coal; Deterioration of ——. S. W. Parr and W. F. Wheeler. J. Amer. Chem. Soc., 1908, **30**, 1027—1033.

The authors have observed a kind of deterioration of coal which cannot be described as "weathering," but rather appears to be due to the removal of the coal from the conditions under which it existed in the seam. Samples taken from the seam were packed, without drying, in gas-tight jars; when the jars were opened 10 months afterwards, a slight pressure of gas was observed, which gas ignited with a strong blue flame. In another series the coal was air-dried and placed in the jars so as to occupy only about one-fourth of their capacity; when the jars were opened after 18 months, a considerable absorption of oxygen was found to have taken place, the atmosphere in the jars containing less than 1·5 per cent. of oxygen and 2 per cent. of carbon dioxide. Between the time of mining and the delivery of the coal at its destination, a loss of calorific value has been observed; losses of 1·3 to 3·4 per cent. have been recorded as the result of 10 months' storage in the laboratory. This loss apparently occurs during the first 2—3 weeks after mining, and is attributed to the liberation of combustible gases owing to the release of the conditions of pressure and sealing in the seam. The authors have made observations on the deterioration of coal by "weathering," which may be ascribed to the oxidation of certain of its constituents. Pillars of coal which had been exposed for 25 years in the mine showed a loss of 2·5 per cent. in calorific value as compared with freshly exposed coal in adjacent seams. The loss described as "weathering" takes place in a dry atmosphere just as much as on exposure to the weather; the losses under this head do not appear to exceed 3—4 per cent.; no loss occurs if the coal be submerged in water.—J. F. B.

Explosive gas-mixtures; Influence of the silent electric discharge on ——. H. Fassbender. Z. physik. Chem., 1908, **62**, 743—758.

The velocity of explosion of a mixture of carbon monoxide and oxygen is increased by previous exposure to an alternating electric field; but this is due only to the production of ozone, for, first, the same increase is shown if a mixture of carbon monoxide and previously ozonised oxygen be exploded, and, second, the alternating field produces no corresponding increase in the explosion-rate of a mixture of hydrogen and chlorine. The alternating field is not, however, altogether without influence; for it markedly increases the rate at which hydrogen and chlorine gradually combine (without spark and consequent explosion), and even induces gradual formation of carbon dioxide in the carbon monoxide and oxygen mixture.—J. T. D.

Patents.

Fine coal free from shale, shale free from coal, and intermediate products; Process and apparatus for obtaining separately or simultaneously, by a single operation ——. Maschinenbau-Anstalt Humboldt and F. W. Wissmann. Fr. Pat. 385,986, Jan. 7, 1908. Under Int. Conv., Aug. 7, 1907.

The mixture of fine coal and shale is passed, together with a stream of water, over a bed of felspar, which is impervious to the coal, and on which the light pieces of shale are mechanically caught and retained. The coal passes continuously off the bed, together with the water, through an opening, the size of which can be regulated, placed a little below the level of the bed, whilst the shale is washed off the bed from time to time after increasing the size of the opening. The felspar is kept in place by means of transverse bars of iron running across the bed. If intermediate products are obtained, they may be treated on a second bed.—A. G. L.

Peat turf; Manufacturing wet —— into dry peat fibre or peat dust. J. Hemmerling, Dresden, Germany. Eng. Pat. 13,016, June 5, 1907.

The wet turf is deprived of 50 to 60 per cent. of its moisture by pressure in a suitable machine, the partially dried mass is broken up and treated in a drier till the moisture is reduced to 20 or 25 per cent., and the dried fibre or dust is finally sifted.—A. T. L.

Coke ovens. A. O. Jones, Whitley Bay. Eng. Pat. 18,141, Aug. 10. 1907.

In a coke oven with horizontal coking chambers and vertical heating flues formed by the dividing walls, and with air-conveying tubes surrounded by the exhaust flues for the products of combustion, these air conduits are arranged vertically, and in such a manner that the upper end of each tube communicates directly with the base of its particular heating flue in the side walls of the oven. Each tube is supplied with air by a separate horizontal passage from the exterior face of the oven structure, its opening being easily reached and controlled from outside. In a similar manner the gas passages are arranged horizontally, and extend directly from the outside of the oven structure to the heating flues. The horizontal passages for the air and gas supply are arranged in double layers beneath each other.—R. L.

Fuel; Furnaces for the production of smokeless ——. S. O. Cowper-Coles, London. Eng. Pat. 27,833, Dec. 17, 1907.

The furnace comprises a chamber in which a series of tapering retorts are arranged in pairs, provided with charging covers at their upper ends and with sliding discharge doors at their lower ends. Partitions are arranged between the front and rear of the retorts and the inner wall of the furnace, the front partitions extending from top to bottom of the retorts, but the rear partitions leaving openings at their upper ends. Thereby a zig-zag passage is formed, through which is passed the gases of combustion from a series of grates; the disposition of the grates ensures an even heating of the whole surface of the retorts.—R. L.

Kindling or fuel; Process for the production of artificial ——. V. Suchowiak, Essen-on-Ruhr, Germany. Eng. Pat. 907, Jan. 14, 1908.

In the process of saturating wood with mineral oils or oil residues for the production of kindling material or fuel, the proteins, starch, mineral salts, etc., contained in the cellular tissue, prevent a complete saturation. To effect this without forcing most of the cells open, the wood is steeped in water for several weeks, with an addition of nutritive reagents, such as ammonium nitrate and potassium phosphate and of cultures of bacteria capable of rapidly producing fermentation. Limestone may be added to neutralise the wood extract. When the proteins and starch are decomposed, the wood is dried, and has a greyish-blue appearance In this state it can absorb as much as 75 per cent. of masut (mineral oil residue). —R. L.

Inflammable matter or fuel; Process for making an artificial —— from wood and mineral oils or their residues. V. Suchowiak. Fr. Pat. 385,927, Jan 4, 1908.

See Eng. Pat. 907 of 1908; preceding.—T. F. B.

Suction gas producers. J. B. Catteau, Roubaix, France. Eng. Pat. 12,130. May 25, 1907.

See Fr. Pat. 375,656 of 1907; this J., 1907, 919.—T. F. B.

Coal gas ; Manufacture of ——. E. A. Franks, Ferndale, Glamorgan. Eng. Pat. 16,303, July 16, 1907.

The yield of gas from gas coal is increased by mixing steam coal, or coal other than gas coal, with the charge to be distilled ; for example, 4 tons of gas coal, capable of yielding 40,000 cb. ft. of gas if distilled alone, and 3 tons of steam coal, capable of yielding 9,000 cb. ft. of gas, are stated to yield over 70,000 cb. ft. of gas when mixed and distilled together. The invention described in Eng. Pat 1642 of 1906 (this J , 1906, 840) is specifically disclaimed.—A. T. L.

Gas producing apparatus. G. Marconnet, Paris. Eng. Pat. 21,124, Sept. 23, 1907. Under Int. Conv., Oct. 8, 1906.

See Fr. Pat. 370,301 of 1906 ; this J., 1907, 310.—T. F. B.

Water gas apparatus. A. J. Boult, London. From J. H. Taussig, Philadelphia, U.S.A. Eng. Pat. 25,036, Nov. 12, 1907.

See U.S. Pat. 869,814 of 1907 ; this J., 1907, 1232.
—T. F. B.

Gas retorts. H. Koppers, Essen, Germany. Eng. Pat. 26,057, Nov. 25, 1907.

A vertical retort, in which the gaseous distillation products are continuously removed by passing clean gas upwards through the fuel column, is provided with a distributor for clean gas at the bottom of the retort, so that this gas may pass through the inactive material used to fill the lower end of the retort, below the distillation zone. The filling material is thus kept cool and free from distillation products, and a removable water trough can be used to close the lower end of the retort.
—A. T. L.

Suction gas-producing apparatus. H. H. Ralph, Philadelphia, Pa. U.S. Pat. 888,532, May 26, 1908.

In a suction gas producer the combined generating and fixing chamber is surmounted by a shell provided with a water jacket, in which steam is raised by means of the hot gases leaving the generator through a conduit passing through the side of the jacket. The steam escapes through a pipe above the water level of the jacket, and is led under the grate in the base of the producer. Means are provided for letting air enter the vaporiser and mix with the steam, previous to its passing under the fuel bed, a proper proportion being maintained by an adjustable valve. Any excess of water in the vaporiser runs through an overflow pipe into the ash-pit, which is sealed against the outer atmosphere.—R. L.

Gas producers ; Method of operating ——. E. P. Coleman, Buffalo, N.Y. U.S. Pat. 888,785, May 26, 1908.

Low-pressure exhaust steam, derived from a suitable source is compressed, and supplied at a constant pressure, together with the air blast, to a gas producer. To maintain the terminal pressure, part of the steam supply is subjected to the action of a confined body of violently agitated and finely divided water. It then passes to the compressor previous to being mixed with the air. Live steam may be added when the supply of exhaust steam is insufficient.—R. L.

Gases ; Process of manufacturing combustible ——. E. N. Dickerson, Stovall, N. C. U.S. Pat. 888,969, May 26, 1908.

The manufacture of coal- and water-gas is combined by heating a gas retort with the combustion gases coming from a gas producer during the air blast period. The gases are also utilized for heating the chequer-work employed for the heating of the air blast. The coal gas made in the retort is subsequently mixed with water-gas produced in the usual way.—R. L.

Gas generator. J. G. L. Bormann, Charlottenburg, Germany. U.S. Pat. 890,489, June 9, 1908.

See Eng. Pat. 10,226 of 1907 ; this J., 1907, 1078.—T. F. B.

Hydrogen ; Manufacture of —— *for lighting, heating, and the like.* L. Vignon. First Addition, dated Dec. 27, 1907, to Fr. Pat. 373,271, Jan. 2, 1907 (this J., 1907, 677).

An apparatus capable of carrying out the process described in the principal patent, consists of a set of retorts containing iron oxide. A reducing gas is led from a gas-producer, through a suitable purifier, into the retorts for the reduction of the iron oxide. The heat formed thereby, is utilised for the regenerative heating of the air blast for the producer, the carbon dioxide being subsequently discharged into the atmosphere, or part of it used to keep down the temperature of the producer. Steam is raised in a boiler, and drawn by means of a fan into the retorts, to react with the metallic iron. The hot hydrogen gas produced is used for superheating the steam coming from the fan. A set of four valves can be manipulated by a single handle, allowing the regulating and reversing of the different gas currents.
—R. L.

Blast-furnace and other gases ; Process and apparatus for purifying ——. F. Sepulchre, Liège, Belgium. Eng. Pat. 254, Jan. 4, 1908.

The invention relates to purifying gases by injecting a purifying liquid in the form of a fine spray or mist, and consists in producing the spray within a restricted passage at the point where the gas enters the top of a vertical column, so as to thoroughly moisten the gas. The apparatus comprises a vertical conical column connected at the upper end to the gas flue and at the lower end to a separator, preferably of the kind described in Eng. Pat. 13,510 of 1907 (this J., 1907, 1189). An atomiser of the injector type is arranged at the top of the vertical column, and is supplied, for purifying blast-furnace gas, with water under pressure and with compressed gas which may be a part of the purified blast-furnace gas. The atomiser discharges into the first nozzle of a multiple injector, and the blast-furnace gas is drawn through the other nozzles and intimately mixed with the spray.
—A. T. L.

Ammonia ; Process for the extraction of —— *from coal-gas by washing with acid or salt solutions.* W. Feld. First Addition, dated Dec. 28, 1907, and Second Addition, dated Dec. 31, 1907, to Fr. Pat. 385,628, Dec. 26, 1907 (see Eng. Pat. 27,567 of 1907 ; this J., 1908, 495).

(1). The process of lowering the dew point of distillation gases, referred to in the principal patent, by admixture of cooled and purified gases, may lead to too great a decrease in temperature. To avoid this, the purified gas is prevented from cooling too far, or else the crude gas, or the gas to be admixed, or a mixture of both, are heated sufficiently to obtain the required temperature of the mixture. This effect may also be obtained by passing the mixing gas methodically in a counter current against the crude hot gas. (2). To lower the dew point of distillation gases of any kind, pure or mixed vapours are added in such quantities and at such a temperature as to lower the dew point of the gas with regard to the particular constituent which it is desired to retain in the gases. The gas may be previously saturated with the constituent which it is desired to eliminate. For example, steam, etc., may be mixed with coal gas in order to lower the dew point of the gas with respect to tarry vapours, and thus allow of the separation of ammonia from the gas, without the deposition of tarry matter.—R. L.

Filaments ; Process and apparatus for the continuous manufacture of —— *for lighting and heating by gas or electricity in the open air.* G. Michaud and E. Delasson. Second Addition, dated Dec. 21, 1907, to Fr. Pat. 387,665, June 10, 1907 (this J., 1907, 1131).

The agglutinant described in the principal patent may be replaced by any other, notably by a mixture of 9 parts of gum arabic and 1 part of ammonium soap. The filament may be composed of :—Thorium, 94 parts ; cerium, 1 ; alumina, 4 ; and aluminium silicate, 1 part ; with traces of chromium, and it may have a straight, zig-zag, or curved shape.—R. L.

Electric illuminating bodies; Method of producing —— by causing raw metallic threads to become incandescent by means of the electric current. W. Fairweather, London. From Glühlampenwerk Anker G.m.b.H., Berlin. Eng. Pat. 23,585, Oct. 25, 1907.

SEE Fr. Pat. 382,922 of 1907; this J., 1908, 276.—T. F. B.

Arc lamp electrodes. G. M. Little, Pittsburg, U.S.A. Eng. Pat. 66, Jan. 1, 1908. Under Int. Conv., Jan. 5, 1907.

THE claims are for electrodes consisting mainly of magnetite, with or without chromium oxide (Cr_2O_3), titanium oxide (TiO_2), and calcium fluoride (CaF_2), but containing potassium silicate (K_2SiO_3) or other alkali silicate in order to prevent flickering of the arc when alternating currents are employed. The preferred composition is as follows:—60 parts of magnetic oxide of iron, 27 parts of titanium oxide, 6 parts of ferrous chromite (Cr_2O_3,FeO), together with 12 to 15 parts of potassium silicate, or 20 parts of potassium silicate and 5 parts of calcium fluoride.—A. T. L.

Metallic ores, minerals, and the like; Apparatus for washing, etc. ——. Eng. Pat. 20,622. *See* X.

Alloys of exact composition [*for incandescence filaments*]. Fr. Pat. 385,699. *See* X.

Calorific value of gases; Apparatus for determining ——. Fr. Pat. 386,294. *See* XXIII.

Sugar works; Gas producer in ——. Fr. Pat. 386,745. *See* XVI.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

Nononaphthene [*hexahydropseudocumene*; 1, 3, 4-*trimethylhexamethylene*]; *Occurrence of* —— *in coal-tar.* F. B. Ahrens and L. v. Mozdenski. Z. angew. Chem., 1908, **21**, 1411—1414.

THE raw material investigated consisted of residual oils left in the preparation of nitroxylene, and came from an aniline works in Saarau (Silesia). The nitroxylene was prepared by the action of a mixture of sulphuric and nitric acid on xylol (crude xylenes), and the residual oils in question consisted of that portion of the coal-tar xylol which remained unacted on by the acid mixture. The fraction obtained on distilling these inert oils, and which passed over up to 150° C., was collected, and submitted to a two-fold nitration, followed by repeated fractional distillations with the aid of a dephlegmator, and thus a fraction boiling constantly from 137° to 139° C., and of sp. gr. 0·7662, at 15° C., was obtained. Analytical figures also indicated that the body was nononaphthene, C_9H_{18}. The authors succeeded in converting this nononaphthene into pseudocumene by brominating it in presence of finely divided metallic iron, and then distilling the washed and dried bromononaphthene *in vacuo*. Any unbrominated hydrocarbon thus distilled over, whilst almost the entire residue solidified to a crystalline mass of tribromopseudocumene.—W. S.

Gas liquor; Analysis of ——. M. Mayer and H. Hempel. J. Gasbeleucht., 1908, **51**, 381—387, 403—409, 425—428.

THE authors have tested the various methods which have been proposed for determining the constituents of gas liquors, and recommend the following:—*Ammonia.* (A), *Volatile.* 25 c.c. of the liquor are diluted to 350 c.c., and the ammonia determined by distillation, the liquid being reduced to one-fifth of its bulk. Direct titration of the liquor is inaccurate. (B), *Fixed.* The residue is made up to the original volume and redistilled with caustic alkali or lime. *Carbonic acid.* 50 c.c. of the liquor are added to an excess of an ammoniacal solution of calcium chloride, and heated for two hours on the water-bath. After cooling, the precipitate is filtered off through a Gooch crucible, washed three or four times with warm water, dissolved in standard acid, and titrated with alkali. *Chlorine.* Linder's method is most convenient, but should be carried out as follows:—10 c.c. of the liquor are diluted to 150 c.c., and, whilst boiling, two or three additions are made of about 15 c.c. of a 3 per cent. solution of hydrogen peroxide (freshly prepared from "perhydrol"). When a bluish-green opalescence appears, 10—15 drops of a cold saturated solution of potassium chromate are added, and the boiling continued for five minutes. The solution is cooled, and *N*/10 sodium carbonate added, until the colour changes to greenish-yellow: it is then titrated with *N*/10 silver nitrate. *Sulphuretted hydrogen.* Linder's method is employed, modified as follows:—10 c.c. of the liquor are added to an excess of a solution of the mixed acetates of zinc and ammonium, acidified with acetic acid. The precipitate is washed three or four times with water, containing an ammonium salt, and is then treated with *N*/10 iodine solution and 10—20 c.c. of sulphuric acid (1 : 3). When the precipitate is dissolved, the excess of iodine is titrated with *N*/10 thiosulphate. *Thiosulphate and sulphite.* 25 c.c. of gas liquor are mixed with an excess of strontium chloride and zinc chloride solution, containing ammonium chloride. After 12 hours the precipitate, which consists of zinc sulphide, thiocyanate, and ferrocyanide, and strontium sulphite is filtered off and washed three times with dilute strontium chloride solution. The filtrate is acidified, and the thiosulphate present titrated with *N*/10 iodine solution. To determine the sulphite, an excess of standard iodine solution is added to the acidified gas liquor, which is then titrated with thiosulphate. This gives the total sulphide, thiosulphate, and sulphite, and, the first two being known, the sulphite is obtained by difference. *Thiocyanate.* The most convenient and accurate method is that described by Linder (this J., 1907, 685). *Sulphate.* 250 c.c. of the liquor are evaporated on the water-bath to 10 c.c., and then to dryness with a little hydrochloric acid. The residue is extracted with hot water and filtered, and the sulphate precipitated, as usual, in the acidified filtrate *Total sulphur.* Sulphur may be determined by the method of Dyson and Linder (Rep. on Alk., &c., Works, 1904, 32), but the liquor should be added by drops to a fairly acid solution of bromine water, with constant shaking, and the quantity of potassium salts added should be as small as possible. Oxidation with *aqua regia* also gives accurate results. *Cyanide.* Feld's method of distillation with lead nitrate (this J., 1903, 1068) gives the best results. *Ferrocyanide.* Ferrocyanide may be precipitated in acid solution as Prussian blue, or as zinc ferrocyanide by means of zinc chloride.—F. SODN.

Viscosity and lubrication. C. F. Mabery and J. H. Mathews. J. Amer. Chem. Soc., 1908, **30**, 992—1001.

UNTIL recently lubricating oils of high viscosity had to be compounded of mineral oils and fatty oils, but it is now possible to prepare entire hydrocarbon oils fully equal in viscosity and wearing qualities to castor oil. It is not certain, however, that viscosity is a reliable measure of durability and wearing qualities of oils differing widely in composition. The authors have determined the specific viscosities, *i.e.*, the ratio of the viscosity of the oils to that of water at the same temperature, by Ostwald's method, of a number of mineral oils carefully fractionated so as to represent hydrocarbons of homologous series. In the paraffin series the viscosities increase with some regularity with decreasing percentages of hydrogen. Comparing oils of the same boiling points, but members of different series, the viscosities and specific gravities increase with decreasing hydrogen, but it is reasonable to suppose that with hydrocarbons of the same composition, differences in atomic structure will also have an influence. The members of the C_nH_{2n+2} series have little lubricating value, and the addition of a small proportion of a solid paraffin to an oil of the same boiling point, containing a lower proportion of hydrogen atoms, causes a distinct decrease in viscosity. Neither specific gravity nor boiling point can be depended upon for comparing relative lubricating values unless the origin of the oil be known; the method of manufacture has also much to do with the relation of specific gravity to lubricating power. Since the oils themselves exert friction, lubricating oils should be tested under the same load and speed as those for which they are intended in practical use. For light loads and high speed, an oil of small internal friction is desirable, whilst for heavy, slow work, an oil of higher viscosity is required. Generally the viscosity decreases about 2 per cent. per 1° C. rise in temperature, but two oils of different composition may show the same viscosity at the ordinary temperature and different viscosities at a high temperature. The authors have carried out lubrication tests with a machine designed by C. A. Benjamin. The journal could be placed under any known load, and run at a known speed; the friction coefficient and the temperature were measured before and after a run of two hours with constant lubrication. The test of durability was then applied by cutting off the supply of oil and noting the time during which the oil continued to lubricate; the end of this durability was marked by a sudden large rise in the temperature and frictional load. It was found that the durability of the individual hydrocarbons increases with the decrease of hydrogen, and in a similar ratio to the increase in specific viscosity. The most valuable quality of an oil is its ability to reduce friction to a minimum, and of the hydrocarbons tested, the one with the least hydrogen, of the series C_nH_{2n-4}, showed the best efficiency, as also the best durability; this was better than the vegetable oils in durability and equal to sperm oil as regards temperatures and coefficient of friction. Of the fatty oils, castor oil shows the highest durability, and sperm oil the lowest coefficient of friction and lowest temperatures.—J. F. B.

PATENTS.

Pitch and bitumen and products containing same; Compositions for improving ——. T. Marriott, Kingston-on-Thames. Eng. Pat. 11,498, May 16, 1907.

A COMPOSITION for improving pitch and bitumen for insulating purposes, is made by mixing refined tar with one-third to two-thirds of its weight of kaolin in the form of an impalpable powder. This may be mixed with softened rubber, gutta-percha, or balata in definite proportions, and pitch or bitumen may be incorporated with any of these compositions or with a mixture of them.—R. L.

Pitch; Treatment of ——. T. Parker. Fr. Pat. 386,433, Jan. 22, 1908. Under Int. Conv., Jan. 25, 1907.

SEE Eng. Pat. 1970 of 1907; this J., 1908, 217.—T. F. B.

Pyroligneous products; Process and apparatus for obtaining —— directly. Pagès, Camus, et Cie. Third Addition, dated April 3, 1907, to Fr. Pat. 375,314, May 10, 1906 (this J., 1907, 920).

THE process of the principal patent for the collection of useful products from pyroligneous gases or vapours, and for the destruction or treatment of the other products, is carried out at a constant and predetermined temperature. An inert gas may be injected into the hot vapours to reduce the temperature. The formaldehyde and acetic acid are allowed to act on the phenols, and can be recovered in a resinous form. The temperature may be kept constant by employing non-conducting material instead of a bath of heating liquid. Mechanical means may be employed to secure an even distribution of temperature. —R. L.

Acetone; Process for the purification of ——. J. B. E. E. Arnoult and L. L. Jumau. Fr. Pat. 386,181, April 6, 1907.

THE crude acetone is purified and deodorised by treating it with oxidising agents, either with or without the addition of salts capable of absorbing the products of oxidation. The acetone after treatment is pure enough to be used in perfumery and pharmacy.—W. H. C.

Distillation of wood and similar materials; Process and apparatus for the recovery of the various products contained in the gases from the ——. R. Strobach. Fr. Pat. 386,424, Jan. 21, 1908.

THE crude gases from the distillation of wood are passed through a layer of tar of sufficient height to completely free the gas bubbles from the tar by a single passage, the gas being subsequently washed with milk of lime. To allow of continuous working, two tar washers are provided, which may be used alternately. The tar collected is drawn off through a siphon to a vessel open to the atmosphere.—R. L.

Presses for the treatment of paraffin scale or wax, fats, fatty acids, and like substances; Horizontal ——. J. Bateman, London. Eng. Pat. 19,184, Aug. 26, 1907.

THE charges of paraffin, etc., usually contained in bags, are placed in separate pressing frames provided with porous plates or gratings, and with gear for the expression. Each of these is adapted to be let down into tanks of hot water, wherein the pressing is effected, and the expressed softer material carried off by a current of water. An injection of mixed air and steam, bubbling upwards through the frame, promotes the separation of the softer material.—C. A. M.

Petroleum oils; Process for purifying ——. E. W. Wynne. Fr. Pat. 386,651, Jan. 29, 1908. Under Int. Conv., Jan. 30, 1907.

SEE Eng. Pat. 2314 of 1907; this J., 1907, 863.—T. F. B.

Fat from mineral oils. Eng. Pat. 17,523. *See* XII.

IV.—COLOURING MATTERS AND DYESTUFFS.

Sulphonation; Kinetics of ——. H. Martinsen. Z. physik. Chem., 1908, **62**, 713—725.

EXAMINATION of the conditions of sulphonation of *p*-nitrotoluene gave the following results:—The sulphonation is a reaction of the first order, as far as nitrotoluene is concerned. It is influenced, in the direction of being limited, by the water produced. The velocity of reaction is greater as the acid is stronger; a given amount of water appears to have a greater effect on the velocity, when added as a diluent to actual sulphuric acid, than when added to a fuming acid. The following coefficients express the velocity of sulphonation (at 25° C.) in the corresponding media:—

H_2SO_4, 2·4 per cent. SO_3 ......$k_1 = 0·003$
H_2SO_4 ....$k_1 = 0·0004$
99·4 per cent. H_2SO_4, 0·49 per cent.
H_2SO_3 ....$k_1 = 0·0000005$

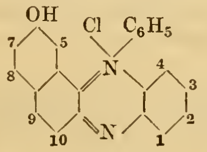
For each 10° C. rise of temperature, the coefficient is increased two- to two-and-a-half-fold. The method affords a new means of following the progress of sulphonation; it consists in keeping the substance to be sulphonated at a constant temperature in a large excess of sulphuric acid of the desired strength, and after stated periods, taking out samples, nitrating with a quantity of nitric acid exactly enough for the amount of the original substance contained in the sample, and ascertaining by the nitrometer the amount of nitric acid in excess, which corresponds to the amount of sulphonation that has taken place.—J. T. D.

o-Nitrobenzaldehyde; Condensation of —— with aromatic hydrocarbons in presence of concentrated sulphuric acid. A. Kliegl. Ber., 1908, **41**, 1845—1851.

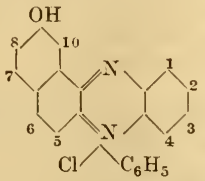
o-NITROBENZALDEHYDE (5 grms.), toluene (20 grms.) and concentrated sulphuric acid (20 grms.) are mixed in the cold and allowed to remain for 24 hours. Water is then added, the whole extracted with ether, and after evaporation of the ether and toluene, distilled in steam. The yellow distillate consists of a mixture of *o*-nitrophenyl-*p*-tolylketone and *p*-tolylanthroxan, which are separated by fractional crystallisation from alcohol. *o*-Nitrophenyl-*p*-tolylketone was also synthesised by oxidising *o*-nitrophenyl-*p*-tolylmethane (prepared from *o*-nitrobenzy chloride, toluene, and aluminium chloride) with sodium bichromate and glacial acetic acid. It crystallises from glacial acetic acid in colourless prisms melting at 155° C., and yields *o*-nitrobenzoyl-4-benzoic acid on oxidation. *p*-Tolylanthroxan is best prepared by reducing *o*-nitrophenyl-*p*-tolylketone with tin and acetic acid. It crystallises from alcohol in yellow needles or plates melting at 95·5° C. *o*-Nitrobenzaldehyde condenses more slowly with benzene to yield chiefly phenylanthroxan : only a trace of *o*-nitrobenzophenone was obtained in one experiment. —J. C. C.

7-Hydroxy-β-naphthoquinone ; Azonium compounds and azines from ——. F. Kehrmann and R. Brunel. Ber., 1908, **41**, 1832—1837.

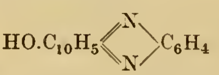
By heating a mixture of phenyl-*o*-phenylenediamine hydrochloride (2·4 grms.) and 7-hydroxy-β-naphthoquinone (2 grms.) in alcoholic solution to which a trace of hydrochloric acid is added (100 c.c. of alcohol : 2 drops of acid), 6-hydroxyphenylisonaphthophenazonium chloride (I) is formed in black, shining leaflets. The free base could only be obtained as a green solution by treating this with silver hydroxide. When the chloride is allowed to remain some days in contact with aniline, the aniline-group enters the position (3), with the formation of a dark-blue substance. The isomeric 9-hydroxyphenylnaphthophenazonium chloride (II.) is formed to a slight extent in the above reaction. By using *o*-phenylenediamine hydrochloride in this condensation instead of the phenyl derivative, 9-hydroxynaphthophenazine



I.



II.



$$HO.C_{10}H_5\genfrac{}{}{0pt}{}{\diagup N \diagdown}{\diagdown N \diagup}C_6H_4$$

is obtained. This crystallises in yellow leaflets, m. pt. 285° C. —J. C. C.

Helianthin [*Methyl Orange*] ; *Action of dilute nitric acid on* ——. J. J. Fox. Ber., 1908, **41**, 1989—1991.

When Methyl Orange is mixed with dilute nitric acid it is decomposed, with formation of dinitromonomethylaniline and elimation of a methyl group. By keeping the mixture cold and filtering from the dinitromethylaniline, the presence of a diazo-compound in the filtrate can be detected.—J. C. C.

Lactone dyestuffs. III. Constitution of ellagic acid. J. Herzig, J. Polak, and M. V. Bronneck. Monats. f. Chem., 1908, **29**, 263—280. (See also this J., 1904, 818 ; 1907, 193).

Ellagic acid was converted into its tetramethyl-derivative by means of diazomethane, and then further methylated by means of methyl iodide in alcoholic solution. In this way two ether-esters were obtained, which on analysis proved to be the mono- and di-ether-ester respectively of the dilactone of diphenyl-2.3.7.8-tetramethoxy-1.6-dihydroxy-5.10-dicarboxylic acid. The formation of these compounds is a further confirmation of the correctness of Graebe's formula for ellagic acid (see this J., 1905, 899, 1087).—A. S.

Lactone dyestuffs. IV. Resoflavin and its analogue from gallic acid. J. Herzig and R. Tscherne. Monats. f. Chem., 1908, **29**, 281—294. (See this J., 1907, 193).

It has been found that the compound, $C_{14}H_3O_2(OCH_3)_7$, obtained by the further methylation of trimethylresoflavin, yields the ether-acid, $C_{12}H_3(OCH_3)_5(COOH))_2$. when saponified with strong alkali. Resoflavin is therefore a derivative of diphenyldimethylolide, and its formation from *sym.*-dihydroxybenzoic acid may be expressed by the equation :

$$2C_7H_6O_4 + O_2 = C_{14}H_6O_7 + 3H_2O.$$

The analogue of resosflavin obtained by the oxidation of gallic acid, and probably identical with Perkin's flavellagic acid (this J., 1906, 258), was proved, in a similar manner, to be a monohydroxy derivative of ellagic acid.—A. S.

Patents

Vat dyestuffs ; Manufacture of ——. O. Imray, London. From Farbwerke vorm. Meister, Lucius, und Brüning, Hoechst a/Main, Germany. Eng. Pat. 8162, April 8, 1907.

New vat dyestuffs are formed when phenylthioglycollic acid, or one of its substitution products having a free ortho-position, is treated in the cold or gently warmed with sulphuric acid chlorhydrin. Dyestuffs prepared from meta-substituted phenylthioglycollic acids tend to have reddish shades, whilst para-substituted derivatives produce dyestuffs of a bluish tint. Substituted naphthylthioglycollic acids with a free peri- or ortho-position can be employed instead of substituted phenylthioglycollic acids, and the sulphuric acid chlorhydrin may be replaced by sulphuric acid chlorhydrin which has been treated with sulphur. —P. F. C.

Azo dyestuff ; Red ——. C. O. Müller and A. Otto, Assignors to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on the Maine, Germany. U.S. Pat. 888,837, May 26, 1908.

See Eng. Pat. 9548 of 1907 ; this J., 1907, 960.—T. F. B.

Methylthiophenol-o-carboxylic acid ; Making ——. B. Homolka, Frankfort, and R. Welde, Assignors to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on the Maine, Germany. U.S. Pat. 889,010, May 26, 1908.

See Eng. Pat. 593 of 1907 ; this J., 1907, 1003.—T. F. B.

Vat [*thioindigo*] *dyestuffs ; Process of making* ——. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 386,317, April 8, 1907.

See Eng. Pat. 8162 of 1907 ; preceding.—T. F. B.

p-Nitrochrysazindi-methylether ; Preparation of ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 193,104, July 15, 1906.

Chrysazindimethyl ether is nitrated by treatment with 1 mol. of nitric acid in solution in concentrated sulphuric acid.—T. F. B.

Leuco-compounds of the oxazine series ; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 17,960, Aug. 7, 1907.

See U.S. Pat. 884,745 of 1908 ; this J., 1908, 497.—T. F. B.

Tetrazo dyestuff ; Red ——. E. Meyer, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 888,522, May 26, 1908.

See Fr. Pat. 383,128 of 1907 ; this J., 1908, 329.—T. F. B.

Leuco derivatives of the gallocyanine series ; Production of new ——. Farbenfabriken vorm F. Bayer und Co. Fr. Pat. 386,065, Jan. 9, 1908. Under Int. Conv., April 22, 1907.

The new derivatives are obtained by the condensation of gallocyanines with compounds containing the glycine radical (.$NH.CH_2.CO_2H$), such as phenylglycine, naphthylglycine, aminophenylglycine, etc. Thus, 65 kilos. of gallocyanine are added to a solution of 31 kilos. of phenylglycine in 24 kilos. of hydrochloric acid (19° B.) and 300 litres of water. The mixture is heated to boiling, and maintained at this temperature until the colour just disappears.—F. M.

Leuco derivatives of the gallocyanine series ; Process for producing ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 386,066, Jan. 9, 1908.

See U.S. Pat. 884,745 of 1908 ; this J., 1908, 497.—T. F. B.

Dyestuff ; Direct cotton ——. J. Turner, Huddersfield. U.S. Pat. 888,942, May 26, 1908.

See Fr. Pat. 375,476 and Eng. Pat. 3167 of 1907 ; this J., 1907, 961, and 1908, 277.—T. F. B.

Tetrazo dyestuff ; Red ——. K. Jedlicka and A. Schedler, Assignors to Soc. Chem. Ind. in Basle, Basle. U.S. Pat. 889,016, May 26, 1908.

See Eng. Pat. 6814 of 1907 ; this J., 1907, 1003.—T. F. B.

Vat [thioindigo] dyestuff ; Production of a red ——. Fabr. Bâloise de Prod. Chimiques. Fr. Pat. 385,920. Jan. 3, 1908. Under Int. Conv., Jan. 16, 1907.

See Eng. Pat. 344 of 1908 ; this J., 1908, 399.—T. F. B.

Sulphonation of aromatic bodies ; Process for the approximate separation of reaction products resulting from the ——. W. Miersch, Niedersedlitz, Germany. U.S. Pat. 889,799, June 2, 1908.

See Fr. Pat. 373,338 of 1907 ; this J., 1907, 680.—T. F. B.

Azo dyestuffs ; Process for producing ——. Act.-Ges. f. Anilinfabr. Fr. Pat. 386,101, April 4, 1907.

See Eng. Pat. 7147 of 1907 ; this J., 1908, 156.—T. F. B.

[Azo] dyestuffs for wool ; Process for producing yellow ——. Act.-Ges. f. Anilinfabr. Fr. Pat. 386.316, April 8., 1907.

See Eng. Pat. 7146 of 1907 ; this J., 1908, 71.—T. F. B.

Disazo dyestuffs and their manufacture. Act.-Ges. f. Anilinfabr. Fr. Pat. 386,719, April 16, 1907.

See Eng. Pat. 8729 of 1907 ; this J., 1908, 329.—T. F. B.

α-β-Hydroxyanthraquinones or anthraquinone-α-β-hydroxysulphonic acids ; Preparation of ——. R. Wedekind und Co. Ger. Pat. 195,874, July 23, 1903.

Anthraquinone-α-β-disulphonic acids or their alkali salts are heated under pressure, in aqueous solution or suspension, with alkaline-earth hydroxides, in presence of an oxidising agent.—T. F. B.

Hydroxy-compounds ; Process for the preparation of —— *from their alkali salts.* Chem. Fabr. Grünau, Landshoff und Meyer. Ger. Pat. 192,881, July 22, 1906.

The alkali salts are treated with carbon monoxide under pressure, at a temperature above 150° C., alkali formates being formed in addition to the hydroxy-compound. In applying the process to the preparation of alizarin, the latter remains dissolved in the alkali formate, but can be separated by addition of a small quantity of a mineral acid.—A. S.

Thiosalicylic acid ($SH:COOH = 1:2$) *; Preparation of* ——. L. Cassella und Co. Ger. Pat. 193,290, July 26, 1906. Addition to Ger. Pat. 189,200, June 29, 1906.

The process described in the original patent (this J., 1908, 246) may be modified by the substitution of alkali sulphides for sulphydrates. The reaction is accelerated by addition of copper or a copper salt.—T. F. B.

p-Aminodiphenylamine and its derivatives ; Preparation of ——. F. Ullmann. Ger. Pat. 193,351, Sept. 9, 1906.

The sulpho-group may be removed from 4-aminodiphenylamine-2-sulphonic acid or its derivatives by heating with mineral acids to a temperature not exceeding 100° C.—T. F. B.

p-Nitrodiphenylamine and its derivatives ; Preparation of ——. F. Ullmann. Ger. Pat. 193,448, July 17, 1906.

4-Nitrodiphenylamine-2-sulphonic acid or its derivatives is converted into *p*-nitrodiphenylamine or its derivatives by heating to temperatures not over 100° C., and without increase of pressure, in presence of mineral acids.—T. F. B.

Vat dyestuffs ; Process for preparing ——. Kalle und Co. Ger. Pat. 197,037, Jan. 17, 1907.

3-Oxy-(1)-thionaphthene is condensed with halogen derivatives of *α*-naphthol or *α*-naphthoquinone which have at least one halogen atom in the *ortho*-position to an oxygen. The dyestuff from 2.3-dichloro-*α*-naphthoquinone, for example, gives a yellowish vat, which dyes blue-black shades on textile fibres.—T. F. B.

Isatin and its monomethyl derivative ; Preparation of ——. R. Bauer. Ger. Pat. 193,633, Feb. 21, 1907.

Diphenyl- or ditolyl-oxalimide chloride, RN:CCl.CCl:NR, obtained by treating the oxamides with phosphorus pentachloride, is warmed with sulphuric acid; the isatin may be isolated by pouring the solution into water, or by neutralising the product with baryta, diluting the solution, and precipitating the isatin with hydrochloric acid. —T. F. B.

o-Hydroxydisazo dyestuffs ; Process for preparing chrome ——. Anilinfarben-und Extrakt Fabr. J. R. Geigy. Ger. Pat. 197,036, May 22, 1907.

m-Hydroxy-*p*-diazobenzene-*p′*-sulphonic acid, obtained by treating *m*-nitro-*p*-diazobenzene-*p′*-sulphonic acid with an alkali bicarbonate, is combined with an azo dyestuff component. Alkali carbonates convert the nitro-compounds into nitrosamines which will not combine with phenols, etc. The dyestuffs dye wool red-brown to green shades, of good depth and fastness.—T. F. B.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

Artificial silk ; Microscopical examination of dyed fibres of ——. W. Minajeff. Z. Farben-Ind., 1908, 7, 63—66, 81—83.

"Glanzstoff" was chosen as the particular artificial silk fibre, because, being produced from cuprammonium solution, the cellulose is said to be more or less pure. The fibres of "Glanzstoff," unlike the cotton fibres from which they are made, are homogeneous and structureless, somewhat resembling glass. Fibres dyed with substantive cotton dyestuffs were found to have the dye fairly evenly distributed over their surfaces ; the sections of the dyed fibres showed that the outside of the fibre was coloured deepest, and that the colour gradually decreased in intensity towards the centre of the fibre. In the case of a group of fibres attached together, the parts of the fibres inside the group were not so strongly dyed as those on the outside ; the group acted in this respect as a single fibre. The sulphide dyestuffs were found to behave entirely differently from the substantive cotton colours towards the "Glanzstoff" fibres, in that the sections of the fibres dyed with these colours showed an even dyeing throughout the mass. Indigo was deposited evenly on the fibres ; the sections of the dyed fibres showed that the outside of the fibre was the deepest dyed, whereas the centre was hardly affected. The intensity of the colour, however, did not fade gradually towards the centre of the fibre, but divided itself into two and sometimes three zones, which were evenly coloured but weaker in intensity as the centre was approached. Basic dyestuffs were not taken up evenly by the fibres. The sections of the fibres dyed with these colours showed that whilst the colour lake was aggregated principally on the outside of the fibres, in some cases small specks of the lake existed inside the fibre. Aniline black was found to be taken up evenly by the "Glanzstoff." On magnifying the fibres dyed with Paranitraniline Red to 220 diameters, the colour lake was seen to be irregularly dispersed in patches over the surface of the fibre. Turkey Red existed on the fibre in small patches, the fibre substance being practically undyed. When a group of fibres was dyed Turkey Red, the colour lake was deposited on the outside of the group, leaving the inner constituents unaffected. In comparing the dyeings in the case of cotton (natural fibre) (see this J., 1907, 1236) with those of "Glanzstoff" (artificial fibre), the author regards the presence of the canal in the former fibre as undoubtedly assisting the penetration of the dyestuff throughout the mass of the fibre. Sketches of the fibre as seen under the microscope are given.—S. H. H.

Indigo ; Action of oxalic acid in discharging ——. W. P. Jorissen and W. E. Ringer. Chem. Weekblad, 1908, **5**, 269—275. Chem. Zentr., 1908, 1, 1996. (See also this J., 1903, 623, 1344.)

By means of conductivity determinations, the authors have found that there is no formation of a double compound when dilute solutions of chromic acid and oxalic acid are mixed, and hence that Prudhomme's explanation of the accelerating effect of oxalic acid on the oxidation of indigotin by chromic acid (this J., 1903, 359, 491) falls to the ground.—A. S.

Indigo, a blue sulphide dyestuff, and Indanthrene Blue ; Examination of —— *on the cotton fibre.* G. Nothnagel and R. Vive. Veröffentl. Gebiete d. Militärsanitätswes., **38**, 20—34. Chem. Zentr., 1908, **1**, 1993.

The authors have examined the fastness of indigo, an unidentified blue sulphide dyestuff, and Indanthrene Blue on cotton. It was found that the Indanthrene dyestuff was faster in all respects than indigo and the sulphide dyestuff. It was fast to light and washing, and was not attacked appreciably by any of the reagents tried (soap, sodium carbonate, alcohol, ether, acids, alum, borax, mercuric chloride, cresol soap solution, perspiration) with the exception of bleaching powder. After attack by bleaching powder, the Indanthrene dyestuff could be regenerated by treatment with sodium hydrosulphite. —A. S.

Patents.

Artificial horse-hair and ribbons of cellulose ; Manufacture of ——. E. Crumière, Paris. Eng. Pat. 6766, March 26, 1908. Under Int. Conv., April 23, 1907.

See Fr. Pat. 377,118 of 1907 ; this J., 1907, 1045.—T. F. B.

Artificial silk threads ; Production of lustrous and soft —— H. E. A. Vittenet. Fr. Pat. 386,109, April 5, 1907.

The opacity of artificial silk is stated to be due to an excess of moisture in the nitrocellulose solution, or to the atmosphere in which the thread is produced being too damp. In the arrangement described, the spinnerets are in a chamber in which air, of about 50 per cent. humidity and with a temperature of about 10° C., is circulated. The reels upon which the threads are wound, are surrounded by a hood, within which a temperature of 60° to 80° C. is maintained by means of steam pipes, or the reels may revolve in frictional contact with a hollow cylinder through which hot water flows. By this arrangement the rate of evaporation of the solvent is retarded during the first period of coagulation, and any moisture which may have been deposited in the thread is at once removed in the warm atmosphere in which the coagulation is completed, the fibres thus produced being soft and highly lustrous. —F. M.

Artificial silk ; Manufacture from commercial cellulose of white, brilliant, supple, elastic, and tough threads of ——. G. Guadagni. Fr. Pat. 386,339, Jan. 18, 1908. Under Int. Conv., Sept. 28, 1907.

Cellulose is dissolved in a solution of ammonia, containing in suspension sufficient copper hydroxide to form a cupric compound with the cellulose, which is readily soluble in the cuprammonium solution. The solution of the cellulose is effected in an airtight vessel, provided with an agitator and connected with an airtight reservoir containing the cellulose to be dissolved. This reservoir is also provided with a device whereby a constant quantity of cellulose can be transferred automatically into the solution vessel. A current of air is forced into the cuprammonium solution, and by the rapid evaporation of ammonia which is thus produced, the low temperature necessary for the solution of the cellulose is obtained. The ammonia, liberated in this manner, is afterwards brought into contact with the cellulose contained in the reservoir. The solution of cellulose in the cuprammonium liquor is forced through fine apertures into a coagulating bath consisting of solutions of hydrochloric and sulphuric acids in such quantities that the total acidity is just sufficient to convert the bases (copper and ammonia), employed in the solution of the cellulose, into salts. —P. F. C.

Felt ; Process for preparing fabrics for milling and for removing acid and fatty substances from ——. E. Thomas. Fr. Pat. 386,432, April 10, 1907.

The fabric is first treated with a sulpholeic acid and then milled in dilute sulphuric acid (0·5°—2° B.). The material is then worked for 20—25 minutes in lukewarm water, and is finally washed for 45 minutes in cold water.—P. F. C.

Bleaching of [*vegetable*] *fibres, fabrics, etc.* A. G. Bloxam, London. From Kirchhoff und Neirath, Berlin. Eng. Pat. 15,137, July 1, 1907.

It is proposed to treat the material with magnesium perborate at a temperature just above 100° C., and under pressure, in the presence of an alkali (caustic soda, sodium carbonate), or a weakly alkaline salt such as sodium phosphate or borate, or an alkali salt of a fatty acid. The amount of active oxygen required for effective bleaching is stated to be 0·03 to 0·06 per cent. of the weight of the goods taken. The feature of the process is the working under raised temperature and pressure, and it is claimed that even though the boiling is carried out in the presence of alkali and an oxidising agent, there is no tendering due to the formation of oxycellulose.—F. M.

Mercerising ; Process of ——. A. E. Smith and J. K. Milliken, Dighton, Mass. U.S. Pat. 889,861, June 2, 1908.

The material is successively treated with a crude solution of viscose and with an alkali.—P. F. C.

Fabrics ; Treatment of textile ——. D. Chedlow, Great Yarmouth, W. P. Dreaper, Felixstowe, and W. T. Hall, Great Yarmouth. Eng. Pat. 11,575, May 17, 1907.

A frame consisting of two slotted sides, held together by four stout stay-rods, is fixed at the middle in suitable bearings, so as to swing and rotate freely. In order to fill the frame with the fabric, the two end stays are removed, one end of the fabric to be treated is attached to a slender rod, and this rod is then inserted into two opposite slots in the arms of the H-shaped skeleton frame. The whole frame is given a half turn, a second rod is slipped into the second pair of slots, and the fabric then wrapped round it. These operations are repeated until the whole length of the fabric is wound on to the frame. To keep the rods from touching one another along their length, they are provided with button ends. In order to allow of the necessary contraction in the length of the goods, the machine is provided with a device which ensures that the folds of the fabric are quite loose at the time of immersion. The whole frame with the fabric wound upon it, is arranged inside a tank containing the necessary solution, and a swaying or other suitable motion is imparted to it.—P. F. C.

Wool or like fibres ; Appliances for the treatment of —— *by dyeing, etc.* J. W. Burgoyne, Bradford. Eng. Pat. 23,736, Oct. 28, 1907.

Yarn or slubbing, of wool, cotton, flax, or the like, may be scoured, disinfected, or dyed in a tank, in which it rests upon a false bottom. Above the tank is a hydraulic press, the plate of which works in guides, and beneath this plate, and adjustable in relation to it, is a "scray," or auxiliary presser, which comes into contact with the material under treatment, and squeezes out all superfluous liquor, when the ram of the press is lowered. Thorough impregnation of the material is obtained by lowering and raising the press, whilst the liquor is in the tank, after which the liquor is run off, and the material is washed with water. The excess of water is then squeezed out, and the false bottom, with the material resting on it, is lifted out by a device described in the patent.—F. M.

Starching and dyeing. E. M. Sharp, Padiham, Lancs. Eng. Pat. 12,695, June 1, 1907.

The goods to be starched and dyed are dipped into a liquid containing starch and with the dyestuff held in suspension by gum tragasol. The gum tragasol also prevents the subsequent rotting of the goods submitted to this process. On drying the material after the dipping, it is ready for use, and has a brilliant colour. The starch and gum tragasol may be combined as described in Eng. Pat. 7560 of 1904 (this J., 1904, 1212).—S. H. H.

Dyeing with sulphide dyestuffs; Process for ——. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 386,501, April 11, 1907.

See Eng. Pat. 8631 of 1907; this J., 1908, 559.—T. F. B.

Colouring matters [azo dyestuffs] on the fibre; Production of ——. Calico Printers' Assoc., Ltd., and E. A. Fourneaux. Fr. Pat. 386,681, Jan. 2, 1908. Under Int. Conv., Jan. 11, 1907.

See Eng. Pat. 765 of 1907; this J., 1908, 157.—T. F. B.

Colouring matters on the fibre; Production of ——. Calico Printers' Association, Ltd., and E. A. Fourneaux. Fr. Pat. 386,069, Jan. 9, 1908. Under Int. Conv., Jan. 11, 1907.

See Eng. Pat. 764 of 1907; this J., 1908, 157.—T. F. B.

Yarns; Apparatus for printing or dyeing ——. N. Costikyan, Leicester. Eng. Pat. 23,675, Oct. 26, 1907.

Warp yarns, and especially carpet or pile yarns, are suitably supported, and as many knots or spaces printed, or dyed, in uniform or different shades as desired, by causing suitable discs which revolve in troughs containing the colour or dyestuff, to come into contact with them. The discs are secured upon shafts (supported upon spring-bearings) which are carried in a framework or carriage, capable of movement in a lateral direction. When one length of yarn has been printed, the carriage is moved, or the yarn drawn forward, so that a fresh length comes opposite the printing rollers, and the operations are repeated until the whole length of yarn has been treated. —F. M.

Aniline Black on fibres and fabrics; Production of ——. A. G. Green. Fr. Pat. 386,361, Jan. 18, 1908. Under Int. Conv., Feb. 12, 1907.

The material is impregnated or printed with a mixture containing aniline or its homologues, an organic or a mineral acid, and an oxygen-carrier such as a copper salt, together with a para-diamine or a para-aminophenol. To prevent the formation of oxidation products in the padding liquor, the copper salt may be reduced to the cuprous state by the addition of a sulphite, and the cuprous salt thus formed may be kept in solution by adding an alkali chloride to the liquor. After impregnation, the black is developed by steaming, ageing, chroming, or in any other manner.—P. F. C.

Printing of felt and like material. R. J. C. Mitchell, Swinderby, Lincoln. Eng. Pat. 20,747, Sept. 18, 1907.

An ordinary lithographic machine is employed for the process, but in order to ensure a good impression, the design may be raised more than is usually the case when paper is printed. The felt may be dyed before printing. The various colours forming the design are printed separately, each colour being allowed to dry before another is applied; by this means the colours are given greater prominence and brightness. The products have a hand-painted appearance, and are more artistic than those obtained by the use of printing rollers, followed by steaming and washing. When the felt is liable to stretch and so interfere with the register of the colours, it is coated with a substance which produces a non-stretching film or skin. Short pile velvet which has a firm surface may also be printed in this way.—S. H. H.

Textile fabrics; Process for producing impressions fast to water on ——. L. Lilienfeld, Vienna, Assignor to G. H. Winterbottom, Northampton. U.S. Pat. 888,516, May 26, 1908.

See Eng. Pat. 592 of 1907; this J., 1908, 73.—T. F. B.

Printing of fabrics, yarn, and the like; Multi-colour, rotary machine for the ——. W. Erler. Fr. Pat. 386,357, Jan. 18, 1908.

This machine is provided with a number of felt-covered cylinders, which rotate in unison and are arranged in sets of two, the uppermost cylinder in each set being so mounted that it dips into a reservoir containing the printing colour. An endless band, out of which the desired design has been cut, is carried by each pair of cylinders, and at the uppermost part of its journey, each band travels just underneath the slot-shaped mouth of an aspirator. The material to be printed is made to travel between the endless bands and the aspirators, and the printing colour is thus drawn from the saturated felt of the upper cylinders through the perforations in the endless bands, and on to the material.—P. F. C.

Impregnating textile fabrics, etc.; Preparation for ——. H. Dugour, Paris. Eng. Pat. 12,556, May 30, 1907.

Textile fabrics and other materials are rendered waterproof and impermeable when impregnated with a solution prepared with 30 parts of denatured alcohol, 5 parts of of colophony, 5 parts of ether, 6 parts of glycerin, 35 parts of benzene, 10 parts of gutta-percha, and 7 parts of amyl acetate. The solution is fluid and transparent and easily penetrates the fibre. It may be applied mechanically or by hand, by means of a brush. Textile fabrics after impregnation are supple and strong, the freshness of dyed shades is not impaired, the "finish" is rendered permanent, and the fabrics will stand washing. —F. M.

Dyeing paper or fabric in the web. Eng. Pat. 25,090. *See* XIX.

VI.—COLOURING WOOD, PAPER, LEATHER, &c.

Acid in leather dyeing: its absorption and effect. M. C. and J. W. Lamb. Leather Trades Rev., 1908, **41**, 262—263, 345—346.

A series of experiments was made with small pieces (5 in. by 4 in.) of oak-bark tanned calfskin. Previous to cutting up, the skin was washed, sumached, struck out, and dried. The pieces of leather were immersed in 800 c.c. of $N/50$ solutions of sulphuric, hydrochloric, formic, and oxalic acids, and sulphuric acid with sodium sulphate, respectively. In these solutions they remained one hour and were then removed, allowed to drain back into the solution, and the residual acid titrated with standard alkali. The pieces of skin were then dried, and their colour and quality examined. Experiments of this nature were made at the following temperatures: 15°, 50°, 55°, 60°, 65° and 70° C.; and also when the concentration of the acid was varied to $N/100$. The effect of plain water at the above temperatures was also noted. Similar experiments were made with pieces of East India tanned (Turwar bark) goat skin, sumach goat skin, sumach skiver, and Australian (mimosa tanned) basils. The authors' conclusions are as follows:—(1.) There is little liability of injury to well tanned leather by immersion in water below 60° C. (2.) The amount of acid absorbed by the leather is practically the same, no matter what the concentration, providing that sufficient excess is employed. The maximum absorption (in percentages by weight) is given in the following table :—

Acid.	Calf.	E. I. goat.	Sumach goat.	Skiver.	Basils.
Hydrochloric ...	2·0	2·9	4·0	8·0	1·8
Sulphuric	3·0	4·5	6·0	11·6	3·2
Formic	0·9	1·5	1·7	6·3	1·5
Oxalic	1·6	3·5	0·8	5·7	2·0

(3.) Any excess of acid not absorbed by the leather conduces to rapid disintegration of the leather at a much lower temperature than would otherwise be the case. (4.) There is much less liability of damage to goods with using formic acid than with any other of the acids mentioned.

—H. G. B.

VII.—ACIDS, ALKALIS, AND SALTS, AND NON-METALLIC ELEMENTS.

Sulphuric acid manufacture ; Explanation of the contact-process of ——. L. Wöhler, W. Plüddemann, and P. Wöhler. Z. physik. Chem., 1908, **62**, 641—677.

A COMPARISON of the contact-action of chromium sesquioxide, cupric oxide, cuprous and cupric chromite, ferric oxide, alumina, silica, and the oxides of thorium, cerium, and titanium, showed that the curves expressing the ratio of actual to theoretical yield, for equilibrium, in relation to the temperature, all pursue a similar course, rising with the temperature, without showing a maximum. The sintering of the surface of the contact-substance during heating was found to exert a very great effect on its action, and certain apparent maxima were found to be really due to this cause. The influence of the surface was found not to be proportional to the size of the particles, as ascertained by the Chancel sulphurimeter. In the case of differently prepared or treated samples of the same substance, their adsorptive powers were found to be proportional to the efficiencies of their contact action ; but this relation does not exist when different substances are compared. The variation of adsorption with concentration depends on the adsorbing substance; the exponent of adsorption varies between 0 and 1. The action of the contact substances in the sulphuric acid process can be explained by the supposition of the intermediate formation of a solid solution of the gas components, whether it be of gas or of a solid chemical compound.—J. T. D.

Chilian " caliches " ; Composition of some ——. F. W. Dafert. Monats. f. Chem., 1908, **29**, 235—244.

CHEMICAL examination of eight specimens of " caliche " from widely different sources showed that in all cases the portion soluble in water contained calcium, magnesium, potassium, sodium, nitrate, chloride, sulphate, and iodate. In most cases, perchlorates also were present ; and in the two specimens richest in nitrates, small quantities of chromate were found. In no case did the soluble portion contain bromide, borate, nitrite, ammonia, carbonate, phosphate, or iodide. The specimens richest in sodium nitrate contained also much potassium nitrate. Different views as to the causes of the presence of iodate and perchlorate are discussed, the author being inclined to the hypothesis that iodate and periodate are produced by the action of the higher oxides of nitrogen, or of their unstable compounds with ammonia, on iodide, and perchlorate by the oxidation of chloride by iodate.—A. S.

Nickel oxides ; Reduction and oxidation of —— at various pressures. W. Ipatiew. J. prakt. Chem., 1908, **77**, 513—532.

SO-CALLED " pure " nickelic oxide contains little of the oxide, Ni_2O_3, but consists largely of nickelous oxide, NiO, and water. Nickelic oxide is reduced by hydrogen at 190°—200° C. to the metal, but nickelous oxide, which is present in the commercial oxide, is not reduced at this temperature, which explains why the commercial oxide is not completely reduced at 200° C. In experiments on the reduction of the oxide, the production of brown fumes with nitric acid forms a safe indication of the presence of reduced metal, even in traces. Nickel, reduced below 270° C., is pyrophoric, burning to form nickelous oxide. Reduced nickel is not acted upon by dry oxygen at 300° C., though it is oxidised at this temperature by moist oxygen ; at 400° C. dry air or oxygen converts the metal completely into the monoxide, but even at 480° C. and in the presence of moisture, this is not converted into the higher oxide. When heated in hydrogen under pressure, nickelic oxide is reduced energetically and completely to the metal at 210° C., though it is not appreciably affected at 172° C. The monoxide, on the other hand, is reduced to nickel at 172° C. and at a high pressure. If previously strongly heated, however, reduction is slow, even at 250° C., showing the important influence of water. In bringing about the combination of hydrogen and oxygen, nickelic oxide acts as a catalyst, causing explosion at 160° C., the oxide being partly reduced. In the conversion of benzene into hexahydrobenzene, the oxide is reduced to the metal (compare this J., 1907, 492). The ignited oxide requires a much higher temperature than 200° C. to effect this change. In experiments on the maximum speed of hydrogenation of benzene in the presence of nickelic oxide and of reduced nickel respectively, the magnitude of $\left(dP/dT\right)$ max. is found to be greater for the oxide than for the reduced metal, which shows that the oxide plays the more important part as a catalyst, probably being reduced and reformed, with the liberation of nascent hydrogen. The special value of nickel and cobalt, in this connection, is probably due to the readiness with which they undergo oxidation and reduction.—F. SODN.

Silicide ; A new calcium ——. L. Hackspill. Bull. Soc. Chim., 1908, **3**, 619—621.

A MIXTURE of powdered silicon and calcium filings is heated to 1000° C. in a hole bored in a cylinder of calcium fitting into an iron test-tube and contained in a porcelain tube. Excess of calcium is removed from the product by sugar solution, and small needles of calcium silicide, Si_2Ca_3, are obtained. This is acted on by the halogens in the cold and by oxygen at a red heat. Dilute mineral acids decompose it with evolution of spontaneously inflammable hydrides of silicon.—J. C. C.

Sicilian sulphur industry. Board of Trade J., June 25, 1908. [T.R.]

THE combined efforts of the Sulphur Association and the Government have not succeeded in averting the crisis that threatens the industry ; the excess of production over consumption still continues, and it seems impossible to arrest it. At the end of February last the stock in hand was estimated at 572,778 metric tons, the production at about 450,000 metric tons, and the exports not exceeding 400,000 metric tons. At Port Empedocle and Licata there is no room for new warehouses or depots, the stocks there being already of an enormous size. It has been proposed that, in order to limit the production, the mining law should be stringently enforced ; this would certainly affect some mines. The sale of sulphur for industrial purposes at specially low rates has also been advocated, but this proposal has been abandoned as difficult to control and also as contravening an agreement with the American industry. Another scheme is for the sale abroad of sulphur ore (unrefined) as a substitute for pyrites, and the use of the ore for this purpose was made the subject of special study on the part of the Government (see this J., 1908, 222).

PATENTS.

Red oxide of iron, zinc sulphate, and sulphuric acid ; Process for preparing ——. G. Evans, London. Eng. Pat. 11,338, May 15, 1907.

To ores or tailings, containing zinc as oxide or carbonate, ferruginous material, *e.g.*, burnt pyrites or iron ore, is added, the whole is ground and mixed with sufficient sulphuric acid of 50° B. to convert all the metals present into sulphates. The mass is then slowly calcined in a current of air, so as to decompose the ferric sulphate formed, the sulphur trioxide given off during this calcination being converted into sulphuric acid. From the residue, zinc sulphate is leached out with water or very dilute sulphuric acid, leaving a ferric oxide which may be used as a pigment. A purer ferric oxide may be obtained by leaching the sulphates originally obtained from the insoluble residue, evaporating this solution to dryness, and calcining the residue obtained.—A. G. L.

Metal sulphates from metal sulphides ; Manufacture of ——. O. Meurer, Cologne, Germany. Eng. Pat. 21,725, Oct. 1, 1907. Under Int. Conv., Oct. 19, 1906.

See Fr. Pat. 382,230 of 1907 ; this J., 1908, 226.—T. F. B.

Sodium hydrosulphide and thiosulphate ; Manufacture of anhydrous, pulverulent ——. G. W. Johnson, London. From Verein Chem. Fabr., Mannheim, Germany. Eng. Pats. 23,217B and C, Oct. 21, 1907.

See Fr. Pat. 383,136 of 1907 ; this J., 1908, 282.—T. F. B.

Cyanide of an alkali metal ; Process for the production of a ——. F. W. Morris, Victoria, J. B. Raine, J. Kerr, and C. McLachlan, Vancouver, B.C. Eng. Pat. 24,864, Nov. 9, 1907.

See U.S. Pat. 871,948 of 1907 ; this J., 1907, 1279.—T. F.B.

Cyanides ; Process of making ——. H. S. Blackmore, Mount Vernon, N.Y. U.S. Pats. 889,096 and 889,097, May 26, 1908.

A molten " oxy-compound " of a metal " inert to cyanide" is treated with nitrogen and with the carbide of an electropositive element at a temperature at which the metal of the carbide has a greater affinity than carbon for oxygen. According to the second patent, the carbide used is an endothermic compound.—A. G. L.

Alkali salt, a phosphorus-containing-manure, and carbonic acid ; Process for simultaneous production of an ——. C. N. Riiber, Christiania. Eng. Pat. 272, Jan. 4, 1908.

See Fr. Pat. 385,939 of 1908 ; following.—T. F. B.

Alkali salt, phosphatic fertiliser, and carbon dioxide ; Process for manufacturing simultaneously ——. C. N. Riiber. Fr. Pat. 385,939, Jan. 4, 1908.

A calcium phosphate insoluble in water, *e.g.*, bones, apatite, etc., is dissolved in an acid, *e.g.*, nitric acid, and an alkali carbonate, *e.g.*, sodium carbonate, is added to the liquid. Carbon dioxide is evolved, a precipitate consisting of calcium carbonate and monohydrogen calcium phosphate is obtained, and the alkali salt of the acid used is left in solution.—A. G. L.

Carbide ; Process and apparatus for the manufacture of ——. H. L. Hartenstein, Constantine, Assignor to Continental Investment Co., Duluth, Mich. U.S. Pats. 888,610 and 889,124, May 26, 1908.

See Fr. Pats. 383,053 and 383,054 of 1907 ; this J., 1908, 281.—T. F. B.

Oxycarbide of barium ; Process for the manufacture of ——. R. Battistoni, Ancona, and R. Rotelli, Venice, Italy. U.S. Pat. 888,956, May 26, 1908.

See Fr. Pat. 364,639 of 1906 ; this J., 1906, 944.—T. F. B.

Salts of cobalt and nickel ; Process of separating ——. T. B. McGhie, Assignor to T. Barton, London. U.S. Pat. 888,839, May 26, 1908.

See Eng. Pat. 7035 of 1907 ; this J., 1908, 448.—T. F. B.

Cobalt and nickel salts ; Process of separating ——. T. Barton and T. B. McGhie. Fr. Pat. 386,623, Jan. 28, 1908. Under Int. Conv., March 23, 1907.

See Eng. Pat. 7035 of 1907 ; this J., 1908, 448.—T. F. B.

Solutions of gases [sulphur dioxide] ; Method of preparing ——. H. Howard, North Woburn, Mass. U.S. Pat. 889,132, May 26, 1908.

Sulphur dioxide, mixed with other gases, is absorbed by water. The solution obtained is heated, and the evolved concentrated gas is cooled and absorbed by a sulphite solution, the water left being used over again.—A. G. L.

Evaporating apparatus for sea-water. K. Köhnke. Fr. Pat. 386,073, Jan 9, 1908.

The sea-water is continuously admitted into a closed vertical cylinder, which is filled to a definite level, and is evaporated by injecting live steam directly into the water through a rose. The vapour escapes through a valved outlet in the top of the vessel to a condenser, and by regulating the valve, a pressure equal to about two atmospheres is maintained in the vessel. The deposited salts are continuously discharged through a valved pipe controlled by a float.—W. H. C.

Oxides of manganese ; Process for the hydration of ——. O. Dieffenbach. Ger. Pat. 195,524, Aug. 27, 1904.

Native or other oxides of manganese, which are attacked only with difficulty, especially manganese dioxide, are hydrated by heating with alkaline solutions under pressure. —A. S.

Alkali manganates ; Process for the preparation of ——. O. Dieffenbach. Ger. Pat. 195,532, Aug. 27, 1904.

Alkali manganates are prepared by the action of permanganates on manganese peroxide or other oxides of manganese, suspended in a hot concentrated alkaline solution, care being taken to keep the alkaline solution agitated, and that at any one time only very small quantities of permanganate are present. For this purpose it is preferable to produce the permanganate in the solution itself, as wanted, by the chemical or electrolytic oxidation of the already formed manganate. The process may be started by the aid of other oxidising agents than permanganates.—A. S.

Basic aluminium, chromium, and iron acetates ; Process for the preparation of soluble, solid —— *by the action of sodium acetate on the corresponding sulphates.* E. de Haën, Chem. Fabr. " List." Ger. Pat. 190,451, April 24, 1906.

Solid basic acetates are obtained directly by the action of sodium acetate on the monohydroxydisulphates of aluminium, chromium, and iron, the concentration of the solutions being so adjusted that the total quantity of water, including that formed in the reaction, is just sufficient to hold the resulting sodium sulphate in solution at 34° C. —A. S.

Platinum ; Process for the recovery of —— *from platiniferous materials [e.g., contact substances].* Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 193,457, May 20, 1906.

The platinum-containing material is treated with a moist gaseous mixture of hydrochloric acid and chlorine, the product lixiviated, and the solution, after addition of barium chloride if necessary, evaporated in presence of ammonium chloride or potassium chloride. The residue is extracted with alcohol, the alcoholic solution treated with hot water, and the platinum precipitated in any of the usual ways. The process is suitable for the recovery of platinum from the platinised asbestos used in the manufacture of sulphuric acid by the contact process.—A. S.

Metallic phosphides ; Process for the preparation of ——. Gebr. Seyboth. Ger. Pat. 190,450, Sept. 30, 1906.

A dry metallic oxide is ground up with amorphous phosphorus, dextrin, ammonium chloride, and rosin, and the mixture compressed into blocks. It is stated that after this treatment, the reaction between the oxide and the phosphorus proceeds to completion in the cold.—A. S.

Sulphur compounds [with naphthalene]. H. Köhler, Berlin. Eng. Pat. 11,494, May 16, 1907. Under Int. Conv., May 28, 1906.

See Ger. Pat. 192,815 of 1906 ; this J., 1908, 503.—T. F. B.

VIII.—GLASS, POTTERY, AND ENAMELS.

Porcelains ; Microstructure and constitution of ——. E. Plenske. Sprechsaal, 1908, **41**, 256—258, 271—274, 287—290, 301—304, 313—315, 326—328.

The author gives first a *resumé* of the various products that have been classed as porcelains, and of the theories that have been advanced as to their constitution, and then the results of his own observations on the microstructure of 41 commercial porcelains of German origin. Briefly, he finds that all porcelains contain two classes of components ; first those which have preserved wholly or partly their original characteristics, and second those which have lost their mineralogical nature. Only quartz belongs to the first class, whilst the other constituents of the raw porcelain mass form the second class. Hence, the porcelains are masses in which quartz is embedded as a crystalline body in a ground mass derived from felspar and kaolin. The author carried out firing experiments in a porcelain kiln, with kaolin, quartz, and felspar, and with binary and ternary mixtures of these materials, and examined the burnt products microscopically, and also noted their physical characteristics, such as shrinkage, etc. The following are the main conclusions from these experiments. Felspar (orthoclase or microcline) on heating in the porcelain kiln to 1315° C., dissolves appreciable amounts of amorphous aluminium silicate, $Al_2O_3,2SiO_2$ (the body produced by the dehydration of kaolin), and crystalline silica, but more of the former than of the latter in a unit of time, with the production of supersaturated alumino-silicate solutions. When more aluminium silicate, $Al_2O_3,2SiO_2$, is present in the mass, and when this is heated to higher temperatures and for a longer time, the degree of supersaturation of the alumino-silicate solution, resulting from the interaction of felspar and the silicate, is raised. There appears to be a maximum value for a given ratio of the two constituents. Crystallites, which are regarded as sillimanite, Al_2O_3,SiO_2, separate out in the porcelain kiln from alumino-silicate solutions, supersaturated with alumina and silica, at a definite degree of supersaturation. Porcelains consist of a vitreous ground-mass, with more or less amorphous aluminium silicate, $Al_2O_3,2SiO_2$, corroded crystalline silica, sillimanite crystals, Al_2O_3,SiO_2, and vesicles. The ground-mass contains more silica, and perhaps also more alumina than the felspar used for the production of the porcelain. In type, the structure of porcelains can be described as hypocrystalline porphyritic, as distinguished from hyalopilitic. Porcelains, with a predominating content of felspar, burnt at a proportionately lower temperature (about Seger cone 9, say 1310° C.) and containing no crystallites, are an exception. Their structure may be described as vitrophyritic.—W. C. H.

Patent.

Glass ; Method of and apparatus for drawing ——. F. L. O. Wadsworth, Assignor to Window Glass Machine Co., Pittsburg, Pa. U.S. Pat. 889,832, June 2, 1908.

The pots containing molten glass are mounted on a series of trucks, which move on a track extending through the furnace. One or more drawing stations are provided in the path of the pots, as well as means for returning the latter to the entrance end of the furnace.—A. G. L.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Patents.

Stone ; Artificial ——. L. Lefranc, Paris. Eng. Pat. 12,137, May 25, 1907. Under Int. Conv., May 26, 1906.

See Addition of May 26, 1906, to Fr. Pat. 355,222 of 1905 ; this J., 1906, 1098.—T. F. B.

Products for the ceramic industry ; Process for making abrasive materials and —— *from bauxite or aluminous earths.* R. J. E. von Seemen. Fr. Pat. 386,110, Jan. 11, 1908. Under Int. Conv., Jan. 11, 1907.

Bauxite or other aluminous mineral is fused at a high temperature, *e.g.*, in an electric furnace, in presence of oxygen or a substance (nitre, zinc sulphate, manganese dioxide, &c.), capable of yielding oxygen. In this way the whole of the carbon present is oxidised, and the reduction of the oxides of iron, &c., contained in the mineral, is prevented. In order to overcome the injurious effect of the silica in the aluminous mineral, a quantity of a basic substance, such as magnesia, sufficient to combine with it, is added if the proportion does not exceed 15 per cent., whilst if the proportion be greater, a further quantity of silica is added, in order to produce by the subsequent fusion and oxidation, an aluminium silicate of a composition approximately the same as that of Bischoff's ideal clay.—A. S.

Enamelled bricks ; Process for making —— *in the cold for building and ornamental purposes.* F. Lostalo y Romeu. Fr. Pat. 386,328, Jan. 13, 1908.

Magnesia, lime, sand, and colouring matters are mixed with water, and either moulded under a pressure of 30,000 kilos. or more, or else placed in wooden or metallic moulds, and allowed to dry in the air.—A. G. L.

Wood ; Process for preserving ——. J. Chateau and J. Merklen. Fr. Pat. 386,441, Jan. 22, 1908.

Wood is treated under pressure, in a closed vessel, with cold water or with steam ; if steam is used, the chamber is alternately evacuated and filled with steam, the latter being supplied from a number of distributing jets. The vessel is then evacuated and filled with an antiseptic liquid under pressure, after which the antiseptic is diffused through the wood by the action of an auxiliary fluid (water or steam).—A. G. L.

Wood and other fibrous or cellular materials ; Impregnation of ——. L. H. Baekeland. Fr. Pat. 386,628, Jan. 28, 1908. Under Int. Conv., Jan. 27, 1908.

Wood or other porous material is impregnated in any usual manner with a mixture of approximately equal parts of phenol and a 40 per cent. solution of formaldehyde in water. The impregnated material is then gradually heated to 120°—150° C., at which temperature it is kept for several hours, a hard, highly-resistant condensation product of formaldehyde and phenol being formed. The reaction is greatly accelerated if the wood is first of all treated with a "catalytic agent," *e.g.*, zinc chloride. The mixture of aqueous formaldehyde and phenol is preferably replaced by an anhydrous solution of formaldehyde in phenol ; or else, sufficient sodium chloride or calcium chloride may be added to the aqueous mixture to take up the water, the aqueous solution of the chloride obtained being then removed, leaving an anhydrous mixture of formaldehyde and phenol. Or, the aqueous mixture may be heated for some time in an apparatus provided with a reflux condenser, the resulting condensation product being used to impregnate the wood, etc. ; if too viscous, this product may be thinned with an appropriate agent. Wood-shavings or sawdust may be treated in this manner, the final heating being carried out under sufficient pressure to mould the product together. —A. G. L.

Cement from blast-furnace slag ; Process for manufacturing ——. H. Colloseus, Berlin, Assignor to W. R. Warren, New York, and E. J. V. Earle, London. Reissue No. 12,801, dated June 2, 1908, of U.S. Pat. 837,918, Dec. 11, 1906.

See Eng. Pat. 15,764 of 1907 ; this J., 1908, 125.—T. F. B.

Cement ; Process of making ——. S. O. Cowper-Coles. Fr. Pat. 386,068, Jan. 9, 1908.

See Eng. Pat. 22,425 of 1906 ; this J., 1908, 162.—T. F. B.

X.—METALS AND METALLURGY.

Siemens-Martin furnace; Thermal technology of the ——. F. Mayer. Stahl u. Eisen, 1908, **28**, 717—725, 756—766, 802—810.

The results of a long investigation are summarised as follows:—The heat contained in the chimney-gases, if these be at a temperature of 600° C., cannot as a rule be utilised to secure better regeneration; nor can the temperature of the chimney-gases be used as a means of judging whether the regenerators are properly dimensioned; the only way of deciding this is to compare the temperature of the heated air or gas with that of the furnace-gases as they enter the regenerating chambers. The chimney of a Siemens-Martin furnace, because of the great resistances to be overcome, the necessary reversals of the gases, and the necessity for a proper direction of the flame, demands a much greater suction at its base, and hence should be built much higher, than has hitherto been recognised as necessary. When the reversal-periods are shortened, the depth to which the changes of temperature penetrate in the chequer-work is sensibly lessened: hence there must be a sufficiently large regenerator-space if the heat is to be properly utilised when these short periods are necessary, as they are towards the end of the process, in order to spare the heads and the roof of the furnace. As the gas from the producers reaches the regenerator at a temperature of about 600° C., a given area of heating surface affects it much less than it does the colder air. If the gas-chamber were increased in volume by about 10 per cent., the producer-gas might be cooled, and freed from most of its water and sulphur contents, and still be raised to the same temperature as at present in the regenerators, without any sensible loss. The hydrogen in the gas burns *pari passu* with the carbon monoxide; but a minimum of hydrogen in the gas is yet desirable, for it carries sulphur and tends to injure the quality of the steel, and moreover is more liable to endanger the roof (from its low density and consequent ascension) than is carbon monoxide. The calorific value of the gas is not sensibly diminished by the heating in the regenerators, though its methane-content is greatly reduced. The loss of gas during reversals is only very slight, if good and suitable valves be used. To ensure proper direction of the flame in the furnace, the gas- and air-channels should run through a long furnace-head, the air-channel being vertically above the gas-channel, both being inclined slightly downwards towards the hearth, but the air-channel rather more so than the gas-channel, and the area of each (gradually lessening towards the mouth) must be so dimensioned as to secure a sufficient speed of efflux. If they are properly arranged, an approximation to uniform burning right across the hearth is secured, and the unburnt air on the entry side protects the roof. The paper contains numerous tables and diagrams showing the composition of the gases from the producers to the chimney, the temperature and variations of temperature at different parts of the installation, and the pressure of the gases.—J. T. D.

Iron and vanadium [in ferrovanadium, etc.]; Volumetric determination of ——. T. Warynski and A. Mdivani. Ann. Chim. analyt., 1908, **13**, 210—212.

The iron and vanadium are obtained in sulphuric acid solution after oxidation with nitric acid and the complete removal of the latter. A portion of the solution is then titrated with standardised solution of stannous chloride (see page 716), the quantity of the latter used being a measure of the iron and vanadium together. A second portion of the solution is next distilled with an excess of hydrochloric acid, the liberated chlorine is collected in a receiver containing potassium iodide, and the iodine set free is titrated with a standardised solution of sodium thiosulphate. The quantity of chlorine found is equivalent to the amount of vanadic acid present. The method may be used for the analysis of ferrovanadium.
—W. P. S.

Gold ores; Assay of telluride ——. G. Borrowman. J. Amer. Chem. Soc., 1908, **30**, 1023—1027.

The author's experiments seem to warrant the conclusion that the influence of tellurium as the cause of irregularities in crucible work has been over-estimated. Slag losses are no greater with telluride ores than with ordinary gold ores; the element may be present in the lead button in relatively large amounts with no considerable percentage of loss. The presence of tellurium in the lead does not necessarily imply a loss of gold in the cupellation, though a frosted bead, indicative of tellurium, would not be permissible when silver is to be determined. In high-grade tellurides, when silver is to be determined, the author suggests a preliminary treatment of the sample with nitric acid, which removes both silver and tellurium, with subsequent precipitation of the silver as chloride, which may be dried and added, with the residue from the acid treatment, to the fluxes in the crucible. Variation in the temperature of fusion does not seem to be of great moment, though a temperature of about 1200° C. may be most favourable. In the author's opinion the variations recorded in the assay of high-grade tellurides are due more to the lack of homogeneity inherent in high-grade samples rather than to the presence of tellurium. It is possible that in ores less rich in gold, the ratio of tellurium to gold might be very much higher than in the cases studied by the author, and the percentage of loss therefore greater; in such ores removal of the tellurium by nitric acid might be advisable. (Compare this J., 1908, 571.)—J. F. B.

Cyaniding; Use of coarse and fine lime in ——. W. J. Sharwood. J. Chem. Met. and Min. Soc., S. Africa, 1908, **8**, 293.

The tests were made to ascertain the relative solubility of commercial lime, in varying states of division, under conditions of percolation similar to those prevailing in the cyanide leaching of tailings at the Homestake mine, Transvaal. These tailings consist of the sandy underflow from conical classifiers, free from slimes but containing a good deal of pyrrhotite, and therefore requiring lime to neutralise the oxidation products formed during treatment. The lime is crushed and carried by a small stream of water into a launder, where it mixes with the tailings on their way to the distributor and leaching tank, in the proportion of 3·5 lb. of lime per ton of sand. Laboratory tests were made using commercial lime, which was crushed and graded by sifting. Products representing the material passing a sieve having 10, 20, 40, 60, 100, and 200 meshes respectively per linear inch, showed practically the same composition on assay. Narrow percolators were charged with 575 grms. of clean sand (about 40-mesh) mixed with 1 grm. of lime, using a different sized product for each, and then leached with distilled water at the rate of 115 cm. per day, the effluents being tested periodically for alkalinity. The results showed that lime coarser than 20-mesh, was very slowly dissolved, only 54·5 per cent. being removed in five days. The solubility of all the products, from 20-mesh to finer than 200-mesh, varied, in proportion to their fineness, within the following comparatively narrow limits. In one day, from 13·4 to 21 was dissolved; in two days, 31—40; in three days, 49—60; in four days, 63·6—74; and in five days, 77·5—85·6 per cent. Tests were also made with air-slaked lime (finer than 200-mesh), using an amount equal to 1 grm. of calcium oxide. The amounts dissolved were, in one day, 18; two days, 36; three days, 55; four days, 70·6, and five days, 80·6 per cent. These results show that it is advantageous to use lime varying between 20- and 100-mesh, coarser lime being too slowly, and finer lime too quickly dissolved. Tests using cyanide solutions instead of water, showed that the solvent power of the former for lime, is substantially the same as that of water. The paper includes a series of alkalinity and solubility curves, and three tables giving analyses and details of the percolation tests.—F. R.

Silver bullion containing arsenic and antimony; Refining of ——. B. Neilly. Applied Science, 1908, **1**, 287—292.

The author describes a series of experiments in which the oxidising power of a blast of air was used for removing arsenic and antimony from silver bullion. The bullion, which assayed 80·9 per cent. of silver, 7·5 per cent. of arsenic, 9·6 per cent. of antimony, and some nickel and cobalt, was first purified as much as possible by producing a speiss, by the addition of iron nails to the molten metal, at a temperature of about 1140° C., until all action ceased. The melt was then cooled suddenly, causing the metal to be readily separated from the speiss. The bullion, which could not be refined, by this means, above 832 to 838 fine, was remelted under a thin layer of flux, composed of two parts of sand to one of borax, and a blast of air directed vertically on to it with sufficient force to expose, but not penetrate, the surface of the metal. For the complete oxidation of the impurities, the blast was maintained for about four hours. The end was determined by taking dip samples, cooling and hammering them, a small fraction of impurity causing the silver to crack. A fineness of 999·85 was readily obtained, the average loss of silver being 0·88 per cent., of which 0·22 per cent. went into the speiss and slag, the remainder being volatilised or lost mechanically. Blowing air through the metal, as recommended by T. K. Rose (this J., 1905, 500) instead of on the surface, was tried, but found to be less satisfactory.—F. R.

Cobalt and lead; Alloys of ——. F. Ducelliez. Bull. Soc. Chim., 1908, **3**, 621—622.

Four alloys of cobalt and lead were prepared by subjecting mixtures of powdered cobalt and small fragments of lead to hydraulic compression, and then heating them to about 1400° C. in a current of hydrogen. The ingots contained 22·84, 51·92, 82·23, and 95·12 per cent. respectively of cobalt. No evidence was obtained of chemical combination having taken place.—J. C. C.

Pyrophoric alloys. B. Weiss. XV. Hauptversamm. d. Deutsch. Bunsen-Ges. f. angew. phys. Chem., 1908. Chem.-Zeit., 1908, **32**, 551.

These alloys consist of 70 per cent. of cerium or other rare earth metal and 30 per cent. of iron, nickel, cobalt, or manganese. They are formed by adding the requisite quantity of iron or its congener to the electrolytically separated [fused] cerium, while the current passes, when solution at once occurs. A small percentage of iron confers the pyrophoric property, but this is at a maximum with 30 per cent. These alloys are extremely hard, very permanent in the air, and melt at about the same temperature as cast iron. On being scratched, or struck, they emit showers of sparks, and can be used as a means of obtaining light or of igniting combustible substances. They were discovered in 1903 by Auer von Welsbach.
—J. T. D.

Patents.

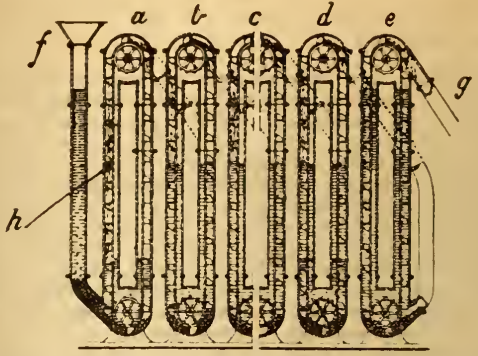
Metals, metalloids, or alloys of the same; Process for the production of ——. K. A. Kühne, Dresden, Germany. Eng. Pat. 11,606, May 17, 1907. Addition to Eng. Pat. 20,884, Oct. 14. 1905.

See Addition of May 4, 1907, to Fr. Pat. 364,329 of 1906; this J., 1907, 1145.—T. F. B.

Slimes and other substances; Apparatus for treating —— with air and other fluids. W. H. N. Goschen, London. From B. Solis, Mazatlan, Mexico. Eng. Pat. 12,726, June 1, 1907.

The invention constitutes an improvement on Eng. Pat. 13,275 of 1906 (this J., 1907, 1095). The gearing is dispensed with, the rotation of the frame, which causes the rotatory distributing nozzles to travel in epicyclic paths, being brought about by the action of fluid under pressure, issuing tangentially from one or more tubular arms placed at a distance from the axis of rotation of the frame.—A. G. L.

Treating solid material [Cyaniding]; Process and apparatus for ——. J. Gormly, Philadelphia, Pa. U.S. Pats. 888,608 and 889,120, May 26, 1908.



The solid material is passed in succession through a series of vessels, *a*, *b*, *c*, *d*, *e*, provided with continuously working elevators, *h*. The material is introduced at *f*, and finally discharged at *g*, and is caused to pass through, and is agitated in, the (cyanide) solution, which also forms a liquid seal at the inlet and outlet, and is discharged to the next vessel by the elevators, *h*. The vessels are closed and may be kept at any desired pressure.—W. H. C.

Precious metals; Process and apparatus for the extraction of —— associated with base metals in refractory or complex ores. T. Pellerin. Fr. Pat. 386,582, Jan. 27, 1908.

The crushed ores are treated with chlorine at a temperature of 100°—200° C., and under a pressure of 50—60 kilos. per sq. cm., the pressure being released from time to time. The process is carried out in a horizontal or inclined cylinder which is rotated about its long axis. The cylinder is enamelled on the inside to protect it from the action of the chlorine.—A. G. L.

Silver; Rendering —— non-tarnishable. S. O. Cowper-Coles, London. Eng. Pat. 12,748, June 1, 1907.

Silver articles are rendered non-tarnishable, by coating them electrolytically with an alloy of cadmium and silver, or of zinc and silver. For this purpose, the electrolyte is caused to impinge in the form of jets over the whole of the surface to be coated, the article itself being kept in motion. (See also Eng. Pats. 1391 of 1892 and 25,966 of 1906; this J., 1907, 928.)—A. G. L.

[Zinc] ores; Method of treating —— by the precipitation process, by means of a superheated liquid reacting metal. A. H. Imbert, Grand-Montrouge, France. Eng. Pat. 16,834, July 23, 1907.

Zinc or other ores are reduced by causing a continuous flow of a superheated reacting metal, *e.g.*, cast-iron, to pass through a closed chamber in a thin layer, and in supplying to the surface of this metal such a quantity of ore only as will allow the reaction to be practically completed by the time the metal reaches the exit end of the chamber. The cast-iron may be melted on the hearth of an ordinary Martin furnace, and may be superheated electrically. It may be circulated by means of a graphite wheel. The ore may be mixed with "dissolvents," which aid its liquefaction; *e.g.*, 100 parts of zinc blende are mixed with 23 parts of ferric oxide and 10 of slaked lime, or 100 parts of zinc oxide or silicate ore are mixed with 50 of iron sulphide and 10 of lime. The zinc vapours are removed and condensed as usual. At the exit end of the chamber, the iron sulphide formed, together with the slag, are removed by means of a trapped outlet from the excess of cast-iron, which goes back to the superheating furnace. If the ore contains lead, silver, etc., these metals are recovered from the iron sulphide by treating it with iron, ferric oxide, and slaked lime. In any case the iron may be recovered from the iron sulphide by roasting and smelting with carbon.—A. G. L.

Metallic ores, minerals, and the like; Apparatus for washing and separating or concentrating ——. C., W. and G. K. Craig, Sacriston, Durham. Eng. Pat. 20,622, Sept. 17, 1907.

The invention constitutes an improvement on Eng. Pat. 15,604 of 1894. The apparatus consists of a Y-shaped table, having outlets in the front and at the sides, and to which a reciprocating motion is imparted. The material to be concentrated is delivered, together with a stream of water, on to a raised portion at the back of the table, the heavier constituents passing off the table by the lateral outlets and the lighter constituents by the forward outlet. With certain materials, however, such as fine coal rich in pyrites, the heavy constituents tend to accumulate in front of the raised part of the table. To cause them to pass into the lateral outlets, worms or scrapers are now employed. When worms are used, they are mounted so as to lie in grooves, of gradually decreasing depth, formed in the table, and are driven from a cross shaft supported in hanger brackets across the table. In the case of scrapers, a reciprocating motion is given to them, as well as a rotatory motion to the blades, so that the face of the blade is presented to the material during the outward (or operative) stroke, and the edge during the inward stroke. The table itself is now mounted on elastic supports of steel, wood, etc., and the mechanism operating it is placed at the back or below the table instead of in front. The width of the forward outlet is increased; the front end of the distributing shoot is cut off square. The centre of the raised portion of the table is made straight instead of V-shaped.—A. G. L.

Ores; Process for the concentration and preparation of ——. F. G. Buendia. Fr. Pat. 385,717, Nov. 8, 1907. Under Int. Conv., Nov. 10, 1906.

The ore is treated in an apparatus such as a continuous series of inclined tubes arranged in zig-zag fashion. Water under pressure is admitted into the bottom tube, and carrying with it the lighter portions of the ore, flows out at the top. The ore is fed into the upper portion of the apparatus by a vertical side tube, and the concentrates are withdrawn from the end of the bottom tube.—O. F. H.

Mineral substances; Apparatus for washing and extracting ——. R. Freygang. Fr. Pat. 385,934, Jan. 4, 1908. Under Int. Conv., Jan. 28, 1907.

See Eng. Pat. 13,901 of 1907; this J., 1908, 408.—T. F. B.

Aluminium and aluminium alloys; Solder for ——. J. F. Guggenbühl, Paris. Eng. Pat. 28,511, Dec. 27, 1907.

The solder consists of an alloy of zinc, pure copper, and aluminium in, for example, the following proportions: Zinc, 850; pure copper, 107; aluminium, 43 parts.
—O. F. H.

Aluminium solder. T. J. and R. Wibrin, Liege, Belgium. Eng. Pat. 28,687, Dec. 31, 1907.

See Fr. Pat. 380,952 of 1907; this J., 1908, 128.—T. F. B.

Soldering aluminium; Process for ——. F. F. Payne. First Addition, dated Dec. 24, 1907, to Fr. Pat. 374,750, Feb. 16, 1907.

See Eng. Pat. 14,157 of 1907; this J., 1908, 127.—T. F. B.

Alloy; Metallic silver-like ——. E. Barraia, Palermo, Italy. Eng. Pat. 5451, March 11, 1908. Under Int. Conv., May 15, 1907.

See Fr. Pat. 381,347 of 1907; this J., 1908, 128.—T. F. B.

Tin scrap; Method of detinning ——. M. Leitch, Springfield, Mass., Assignor to Metal Process Co., New York. Reissue No. 12,803, June 2, 1908, of U.S. Pat. 883,411, March 31, 1908.

The tin scrap is treated with anhydrous chlorine in a closed chamber. The chlorine is then expelled by anhydrous stannic chloride, after which the chamber is evacuated and cooled to condense the vapours in it.
—A. G. L.

Furnace applicable for use in roasting ores or the like; Rotary ——. W. Hommel, Lee. U.S. Pat. 888,502, May 26, 1908.

See Eng. Pat. 27,639 of 1906; this J., 1908, 25.—T. F. B.

Furnace; Roasting and smelting ——. J. J. Brown, jun., Troy, Ill. U.S. Pat. 888,582, May 26, 1908.

The furnace consists of a hearth and a number of agitators placed in a housing above the hearth. Means are provided for giving a circular motion to the agitators, so that the forks carried on their lower ends may alternately dip into and stir up the material in the hearth.—O. F. H.

Iron; Method of manufacturing ——. H. L. Hartenstein, Constantine, Mich., Assignor to Electro Chemical and Development Co., Pierre, S.D. U.S. Pat. 869,125, May 26, 1908.

Flue dust is mixed with finely divided carbonaceous material, heated, and the iron sponge so produced compressed.—O. F. H.

Flue- and ore-dust; Process for the treatment of —— in the blast-furnace. A. Custodis. Ger. Pat. 194,042, May 26, 1906.

The flue- or ore-dust is finely-ground, mixed with coke, charcoal or other fuel, *e.g.*, crude petroleum, and introduced by means of an atomiser into the blast, before the latter enters the furnace.—A. S.

Iron oxide for use in blast-furnaces; Preparing fine particles of ——. U. Wedge, Ardmore, Pa. U.S. Pat. 889,563, June 2, 1908.

Fine particles of iron oxide are mixed with air-slaked lime, and the mixture is formed into nodules by subjecting it to heat and agitation.—A. G. L.

Earthy (clayey) ores; Process for adapting —— to metallurgical treatment. Fellner und Ziegler. Fr. Pat. 385,632, Dec. 27, 1907. Under Int. Conv., Feb. 5, 1907.

The ore is divided into two parts, one of which is dried, roasted, and agglomerated into blocks in a rotating furnace, and while hot is mixed with the other portion. The raw ore is dried by the heat of the roasted ore, and, it is stated, adheres to the blocks, giving a product suitable for treatment in the blast-furnace.—O. F. H.

Steel; Process for eliminating the oxides contained in molten ——. Soc. des Fonderies, Forges et Aciéries de Saint-Etienne. Fr. Pat. 386,383, Jan. 20, 1908.

The molten steel is intimately mixed with silica or silicious materials, which combine with the oxides contained in the steel to form a slag. The mixing is carried out by placing the highly heated silica or silicious materials in the channel through which the molten metal is run off from the furnace. The metal is preferably kept molten for some time after the mixing, by running it into a second furnace, etc., in order to enable the slag formed to rise to the surface.—A. G. L.

Molten pig-iron; Process for refining —— by means of fluid oxidising agents (fused iron ore, fused hammer-scale, etc.). A. Faddeeff and H. Katterfeld. Ger. Pat 190,170, June 6, 1905.

The refining is effected by the regulated introduction of the fused oxidising agent into the molten iron, in such a manner that the pig-iron or the oxidising agent, or both, can be superheated as desired.—A. S.

Basic Bessemer process; Addition of substances containing iron oxide and of lime in the —— in order to shorten the after-blow. Eisenhütten-Akt.-Ver. Ger. Pat. 197,591, July 15, 1906.

Towards the end of the decarbonising period, or later, a mixture of slaked lime and substances containing iron oxide (hammer-scale, etc.), is added to the charge in the converter. It is stated that the oxidation of the phosphorus is completed on continuing the blast for a few seconds only.—A. S.

(1) *Ores; Apparatus for treating* ——. (2) *Ores; Method of treating* ——. (3) [*Metalliferous*] *liquids; Apparatus for treating* ——. (4) [*Ore-pulp*]; *Filtering and decanting apparatus* [*for*] ——. W. A. Hendryx, Denver, Colo. U.S. Pats. 889,128—889,131, May 26, 1908.

(1). THE apparatus comprises a tank, having a central pipe or passage-way communicating with its lower portion. By means of a conveyor, the ore pulp is forced upwards through the pipe and discharged over the top on to a conical spreader placed in the upper part of the tank. Electrodes are placed on the spreader, substantially parallel to it. (2). Oxidised ores are dissolved by subjecting them to the action of a saline solvent, *e.g.*, sodium chloride solution, which may be heated, then adding an acid solvent, *e.g.*, sulphuric acid, and allowing the resulting solution to act on the ore. (3). The apparatus consists of a tank in which are placed a number of filter cells, and of a casing provided with an agitator which creates a pressure within the tank. Means are also provided for mixing a treating agent with the metalliferous solution which is circulated through the tank and casing. (4). The apparatus consists of a tank having a converging bottom and a central outlet for ore-pulp. A filter is placed above the converging bottom and forms a closed space above the outlet, a pipe forming communication with this space. Above the filter there are placed in the tank a number of filter-cells, provided with separate outlets. The tank also has a number of auxiliary outlets for liquid at different levels.—A. G. L.

Aluminium; Process for the oxidation and coloration of ——. A. Lang. First Addition, dated Dec. 18, 1907, to Fr. Pat. 354,713, May 27, 1905 (this J., 1905, 1114).

THE oxidised articles may be reheated during subsequent treatment. Suitable colouring substances can be applied, and a film of oxide produced by an alkali, hydrochloric acid, or solutions of metallic chlorides.—O. F. H.

Alloys of exact composition; Process of manufacture of —— *and of articles made from these alloys.* H. Kuzel. Fr. Pat. 385,699, Dec. 30, 1907. Under Int. Conv., Jan. 7, 1907.

ONE or more of the components of the alloys are used in the form of colloidal metals and the others in the form of crystalline metallic compounds. The latter are mixed with the colloidal metals in a uniform state of division either by suitable precipitants, such as salts, acids, or alkalis, or simply by mixing together solutions of the colloidal metal and the metallic compound, so that on precipitation of the colloid, a plastic mass is obtained, which by heating to a white heat in a reducing atmosphere, or other suitable means, is converted into the required metallic alloy. This process may be used for the production of alloys to be used for electric lamp filaments or electric resistances. (See also Eng. Pat. 28,154 of 1904; this J., 1906, 115.)—O. F. H.

Sulphide ores; Process of treating poor ——. The D. E. Syndicate, Ltd. Fr. Pat. 386,634, Jan. 28, 1908.

SEE Eng. Pat. 25,574 of 1906; this J., 1908, 287.—T. F. B.

Minerals; Treatment of —— *with sulphuric acid produced from the sulphur of the minerals.* A. M. G. Sebillot and L. Mauclaire. Fr. Pat. 386,672, Jan. 29, 1908.

THE mineral is roasted in a furnace with superimposed hearths, communicating with one another, in order to obtain the sulphur dioxide in as concentrated a state as possible. The furnace gases, at a temperature of 400—500° C., enter a contact chamber, where they are cooled to about 325° C. by admixture of air and steam. The contact mass consists of finely divided ferric oxide or asbestos fibre. The gases then traverse a leaden worm surrounded by cold water, in which the sulphuric acid formed condenses; they then traverse a second smaller contact chamber, and are finally discharged through a fan. The dilute sulphuric acid thus obtained is used for the systematic extraction of the roasted ore. For this purpose the ore is placed in a tank of lead or wood divided into compartments, along which the ore is moved by means of a shaft provided with blades, the acid being run through the tank in the opposite direction.—A. G. L.

Volatile metals; Process for the recovery or melting of readily —— *under pressure.* L. Grüter. Ger. Pat. 192,575, Nov. 23, 1906.

THE claim is for the use of a "transformer furnace" enclosed in a gas-tight casing, which is filled with a compressed inert gas.—A. S.

Blast-furnace and other gases; Purifying ——. Eng. Pat. 254. *See* II.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(*A.*)—ELECTRO-CHEMISTRY.

PATENTS.

Batteries; New material for the purpose of separating or enclosing plates of ——. A. P. Strohmenger, Harrow-on-the-Hill. Eng. Pat. 665, Jan. 11, 1908.

THE pores of an open-mesh fabric, *e.g.*, muslin, are filled with cellulose pulp, so as to form a sheet of porous paper reinforced by the fabric. After drying, the whole is nitrated to such an extent that it will resist the action of the electrolyte, when the material is used to envelop or separate the plates of a secondary battery. (See also Eng. Pat. 1396 of 1906; this J., 1907, 156.)—A. G. L.

Electrolytes for accumulators with alkaline electrolyte. T. A. Edison. Fr. Pat. 386,001, Jan. 7, 1908. Under Int. Conv., May 10, 1907.

SEE U.S. Pat. 876,445 of 1908; this J., 1908, 167.—T. F. B.

Electric furnace. A. J. Petersson, Alby, Sweden. U.S. Pat. 889,857, June 2, 1908.

SEE Eng. Pat. 9164 of 1906; this J., 1906, 593.—T. F. B.

Insoluble product [*insulating material, etc.*] *resulting from the condensation of phenols and formaldehyde.* L. H. Baekeland. Fr. Pat. 386,627, Jan. 28, 1908. Under Int. Conv., Jan. 27, 1908.

APPROXIMATELY equal quantities of commercial phenol and a 40 per cent. solution of formaldehyde are gradually heated together in a closed vessel to 130°—150° C., and kept at this temperature for one or several hours, when a condensation product is obtained. The reaction is advantageously carried out in two stages: the mixture is first boiled under a reflux condenser until a viscous intermediate product is obtained; this product is removed from the aqueous layer, heated in an open vessel to remove traces of water, and then further heated in a closed vessel, under pressure, to complete the reaction. From 1 to 10 per cent. of accelerators, *e.g.*, acids, bases, alkali sulphites, acetates, phosphates, or borates, may also be added to the aqueous mixture. The final product obtained is claimed to be white to brown in colour, less elastic but harder than caoutchouc, unaffected by alkalis, acids, or temperatures up to 300° C., and a bad conductor of electricity. When heated to a high temperature it carbonises without fusing; it is insoluble in alcohol, acetone, glycerin, and phenol.—A. G. L.

Gas reactions; Process for effecting —— *with the aid of electric discharges.* A. Hauck. Ger. Pat. 193,518, June 9, 1905.

THE reaction is effected in a gaseous sphere formed by electric discharges (flame arcs or the like) produced in a liquid, with the aid of conductors of the second class.

The process is suitable for the electrical oxidation of atmospheric nitrogen. A metal electrode, surrounded by a tube of a material which does not conduct electricity when cold, is immersed in a liquid, and with the aid of a second electrode, electric discharges are produced below the surface of the liquid, varying according to the E. M. F. and current density employed, from silent to loud crackling discharges or discharges similar to flame arcs. If now the gaseous mixture (air) be led through the hollow electrode into the discharge zone, the reaction products are immediately condensed, fixed, or chemically altered by the surrounding liquid. In the oxidation of nitrogen, for example, the oxides of nitrogen produced are converted into nitric acid, nitrates, nitrites, etc., by the surrounding liquid.—A. S.

Arc lamp electrodes. Eng. Pat. 66. *See* II.

Pitch and bitumen, etc.; Improving ——. Eng. Pat. 11,498. *See* III.

Invert sugar and syrups; [Electrolytic] process for purifying and making ——. Eng. Pat. 12,762. *See* XVI.

Sugar refinery products, etc. [Electrolytically] purifying ——. Fr. Pat. 386,534. *See* XVI.

Nitrosobenzene and other nitroso-compounds; Electrolytic preparation of ——. Ger. Pat. 192,519. *See* XX.

Sulphite cellulose lyes; Treating ——. Ger. Pat. 197,195. *See* XIX.

(*B.*)—ELECTRO-METALLURGY.

Héroult process; Desulphurisation in the ——. T. Geilenkirchen. Stahl u. Eisen, 1908, **28**, 873—876.

A remarkable feature of the Héroult process is the way in which the sulphur of the charge is eliminated. Tests of the product of 1000 successive charges from a Héroult furnace showed that the sulphur content varied from 0·001 to 0·026 per cent.; but 743 of the tests were below 0·01 per cent., and 958 were below 0·015 per cent. Two causes, in the author's opinion, contribute to this. In the first place, the sulphides of iron and manganese, being soluble both in the metal and the slag, distribute themselves in any furnace between the metal and the slag, the final proportions, when equilibrium is reached, depending on their relative solubilities; and at the higher temperature of the Héroult furnace the solubility in the slag is increased to a greater extent than that in the metal. The more important cause, however, is the powerful reducing action of the calcium carbide formed in the furnace, which first of all effects the reduction of the metallic oxides in the slag, and the return of the reduced metals to the bath, then reduces the sulphides by converting them into calcium sulphide, according to the equation, $2CaO+3FeS+CaC_2=2CO+3CaS+3Fe$; this disturbs the sulphide equilibrium, more sulphide enters the slag from the bath, and so on, till almost complete desulphurisation is effected. Two points follow from this strong desulphurising action:—1. That a thoroughly worked charge from the Héroult furnace can never retain a notable proportion of sulphur, however high may have been the sulphur content of the materials. 2. That the desulphurising action goes on independently of and without alteration of the proportions of the other constituents of the iron. Thus Thomas steel, for example, poured into the electric furnace to be finished, will undergo no change in its composition beyond the removal of the sulphur; and any special foundry iron, of low content in carbon, manganese, and silicon, for example, which can hardly be otherwise obtained without an injuriously high sulphur content, may be produced by refining in the Héroult furnace any inferior iron of the kind, no matter how much sulphur it may contain.—J. T. D.

Passivity; Theories of ——, *and observations on the passivity of iron, nickel, and chromium.* C. Fredenhagen. Z. physik Chem., 1908, **63**, 1—47.

The author gives a summary of the three main theories by which it has been sought to account for the passive state of metals, and of the arguments by which they have been supported. He then describes experiments which show that, in the case of anodic passivity of iron, nickel, and chromium:—1. The changes from active to passive state and *vice versâ* do not, except accidentally, occur at the same potential, and on repeating the experiments under conditions as nearly identical as are attainable, the same values for the potential causing passivity or for that causing activity are not always obtained. 2. The values of both of these potentials are very greatly influenced by change of temperature. 3. Change in the strength of the acid exerts a very great, but not regular or calculable influence on the potentials. The conclusion is that neither the valency theory nor the oxide theory is in accord with the facts, which can only be explained by the theory that passivity is caused by the electrode becoming coated with a homogeneous film either of oxygen gas, or of a solid solution or alloy of the metal with oxygen. So long as the oxygen-polarisation is local and uneven, so long is the metal active; but when it has spread uniformly over the whole surface, which occurs when the polarisation-potential has increased sufficiently, passivity sets in. Even while passive, the metals are not wholly unattacked, but are dissolved to an extent measured by the direct reaction between the passive metal and the oxygen. When the velocity of the reactions using oxygen surpasses that of the reactions generating it, so that the potential of oxygen-polarisation is sufficiently lowered, activity again sets in. The author draws attention to the difference between true passivity and the apparent passivity shown, for example, by lead in sulphuric acid or by copper in strong solutions of alkali, which is due to the actual physical protection of the metal by the formation of well-defined oxides.—J. T. D.

Platinum; Passivity of ——. R. Ruer. Z. Elektrochem., 1908, **14**, 309—314.

The author has made further experiments to determine whether the deposit formed on a platinum anode when solutions of sulphuric acid are electrolysed (Marie, this J., 1907, 876) is a peroxide, and is identical with that which, in the author's view, is produced during the passage of alternating currents between platinum electrodes through sulphuric acid, and is the cause of platinum becoming dissolved under these circumstances. The experiments are not decisive: they show that the anodic deposit is insoluble in cold sulphuric acid even of 50 per cent. strength, but dissolves readily even in dilute acid if a reducing agent be added, that it has a negligible resistance, and cannot be detected under ordinary circumstances, by potential measurements, so that it possesses some of the properties of the author's hypothetical peroxide film of his earlier experiments; but it is best produced in an acid of about 6 per cent. strength, and is not only not produced, but when already formed on the anode, is dissolved, in 50 per cent. acid when electrolysed. In this stronger acid, however, though no visible deposit is formed, the surface of the anode is altered, so that, if a reducing agent be present, traces of platinum enter into solution.—J. T. D.

Patents.

Tin; Process of obtaining pure —— *from crude tin or tin alloys electrolytically.* O. Steiner, Crefeld, Germany. U.S. Pat. 890,249, June 9, 1908.

See Eng. Pat. 10,230 of 1907; this J., 1907, 1055.—T. F. B.

Zinc; Electrolytic process for extracting ——. H. Paweck. Fr. Pat. 386,678, April 15, 1907.

See Eng. Pat. 8562 of 1907; this J., 1908, 631.—T. F. B.

Electrodeposition of metals. S. O. Cowper-Coles, London. Eng. Pat. 11,471, May 16, 1907.

Copper and other metals may be electrolytically deposited in a smooth, homogeneous form and at a very rapid rate, by making the electrolyte travel over the cathode surface at a speed of 500 feet or more per minute, by means of jets of compressed air.—J. W. H.

Chromium; Process of depositing —— electrolytically. F. Salzer. Fr. Pat. 386,258, Jan. 15, 1908. Under Int. Conv., Feb. 21, 1907.

Deposits of chromium are obtained electrolytically by the aid of a bath containing a mixture of chromic acid and chromic oxide in approximately equal proportions, or preferably with an excess of chromic acid, the quantities being kept as constant as possible during the working. A small quantity of acid may be added to increase the conductivity. Anodes, capable of oxidising the chromium oxide to chromic acid during the passage of the current, may be employed, in order to maintain a constant composition in the bath by compensating for the chromic acid reduced at the cathode. Or, insoluble anodes, such as lead or platinum, may be used to maintain a constant composition, these being in part freely suspended in the bath, and in part separated from the cathode chamber by convenient diaphragms. The bath is cooled during the working in order to maintain the temperature as constant as possible.—B. N.

Galvanic baths; Process for heating and circulating ——. A. Barth. Ger. Pat. 196,179, July 26, 1907. Addition to Ger. Pat. 193,642.

The columns of liquid flowing from the heating vessel as described in the main patent, are divided into several portions, which are introduced into the electrolytic bath at different levels, in order to heat the latter uniformly.
—A. S.

Ores and metal-bearing solutions; Treatment of —— for the separation of metals contained therein. W. J. Lavington, London. From F. C. Brown, Komata, New Zealand. Eng. Pat. 17,779, Aug. 3, 1907.

The invention relates to the separation of gold and silver by amalgamation and electrolysis from ores and metalliferous solutions whilst these are agitated in the apparatus claimed in Eng. Pat. 18,922 of 1904 (this J., 1905, 973). The apparatus consists essentially of a tall tank provided with a vertical central pipe reaching nearly to the top and bottom of the tank. By passing compressed air up this pipe, ore and liquid are sucked up with the air, and overflow from the top of the pipe. Electrodes are placed at the bottom of the central pipe, being protected by an inverted cone placed above them; another set of electrodes is placed at the top of the tank. In each case the anodes consist of carbon, iron, or lead, whilst the cathodes are made of copper, and are kept supplied with mercury, the lower ones being in the form of cups, and the upper ones sloping downwards from a launder into which the central pipe overflows and to which mercury is also supplied. Suitable pipes are arranged to supply water to the apparatus, to wash sand, etc., off the inverted cone, and to empty and fill the tank.—A. G. L.

Tin; Process and apparatus for the recovery of —— from waste scrap and lead-tin alloys. A. Nodon. Fr. Pat. 386,499, April 11, 1907.

The process is designed especially to recover tin from the waste obtained in making lead-tin foil and capsules. The scrap is freed from grease by treatment with sodium carbonate solution and is then subjected to the action of a solution of ammonio-stannic sulphate or of a solution of stannic sulphate containing free sulphuric acid and ammonio-stannic chloride, heated to 40° C. The solution obtained is systematically electrolysed by means of a current of 1—2 ampères per sq. dcm. at 2—3 volts. For this purpose the liquid is circulated through a number of stoneware cells containing graphite anodes and porous cylinders in which the tin cathodes are placed; the tin deposits in the form of a tree. The liquid is evaporated from time to time, the final solution obtained being used for the treatment of a fresh quantity of scrap.—A. G. L.

Aluminium or other metals; Process of [electrically] winning —— from their compounds. H. S. Blackmore, Mount Vernon, N.Y. U.S. Pat. 889,098, May 26, 1908.

Aluminium or other metal is obtained by electrolysis of one of its non-haloid compounds, which is mixed with the fluorine or other halogen compounds of other metals, *e.g.*, magnesium, the current used for the electrolysis being of such a voltage that fluorine or other halogen will not be liberated, and a separate electric current being used for the fusion of the mixture.—A. G. L.

Metals; Process of extracting —— from metalliferous rocks. A. F. G. Marin and E. Tarin de Montépreux. Fr. Pat. 386,303, Jan. 17, 1908.

The metalliferous mineral is finely powdered and placed in an aqueous solution of chlorides, bromides, iodides, or fluorides of the alkali or alkaline-earth metals, acidulated with sulphuric acid. The solution is agitated, and an electric current passed through it between unattackable electrodes. The agitation is continued for some time after the current is interrupted, after which the dissolved metals are recovered as usual.—A. G. L.

Electric furnace. L. Dion, Assignor to The Americus Electro-Hermetic Co., Wilkes-Barre, Pa. U.S. Pat. 888,877, May 26, 1908.

The furnace is divided by an internal inclined flange into an upper and a lower section, communication between which can be completely interrupted by means of a sliding door. A hopper delivers the metal or other material to be treated to the upper section, whence it falls into the lower compartment, in which it encounters two electrodes. The fused material is drawn off through a passage at the bottom of the lower compartment, which is also provided with a discharge-opening for fumes or vapours, placed above the electrodes.—A. G. L.

[Electric] Furnace for metallurgical and smelting purposes. K. Birkeland and S. Eyde, Christiania, Norway. U.S. Pat. 889,431, June 2, 1908.

The furnace has a "channeled" annular hearth, and a number of steps arranged concentrically outside the channel. Over the centre of the hearth is an arc gap between the ends of a pair of electrodes. The material is fed on to the outer steps of the hearth, and magnets of different intensity, mounted centrally with respect to the hearth, spread the arc over the material.—B. N.

Manganese; Direct manufacture in the electric furnace of metallic —— melted, refined, and poor in carbon. Soc. anon. "La Néo-Métallurgie." Fr. Pat. 386,442, Jan. 22, 1908.

Manganese, commercially pure and containing not more than one or two per cent. of carbon, is obtained by direct reduction of oxides or carbonate of manganese by means of carbon in the electric furnace.—B. N.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

Himalayan bear fat. D. Hooper. J. and Proc. Asiatic Soc. of Bengal, 1908, **4**, 33—34.

The author has examined two samples of bear fat obtained from Mussoorie, in the United Provinces, India. No. 1 was purchased in the Landour bazaar, and No. 2 was separated by ether from a quantity of genuine adipose tissue. The fat is known locally as "*Balu-ke-cherbee*" and is obtained from the Himalayan black bear (*Ursus torquatus*). Both samples had a yellowish-white colour, a rancid odour, and a soft granular consistence at 21° C. On examination they gave the following results:—Sp. gr. at 50° C., (No. 1), 0·9013, (No. 2) 0·9007; m.pt., 37·5° C., 34·5° C.; acid value, 13·8, 33·19; saponification value, 203·8, 204·25; iodine value, 52·77, 62·80; Reichert-Meissl value, 0·93, 0·86; m.pt. of fatty acids, 42°C., 40° C.; saponification value of fatty acids, 205·64, 207·37; iodine value of fatty acids, 57·28, 62·98. The fatty acids of the second sample, when converted into lead salts and separated by means of ether, yielded 59·1 per cent. of liquid and 40·9 per cent. of solid acids. The yellow liquid

acids had an iodine value of 82·36 and an acid value of 198·34. The solid acids, which were white and crystalline, and melted at 54° C., had an acid value of 214·84. On being recrystallised from alcohol, the solid acids yielded a small quantity of crystals melting at 70° C., corresponding to stearic acid. The fat consists chiefly of olein and palmitin, and in many of its properties resembles lard.
—J. A.

Lawsonia alba, Lamk.; *Oil from seeds of* ——. D. Hooper. J. and Proc. Asiatic Soc. of Bengal, 1908, **4**, No. 2.

The seeds of *Lawsonia alba*, the henna plant of Western Asia, known to the natives of India as "*mehndi*," are contained in a capsule of the size of a peppercorn, and consist of angular grains of a cinnamon-brown colour, from 1·5 to 2 mm. long. The weight of 100 seeds is about 0·073 grm. A sample of the seeds obtained from the Government Botanical Gardens, Saharanpur, gave the following results on analysis :—Moisture, 10·0 ; oil (by ether), 10·48 ; albuminoids, 5·00 ; carbohydrates, 33·62 ; fibre, 35·55 ; and ash, 4·75 per cent. These seeds are, therefore, useless as a commercial source of oil, and would be considered the reverse of nutritious. The oil was thick, dark-green in colour and slowly oxidised to a solid jelly. It solidified at 25·5° C., and had a slight acid reaction. The iodine value of the oil was 121·63 and of the fatty acids, 127·45. The oil, except for its green colour, is similar to poppy-seed oil.—J. A.

Tonka butter; Characters of ——. Duyk. Répert. Pharm., 1908, **20**, 193.

Under the name of "Tonka butter," a fat, said to be derived from the Tonka bean, *Coumarouna excelsa* (*Dipterys odorata*) is becoming an article of commercial importance. It has the following characters :—M.pt. 28° C. ; butyro-refractometer value, (Abbé-Zeiss) 47° ; sp. gr. at 100° C., 0·888 ; critical temperature of solution, 32·5° C. ; saponification value, 257 ; ester value, 250 ; volatile acid value (Leffmann-Beam) 5·4. The fat is used for flavouring dietetic articles.—J. O. B.

Glycerol esters; Theory of the hydrolysis of ——. R. Wegscheider. Monats. f. Chem., 1908, **29**, 233—234.

Corrections of certain numerical errors in the author's earlier paper (see this J., 1908, 233).—A. S.

Saponification process; Theory of the ——. *IV.* R. Fanto and M. J. Stritar. Monats. f. Chem., 1908, **29**, 299—316. (*See* also this J., 1907, 263, 623).

The authors have carried out further experiments with tallow, tripalmitin, and olive oil. From the results of the whole investigation they conclude that :—(1). The saponification of fats by aqueous potassium hydroxide solution (heterogeneous system) occurs practically directly. (2). The conversion of glycerides into ethyl esters by means of alcoholic potassium hydroxide solution (esterification) in a homogeneous system proceeds by stages. (3). In a heterogeneous system, also, esterification in practice proceeds by stages, but not so well-defined as in a homogeneous system, and the explanation is probably that a true heterogeneous system cannot be attained owing to the partial miscibility of the components produced by the ester as it is formed. (4) As the water content of the alcoholic alkali increases, the esterification is diminished, and the system approaches more nearly to a true heterogeneous system, in which the reaction proceeds directly. (See also this J., 1898, 673, 853, 1107 ; 1899, 1031 ; 1900, 254 ; 1904, 905 ; 1906, 856 ; 1907, 24.)—A. S.

Saponification value; Determination of the ——. N. Rusting. Pharm. Weekblad, 1908, **45**, 433—435. Chem. Zentr., 1908, **1**, 1992.

The author recommends the employment of a solution of potassium soap and potassium hydroxide in absolute alcohol instead of the usual alcoholic solution of potassium hydroxide for the determination of the saponification value.—A. S.

Viscosity and lubrication. C. F. Mabery and J. H. Matthews. *See* III.

Cholesterol and cholic acid, and a common decomposition product of the same. H. Schroetter and others. *See* XX.

Patents.

Fat from mineral oils; Method for producing a —— *for industrial purposes, and as a basis for ointment and the like.* S. Knopf, Vienna. Eng. Pat. 17,523, July 31, 1907.

Forty parts of oleic acid are mixed thoroughly with 20 parts of alcohol and 8 parts of potash lye (1 : 1), the mixture being made at the ordinary temperature. From 150 to 300 parts of mineral oil (petroleum) are then added to every 100 parts of the mixture ; the product obtained may be used for different purposes. For instance, by the addition of 50 per cent. of water, a consistent ointment base is obtained from the emulsion. On adding 17 per cent. of ceresin or wax to the product, a substance similar to vaseline is produced, and if 50 per cent. of water be added to this vaseline-like body, a material resembling lanoline is obtained.—W. P. S.

Fat mixtures; Process for the preparation of ——. Norddeutsche Wollkämmerei und Kammgarnspinnerei. Ger. Pat. 190,959, Feb. 18, 1905. Addition to Ger. Pat. 185,987, Jan. 21, 1904.

The process described in Ger. Pat. 163,254 (see Lifschütz, this J., 1905, 1242) for the decomposition of wool-fat into two portions, by one of which water is absorbed readily, by the other only with difficulty, has already been shown in Ger. Pat. 171,178 to be applicable also to products containing wool-fat. In this application of the process, it is now proposed to use solutions of wool-fat or other fats, instead of alcohol, ether, or the like for extracting the portion of the fat absorbed by the bone-charcoal.—A. S.

Soap [finely divided]; Production of ——. A. H. Finlay, Belfast. Eng. Pat. 12,849, June 3, 1907.

The soap is poured in a fluid condition into a solution in which it is insoluble, such as cold brine, and the mixture is agitated by any suitable means. If the soap be poured in a sufficiently fine stream from a height of, say, 10 ft. or more, agitation of the mixture may be entirely dispensed with, or nearly so.—W. P. S.

Soap frames. A. G. Bloxam, London. From the Firm A. Jacobi, Darmstadt, Germany. Eng. Pat. 18,253, Aug. 12, 1907.

The upper part of the frame is provided with an opening partially closed by a stopper, so as to leave sufficient vent for the escape of air. When, however, the liquid soap enters this space it congeals, and automatically closes the opening. This stopper may be constructed of a bent piece of iron of smaller diameter than the opening, and be kept in position by means of a hook from which it can be readily detached.—C. A. M.

Soap cooling frames; Air-exit device for ——. A. Jacobi. Fr. Pat. 386,543, Jan. 24, 1908. Under Int. Conv., Feb. 13, 1907.

See Eng. Pat. 18,253 of 1907 ; preceding.—T. F. B.

Soap powder; Process for the production of ——. W. Lüring, Hanover, Assignor to Gebr. Körting, A.-G., Körtingsdorf, Germany. U.S. Pat. 890,078, June 9, 1908.

See Eng. Pat. 25,276 of 1907 ; this J., 1908, 345.—T. F. B.

Presses for treatment of paraffin scale or wax, fats, etc. Eng. Pat. 19,184. *See* III.

Cottonseed industry; U.S. Census of the ——. U.S. Census Bureau. [T.R.]

There were, in 1907, 873 cottonseed mills in operation, 786 of which were in the United States, and 25 in England. In 1867, there were only four mills in the United States; in 1890, 119; and in 1900, 369. The cost of materials used increased from $14,363,126 in 1890, to $80,030,963 in 1905, and the value of products from $19,335,947 to $96,407,621. 2,564,873 tons of cottonseed were crushed in the United States in 1907, resulting in the production of 103,049,820 gallons of oil, 1,043,080 tons of meal and cake, 926,705 tons of hulls, and 128,243,639 lb. of linters. Exports of cottonseed oil in the year ended June 30, 1907, amounted to 41,880,304 gallons, valued at $17,074,403. 670,484 tons of meal and cake, valued at $17,062,594, were also exported.

United Kingdom.—There are about 25 cottonseed establishments in the United Kingdom. Hull is the great crushing centre of the country, about one-half of the annual imports of cottonseed being entered and consumed there. The quantity of seed imported in 1906 amounted to 617,825 tons, principally from Egypt and India. The oil is not suitable for edible purposes, and is taken almost exclusively by soap manufacturers.

There is only one cottonseed oil mill in India, on the Irrawaddy River, using about 10,000 tons of seed a year. The annual export of seeds from India amounts to over 200,000 tons. Egypt has 7 cottonseed mills, consuming about 105,000 tons of seed. The production of seed in Egypt was 750,000 tons in 1906. Russia has 6 cottonseed oil mills, China 10, France 5, Mexico 4, and Germany 2.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(*A.*)—PIGMENTS, PAINTS.

Patents.

Colours or pigments [from azo dyestuffs] for use in painting and printing; Process for the preparation of ——. K. Merz, Frankfort, Germany. Eng. Pat. 20,990, Sept. 21, 1907. Under Int. Conv., Sept. 24, 1906.

See Fr. Pat. 382,191 of 1907; this J., 1908, 219.—T. F. B.

Azo dyestuff lakes; Making red ——. O. Ernst and C. Pretzell, Assignors to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. U.S. Pat. 888,981, May 26, 1908.

See Fr. Pat. 375,828 of 1907; this J., 1907, 977.—T. F. B.

Lakes [from azo dyestuffs]; Process of making ——. E. Ulrichs, Elberfeld, Assignor to Wülfing, Dahl, und Co., A.-G., Barmen, Germany. U.S. Pat. 890,254, June 9, 1908.

See Fr. Pat. 381,205 of 1907; this J., 1908, 132.—T. F. B.

Soot; Manufacture of —— and apparatus therefor. G. Wegelin, Kalscheuren, Germany. Eng. Pat. 21,601. Sept. 30, 1907.

See Fr. Pat. 380,983 of 1907; this J., 1908, 81.—T F. B.

Lampblack; Manufacture of —— from tar or other carbonaceous substances. G. Wegelin. Third Addition, dated Jan. 3, 1908, to Fr. Pat. 294,306, Nov. 14, 1899.

See Eng. Pat. 28,189 of 1907; this J., 1908, 579.—T. F. B.

White lead and lead carbonate; Process for the production of ——. F. W. Morris, Victoria, J. B. Raine, J. Kerr, and C. McLachlan, Vancouver, B.C. Eng. Pat. 24,865, Nov. 9, 1907.

See U.S. Pat. 871,947 of 1907; this J., 1907, 1287.—T. F. B.

Zinc sulphide or a mixture hereof with other colours, resistant to light and the atmosphere, and their manufacture. H. W. de Stucklé. Fr. Pat. 386,061, Jan. 9, 1908.

See U.S. Pat. 884,874 of 1908; this J., 1908, 512.—T. F. B.

Artists' colours containing alkali silicates as binding agents. A. Winther. Ger. Pat. 192,642, May 27, 1906.

The claim is for the addition of alkali sulphate to artists' colours containing alkali silicates as binding agents, with the object of preventing them from drying too quickly on exposure to air.—A. S.

Lime colours; Process for the preparation of ——. E. C. L. Kressel. Ger. Pat. 192,722, Dec. 25, 1906.

The colouring matter is dissolved in a volatile solvent at a low temperature, the solution applied to the material which is to form the basis of the paint, and the solvent allowed to evaporate.—A. S.

Colouring matters; Process for the preparation of red, orange, or violet —— from ferrous salts. Scherfenberg und Prager. Ger. Pat. 192,485, Jan. 4, 1907.

The ferrous salt is mixed with a freshly-precipitated alkaline-earth sulphate, and the mixture after being, if necessary, diluted with a further quantity of the alkaline-earth sulphate, is heated at a temperature at which no acid fumes are evolved. If a violet-coloured product be desired, a chloride is added to the mixture before heating it.—A. S.

Red oxide of iron, zinc sulphate, and sulphuric acid. Eng. Pat. 11,338. *See* VII.

(*B.*)—RESINS, VARNISHES.

Turpentine and turpentine substitutes; Examination of ——. J. H. Coste. Analyst, 1908, **33**, 219—230.

The following determinations are mentioned, not as being new, but as having been found useful in judging the nature and quality of samples of turpentine. *Sp. gr. at 15° C.*: this varies from 0·86 to 0·871; a lower value may be due to the presence of petroleum or shale oil, a higher to resin spirit, Russian turpentine, or old oxidised turpentine. *Refractive index* (n_D 20°) varies from 1·4690 to 1·4720 and is influenced similarly to the specific gravity. *The optical rotation* affords no direct information as to quality; it is generally much lower than was the case 10 years ago. *Fractional distillation:* a good American box turpentine should comply with the following specification:—100 c.c., on distillation in a 3-bulb Ladenburg flask of 180 c.c. capacity to neck, shall yield no distillate before the temperature reaches 155° C., not less than 70 c.c. between that temperature and 160° C., and a total distillate of not less than 95 c.c. up to a temperature of 180° C. *Determination of petroleum spirit:* the method described by Armstrong (this J., 1882, 480) is recommended in preference to later processes which have been suggested. If *the sulphurous acid colour-test* (this J., 1897, 519) be trustworthy, a good deal of wood turpentine, that is, turpentine distilled from the wood and stumps of the pines, finds its way into the United Kingdom; but in the author's opinion, this test is not very reliable. The results of analyses of 30 samples of turpentine and of 14 samples of turpentine substitutes are given.—W P. S.

Copals; Congo and white Benguela ——. A. Tschirch and A. Engel. Archiv. Pharm., 1908, **246**, 293—305.

Congo copal occurs in very irregular pieces of pale yellow to reddish-brown colour, with a vitreous fracture and a faint odour, resembling that of copaiba. It has no sharp melting point, sintering at 105° C., showing bubbles at 125—130° C., and giving a clear fluid at 175° C. The following approximate percentages are dissolved by the solvents named:—Ether, 55; alcohol, 48; acetone, 28: methyl alcohol, 33; amyl alcohol, 80; chloroform, 24; light petroleum spirit, 15; benzene, 26; alcohol-ether, 85. The copal is insoluble in carbon tetrachloride and in oil of turpentine. Direct acid value, 117·7; indirect acid value, 124·8; saponification value (cold) in 24 hours, 138·6; saponification value (hot) in 1 hour, 152·6; saponification value (hot) in 2 hours, 149·2. The ether solution yields, when shaken with 1 per cent. aqueous sodium carbonate solution, from 48 to 50 per cent. of amorphous *congocopalic acid*, $C_{19}H_{30}O_2$, m. pt., 115—118° C. The ether retains about 5 to 6 per cent. of *a-congocopalresene* and 3 to 4 per cent. of a fragrant essential oil, a small fraction of which boils at 118° C., the major fraction at 165—168° C. The alcohol-ether solution gives, when shaken with 1 per cent. aqueous potassium carbonate solution, a portion soluble in ether from which 22 per cent. of amorphous *congocopalolic acid*, $C_{22}H_{34}O_3$, m. pt. 108—110° C., was isolated. The portion insoluble in ether consists of about 12 per cent. of *β-congocopalresene*, $C_{23}H_{36}O_2$.

Benguela copal occurs in various shaped pieces and lumps of both pale and dark colours. Some of the larger pieces contain, in the interior, a small quantity of a reddish fluid, of very unpleasant odour, insufficient for separate examination. The lower m. pt. of the copal is 106—108° C., and the highest m. pt., 156—158° C. Solubility, in approximate percentages, in the solvents named:—ether, 52; alcohol, 56; methyl alcohol, 28; amyl alcohol, 72; acetone, 36; chloroform, 35; benzene, 24; light petroleum spirit, 12; ether-alcohol, 92. Acid value, direct, 112—114·8; acid value, indirect, 117·6—120·4; saponification value (cold) 117·6—123·2; saponification value (hot) 120·4—123·2. The ether solution when shaken with 1 per cent. sodium carbonate solution, gives about 43 to 45 per cent. of amorphous *bengucopalic acid*, $C_{19}H_{30}O_2$, m. pt., 134—136° C. The ether after this treatment, retains about 4 to 5 per cent. of *a-bengucopalresene*, and 3 to 4 per cent. of essential oil, b. pt. 148—155° C. The alcohol-ether solution when shaken with 1 per cent. potassium carbonate solution, gives a portion soluble in ether, from which 22 per cent. of amorphous *bengucopalolic acid*, $C_{21}H_{32}O_3$, m. pt. 114—116° C., was isolated. The portion insoluble in ether consists of 14 to 16 per cent. of *β-bengucopalresene*, $C_{22}O_{36}O_2$. *Congocopalic* and *bengucopalic acids* have the common formula, $C_{19}H_{30}O_2$. Bengucopalolic acid, $C_{21}H_{32}O_3$, *congocopalolic acid*, $C_{22}H_{34}O_3$, and *angocopalolic acid*, $C_{23}H_{36}O_3$, are homologues. *Camerucopalolic acid* and *trachylolic acid* have the common formula, $C_{21}H_{36}O_3$. These formulæ approximate to those of the coniferous resin acids, such as abietinic acid, $(C_{20}H_{30}O_2)$.
—J. O. B.

Patents.

Linseed oil products [varnishes, etc.]; Process for making ——. A. Genthe, Goslar, Germany. Eng. Pat. 6825, March 21, 1907.

See Fr. Pat. 375,985 of 1907; this J., 1907, 935.—T. F. B.

Condensation products suitable as substitutes for resins and natural lac. Badische Anilin und Soda Fabrik. Fr. Pat. 386,664, Jan. 29, 1908. Under Int. Conv., April 23, 1907.

See Eng. Pat. 16,245 of 1907; this J., 1908, 457.—T. F. B.

(C.)—INDIA-RUBBER, &c.

Patents.

Rubber substitute; Compound for use as a —— *and process of manufacture thereof.* F. Tolkien, East Barnet, Herts. Eng. Pat. 23,755, Oct. 28, 1907.

The composition consists essentially of starch and any chloride or mixture of chlorides which possesses the property of forming an elastic mass when added to starch. The following formula gives a composition which may be used for filling into the inner tubes of motor tyres, etc., so as to form an elastic core:—calcium chloride solution of 37° B., 200 parts: zinc chloride solution of 102° T., 55 parts; glycerin, 20 parts; and potato starch, 250 parts. After standing for 24 hours this mixture becomes highly elastic. A hard rubber substitute may be prepared by mixing:—calcium chloride of 37° B., 100 parts; zinc chloride solution of 102° T., 25 parts; and potato starch, 100 parts.
—W. P. S.

Rubber and gutta-percha, and their substitutes; Process for the agglomeration and regeneration of ——. E. A. L. Rouxeville. First Addition, dated March 30, 1907, to Fr. Pat. 378,801, Mar. 21, 1907 (this J., 1907, 1207).

The action of the product described in Fr. Pat. 356,716 of 1905 (this J., 1906, 83) on rubber, etc., is explained. Certain substances, such as oils, glycerin, vaseline, gelatin, etc., may be added, provided that the rubber substitute obtained is capable of being dissolved or agglomerated with the above-mentioned product.—W. P. S.

Rubber articles; Process of making ——. W. Price. Fr. Pat. 386,148, Jan. 11, 1908. Under Int. Conv., Jan. 12, 1907.

See Eng. Pat. 893 of 1907; this J., 1908, 169.—T. F. B.

Rubber; Extraction of raw ——. Rheinische Gummiwerke, Soc. Anon. Ger. Pat. 193,224, Dec. 22, 1905.

In the removal of resins and oils from raw rubber by treatment with solvents, claim is made for spreading the material in a shallow layer in the extraction apparatus, and keeping it in this state throughout the operation. The extraction is effected with liquid solvent at a temperature below the boiling point of the latter.—A. S.

Substitute for horn, &c. Fr. Pat. 386,011. See XIV.

XIV.—TANNING, LEATHER, GLUE, SIZE.

Extraction of sumach and myrabolans; Preliminary work on the ——. C. Eachus. J. Amer. Leather Chem. Assoc., 1908, **3**, 157—165.

Experiments are recorded with several methods of extraction, none of which are regarded as wholly satisfactory. The percolation method of Procter is said to require too much attention, and solutions that were boiled under a reflux condenser are found to give wide variations in both "total solubles" and "non-tannins."—H. G. B.

Hide powder; Standardisation of ——. J. G. Parker and A. T. Hough. Collegium, 1908, 165—167.

The authors confirm the conclusions of Bennett (this J., 1907, 455) as to the influence of the texture and the acidity of the hide powder on the absorption of non-tanning matters in the ordinary course of analysis. They point out that these two factors may be made to compensate each other, and that by adjusting the acidity of a powder immediately prior to use, it may be made to give the same results as a powder of different texture. If this be carried out so that the "non-tannin" results are always the same, any good powder may then be made "standard." It is also pointed out that powders now excluded from use because of their high acidity, may be brought within the legal limit of 5·0 (as determined by Bennett's method) by the addition of a few c.c. of $N/10$ caustic soda to the powder, when "wet down" in ten times its weight of water. It is suggested that the alkali should be agitated with the acid powder for 20 minutes, the chromium chloride solution then added, and the analysis proceeded with in the usual way. Experimental results are given with specific powders.—H. G. B.

Tannin analysis ; Circular to the members of the International Commission on ——. H. R. Procter (Chairman). Collegium, 1908. 169—172.

Further experiments are suggested on the treatment of hide powder for tannin analyses, and the method of using it, and also on the evaporation of infusions and the drying of residues.—H. G. B.

Lactone dyestuffs. III. Constitution of ellagic acid. J. Herzig, J. Polak, and M. v. Bronneck. *See* IV.

Acid in leather dyeing : its absorption and effect. M. C. and J. W. Lamb. *See* VI.

Patents.

Tanning ; Methods of and extracts used in ——. J. P. Rasmussen, Skjelskör, Denmark. Eng. Pat. 18,773, Aug. 20, 1907.

See Fr. Pat. 384,080 of 1907 ; this J., 1908, 414.—T. F. B.

Quebracho extract ; Manufacture of ——. A. Redlich, Vienna, and L. Pollak, Wilsdorf, Austria. Eng. Pat. 4358, Feb. 26, 1908.

The quebracho wood is extracted with hot water, the extract is allowed to cool, and the mud which settles is separated and dissolved by heating it with a solution of sodium or potassium hydroxides. About 1 part by weight of the alkali is required for every 1000 parts by weight of the original liquid, and the heating is continued for about 7 hours. The dark red solution obtained is used for clarifying the liquid separated from the mud, about 50 litres of the solution being added to 1000 litres of the liquid. After the lapse of a few hours, the liquid becomes quite clear and is decanted from the mud, which again settles out ; the latter is further treated with alkali and used for clarifying subsequent quantities of the extract. The alkali solution of the mud may also be added to solutions of other tanning materials which have a high degree of acidity. The precipitate which forms in this case is useless for tanning purposes and is rejected.—W. P. S.

Extracts containing tannin ; Decolorisation of ——. A. J. Stiegelmann and E. Dehnel, Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 889,059, May 26, 1908.

See Fr. Pat. 362,780 of 1906 ; this J., 1906, 770.—T. F. B.

Leather ; Process for obtaining waterproof, fast coloured —— similar to shagreen, from split leather or the like. S. Pianko and M. Knaster. Fr. Pat. 385,900, Jan. 3, 1908.

See Eng. Pat. 28,743 of 1907 ; this J., 1908, 459.—T. F. B.

Artificial leather ; Manufacture of ——. A. W. Case. Fr. Pat. 386,420, Jan. 21, 1908.

Sheets of leather, prepared from pulped scrap leather by known processes, are treated with a mixture of resin and mineral oil or wax, or of all three of these substances. The treatment improves the rigidity, etc., of the leather, and the best results are obtained when the mixture is heated to a temperature of 180° C. at the time of applying it to the leather.—W. P. S.

Substitute for horn, celluloid, caoutchouc, and analogous substances in all their industrial applications ; Manufacture of a product capable of being used as a —— from casein or skimmed milk. C. Pozzi and A. Tondelli. Fr. Pat. 386,011, Jan. 7, 1908.

Casein, or the purified coagulum from skimmed milk, is heated on the water-bath with twice its weight of water containing some lactic acid at 35° to 40° C., until, after 12 to 18 hours, it can be drawn into ductile threads when immersed in boiling water. The temperature is then raised to 70°—75° C. until the casein particles agglomerate, after which the mass is kneaded at 50° to 55° C. to eliminate water, and allowed to cool at 15°—20° C. It is next pulverised, and compressed in moulds for 12 to 14 hours. The resulting sheets or tablets are coloured, and placed one above the other on thick cloths in an iron carrier, which is introduced into an autoclave containing water, glycerin, and formaldehyde in proportions varying according to the hardness and plasticity of the required product. Air under a pressure of about 2 atmospheres is introduced into the autoclave to accelerate the endosmosis, and after about 10 hours, the tablets are withdrawn and dried. —C. A. M.

Sulphite cellulose lyes ; Treating ——. Ger. Pat. 197,195. *See* XIX.

XV.—MANURES, &c.

Tricalcium phosphate ; Study of the natural factors in rendering —— soluble. R. Perotti. Atti. R. Accad. dei Lincei, Roma, 1908, [5], 17, I., 448—451. Chem. Zentr., 1908, 1, 1945.

By using different sources of nitrogen in the cultivation of micro-organisms in presence of tricalcium phosphate, the author found that the so-called " physiologically acid " salts of the type of ammonium sulphate, exercised a considerable effect in rendering the phosphoric acid soluble, whereas " physiologically alkaline " salts of the type of potassium nitrate, had very little influence. Experiments were made with ammonium tartrate, potassium nitrate, ammonium sulphate, urea, and asparagine as sources of nitrogen, and of these, ammonium sulphate was far superior to the others with respect to their action in rendering the phosphoric acid soluble.—A. S.

Calcium cyanamide ; Utilisation of atmospheric nitrogen in the production of ——, and its use in agriculture and chemistry. A. Frank. Faraday Soc., June 9, 1908. [Advance proof].

An account of the present position of the manufacture of calcium cyanamide (" Kalkstickstoff," lime-nitrogen, nitrolim), and the numerous applications of this substance. (See also this J., 1903, 794, 809 ; 1904, 1037 ; 1905, 143, 554, 1245 ; 1906, 567, 598, 647 ; 1907, 478, 1059, 1153). —A. S.

Calcium cyanamide ; Storage of ——. H. von Feilitzen. Chem.-Zeit., 1908, 32, 542. (Compare this J., 1907, 478.)

Calcium cyanamide, when carefully packed in wooden barrels, lined with paper, may be kept for many months in good condition, and almost unchanged in composition. —F. Sodn.

Chilian " caliches " ; Composition of some ——. F. W. Dafert. *See* VII.

Patent.

Alkali salt, phosphatic fertiliser, and carbon dioxide. Fr. Pat. 385,939. *See* VII.

XVI.—SUGAR, STARCH, GUM, &c.

Beetroots ; Lævorotatory substance found in altered ——. J. Weisberg. Bull. Assoc. Chim. Sucr. et. Dist., 1908, 25, 946—949. (See also this J., 1908, 582).

The author has found that the juice of beetroots which have been frozen (or frozen, thawed, and more or less decomposed) yields a precipitate with basic lead acetate, which, on decomposition with oxalic acid (or better, aluminium sulphate) furnishes a lævorotatory solution. This solution, which is partially precipitated by excess of milk of lime, does not reduce Fehling's solution; on boiling with hydrochloric or sulphuric acid, however, it becomes dextrorotatory and acquires cupric-reducing power, and on distillation with either of these acids, furfural is obtained. These results show that the lævorotatory substance is an acid belonging to the pectic group, being formed from pectin owing to the alteration of the beetroot by freezing and thawing. The greater the alteration that the beetroot has undergone, the greater is the amount of lævorotatory substance formed. Since this acid, like dextrorotatory parapectic acid, is precipitated by basic lead acetate and by lime, the author has named it lævorotatory parapectic acid. On acid hydrolysis, it yields, like all the bodies of the pectic group, arabinose and galactose.—L. E.

Diffusion; Further study of ——. L. Naudet. Bull. Assoc. Chim. Sucr. et Dist., 1908, **25**, 950—954.

The author objects to the stoppage of the circulation in the diffusion battery (which has been suggested as a means for increasing the density of the juice) on the ground that in doing so the density of the juice in a given diffuser, which is different at different depths of the diffuser, is equalised to a certain extent, the regularity of the extraction being thus disturbed. He also emphasises the importance of maintaining a constant speed of circulation in the battery, in order to obtain a satisfactory diffusion.—L. E.

Diffusion; Acidity of juice in ——. H. Claassen. Z. Ver. deut. Zuckerind., 1908, 497—505. (See also this J., 1907, 704).

Determinations of the acidities of filtered and unfiltered juices and waste waters of the diffusion battery showed that part of the acidity of these liquors is due to the acid character of the particles held in suspension. In determining acidity for practical purposes, the liquor should be allowed to stand for a short time and then decanted, prior to analysis, comparative determinations being occasionally made with filtered liquor. Investigations of the degree of acidity of the diffusion juice at various stages, and of the waste waters, yielded the following results:—If fresh water, or waste water diluted with fresh water, is used for working the battery, the acidity increases fairly uniformly with the density of the juice from diffuser to diffuser; if, however, waste water alone is used (the additional water required consisting of waste water from another battery), the acidity decreases at first and then increases uniformly. This initial decrease may be due to retention of colloidal acid substances by the beetroot slices, and perhaps also to precipitation of these substances as a result of diffusion processes. The acidity of the diffusion juice is not affected by returning the waste water to the battery, provided that this waste water has not suffered decomposition. The relatively high acidity of the waste water cannot be due to bacterial action, since it only increases slightly during the week's work, such increase being due to accumulation of acid substances from the slices; moreover, the waste water shows no sign of bacterial action. Though the acidity of the waste water does not affect the working of the battery, or the quality of the diffusion juice, it attacks ironwork which is subjected to mechanical friction at the same time, *e.g.*, the pumps, and the sieves of the slice presses. Such parts of the apparatus should be made of brass or bronze; the sieves may be galvanised. The average percentage acidity (calculated as oxalic acid, and determined with phenolphthalein as indicator) of the diffusion juice used in the experiments was 0·04—0·05, that of the unfiltered waste water (from the battery in which waste water only was used) being 0·025—0·03.—L. E.

Saturations; Convenient method for determining alkalinity in the ——. J. Bohle. Deutsche Zuckerind., 1908, **33**, 33—34.

For the rapid, approximate determination of alkalinity in the saturation processes, the author recommends the use of test papers. The test paper for use in the first saturation, showing a faint red coloration at an alkalinity of 0·07, is prepared as follows:—3·5 grms. of citric acid and 1·5 grms. of phenolphthalein are dissolved in 500 c.c. of alcohol, the solution being made up to 1 litre with distilled water. A sheet of porous paper is soaked in this solution, spread out to dry on another sheet of porous paper, and then cut into strips. The strips are tested with an alkali solution of known concentration, the citric acid-phenolphthalein solution being adjusted if necessary. For the second saturation test paper, 0·25 grm. of citric acid is used in preparing the solution; the paper indicates an alkalinity of 0·005—0·008.—L. E.

Diffusion juices; Some laboratory experiments on last ——. J. Bohle. Deutsche Zuckerind., 1908, **33**, 275—276.

According to Karlson, to prevent introduction of uncrystallisable products into the diffusion juice, extraction should be stopped when the last juice begins to show a lower purity than that of the molasses produced in the factory; this means that in most cases, 0·4—0·6 per cent. of sugar, or more, must be left in the extracted slices. Claassen considers, however, that final juices of far lower purity than that of the molasses may be so far purified by precipitation with lime and saturation, as to yield, good, crystallisable products. The degree to which extraction is carried must depend on the conditions of working in each factory; the author's experience in the factory with which he is connected, has led him to the conclusion that the extraction should be carried as far as possible (consistently with normal withdrawal of juice and time of diffusion). Throughout the whole campaign, only 0·20—0·25 per cent. of sugar was left in the slices, and the final juices obtained under these conditions gave a good, crystallisable product. The author quotes experiments which show that last juices (containing about 0·3 per cent. of sugar, with a purity coefficient of about 40) treated with lime, submitted to two saturations, then concentrated and saturated again, filtered, and finally evaporated, yielded a syrup which, on cooling, formed a substance resembling after-products boiled to grain.—L. E.

[*Sugar*] *Refinery yields.* H. Fischek. Z. Zuckerind. Böhm., 1908, **32**, 499—501.

The author shows that in the raw sugars treated in the refinery with which he is connected, the proportion of organic non-sugar to ash has increased of late years, and he points out that though the calculated yield determined by deducting five times the percentage of ash from the polarisation of the raw sugar may be accurate enough if the ratio of ash to organic non-sugar is about 1 : 1, it is appreciably greater than the yield actually obtained if the ratio is, say, 1 : 2.—L. E.

Sugars; Deterioration of —— *on storage.* N. Deerr and R. S. Norris. Hawaiian Sugar Planters' Assoc., Div. Agr. and Chem., Bull, **24**, 1—31.

In the great majority of cases of the deterioration of sugars, the fall in polarisation value is traceable to bacterial action, though sugar may fall in this respect apart from any evidence of bacterial activity. The presence of a certain amount of moisture is essential for the commencement and continuance of bacterial activity, but so long as the sugars do not contain more than 1 per cent. of moisture the danger is but small. Four distinct organisms in particular occur in Hawaiian sugars, one being of very frequent occurrence in sugars which have deteriorated. These organisms are now being studied.

The capacity of sugars for absorbing moisture varies greatly, and it is now evident how important this question becomes. Some evidence exists that the amount of moisture absorbed is connected with the amount of chlorides in the sugars. A sugar which has been dried, and then subsequently exposed to a damp atmosphere, will absorb moisture, and is then liable to deterioration.

The authors suggest the use of an interior paper lining as a means of protecting the sugar from atmospheric changes, in the case of factories experiencing trouble from deterioration of sugars.

Refractometric determination of dry substance [in sugar products]. Prinsen-Geerligs. Archiv. Zuckerind. Javas, **15**, 621 ; Deutsche Zuckerind., 1908, **33**, 50.

THE author has shown that sucrose, dextrose, lævulose, and caramel, possess very nearly the same refractive indices ; with sodium salts (sulphate, acetate) the index is approximately the same as that of sugar solutions of equal concentration ; with potassium salts (chloride, acetate, sulphate) it is generally somewhat smaller, and with calcium salts (chloride, acetate) it is appreciably greater than that of sugar solutions. Mixtures of salts, which do not interact chemically, show the calculated mean index of refraction. Mixtures of sugar solutions (containing 35·3 per cent. of sucrose and 33·3 per cent. of invert sugar) with 25 per cent. of solutions containing about 10 per cent. of the above salts or of their mixtures, show discrepancies which justify the conclusion that interaction occurs between the sugars and the salts. The errors are of no practical importance, however ; determinations of the dry substance-contents in 85 samples of molasses : (1), from the water-content ; (2), by the refractometric method, showed that for all practical purposes, the latter method is quite satisfactory.—L. E.

Refractometric determination of dry substance [in sugar products]. E. O. von Lippmann. Deutsche Zuckerind., 1908, **33**, 33, 106—108, 244. (See also this J., 1906, 1164).

THE author quotes the results of the determination of dry substance in a number of crude syrups and waste liquors ; (1), by the Abbé refractometer (Zeiss) ; (2), by the Brix hydrometer ; (3), from the water-content. A comparison of these figures shows that the refractometric method gives results, even with highly concentrated and very crude syrups, which agree extremely well with those obtained from the water determination. If the liquor is very dark, the diluted (1 : 1) solution used for the polarisation should be employed. In using the Abbé refractometer, a few drops of the solution under examination are introduced between the prisms ; in the case of another refractometer—the Wagner refractometer (Zeiss) —the prism is immersed in the solution ; this instrument can only be used with solutions containing up to 21·72 per cent. of dissolved substance (sugar), and is applicable to the analysis of beetroot and diffusion juice, waste waters, etc. Wagner's table for use with this instrument only gives the amount of sugar (grms. per 100 c.c.) corresponding to whole scale divisions of the refractometer. The author quotes a table (compiled by T. Hübener) giving the amounts of sugar corresponding to tenths of a division. —L. E.

Sugars ; Colour and spectrum reactions of —— with naphthoresorcinol and hydrochloric acid. B. Tollens and F. Rorive. Z. Ver. deut. Zuckerind., 1908, 521—526. (See also this J., 1896, 744).

NAPHTHORESORCINOL, like phloroglucinol, orcinol, and resorcinol, gives characteristic colour reactions when heated with hexose sugars and hydrochloric acid, though the spectrum absorption bands are not so well defined as those obtained in the case of phloroglucinol and the pentoses. The reaction is effected as follows :—A small quantity of the sugar is slowly heated to boiling, in a test-tube, with about the same quantity of naphthoresorcinol and about 10 c.c. of a mixture (1 : 1) of hydrochloric acid (sp. gr. 1·19) and water, and kept boiling very gently for 1—3 minutes. The now turbid liquid is allowed to stand for 3—5 minutes, cooled under the tap, with shaking, and filtered (the filtering funnel has a Piccard's tube fused to it), the deposit being washed 3—4 times with water. Any water in the filter-tube is removed, and alcohol (of 95° Tr.) is poured on the filter, the alcoholic solution being collected in a test-tube. If the solution is too dark for examination (which is always the case if about 20 mgrms. of sugar have been used), alcohol is carefully added, so that the colour deepens towards the bottom of the tube. The tube is then examined in the spectroscope. Various sugars and related compounds were examined ; the following were the chief results :—Lævulose and sorbose, when gently heated with naphthoresorcinol and hydrochloric acid, give a fine red coloration (rather more violet or purple red than the lævulose-resorcinol colour). Dextrose and mannose (and bodies which yield these compounds on hydrolysis) give deposits which dissolve in alcohol to reddish solutions with moderate, green fluorescence ; these solutions show an absorption band in the green. Galactose and galactosides (in absence of lævulose) give a deposit, the alcoholic solution of which shows a band on the D-line and another in the green ; if lævulose is present, it may be decomposed before making the test, by heating with the hydrochloric acid mixture. With the pentoses, and especially the methylpentoses, the deposit obtained gives a striking green fluorescence when dissolved in alcohol ; the deposits obtained in the case of the methylpentoses, give violet-blue alcoholic solutions which show a band on the D-line and a second in the green. Glucuronic acid gives a deposit which dissolves in alcohol to a fine blue solution ; this solution shows a band on the D-line. —L. E.

Invert sugar ; Reduction of cuprous oxide in the determination of ——. V. Staněk. Z. Zuckerind. Böhm., 1908, **32**, 497—499.

THE author recommends the following modified method for reducing cuprous oxide with methyl alcohol vapour :— A layer of asbestos (previously boiled with dilute acid, washed with water, and digested for some hours with a hot 10 per cent. solution of Rochelle salt in 5 per cent. sodium hydroxide) is placed in a porcelain or copper Gooch crucible, the bottom of which is covered with a piece of fine copper gauze folded double. The whole is washed with boiling water and alcohol, dried, heated to low redness, and, whilst still red-hot, placed on a pipe-clay triangle, the wires of which are bent downwards and rest on the bottom of a covered beaker containing boiling 60—70 per cent. methyl alcohol. The alcohol is kept boiling for about 3 minutes, the whole is allowed to cool somewhat, the crucible then being dried for about 5 minutes at 100°—120° C., cooled and weighed. Prior to the introduction of the crucible into the beaker, the alcohol is boiled for sufficient time to fill the beaker with vapour. The bent wires of the triangle support a crucible lid or metal plate, the object of which is to prevent the alcohol from spirting on to the hot crucible. The cuprous oxide is now filtered off under moderate air pressure, into the weighed crucible, washed with hot (not boiling) water, and reduced as above described. The author shows that the results obtained agree closely with those obtained by reduction with hydrogen in a Soxhlet tube. The surface of copper crucibles used in the above process, becomes covered with a thin, spongy layer of copper ; this should be removed with fine emery paper when the crucible has been used 3—4 times. A crucible may be used successively, without removing the reduced copper from previous determinations, until the layer of metal renders filtration too slow ; the asbestos recovered from an exhausted filter by treatment with nitric acid, must, after being washed with water, be digested with alkaline Rochelle salt solution again, prior to use.—L. E.

Reducing sugars ; Bang's method for the determination of ——. H. Jessen-Hansen. Biochem. Zeits., 1908, **10**, 249—257.

I. BANG (this J., 1907, 161) described the following method for the determination of dextrose :—10 c.c. of the sugar solution are boiled for 3 minutes with 50 c.c. of Soldaini's copper solution to which potassium thiocyanate has been added ; after cooling, the excess of cupric salt is determined by titration with a standardised hydroxylamine solution, also containing thiocyanate. The author has investigated this method and finds it more convenient than any other : the accuracy obtainable is sufficient for most ordinary purposes, especially for comparative results, but if the greatest accuracy be required, Kjeldahl's modification of Fehling's method is to be perferred. Bang's method only yields good results provided his directions be rigorously followed. This applies to every detail, particularly to the concentrations and temperatures at which the components of the standard solutions are mixed. If the concentration of the copper salt be too high when mixed with the alkaline thiocyanate solution, a portion of the cupric salt may be reduced by the latter, and the titer of the solution seriously lowered. The complicated mode of action of the hydroxylamine on the cupric salt also necessitates very careful standardisation of the conditions of titration, *e.g.*, the temperature of the solution to be titrated, the rate of addition of the hydroxylamine, and the volume of the liquid; 10 c.c. of water more or less may cause a divergence of 0·7 c.c. in the titration. Strictly speaking, although Bang does not say so, the standardisation of the copper solution by the hydroxylamine should take the form of a blank experiment, and the copper should be boiled with 10 c.c. of water in exactly the same manner as in the sugar determination. Lastly the author criticises the form in which Bang has drawn up his tables. These show the excess of cupric salt remaining after reduction by the sugar, and consequently presuppose exact equivalence between the copper and the hydroxylamine solutions. It would have been better to have tabulated the differences between the titrations before and after reduction by the sugar.—J. F. B.

Milk sugar [*lactose*]; *Heats of solution of the three forms of* ——. C. S. Hudson and F. C. Brown. J. Amer. Chem Soc., 1908, **30**, 960—971.

Lactose can be crystallised from solution in two forms, one of which is a monohydrate and the other β-anhydrous lactose. When either of these is dissolved in water, it changes partially into the other, until a condition of dynamic equilibrium is reached. When the monohydrate is heated at 125° C., it yields the α-anhydride which is hygroscopic. Each of the three forms of lactose shows two heats of solution: the initial heat is that produced when any form of the sugar is dissolved under such conditions that its passage to the stable equilibrium is very slow; the final heat is the total heat produced when the sugar dissolves to give the stable mixture. The following values have been determined for a temperature of 20° C.:—

	Hydrated lactose.	α-anhydride.	β-anhydride.
	grm.-cals.	grm.-cals.	grm.-cals.
Initial heat of solution	−12·0	+7·3	−2·3
Final heat of solution.	−11·4	+7·9	−2·7
Heat of passage into β-anhydride	+1·0	+1·0	—

The initial heat of solution of the hydrate increases about 0·1 cal. per 1° C. rise of temperature. The heat of solution is independent of concentration when this is less than 0·3 molal (molal=1 grm. molecule per litre); the dilution of stronger solutions causes a slight development of heat. The authors have prepared the pure β-anhydrous lactose by an improved method of slow crystallisation; its sp. gr. at 20° C. is 1·59, that of the hydrate being 1·54. The crystalline substance precipitated from cold stable solutions of lactose by alcohol and ether, is not a pure substance, but a mixture of the hydrate and β-anhydride; it does not show mutarotation when re-dissolved in water, because the two substances are present in the proportions in which they occur in stable solutions. When the temperature of a stable solution is suddenly changed, a slight thermal lag is observed in the rotatory power, which indicates that the hydration is slightly increased with rise of temperature between 0° and 100° C.—J. F. B.

Almond tree gum. R. Huerre. J. Pharm. Chim., 1908, **27**, 561—569.

Almond tree gum occurs in two forms, *viz.*, hard, rounded or angular pieces, varying in colour from amber to dark brown, with a conchoidal fracture, and readily reduced to powder; and flat pieces which retain their elasticity indefinitely after prolonged exposure to the atmosphere, are not capable of being powdered, and differ in properties from the hard kind. The results obtained in the examination of these gums, are compared with those obtained by Lemeland with the gums of apricot and plum trees in the following table:—

Kind of gum.	Soluble in water, calculated on dry gum, per cent.	Insoluble in water, per cent.	Loss at 100° C., per cent.	Ash, per cent.	Galactans as galactose, per cent.	Pentosans as arabinose, per cent.	Total sugars, per cent.	Sugars identified.
Almond tree (hard)	21·06	78·94	15·76	2·34	23·70	54·60	85	Arabinose and galactose.
Almond-tree (elastic)	8·9	91·10	25·0	—	—	—	91	Arabinose and galactose.
Apricot-tree	91·17	8·83	16·14	3·39	23·60	48·57	78·74	Arabinose.
Plum-tree	79·16	20·84	15·48	2·52	16·36	76·35	94·81	Arabinose.

Although these gums are closely similar in chemical composition, they differ widely in solubility in water.
—J. O. B.

Valerian rhizome; Presence of sucrose in ——. N. Kromor. *See* XX.

Explosion at a Paris sugar refinery. "Times," May 23, 1908. [T.R.]

A serious explosion occurred on May 22 at the Say sugar refinery, Paris. Some 40 workpeople in all were injured. The part of the factory in which the explosion took place, being devoted to the breaking and packing of sugar, was filled with sugar dust, and the ignition of an explosive mixture of sugar dust and air is attributed to a short circuit.

PATENTS.

Invert sugar and syrups; [*Electrolytic*] *Process for purifying and making* ——. J. J. Eastick, London. Eng. Pat. 12,762, June 3, 1907.

An electric current of sufficient voltage is passed through a cane-sugar solution, the acid substances resulting from the action being left in the solution, whilst the basic impurities are collected in a porous pot, which forms part of the electrolytic cell, and removed. The solution is agitated to facilitate the removal of volatile substances, and, when the sugar is sufficiently inverted, the solution is neutralised in the usual way, or the acids may be removed by diffusion, etc. A little calcium citrate may be added when all but traces of acid have been removed. The temperature must be kept at about 170° F. during the inversion.—W. P. S.

Saccharine juices; Purification of —— *by sulphurous acid.* E. A. Barbet and J. de Grobert. Fr. Pat. 386,390, Apr. 9, 1907.

According to this invention, sulphurous acid is employed in the manufacture of sugar, not merely as a decolorising and disinfecting agent but as a defecating agent proper, being added to the crude juice before liming. The sulphurous acid precipitates pectic and nitrogenous matters from the juice, and it is important that its action on the juice should take place before the latter has been exposed to the air, otherwise a darkening of the colour owing to the action of oxydases will occur. The sulphurous acid treatment is preferably carried out in the diffusion vessels, an aqueous solution being used as diffusion water, or it may be mixed with the juice coming from the last diffuser; the excess of the acid is subsequently precipitated by lime. Sulphurous acid may be employed for defecating the waste waters expressed from the pulps, or for the vinasses from the distillery.—J. F. B.

Sugar refinery products, juices, syrups, etc.; [Electrolytic] Process and apparatus for decolorising ——. S. Kugler. Fr. Pat. 386,534, Jan. 24, 1908.

The process relates to the decolorisation of liquids in sugar refineries by electrolytic reduction. The negative pole (zinc, or nickel or lead-plated iron, etc.) is immersed in the liquid to be reduced, whilst the positive pole (carbon or graphite) is immersed in an alkaline electrolyte, such as lime-water, which is separated by means of a diaphragm from the liquid to be decolorised. This liquid is diluted or concentrated to a density of 60°—65° B. and is maintained at a temperature of about 50° C. during treatment. The apparatus consists of a series of frames, each of which is provided with inlet and outlet openings for the saccharine liquid and similar openings for the electrolyte. The frames are divided into two compartments by means of parchment or unglazed earthenware plate-diaphragms with rubber joints. The electrodes in the liquid under treatment may consist of plates held in wire baskets of the same material in order to distribute the reducing action.—J. F. B.

Sugar works; Application of gas producers in ——. E. Bazin. Fr. Pat. 386,745, Jan. 30, 1908.

A form of generator capable of producing power-gas and steam simultaneously and suitable for use in sugar factories is described. The generator furnace communicates with the chimney by way of a flue, a door being provided for opening or closing the communication; another door provides communication between the flue and a large gas-washing vessel containing a constant volume of water. The generator acts as an ordinary boiler until a pressure of steam is developed; the door leading to the chimney is then closed, and steam is injected into the glowing coal, power-gas being produced. The gas goes through the washer and passes upwards through a scrubbing tower filled with coke, over which water is sprayed. It then traverses a drying chamber and is sucked thence into the motors. When the motors are not in use, the furnace of the boiler is re-connected with the chimney.—J. F. B.

Starch; Perfumed ——, *and process of making the same.* W. J. Marshall, New York, Assignor to I. M. Bird, New York, and F. E. Rowland, Brooklyn. U.S. Pat. 890,524, June 9, 1908.

Tertiary butyltoluene is treated with a mixture of equal parts of sulphuric and nitric acids for several hours at a temperature of about 210° F.; alcohol is then added, and the crystals which form are separated. These crystals are dissolved in a solution of an essential oil in alcohol, and the solution is applied to starch and uniformly distributed.—J. F. B.

XVII.—BREWING, WINES, SPIRITS, &c.

Oats; The amylolytic enzyme of ——. P. Klempin. Biochem. Zeits., 1908, **10**, 204—213.

If oat grist be ground for 24 hours in a ball-mill with a mixture of equal parts of glycerol and water, an extract is obtained which possesses a marked amylolytic activity, as well as proteolytic properties. The amylolytic power of the extract was studied with solutions of starch by the tube method, using iodine as an indicator. Since the extracts which are prepared at temperatures of 15°—20° C. contain considerable proportions of sugar, it is to be inferred that the enzyme has an appreciable diastatic action at these temperatures, whereas extracts prepared at 4°—6° C. are almost free from sugar. The saccharifying power of the enzyme, under the conditions of the experiments, is distinct at a temperature of 25° C., above which it rises rapidly to a maximum at 45° C. Between 40° and 70° C. the saccharifying power is fairly constant; at 75° C. it is still considerable; at 80°—85° C. it is small but marked, and it is destroyed at a temperature of 90°—95° C. A study of the relations between the quantity of enzyme and the time required for the saccharification of a given quantity of starch, showed that this enzyme follows the rule enunciated by Schütz and Borissow, which is expressed by the formula, $f.\sqrt{t}=$constant, where f is the quantity of enzyme and t is the time of action.—J. F. B.

Malt; Influence of flooring conditions on the composition of ——. P. Bernier. Pet. Jour. Brass, 1908, 358; Woch. für Brau., 1908, **25**, 352—354.

Barley was germinated on floors, of which the maximum temperatures were 18°, 21°, and 24° C. respectively, these temperatures being maintained in one series of experiments for 48 hours, and in another series for 72 hours. In each series the quantities of soluble and coagulable nitrogen were practically the same in all three malts, but higher in the second series than in the first. The author concludes that the increased temperature on the floors had no influence on the quantity of soluble nitrogen, but the longer duration of the maximum temperature increased it. This increase of soluble nitrogen, due to increased time, is attributed to the proportionally larger development of the acrospire; the extract was also increased owing to the more perfect modification. The author considers that the ratio of soluble nitrogen to total nitrogen depends on the rootlet development. If the rootlet be strong and long, the total nitrogen is decreased and the soluble nitrogen is relatively increased. On the other hand, a strong development of the acrospire causes an absolute increase of the soluble nitrogen. Malt containing the lowest proportions of soluble nitrogen is obtained by allowing a strong rootlet development and restricting the acrospire. Short acrospires of about two-thirds corn-length are obtained by short steeping and cool flooring; the air-water steep is best because it influences the modification apart from the embryo. The beer from such malt is more stable and possesses more body than that from long grown malt. In other experiments the author prepared two malts, one on the cool system (maximum temperature, 16·7° C.) and the other on the warm system (temperatures of 24°—25° C. maintained for 2½ days, maximum, 26° C.), which had one day less on the floor than the cool-grown malt. Both malts were turned somewhat frequently. They were finished off and made into beer under identical conditions; statistics and analyses were recorded at each stage. The warm-grown malt contained less total and less soluble nitrogen than the cool; this is attributed to the formation and escape of ammonia. The warm germination gave a lower weight of malt, and the malt gave a lower yield of extract. The wort from the warm-grown malt, however, contained less nitrogen, and did not attenuate so far as the other. During secondary fermentation the beer from the warm-grown malt underwent a further loss of nitrogen, whilst that from the cool-grown actually took up nitrogen from the yeast. The maltster need have no scruple in allowing the temperature in the couches to rise so as to obtain a "felted" malt, provided the high temperature be not maintained too long and the modification be not allowed to go so far as to produce a beer deficient in body and stability.—J. F. B.

Malt extract; Difference between laboratory and practical yields of ——. O. Pankrath. Z. ges. Brauw., 1908, **31**, 221—225, 233—235.

The adoption of the fine meal method of extract determinations has re-opened the question how far the results obtained in the laboratory agree with those obtained in practice. Bergdolt (this J., 1905, 1038) showed that the "proportionality" method, used in the laboratory, gave higher results than the absolute extraction method, consisting in washing out the extract until the grains were exhausted. His results in the latter direction contain an error due to the greater dilution of the extracts obtained by washing, as compared with the extracts prepared in the ordinary method of analysis. In order to obtain extracts of similar concentrations, the author has devised a small apparatus for exhausting the grains with minimum dilution of the wort. It consists of a metal cylinder 22 cm. high and 4 cm. in diameter, of a capacity of about 260 c.c. Over the slightly dished bottom is fixed a sieve of wire gauze, beneath which is a discharge pipe with a cock. The cylinder is surrounded by a hot-water jacket to maintain the temperature during the process of filtration. The cylinder can be closed by a cork connected with a supply of compressed air, if pressure is required. With this apparatus any variations in the method of running off and sparging may be tested on a small scale. In using it for the determination of extract by the absolute method, the whole mash, at a temperature of 70° C., is poured into the cylinder, the water jacket being at 70°—75° C. The mash is allowed to settle for 10—15 minutes, the tap is then opened, and the wort allowed to run off at a rate not exceeding 1—2 drops per second. After about 20 minutes the grains begin to show above the liquid, and the sparging water may be started. At this stage the tap should be further closed, and the liquid caused to run more slowly. The necessary quantity of wort, 450—500 c.c., is obtained in about 2½ hours, but further runnings of 100 c.c. or more should be collected separately as a precaution. The extracts obtained in this way from coarse grist are not only equal to, but generally higher than those obtained by the mashing of coarse grist by the proportionality method. This is due to the continued saccharification of residual hard particles of starch during the filtration of the wort. If the mashes be boiled before filtration, the absolute method yields results slightly lower than those obtained by the ordinary laboratory method. The boiled mashes part with their extract far more easily than ordinary mashes. In the ordinary laboratory method of determining extracts, coarse grist does not give the full extract-contents of the malt, particularly if the modification is somewhat deficient. Mashes made from fine meal cannot be extracted satisfactorily in the author's apparatus unless they be boiled, and even then it is sometimes necessary to assist filtration by means of pressure. In these cases the results obtained by the absolute process are constantly about 0·5 per cent. lower than those afforded by the standard laboratory mashing of fine meal, and for normal malts this difference may be taken as representing the extent to which the analytical results exceed the practical. Dark malts behave rather differently; the extract is not washed out so rapidly as with pale malts, and the results are in closer concordance with those afforded by the proportionality method.

—J. F. B.

Date; The endo- and ekto-invertase of the ——. A. E. Vinson. J. Amer. Chem. Soc., 1908, 30, 1005—1020.

The invertase of the date remains insoluble throughout the green stages of the fruit, but becomes readily soluble when the latter is ripe. This change in the condition of the invertase coincides in point of time with the passage of the tannin into the insoluble form; but there is no direct connection between the change in the state of the tannin and that of the invertase, since although soluble tannin hinders the solution of date-invertase in water, it does not affect its solubility in glycerol, provided the latter be added simultaneously with the tannin. The invertase of green dates is insoluble when the fruit is crushed in presence of glycerol; its insolubility cannot therefore be due to the liberation of the tannin from the tannin cells on crushing. The inversion of cane sugar by green date pulp is not accomplished by the living protoplasm liberating a soluble ferment from a pre-existing insoluble zymogen or by rendering active a pro-ferment for the following reasons. The rates of inversion of cane sugar by equivalent amounts of green and ripe date pulps are practically identical; both are retarded in approximately the same degree by the presence of protoplasmic poisons. Green date tissue is not rendered inactive by treatment with ether, chloroform, acetone, etc.; its activity is therefore not connected with that of the protoplasm. According to the author's observations, the theory of the impermeability of the cell wall, which has been advanced to account for the confinement of the invertase of green dates, is untenable. When the green dates are crushed and pressed, the expressed juices are inactive, and the pulp residues are active. Both tannin and basic lead acetate form insoluble compounds with the soluble invertase of dates, and these precipitates retain the inverting properties. It is highly probable that green date invertase and possibly other endo-enzymes are held in insoluble combination by some constituent of the protoplasm. In some cases this combination may be broken down and the enzyme pass into solution during the life of the protoplasm, but in other cases the combination may persist after the protoplasm is dead. On maturity of the tissues the enzyme is generally liberated, possibly by autodigestion or other profound change in the protoplasm.

—J. F. B.

Enzymes; Adsorption analysis of ——. L. Michaelis and M. Ehrenreich. Biochem. Zeits., 1908, **10**, 283—299.

The authors have studied the adsorption of enzymes by certain non-specific substrata, whereby in many cases a means is provided for the separation of the enzymes from mixtures. The results are set forth below:—*Malt-diastase.*—Not adsorbed by kaolin in neutral or alkaline media, but completely in acid media; not adsorbed by talc under any conditions; not adsorbed by animal charcoal in alkaline media, but completely in neutral or acid media; completely adsorbed by precipitated alumina in neutral or alkaline media, incompletely in acid media. *Saliva diastase.*—Readily adsorbed by kaolin under all conditions; completely adsorbed by talc; fairly completely adsorbed by animal charcoal; readily adsorbed by alumina. *Trypsin.*—Completely adsorbed by kaolin in neutral and acid media, not quite completely in alkaline; completely adsorbed by charcoal in all media; completely adsorbed by talc and alumina in neutral and acid media; almost completely in alkaline media. *Pepsin.*—Not adsorbed by kaolin in neutral and acid media; destroyed by alkalis; completely adsorbed by talc and charcoal in neutral and acid media; completely adsorbed by alumina in acid media, largely in neutral media. The milk-coagulating properties of pepsin, tested with kaolin and talc, coincided with the proteolytic properties. *Rennet.*—Completely adsorbed by kaolin and talc in acid media. *Invertase of yeast.*—Not adsorbed by kaolin in any media; completely adsorbed by animal charcoal in all media; completely adsorbed by talc in acid media, hardly at all in alkaline; largely adsorbed by alumina in all media. Colloidal ferric oxide, prepared by dialysis, showed reactions corresponding with those of alumina towards the different enzymes. The adsorption relations of the enzymes are comparable with those of the dyestuffs and may be explained on an electro-chemical hypothesis thus: The enzymes which are adsorbed by kaolin are basic, those which are adsorbed by alumina are acid, whilst those which are adsorbed by both are amphoteric. The acid or alkaline reactions of the various media serve to develop one or other of the functions of the enzyme in a more marked degree.—J. F. B.

Asporogenous budding fungi, occurring in the neighbourhood of breweries; Studies on ——. H. Will. Cent. Bakt. [Abth. II.], 1906, **17**; Z. Spiritusind, 1908, **31**, 276—277.

The author has continued his studies on 15 unnamed species of yeast-like organisms (see also this J., 1903, 814 and 1906, 490). Several of these were isolated from brewing waters, a few from the air of breweries and fermentation cellars, others from cooler-back worts and one each from beer and grapes. The organisms fall into 3 groups, first the Torula group in Hansen's terminology, comprising 8 members. Secondly a group of 6 organisms which form, under special conditions and in their films, elongated cells strung together in branched or unbranched chains, but not forming real mycelia. In the large colonies of this group the upper surface generally consists of spherical or ellipsoidal cells, and the under layer of elongated cells. The third group, containing one member, resembles the Mycodermæ. The author gives the results of his study of the behaviour of these fungi in hopped wort, their resistance towards a 4 per cent. solution of tartaric acid (with reference to the tartaric acid method of yeast analysis), their behaviour in presence of culture yeast, and their resistance to heat. The cell wall is generally of considerable thickness and sometimes tends to peel off, but in some cases the membrane is slimy and gelatinous. Oily globules are generally present in the cell-contents. The large colonies of these organisms constitute a good diagnostic character. The colonies of the first group are relatively very simple; those of the second and third groups often assume very delicate shapes. One species especially is distinguished by beautiful foliaceous streamers with small lumps caused by crystals. Many are distinguished by their colour, their dry or slimy appearance, their waxy or pearly lustre, &c. The author deals with the special morphology of each organism, the phenomena observed when they develop in various media, their production or consumption of acid, their liquefying action on gelatin, and other physiological characters.—J. F. B.

Beer; Influence of the internal coating of the fermentation tuns on the attenuation of —— and on the separation of the yeast. Thausing. Allgem. Zeits. Bierbrau. u. Malzfabr., 1908, **36**, 247—248.

The author refers to the work of Emslander and Freundlich (this J., 1904, 945) on this subject. He states that he has used paraffined wooden tuns for many years with great success; paraffin is preferable to lacquer, because the latter only adheres to the surface and must be renewed every year, whereas paraffin penetrates the pores of the wood and is permanent. The author has made the following experiments: Four different wooden tuns were placed under observation and were used 11 times in succession under absolutely equal conditions with the same wort. The percentage attenuations of the beer in the different tuns are shown in the following table:—

Internal coating of tun.	1st fermentation.	9th fermentation.	11th fermentation.
1. Paraffined several years before	49	49·7	46
2. Coated with mixture of pitch and paraffin	59	59·8	49
3. Coated with resin enamel	58	56·8	47
4. Freshly paraffined	50	49·7	47

It will be noticed that up to the 9th consecutive fermentation, considerable differences were maintained in the attenuations of the beers in the different tuns, but that these differences had nearly disappeared in the 11th fermentation, possibly owing to the formation of a crust of scale. The fermentation in the freshly paraffined tun was quite normal in the first time of using. It has been regularly observed that, when tuns have been exposed to the air for a long time, the beer shows higher attenuations, even if they have been steeped in water before use. A further advantage with paraffined tuns is that the yeast settles out quite normally from the first, whereas with new iron or concrete fermentation vessels, considerable trouble is frequently encountered with the bottom-fermentation yeast. Sometimes this trouble of the rising of the yeast lasts for months after the vessel has been started, in other cases it may not arise at all. It is not entirely a question of the material of the vessel, but it would appear that when the beer is of such a nature as to be capable of retaining large proportions of carbon dioxide, the sediment of yeast holds so much gas that it rises to the top when a portion of the beer has been racked off.
—J. F. B.

Wormwood oil (essence of absinthe); Detection and determination of —— in liqueurs. X. Rocques. Ann. Chim. analyt., 1908, **13**, 227—232.

A volume of 200 c.c. of the liqueur is distilled after the addition of 20 c.c. of water and a few pieces of pumice-stone. The distillate, amounting to 200 c.c., is treated with 1 c.c. of pure aniline and 1 c.c. of syrupy phosphoric acid, and the mixture is heated for 1 hour under a reflux condenser. After cooling, 20 c.c. of water are added, and the solution is once more distilled, 200 c.c. of distillate being collected. This distillate is placed in a separating funnel, and shaken with 120 c.c. of ether, 400 c.c. of water being then added. The ethereal layer is separated, added to 10 c.c. of alcohol contained in a basin, and allowed to evaporate for about 16 hours at the ordinary temperature. The residue, amounting to about 5 c.c., is taken up with a little alcohol, and the solution is tested by the nitroprusside reaction described by Cuniasse (this J., 1907, 269). Besides thujone, citral and carvone also yield colorations under similar conditions; citral is, however, removed by the treatment with aniline and phosphoric acid, and the coloration obtained in the case of carvone is much less intense than that yielded by thujone. As the whole of the thujone present in the liqueur is obtained by the above method of extraction, the quantity may be ascertained by comparison with the coloration given by a known quantity of thujone. It might be mentioned that the manufacture and sale of liqueurs containing oil of wormwood is prohibited in Belgium, whilst in France liqueurs must not contain more than 1 grm. of this oil per litre.—W. P. S.

Alcohol; Indirect determination of —— by the refractometer. A. Frank-Kamenetzky. Chem.-Zeit., 1908, **32** 569—570.

The author shows that the method recommended by Wagner, Schultze, and Rüb for the determination of alcohol in distillery washes, wines, liqueurs, etc., is unreliable and wrong in principle. The method in question consists in taking refractometer observations of the liquid before and after evaporation of the alcohol and dilution to the original volume. For purposes of distillery control the mere determination of the percentage of alcohol is not sufficient; the estimation of the solids of the wash by saccharometer observations is indispensable. The author has made a number of comparative determinations by the direct and the indirect methods, which show considerable errors in the latter case. The results are no better than those obtained by calculation by means of the "alcohol factor" from the saccharometer readings before and after fermentation, a method which has now nearly died out. Moreover, it is not to be supposed that a single table will serve for refractometer calculations for washes of different kinds. The only reliable method for using the refractometer in this kind of analysis is to observe the density of the liquid by means of a sensitive saccharometer and to determine the alcohol by distillation and refractometer observations on the distillate.—J. F. B.

Patents.

Brewing, distilling, etc. [Exclusion of actinic light]. S. Armstrong, Burton on Trent. Eng. Pat. 12,012, May 23, 1907.

The inventor states that in brewing and distilling operations, the exclusion of actinic light, particularly in the summer, has a favourable effect in preserving the wort from the activity of injurious micro-organisms. The specification provides for the total or partial exclusion of actinic light from the wort during the period when it is exposed to the air, between the boiling and fermenting operations, also during the period of fermentation until the yeast has acquired sufficient strength.—J. F. B.

Molasses free from potassium salts; Manufacture of —— and their industrial application. L. Rivière. First Addition, dated March 28, 1907, to Fr. Pat. 385,139, Feb. 28, 1907 (this J., 1908, 584).

The treatment of molasses with hydrofluosilicic acid before fermentation, with a view to precipitate the salts of the alkali metals and other impurities, may be extended to all saccharine liquids used in the distillery, the result of such purification being to increase the yield and improve the quality of the alcohol. An apparatus for the continuous production of hydrofluosilicic acid vapour, either directly by the action of acids on fluosilicates, or indirectly by the decomposition of fluorspar and silica, is described. It consists of a number of reaction vessels arranged in a circle on a platform, so that whilst one-half of the vessels are in use, the other half of alternate vessels are being cleaned and charged. Each vessel is provided with an upwardly inclined vapour pipe and a stirring arrangement. The apparatus is surmounted by a hood which can be rotated on a central vertical axis so as to cover one set of vessels or the alternate set. The hood is provided with vapour pipes, which can be connected with the vapour pipes of the reaction vessels, and which conduct the vapours into a central main. It is also provided with shafts, connecting rods, and gear for imparting to the stirrers in the reaction vessels a reciprocating, vertical as well as a rotary motion. The number of vapour pipes and stirring mechanisms on the hood corresponds only to half that of the reaction vessels, so that when one series of vessels is exhausted, the fittings of the hood are disconnected, turned, and connected with the alternate series of vessels.—J. F. B.

Brandies ; Process for making ——. G. Austerweil. Fr. Pat. 386,718, Apr. 16, 1907.

THE fermented liquid is first neutralised, either completely or partially, and is then distilled either under normal pressure or under reduced pressure. By this process it is claimed that the bouquet esters and the nitrogenous matters are not destroyed, as in the ordinary process, and the flavour of the spirit is improved.—J. F. B.

Beer wort ; Process and apparatus for filtering ——. H. Breker. First Addition, dated Nov. 7, 1907, to Fr. Pat. 385,574, July 19, 1907 (this J., 1908, 637).

THE invention relates to an arrangement for the automatic prevention of the formation of a vacuum beneath the perforated bottom of the mash tun, when, for any reason, the rate of percolation of the wort through the bed of grains becomes slower than the rate at which it runs away through the taps. The pipes which serve for the discharge of the filtered wort, leave the mash-tun with a slight downward inclination ; they are then bent vertically upwards, then horizontally, and finally are connected with a main collecting pipe at a slightly lower level.—J. F. B.

Starch ; Process for saccharifying substances containing ——, *by converting the starch into dextrose with the aid of a ferment.* M. Hoff. Fr. Pat. 386,683, Jan. 6, 1908.

SEE Ger. Pat. 197,468 of 1906 ; this J., 1908, 586.—T. F. B.

Malt beverage poor in alcohol ; Manufacture of a sparkling, stable ——. E. Steffen. Fr. Pat. 386,626, Jan. 28, 1908. Under Int. Conv., March 16, 1907.

A PRACTICALLY non-alcoholic beverage, which does not undergo secondary fermentation, is stated to be made by adding sugar to ordinary beer, and boiling the liquid until an extract is obtained. This is treated with a substance which will give it a "head," and bottled after saturation with carbon dioxide.—J. F B.

Champagne ; Process and apparatus for manufacture of ——. A. Roy and A. Richard. Fr. Pat. 386,699, Jan. 29, 1908.

THE process is designed to obviate the necessity of keeping the bottles in racks, turning and uncorking. The wine is placed in filters consisting of cylindrical glass vessels with rounded bottoms and provided with a tap for drawing off the wine. In these vessels are placed two filtering layers of cellulose mixed with asbestos, supported and separated by perforated glass discs. If desired, the wine may first be saturated with sugar by placing it in a similar glass vessel, without a filtering bed, containing sugar-candy. After filtration, the wine is bottled and carbonated with sufficient gas to replace that lost in the operation of filtration.—J. F. B.

Denatured alcohol in the United States. Supplemental Regulations. [T.R.]

THE U.S. Internal Revenue has issued supplemental regulations relating to the manufacture, distribution, and consumption of denatured alcohol, which contain the following in reference to Special Denaturants :—

Art. 25. The Commissioner of Internal Revenue will consider any formula for special denaturation that may be submitted by any manufacturer in any art or industry, and will determine (1) whether or not the manufacture in which it is proposed to use the alcohol belongs to a class in which tax-free alcohol withdrawn under the provisions of the law can be used ; (2) whether or not it is practicable to permit the use of the proposed denaturant and at the same time properly safeguard the revenue. But one special denaturant will be authorised for the same class of industries, unless it shall be shown that there is good reason for additional special denaturants.

The Commissioner will announce from time to time the formulæ of denaturants that will be permitted in the several classes of industries in which tax-free alcohol can be used.

Up to date the following formulæ have been authorised, to wit :—

To 100 gallons of ethyl alcohol add—

No. 1. Five gallons of approved wood alcohol, the wood alcohol to be subject to the same specifications as are imposed upon the methyl alcohol used in completely denatured alcohol, which are set out in section 26, Part I., Regulations No. 30.

No. 2. Seven pounds of camphor and 5 gallons of commercially pure methyl alcohol, the methyl alcohol to have a specific gravity of not more than 0·810 at 60° F.

No. 2a (alternative). Two gallons of approved wood alcohol and two gallons of benzol.

The wood alcohol shall be subject to the same specifications as are imposed upon the wood alcohol used in completely denatured alcohol, which are set forth in section 26, Part I.

The benzol shall be subject to the following specifications :—

Solubility in Water.—When 10 c.c. of benzol are shaken with an equal volume of water in a glass-stoppered cylinder, divided into tenths of a cubic centimetre, and allowed to stand five minutes to separate, the upper layer of liquid must measure not less than 9·5 c.c.

Boiling Point.—When 100 c.c. of benzol are subjected to distillation in the same manner as described for the determination of the boiling point of wood alcohol in section 26, Part I., not more than 1 c.c. should go over at 77° C., and not less than 90 c.c. at 100° C.

No. 3. Six and one-half gallons of the following mixture :—Five gallons of commercially pure methyl alcohol, having a specific gravity of not more than 0·810 at 60° F. ; 1 gallon of castor oil ; one-half gallon of 36° B. caustic soda lye.

The denaturing mixture is best prepared by dissolving the castor oil in the methyl alcohol, and then adding the soda lye.

No. 4. One gallon of the following solution :—Ten galls. of an aqueous solution containing 40 per cent. of nicotine ; 0·4 pound acid yellow dye (fast yellow Y) ; 0·4 pound tetrazo brilliant blue, 12 B. Conc. ; water to make 100 gallons.

The tobacco denaturant must conform to the following analytical requirements :—

Determination of nicotine.—It must contain not less than 3·75 per cent. of nicotine when tested by the following process : Ten c.c. of the solution are measured into a 500 c.c. Kjeldahl flask, provided with a suitable bulb tube, 10 c.c. of *N*/10 alkali added, the liquid made up to 50 c.c., and distilled in a current of steam until the distillate is no longer alkaline (about 500 c.c.). The distillate is then titrated with $N/10$ sulphuric acid using rosolic acid as an indicator. Not less than 23·2 c.c. should be required for the neutralisation.

Test of Colouring Matter.—Take 1 c.c. of the denaturant and make up to 100 c.c. with water, acidulating with a few drops of sulphuric acid. Immerse in this solution a piece of white cotton cloth and boil the solution. Continue the process, adding more cloth and more water if necessary, until all the blue colour in the solution is fixed on the cloth. Then add a piece of white woollen cloth, and boil the bath as before, until all the yellow colour is fixed upon the cloth. Both the cotton and woollen cloths should show decided colours—the cotton blue and the woollen yellow.

Intensity of colour.—The denaturant solution, when observed in an eight-inch cell of Lovibond's tintometer, must show a colour of an intensity not less than No. 24 yellow, combined with No. 3 blue.

No. 5. Sixty-five pounds of sulphuric ether, 3 pounds of cadmium iodide, and 3 pounds of ammonium iodide

No. 6. Three gallons of commercially pure methyl alcohol and one-half gall. of pyridine bases ; the methyl alcohol to have a specific gravity of not more than 0·810 at 60° F. ; the pyridine bases to conform to specifications as set forth in section 26, Part I., Reg. No. 30.

No. 6a (alternative). Fifteen gallons of condensed fumes, recovered in the process of manufacture. The condensed liquid shall be subject to the following specifications :—

It must contain not less than 4 grams per 100 c.c. of mixed aldehydes calculated as acetic aldehyde.

The use of this alternative formula will be restricted to factories operating in connection with either a distillery or a central denaturing bonded warehouse.

No. 7. *Revoked.* (Formula No. 1 substituted.)

No. 8. One gallon of pyridine bases and one gallon of benzol. The pyridine bases to conform to specifications set forth in section 26, Part I. The benzol to be subject to the specifications contained in formula No. 2a.

No. 9. Ten gallons of acetone and 2 gallons of petroleum naphtha. The petroleum naphtha to have a specific gravity of not less than 0·650 nor more than 0·720 at 60° F.

No. 10. Two gallons of approved wood alcohol and 2 gallons of benzol. The wood alcohol shall be subject to the same specifications as are imposed upon the methyl alcohol used in completely denaturing alcohol, which are set forth in section 26, Part I. The benzol to conform to the specifications imposed in formula No. 2a.

No. 11. One hundred pounds of sulphuric ether and ten pounds of cadmium iodide.

No. 12. One gallon of pyridine bases and two gallons of coal-tar benzol.

The pyridine bases must conform to the specifications set forth in section 26, Part I., and the benzel must conform to the specifications contained in formula No. 2a.

No. 13. Five gallons of sulphuric acid having a specific gravity of not less than 1·83 at 60° F., and five gallons of sulphuric ether having a specific gravity of not more than 0·728 at 60° F.

No. 13a (alternative). Ten gallons of sulphuric ether, having a specific gravity of not more than 0·728 at 60° F.

This alternative denaturant is authorised because of representations made by manufacturers to the effect that Formula No. 13 would give rise to many difficulties in the production of the anæsthetic grade of ether. It is not as efficient a denaturing material, however, and internal revenue officers are hereby instructed to exercise great caution in recommending the granting of permits for its use, both as to the standing and responsibility of the applicant and the character of the premises described in the application. A very careful and close surveillance of such factories must be maintained.

The use of this alternative formula is further restricted to the manufacture of sulphuric ether containing not more than 4 per cent. of alcohol by weight, and section 40, Part VI. of the revised regulations, is amended accordingly.

No. 14 (alternative). Five gallons of commercially pure methyl alcohol, and 10 pounds of anhydrous zinc chloride.

The methyl alcohol must have a specific gravity of not more than 0·810 at 60° F.

No. 15. Three gallons of sulphuric acid having a specific gravity of not less than 1·83 at 60° F., and 1 gallon of kerosene having a specific gravity of not less than 0·800 at 60° F.

No. 16. Five gallons of commercially pure methyl alcohol and 2 gallons of benzol.

The methyl alcohol shall have a specific gravity of not more than 0·810 at 60° F.

The benzol shall be subject to the same specifications as are imposed in formula No. 2a.

The above formulæ have been authorised for use in the various industries as indicated in the following table :—

Manufacture or preparation of—	Formula No.
Alkaloids and fine chemicals	16
Acetic ether	1
(Provided that the finished product contains not more than 6 per cent. of alcohol by volume.)	
Barometer and thermometer tubes	1
Celluloid, pyroxylin and similar products	2–2a
Confectioners' colours	1
Embalming fluids	1
Ethyl chloride	1–14
Filaments for incandescent electric lamps	1
Fine chemicals and alkaloids	16
Fulminate of mercury	6–6a
Heliotropin	1
Imitation leather	12
Jewellery and watches	1
Lacquers, pastes, and varnishes from soluble cotton	1–10
Mouldings and picture frames	1
Monobrominated camphor	9
Nitrous ether	15
(After the tax-free alcohol has all been converted into nitrous ether it will be permissible for the manufacturer to add alcohol in order to dilute the product so that it may be more readily transported, or for other purposes, but such added alcohol must in all cases be tax-paid alcohol.)	
Photographic collodion	11–15
Photographic dry plates	1
Photo-enlargements and photoprints	5
Photo-engravings	5
Postal cards in colours	1
Resins of podophyllum, etc.	1
Rubber purification	9
Santonin	9
Shellac varnishes	1
Shoe polish	1
Silverware and bronze	1
Soap, transparent	1–3
Sulphonmethane	8
Strychnine	9
Solid and powdered medicinal extracts	1
Sulphuric ether	13–13a
Surgical ligatures	1
Tannic acid	9
Tobacco, smoking and chewing	4

XVIII.—FOODS ; SANITATION ; WATER PURIFICATION, AND DISINFECTANTS.

(*A.*)—FOODS.

Amide nitrogen of the proteins ; The so-called ——. Z. H. Skraup and E. v. Hardt-Stremayr. Monats. f. Chem., 1908, 29, 255—262.

That portion of the nitrogen of proteins which is evolved as ammonia on hydrolysis, is known as amide-nitrogen, although no proof has been afforded that it is derived from amides. The authors have studied the formation of ammonia by the hydrolysis of casein, edestin, serum-globulin, crystallised egg-albumin, gelatin, and lysalbinic and protalbinic acids with hydrochloric acid of approximately 40 per cent., 20 per cent., and 10 per cent. strength respectively. In all cases the yield of ammonia was smaller than has hitherto been recorded. For example the maximum yields from the first five substances in the order given were 1·6, 1·6, 1·0, 1·1 and 0·0 per cent. respectively, as against 1·8, 1·7, 1·7, 1·5, and 0·4 per cent.

recorded by other workers. It was observed that about two-thirds of the ammonia was produced in the first 15 minutes in the experiments with the concentrated acid, and in 5 minutes with the diluted acid. The conclusion is drawn that the chief quantity of the so-called amide substances is liberated in the first stage of the hydrolysis of proteins, *viz.*, in the transformation of the protein into albumoses. The formation of albumoses is thus not exclusively a hydrolytic process, but is accompanied by liberation of ammonia.—A. S.

Boric acid in "liquid eggs"; Determination of ——. A. E. Parkes. Brit. Food J., 1908, **10**, 20—21.

The details of the method recommended are as follows:— A weighed portion of about 5 grms. of the sample is diluted with water, transferred to a 250 c.c. flask, and the albumin, etc., precipitated by the addition of from 4 to 5 c.c. of a freshly prepared solution of mercurous nitrate. The mixture is shaken, diluted to the mark, allowed to stand for a short time, and filtered. 50 c.c. of the clear filtrate are placed in a 110 c.c. flask, and rendered slightly alkaline with a 10 per cent. solution of sodium hydroxide, using phenolphthalein as indicator; 25 c.c. of saturated lime-water, or 10 c.c. of saturated baryta-water, are then added, and the whole is diluted to the mark, and filtered through a dry filter. 100 c.c. of the filtrate are titrated with $N/1$ hydrochloric acid until the colour is discharged, 1 c.c. of a 1 per cent. solution of phenolphthalein is added, and more hydrochloric acid if necessary, and $N/10$ solution of sodium hydroxide is then run in until the faint pink coloration just appears. About 30 per cent. of glycerol are now added, and the solution is titrated with $N/10$ solution of sodium hydroxide. The end point is faint, but quite distinct in a good light. 1 c.c. of $N/10$ sodium hydroxide is equivalent to 0·00736 grm. of boric acid. The solution of mercurous nitrate is prepared by dissolving 1 c.c. of mercury in 12 c.c. of cold concentrated nitric acid, and diluting the solution with an equal volume of water. —W. P. S.

Milk enzymes; Chloroform as an aid in the study of ——. H. A. Harding and L. L. Van Slyke. New York Agric. Exp. Stat. Bull., 1907, No. 6, 41—82.

The results of experiments are given in which the action of chloroform was studied, as regards its use as a germicide in the investigation of enzymic action. It was found that at a temperature of 20° C., skim-milk is saturated by 0·55 per cent. of chloroform by volume, whilst milk containing 5 per cent. of fat requires 1·55 per cent. of chloroform to produce saturation. Skim milk containing 3 per cent. of proteins must be treated with 0·4 per cent. of chloroform in order to destroy the bacteria within 24 hours, and milk containing 5 per cent. of fat requires 2 per cent. of chloroform to accomplish this result. The spores are not destroyed immediately, even with excessive amounts of chloroform. In the case of cheese, at least 10 per cent. by weight of chloroform is needed to effect uniform destruction of the bacteria. Digestion proceeds at a uniform rate in skim milk in the presence of 0·2 to 0·7 per cent. of chloroform, but a decrease in the rate, amounting to 12 per cent. of that occurring in the presence of 0·7 per cent. of chloroform, takes place when 2·5 per cent. is present. Increasing the percentage of chloroform from 2·5 to 30 does not cause a further retardation of the rate of digestion.—W. P. S.

Steam distillation; Studies in —— and the recovery of amyl alcohol from the acid liquors obtained in the Gerber method [of determining fat in milk]. H. D. Richmond. Analyst, 1908, **33**, 209—217.

In the first part of this paper the author deals with steam distillation from a theoretical and mathematical point of view. In the second, the results are given of a number of experiments carried out with the object of recovering amyl alcohol from the waste liquors obtained in the Gerber process for the determination of fat in milk. It is shown that about 97·8 per cent. of the amyl alcohol present may be recovered by steam distillation, but that the product gives too high results when used for determinations of fat in milk by Gerber's process. On further fractionating the crude product, a portion may be obtained, boiling between 123° and 131° C., which gives an excess reading of 0·05 when used for milk analysis.—W. P. S.

Tonka butter. Duyk. *See* XII.

Milk sugar [lactose]; Heats of solution of the three forms of ——. C. S. Hudson and F. C. Brown. *See* XVI.

Date; The endo- and ekto-invertase of the ——. A. E. Vinson. *See* XVII.

Patents.

Nutrient constituents of grain, pulse, and the like; Process for rendering the whole of the —— accessible to digestion. D. Finkler, Bonn, Germany. Eng. Pat. 22,195, Oct. 8, 1907.

See Fr. Pat. 382,686 of 1907; this J., 1908, 243.—T. F. B.

Grain, especially wheat; Process for treating —— with vapours evolved from a mixture containing sulphur, nitre, and substances rich in carbon. J. Bloch. Ger. Pat. 194,786, Feb. 19, 1907.

The grain is treated with the vapours evolved on heating a mixture of sulphur, nitre, rosin, ammonium sulphate, and copper sulphate, whereby injurious spores adhering thereto are destroyed.—A. S.

Flour; Method of producing ——. T. Schlüter, Förderstedt, and H. Paucksch, Landsberg, Germany. Eng. Pat. 25,287, Nov. 14, 1907.

See Fr. Pat. 383,943 of 1907; this J., 1908, 417.—T. F. B.

Flour; Method for the manufacture of ——. M. Silberberg, Vienna. Eng. Pat. 25,809, Nov. 21, 1907.

See Fr. Pat. 380,321 of 1907; this J., 1908, 34.—T. F. B.

Flours; Process for increasing the water-absorbing power of —— and for partially disintegrating them. Witschi A. G. für Herstellung Entfeuchteter Nahrungsmittel. Fr. Pat. 386,407, Jan. 21, 1908.

The flour is heated while a current of air is passed over it; the temperature to which the flour has to be heated varies according to the kind of flour under treatment. (See also this J., 1908, 34.)—W. P. S.

Butter fat from fresh milk or cream; Process for extracting ——. M. E. Stro, Grangeville, Idaho. U.S. Pat. 889,060, May 26, 1908.

One teaspoonful of cream of tartar is added to every gallon of the milk or cream, which has been heated previously to a temperature of 95° F. The milk or cream is maintained at a temperature of 70° F. for two or three hours, and is then churned.—W. P. S.

Alimentary product for use as a substitute for meat extract; Process of manufacturing an ——. S. Rigaut. Fr. Pat. 386,102, Apr. 4, 1907.

Casein is subjected to the action of ammonia, either in aqueous solution or as a gas, until the casein has a characteristic greasy feel. The excess of ammonia is then expelled by heating the mixture, and the dry product is next heated in closed tubes, in an autoclave, at a temperature of from 105° to 150° C., for several hours. The caramelised substance is extracted with water to which alkali may be added, and the solution is evaporated to the consistency of a paste, or to a solid.—W. P. S.

Ingredients of baking powders; Rendering —— impermeable to moisture. R. A. Craig. Fr. Pat. 385,929, Jan. 4, 1908. Under Int. Conv., Feb. 7, 1907.

See Eng. Pat. 3035 of 1907; this J., 1907, 986.—T. F. B.

Substitute for horn, &c. Fr. Pat. 386,011. *See* XIV.

(*B.*)—SANITATION; WATER PURIFICATION.

[Sewage effluents] Studies of incubation tests. H. W. Clark and G. O. Adams. J. Amer. Chem. Soc., 1908, **30**, 1037—1041.

Studies made with a view to determine the stability of effluents from contact and trickling filters have shown that their appearance and the development of odour constitute perhaps the surest proof of putrescibility. Oxygen consumed and oxygen dissolved tests are of value, but are sometimes contradictory. The test based on the decolorisation of "methylene blue" has been used to a considerable extent, but according to this test some samples are apparently putrescible which, when judged by the odour only, are stable, and conversely, one sample was met with which developed considerable quantities of sulphuretted hydrogen without decolorising the dyestuff. The sulphuretted hydrogen formed is derived mainly from the albuminous compounds in the effluents and its amount is in some degree a measure of their putrescibility. The addition of potassium sulphate to the effluents did not increase the formation of sulphuretted hydrogen, but did so considerably when added to sewage. The authors have employed a colorimetric method for measuring the sulphuretted hydrogen: the reagents consist of 2 c.c. of strong hydrochloric acid containing 0·5 per cent. of ferric chloride and 1 c.c. of a 1 per cent. solution of dimethyl-*p*-phenylenediamine sulphate; these are added to known quantities of sulphuretted hydrogen water, standardised by iodine, and made up to 100 c.c. in Nessler tubes. The colour of "methylene blue" reaches its full development in about 30 minutes. If a decolorisation test is to be used as an indication of putrescibility, the authors would prefer "indigo carmine" or "methylene green," which afford results perfectly equivalent to those with "methylene blue" in about half the time.—J. F. B.

Bacteria; Use of saline solutions to differentiate ——. Separation of B. typhosus and B. coli. A. Guillemard. Compt. rend., 1908, **146**, 1177—1179.

Normal cultures of *B. typhosus* and *B. coli* cannot be distinguished when grown in the same medium; but in a boullion containing 20 per cent. of sodium sulphate, whereas the development of *B. typhosus* is quite normal, that of *B. coli* becomes most characteristic and abnormal, consisting of a compact agglomeration of long tufts at the bottom of the tube which is with difficulty broken up by agitation. Sulphate and phosphate of sodium have most influence in causing this abnormal development, nitrates and chlorides having no appreciable influence on the culture. The same applies to salts of magnesium, potassium, and ammonium, and it would thus appear that it is the acid group of the salt which is active, and that this acid group should be polyatomic. Non-electrolytes such as carbohydrates do not influence growth. The method may be applied to the separation of the two bacteria by closing one limb of a U-tube with a pad of cotton-wool placed at the beginning of the curve, filling the tube with boullion containing 10 per cent. of ammonium sulphate, sterilising, and inoculating the other limb with a mixture of the two microbes. When a cloudiness appears above the wool, a pure culture of *B. typhosus* is present in this part of the tube, whilst the *B. coli* remains in the curvature. The test is absolutely certain even in cases when but traces of *B. typhosus* are present among large masses of *B. coli.*—E. F. A.

Patents.

Water; Apparatus for purifying ——. H. Reisert, Cologne, Assignor to Hans Reisert Co. U.S. Pat. 890,301, June 9, 1908.

See Fr. Pat. 365,449 of 1906; this J., 1906, 1000.—T. F. B.

Water; Process of purifying —— [removal of iron and manganese oxides]. A. Pappel. Fr. Pat. 386,212, Jan. 14, 1908.

The water, from which it is desired to remove iron and manganese oxides, is passed upwards through a vessel containing pieces of chalk, and then through two tubes packed with manganese dioxide (pyrolusite).—W. P. S.

Controlling and regulating the addition of chemicals [water softening]; Device for automatically ——. L. and C. Steinmüller. Ger. Pat. 192,467, Aug. 5, 1906.

In order to control and regulate the addition of chemicals in the process of softening boiler-feed water, a selenium resistance, interposed in an electric current circuit, is exposed to light which has passed through a test-sample of the water, the variations in the resistance of the selenium caused by the alteration in the character of the light, being utilised by means of an electro-magnet, arranged in the current circuit, to control and regulate the feeding device for the lime and sodium carbonate. The test-samples of water, withdrawn from time to time, are treated with barium chloride, and phenolphthalein solution added, a more or less deep red coloration being produced, according to the excess of lime present. When this test-sample is now used as a light-filter, more or less of the rays are absorbed or reflected, and thus variations are caused in the resistance of the selenium.—A. S.

Air; Process and apparatus for regenerating vitiated ——. G. F. Jaubert. Fr. Pat. 386,029, Apr. 3, 1907.

The air is passed through cylinders where it is brought in contact with potassium peroxide. The latter is packed in cartridges, which, to the number of seven, are placed in the cylinder, and kept in position by top and bottom plates and partitions. The air is forced in by means of a fan, through a pipe and branch pipes into the lower end of the cartridges, the branch pipes having serrated edges which pierce the cartridges. It leaves the cylinder at the top, and is conducted to the bottom of a second similar cylinder through which it passes before being discharged where required. Three cylinders may be conveniently used together, so that two are in operation while one is being recharged.—W. P. S.

(*C.*)—DISINFECTANTS.

Patents.

Germicidal and fungicidal preparations; Manufacture of water-soluble ——. E. Lutz und Co. Ger. Pat. 192,727, Oct. 4, 1906.

Alkali salts of nitrocresols are mixed with copper salts soluble in alkalis, especially copper-alkali tartrates, in such proportions that in the mixture, the copper is equivalent to the alkali content of the nitrocresylate. For example, 10 kilos. of crude cresol are heated for 2—3 days on the water-bath with 10 kilos. of concentrated sulphuric acid, and the resulting sulphonic acid, after addition of 20 litres of water, is nitrated on the water-bath with 15—20 kilos. of nitric acid of 40° B. The nitro-product is washed free from sulphuric acid, and dissolved by heating with a solution containing 4—6 kilos. of caustic potash, and the solution, after concentrating, if necessary, is mixed with a solution of copper-alkali tartrate prepared by dissolving 9·33 kilos. of copper tartrate in a solution of 3·23 kilos. of caustic potash in 5—10 litres of water. Phenols, naphthols, phenanthrols, salicylic acid, cresolcarboxylic acids, hydroxyphenanthrenecarboxylic acids, hydroxynaphthoic acids or their nitro-derivatives may be used in place of the crude cresol. —A. S.

Condensation products of phenols and formaldehyde; Process for the preparation of ——. L. Sarason. Ger. Pat. 193,136, Dec. 5, 1906.

Before effecting the condensation in one of the usual ways, resins or resin-acids are added to the mixture or to one of the constituents thereof. The reaction-product can be utilised directly, *e.g.*, for the preparation of emulsions for use as disinfectants.—A. S.

XIX.—PAPER, PASTEBOARD, &c.

Rushes; Paper pulp from ——. E. Belani. Der Papierfabrikant, 1908, 6, 604—605.

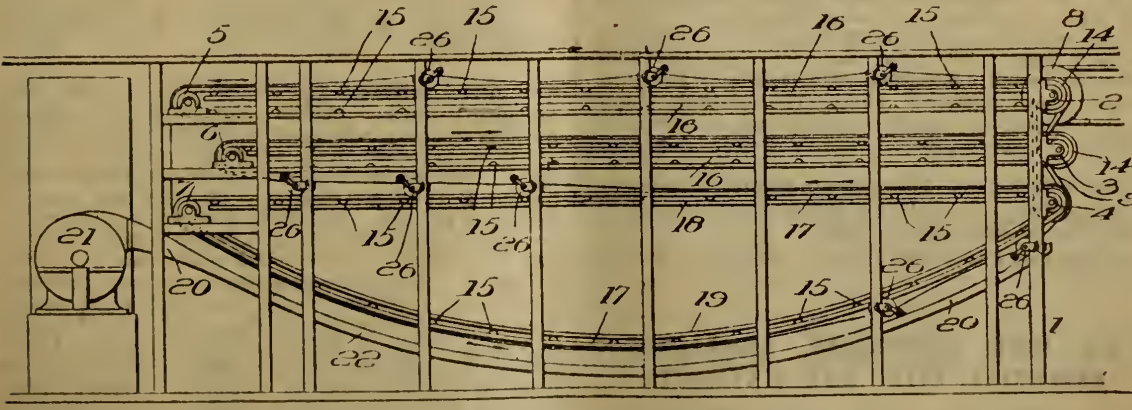
The author has examined samples of cellulose for papermaking purposes prepared from rushes which grow in very large quantities in the delta of the Danube. Although no figures are available, it is probable, from the structure of the stems, that in the preparation of the cellulose the boiling process would have to be relatively severe and the yield of fibre would be low. The pulp somewhat closely resembles that obtained from rye straw, but the characteristic parenchyma and sclerenchyma cells which occur in straw were apparently absent. The bast fibres are, on the average, rather shorter and broader than those of straw, and consequently of lower papermaking value, but still quite capable of industrial utilisation.—J. F. B.

Patents.

Fibrous plants; Treatment of —— *for disintegrating, opening up, or reducing the same.* R. Kron, Golzern, Saxony. Eng. Pat. 19,621, Sept. 2, 1907.

See Fr. Pat. 381,462 of 1907; this J., 1908, 178.—T. F. B.

Drying paper or fabric in the web; Machine for ——. R. W. James, London. From S. A. Cohen, New York. Eng. Pat. 25,090, Nov. 12, 1907.



The frame, 1, of the machine is provided with bearings for the shafts of six rollers, 2, 3, 4, 5, 6, and 7. The roller, 2, is rotated by means of the pulley, 8, fixed to its shaft, and the rollers, 3 and 4, are driven in unison with it by means of an endless belt, 9. The rollers, 5, 6, and 7, are driven by chains wheih engage sprocket wheels mounted upon the shafts of 2, 3, and 4 respectively. Between rollers, 2 and 5, and 3 and 6, are stretched endless blankets, 14, equipped on the inner sides with thin transverse, stiffening strips, 15, which extend beyond the edges of the blankets and are upheld and guided by horizontal guides, 16, extending the length of the machine. An endless blanket, 17, also extends between the rollers, 4 and 7, and this is also provided with transverse strips, 15, which travel along curved grooved guides, 19, during one part of their journey and then along horizontal guides, 18. The pipe, 20, leads from a blower, 21, to a narrow curved hot-air box, 22, which extends beneath and conforms to the curved path of the blanket, 17. The top of the hot-air box is provided with perforations. The web of paper or fabric enters the machine just above the roller, 2, is then carried by the blanket, 14, to the roller, 5, and next travels down to the blanket, 17, which moves in a curved path just above the hot-air box, 22. The web is then carried around the roller, 4, and upon the blanket, 17, until roller, 6, is reached. It is then taken by the middle blanket and delivered from the machine just under roller, 2. At intervals along its path, the web is led over idle concave rollers, 26, to prevent it from curling at the edges.—P. F. C.

Paper pulp; Dyeing —— *with sulphide dyestuffs.* Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 385,944, Jan. 4, 1908. Under Int. Conv., Jan. 30, 1907.

Sulphide dyestuffs may be applied to the dyeing of paper pulp by dissolving the dyestuff in the smallest necessary quantity of sodium sulphide, adding the solution to the pulp in the beater, and injecting air or a gas containing oxygen into the pulp until the whole of the sodium sulphide is oxidised. The pulp is then treated in the usual manner.—J. F. B.

Paper; Method of altering the structure and character of the surface of ——. E. Fues. Ger. Pat. 193,909, Oct. 3, 1906.

The claim is for the addition to paper pulp of structureless cellulose (hydrocellulose or oxycellulose) as a loading agent, instead of the wood pulp, alumina, barium sulphate, chalk, etc., commonly employed. In this way, a light, poreless paper, free from woody fibres, and of a dense structure is obtained. Or, the structureless cellulose may be mixed with a binding agent, and applied as a coating on the surface of the paper. If it be desired to use a coloured structureless cellulose, the cellulose is dyed, with dyestuffs fast to acids, before it is converted into the structureless modification.—A. S.

Wood-pulp, cellulose, and the like; Apparatus for removing water from ——. E. Schreiber. Ger. Pat. 197,983, Aug. 7, 1907.

In the ordinary drum washer for removing dirty water from wood-pulp, etc., the wire cylinder is provided, along the whole of its inner periphery, with radial or approximately radial scoops or bars, by means of which the dirty water, together with any fibre, is led to pulp-catchers. According to the present patent, the scoops or bars are not carried by the frame of the cylinder, but between fixed sectors at either end of the drum, and hence only along a portion of the periphery, whilst the inner surface of the cylinder has no projections. The sectors mentioned are movable, so that one or more of the bars or scoops can be put out of action as desired, according to the character of the water removed from the pulp.—A. S.

Sulphite cellulose lyes; Process for rendering the organic constituents of waste —— insoluble or soluble with difficulty in water. E. Trainer. Ger. Pat. 197,195, Feb. 20, 1906.

The waste lyes are concentrated to about 30° B., and then heated with acids, when, according to the nature of the acid and the temperature, gelatinisation of the mass takes place more or less rapidly. The gelatinisation proceeds more quickly if an aldehyde be added to the lye before the treatment with acid. After treatment with formaldehyde and concentrated hydrochloric acid, for example, the whole mass solidifies almost immediately on heating. The process may be carried out in a closed vessel under pressure. The product may be used for the preparation of insulating materials, artificial leather, etc.—A. S.

Cellulose; Method of eliminating copper from coagulated ——. E. Crumière, Paris. Eng. Pat. 2794, Feb. 7, 1908. Under Int. Conv., March 16, 1907.

See Fr. Pat. 375,827 of 1907; this J., 1907, 922.—T. F. B.

Celluloid; Preparation of —— for painting. C. O. Dressel. Ger. Pat. 193,514, Jan. 26, 1906.

The celluloid is treated with methyl alcohol, whereby its surface is softened, and is then allowed to dry. To the rough matt surface of the celluloid thus obtained, paints can be applied in the usual manner, giving adherent coatings.—A. S.

Crude viscose; Purification of ——. J. P. Bemberg, A.-G. Ger. Pat. 197,086, March 29, 1907.

Crude viscose when purified by treatment with excess of a solution of sulphurous acid or a bisulphite, becomes unstable, and has to be subjected to a further tedious process of purification. This after-treatment can be avoided, it is claimed, by prolonging the treatment with bisulphite until the viscose agglomerates and becomes hard. For example, the crude viscose obtained from 100 grms. of cellulose is treated with about 1 litre of sodium bisulphite solution of 25° B., and allowed to stand for 5—6 hours. The hard lumps of viscose are then removed, pressed, and washed with a 1 per cent. bisulphite solution until perfectly white. The purified viscose swells in water, but dissolves readily and completely on addition of caustic soda. It is very stable.—A. S.

Paper, cardboard, etc., in band form; Method and apparatus for marbling ——. A.-G. für Buntpapier- und Leimfabr. Fr. Pat. 385,995, Jan. 7, 1908.

See Eng. Pat. 426 of 1908; this J., 1908, 640.—T. F. B.

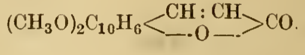
XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

Quinine; Salts of —— with anhydromethylenecitricodisalicylic acid. L. Santi. Boll. Chim. Farm., 1908, **47**, 219—224. Chem. Zentr., 1908, **1**, 1937.

On pouring a very dilute ethereal solution of quinine into a dilute ethereal solution containing an excess of anhydromethylenecitricodisalicylic acid ("novaspirin"), the neutral salt, $C_{20}H_{24}N_2O_2,C_{21}H_{16}O_{11}$, is obtained as a white powder, either amorphous or consisting of minute crystals. It has a bitter taste, is insoluble in water, moderately soluble in alcohol (about 1 : 5), and easily soluble in chloroform (about 1 : 1). If two molecular proportions or more of quinine be taken, the basic salt, $(C_{20}H_{24}N_2O_2)_2C_{21}H_{16}O_{11}$, is obtained. This has similar properties to the neutral salt. Both salts soften at 95° C. and begin to decompose.—A. S.

Piper methysticum (kava-kava); Constituents of the root of ——. J. D. Riedel. Apoth.-Zeit., 1908, **23**, 335.

In addition to water, inorganic salts, gum, starch, and cellulose, kava-kava root contains:—Resin, 5·3 per cent.; methysticin, 0·3; ψ-methysticin 0·268; yangonin, 0·184; alkaloid, 0·022; two glucosides, 0·69, as well as free amorphous sugar; and acids, insoluble in water, 0·7 to 0·8 per cent. The resin consists of α-and β-resins, containing about 23 per cent. of free resin acids and 77 per cent. of resin ester (resene). The portion of the resin separated by means of light petroleum spirit yields more or less crystalline resin esters. The alcohol extract affords a crystalline mixture, from which yangonin, methysticin, and ψ-methysticin are separable by fractional crystallisation from acetone. Yangonin is most easily isolated by saponifying the compounds accompanying it with cold alcoholic potash solution. Methysticin is, as Pommeranz has found, a β-ketonic acid ester; it contains a piperinic acid residue. Methysticol, prepared from it, is identical with Scholtz's synthetic piperonylacetone. ψ-Methysticin, like methysticin, is an ester of methysticinic acid. Yangonin is a lactone, $C_{15}H_{14}O_4$, having the structure



$$(CH_3O)_2C_{10}H_6<\begin{matrix}CH:CH\\ \text{—}O\text{—}\end{matrix}>CO.$$

—J. O. B.

Valerian rhizome; Presence of sucrose in ——. N. Kromer. Pharm. Zentralh., 1908, **49**, 397—399.

A crystalline deposit observed to form in alcohol-ether tincture and extract of valerian, was examined and proved to be sucrose. The presence of this sugar, in varying quantities, was also established in the commercial drug. Thuringian valerian was found to contain 0·142 and 0·073 per cent.; a sample of the Russian drug gave only 0·03 per cent.—J. O. B.

Essential oils; Constituents of ——. *Elemicin and iso-elemicin.* F. W. Semmler. Ber., 1908, **41**, 1918—1921.

The author considers that elemicin (this J., 1908, 641) contains a benzene nucleus with three neighbouring methoxy groups. In the *p*-position to the middle methoxy group is an unsaturated side-chain, possibly an allyl group. The substance formed by treating elemicin with sodium is called *iso-elemicin*. Elemicin was oxidised by means of ozone. One of the products was trimethylhomogallic aldehyde, $C_{11}H_{14}O_4$, which boiled at 162°—165° C. at 10 mm., and formed a semi-carbazone melting at 188° C. The principal product was trimethylhomogallic acid, $C_{11}H_{14}O_5$, which was purified by means of the methyl ester (b. pt. 172°—182° C. at 10 mm., and sp. gr., 1·153 at 20° C.), and then melted at 119°—120° C. These results appear to indicate that the double bond in the side-chain is in the β.γ-position. Iso-elemicin when oxidised with ozone gave trimethylgallic aldehyde, $C_{10}H_{12}O_4$, boiling at 163°—165° C. at 10 mm., and melting at 75° C. The semicarbazone melted at 218° C. The oxime and nitrile were also prepared. In iso-elemicin, the double bond is probably in the α.β-position in the side-chain.—F. Shdn.

Tarragon; The lævo-rotatory component of essential oil of ——. M. Daufresne and Flament. Bull. Soc. Chim., 1908, 3, 656—658.

The higher-boiling fractions of essential oil of tarragon are lævo-rotatory, but the active constituent could not be isolated by fractionation in a vacuum, owing to decomposition. After two fractionations of the oil, the residue had the rotatory power $\alpha_D = -1° 0'$, and by treatment with sodium bisulphite, the active constituent was extracted. This is therefore probably an aldehyde. —J. C. C.

Camphor oil; Presence of d-limonene in ——. Schimmel's Report, April 1908, 25—26.

The presence of *d*-limonene has been detected in a fraction obtained from camphor oil, and having the following constants: b. pt. 175·5—177° C. at 763 mm., sp. gr. 0·8470 at 15° C., α_D (100 mm. tube)$=+39° 46'$, $n_D^{20°}=1·47533$. A nitrosochloride was prepared from the fraction in the usual manner, and was shaken with double its volume of chloroform. The insoluble portion was converted into the corresponding nitrolpiperide by means of piperidine. This was treated with cold petroleum ether, and from the solution, coarse crystals of β-limonene-nitrolpiperide, m. pt. 110°—111° C., were obtained.—A. S.

Sicilian essential oils; Exports of ——. Schimmel's Report, April, 1908, 47—48. [T.R.]

Export of essential oils in the years 1906 *and* 1907.

Destination.	1906.		1907.	
	kilos.	lire.	kilos.	lire.
(*a*) From Messina:				
North German ports	20,460	409,200	21,299	489,877
Austria-Hungary	80,914	1,618,280	61,301	1,409,923
Belgium	3,262	65,240	2,899	66,677
Denmark	2,950	59,000	2,140	49,220
France.........	34,239	684,780	31,710	729,330
Greece	595	11,900	276	6,348
United Kingdom	201,567	4,031,340	213,811	4,917,653
Netherlands	8,960	179,200	10,119	232,737
Russia	9,253	185,060	8,855	203,665
Sweden	7,806	156,120	3,635	83,605
Norway	—	—	3,550	81,650
Spain and Portugal	6,729	134,580	4,678	107,594
Turkey	1,783	35,660	1,223	28,129
United States of N.A.	348,750	6,975,000	483,705	11,125,215
South America .	—	—	—	—
Australia.......	17,581	551,620	33,993	781,839
Egypt	1,656	33,120	1,623	37,329
India	2,568	51,360	581	13,363
Italy	20,829	416,580	19,037	437,851
Other countries	1,237	24,740	2,066	47,518
Total ...	781,139	15,622,780	906,501	20,849,523
(*b*) from Reggio (Cal.):				
North German ports	1,735	34,700	3,548	81,604
Austria-Hungary	28,186	563,720	31,346	720,958
France.........	31,630	632,600	35,811	823,653
United Kingdom	27,411	548,220	25,807	593,561
Netherlands	1,800	36,000	2,320	53,360
United States of N.A.	20,244	404,880	32,062	737,426
Other countries	1,777	35,540	460	10,580
Total ...	112,783	2,255,660	131,354	3,021,142
(*c*) from Catania:				
North German ports	—	—	—	—
Austria-Hungary	7,897	118,455	1,136	26,128
United Kingdom	350	5,250	283	6,509
Other countries	—	—	671	15,433
Total ...	8,247	123,705	2,090	48,070
(*d*) from Palermo:				
North German ports	2,500	30,000	800	12,000
Austria-Hungary	3,582	42,984	1,080	16,200
France.........	3,778	45.336	1,272	19,080
United Kingdom	20,372	244,464	11,910	178,650
United States of N.A.	13,386	160,632	1,510	22,650
Other countries	2,541	30,492	381	5,715
Total ...	46,159	553,908	16,953	254,295

Total exports in the years 1906 *and* 1907:

Port of shipment.	1906.		1907.	
	kilos.	lire.	kilos.	lire.
Messina	781,139	25,622,780	906,501	20,849,523
Reggio (Cal.) ..	112,783	2,255,660	131,354	3,021,142
Catania	8,247	123,705	2,090	48,070
Palermo	46,159	553,908	16,953	254,295
Total ...	948,328	18,556,053	1,056,898	24,173,030

Summary of the exports during the last ten years.

Year.	kilos.	lire.	Year.	kilos.	lire.
1907.	1,056,898	24,173,030	1902..	1,085,497	15,196,958
1906..	948,328	18,556,053	1901..	820.982	12,314,730
1905..	868,244	13,709,760	1900..	842,246	10,972,295
1904..	1,006,103	11,758,590	1899..	797,145	10,722,445
1903..	864,770	11,964,839	1898..	667,293	9,015,083

(1 lira = 9·516d.)

Citronella oil; Exports of —— *from Ceylon.* Schimmel's Report, April, 1908, 31—32. [T.R.]

	United Kingdom. lb.	Germany. lb.	United States. lb.	Various ports. lb.	Total. lb.
1893.....	391,595	40,964	162,648	73,323	668,530
1894.....	543,364	50,559	310,995	33,553	938,471
1895.....	1,028,760	53,373	164,559	35,559	1,282,251
1896.....	923,200	55,492	107,338	46,111	1,132,141
1897.....	602,435	51,853	456,954	71,625	1,182,867
1898.....	696,869	22,883	618,999	27,166	1,365,917
1899.....	766,594	1,335	667,332	43,495	1,478,756
1900.....	848,001	41,854	463,732	55,471	1,409,058
1901.....	928,908	172,984	292,946	35,330	1,430,168
1902.....	556,096	146,518	538,970	53,166	1,295,750
1903.....	348,029	96,422	554,689	63,454	1,062,594
1904.....	514,007	72,376	481,880	88,383	1,156,646
1905.....	398,707	107,976	623,999	88,734	1,309 416
1906.....	484,049	97,396	563,039	97,635	1,242,110
1907.....	520,331	198,109	479,024	214,728	1,312,192

With regard to the export to Germany, it should be borne in mind that a considerable portion of the quantities mentioned under the United Kingdom, subsequently finds its way to Germany.

Oil of Hamamelis virginiana. W. L. Scoville. Amer. Pharm. Assoc., Sept., 1907. Schimmel's Report, April, 1908, 57.

When the branches of *Hamamelis virginiana* (witch hazel) are distilled on a large scale, small quantities of a green, fatty, strongly-smelling substance separate in the distillate, which has long been considered as the active constituent of the latter. The soft, sticky, strongly-smelling "oil," which had a green colour, and contained some water, was distilled with water vapour, and so long cohobated that the distillate passed over almost clear. The yellowish oil, which passed over only very slowly, possessed a strong odour, distinctly resembling that of *Aqua hamamelidis*, without, however, being exactly the same. This may possibly be due to the fact that the natural oil contains a substance which dissolves more readily in water than in the other constituents of the oil, the same as is the case with rose oil. Two samples of the oil were obtained from different portions of the material under examination; they had the following properties: sp. gr. at 25° C., 0·8984 and 0·8985; $n_D^{20^\circ}=1{\cdot}4830$ and 1·4892; α_D (100 mm. tube) $=+4{\cdot}6^\circ$ and $+5{\cdot}05^\circ$; sap. value, 3·80; sap. value after acetylation, 30·3. The bulk of the oil boiled between 250 and 263° C. The oil consisted chiefly of a terpene, with about 7 per cent. of an alcohol, and an ester which was present in still smaller quantity. The non-volatile wax, which had still a strong odour, and which was coloured green by chlorophyll, represented about 72 per cent. of the crude material; it showed a granular fracture like beeswax.

Oil of Heracleum giganteum. Schimmel's Report, April, 1908, 57.

An oil which had been obtained in a yield of 2·94 per cent. from the dry seed of *Heracleum giganteum*, had the following constants: sp. gr. at 15° C., 0·8738; α_D (100 mm. tube) $=+1^\circ 0'$, $n_D^{0^\circ}=1{\cdot}42402$, acid value, 3·7; ester value, 281·9; ester value after acetylation, 311·8; soluble in 1·2 vols. of 80 per cent. alcohol.

Hyssop oil. Schimmel's Report, April, 1908, 57—61.

Three specimens of genuine hyssop oil were examined, with the following results:—(I.). From dried flowering herb: sp. gr. 0·9377 at 15° C., α_D (100 mm. tube) $=-22^\circ 30'$, acid value, 1·8; ester value, 5·8; ester value after acetylation 44·0; insoluble in 10 vols. of 70 per cent. alcohol; soluble in about 6 volumes of 80 per cent. alcohol, with separation of paraffin. (II.). From withered flowering herb: sp. gr. 0·9322 at 15° C., $\alpha_D=-22^\circ 23'$, acid value, 1·3; ester value, 3·6; ester value after acetylation, 37·3; $n_D^{20^\circ}=1{\cdot}48315$; insoluble in 10 vols. of 70 per cent. alcohol; soluble in 8 vols. of 80 per cent. alcohol, with slight turbidity; soluble in all proportions in 90 per cent. alcohol. (III.). From highly faded herb which had ceased blossoming: sp. gr. 0·9336 at 15° C., $\alpha_D=-20^\circ 26$, $n_D^{20^\circ}=1{\cdot}48441$, acid value, 1·8; ester value, 3·1; soluble in about 7 vols. of 80 per cent. alcohol, with slight turbidity. Further examination of oil No. III. showed that it contained β-pipene (nopinene), *l*-pinocamphone and a very small quantity of an alcohol, b. pt. 221°—222° C., together with compounds of the sesquiterpene series. The presence of cineol, thujone, and thujyl alcohol could not be detected. The chief constituent of the oil (about 45 per cent.) is *l*-pinocamphone, which on oxidation with permanganate yields the hitherto unknown *l*-pinonic acid, m. pt. 69·5—70·5° C.—A. S.

Niaouli Oil. Schimmel's Report, April, 1908, 72.

An authentic sample of this New Caledonian oil (from *Melaleuca viridiflora* Brongn. et Gris), which closely approaches cajeput oil, had a bright lemon-yellow colour and a powerful odour of eucalyptol; it contained about 40 per cent. of the latter. The other properties of the oil are: sp. gr. at 15° C., 0·9284; α_D (100 mm. tube) $=-1^\circ 10'$, soluble in 5·5 vols. of 70 per cent., and 1 vol. of 80 per cent. alcohol. It differs from the oils otherwise met with in the trade, by the distinctly higher specific gravity, which lies usually between 0·906 and 0·922. This difference is possibly due to the greatly perfected method of distillation.

Oil of Snake-root; Canadian ——. Schimmel's Report, April, 1908, 98—99.

The snake-root, known in the United States as Indian wild ginger (from *Asarum canadense* L.), has been distilled with the following results:—

The constants of the brown aromatic oil obtained in a yield of 3·36 per cent., from the powdered rhizomes with rootlets, were: sp. gr. at 15° C., 0·9508; α_D (100 mm. tube) $=-22^\circ 0'$; $n_D^{20^\circ}=1{\cdot}48537$; acid value, 3·7; ester value, 115·9; ester value after acetylation, 140·1; soluble in 2·7 vols. of 70 per cent. alcohol. The oil obtained from the rhizomes without rootlets (yield 3·83 per cent.) has a purer yellow colour, and possesses the following constants: sp. gr. at 15°, 0·9516; $\alpha_D=-2^\circ 50'$; $n_D^{20^\circ}=1{\cdot}48508$; acid value, 3·7; ester value, 117·6; ester value after acetylation, 137·2; soluble in 2·3 vols. of 70 per cent. alcohol. The oil obtained from the rootlets of snake-root (yield 1·20 per cent.) had these constants: sp. gr. at 15°, 0·9659; $\alpha_D=-39^\circ 40'$; $n_D^{20^\circ}=1{\cdot}50280$; acid value, 2·2; ester value, 39·2; ester value after acetylation, 110·2; insoluble in 10 vols. of 70 per cent. alcohol, soluble in 0·9 vol. of 80 per cent. alcohol.

Wormseed oil; American ——. Schimmel's Report, April, 1908, 109—119. (See this J., 1907, 837).

American wormseed oils of good quality are required to have a sp. gr. of 0·96—0·98, and to form a clear solution in 10 vols. of 70 per cent. alcohol. At the present time, commercial oils having a sp. gr. 0·93—0·95, and soluble only in 80 per cent. alcohol, are frequently met with. It is found that this is due to slight modifications in the method of distilling the oil. In order to obtain the heavier, more soluble oil, it is best to distil only the crushed seed (the stalks and leaves yield no oil); the cooling should be slight, so that the distillate is collected whilst still hot, large receivers should be used, and the distillation should not be too rapid. A specimen of Baltimore wormseed oil examined, had the following characters: sp. gr. 0·9768 at 15° C., α_D (100 mm. tube) $=-4^\circ 29'$, $n_D^{20^\circ}=1{\cdot}47850$, acid value, 0; saponification value, 8·4; saponification value after acetylation, 280·1; soluble in 4 parts of 70 per cent. alcohol. The oil contained *p*-cymene and small quantities of an unknown terpene and possibly, also, of sylvestrene and *d*-camphor. The chief constituent is a substance, *ascaridol*, $C_{10}H_{16}O_2$, having apparently a constitution analogous to that of cineol. It boils at 83° C. at 4—5 mm., sp. gr. 1·0079 at 15° C., $\alpha_D=-4^\circ 14'$, $n_D^{20^\circ}=1{\cdot}47431$.—A. S.

Atoxyl; Aniline poisoning by ——. F. Blumenthal and F. Herschmann. Biochem. Zeits., 1908, 10, 240—244.

Since the introduction in 1902 of atoxyl (sodium salt of *p*-aminophenylarsinic acid) as a therapeutic agent, several cases of poisoning by this substance have been recorded. These have been described by some observers as cases of arsenic poisoning, but by the majority as cases of aniline poisoning. According to the authors' observations, the symptoms correspond principally with those caused by arsenic preparations. After the injection of atoxyl, the authors have found no traces of aniline in the urine, but have ascertained by diazotisation and combination with β-naphthylamine that the atoxyl is excreted in the form of a product which shows reactions which are similar

to but not identical with those of the original substance. The arsenic is excreted still in combination with the amino-derivative, and since the test for arsenic is more delicate than the diazo reaction, its presence in the urine can be detected for a longer period after administration.
—J. F. B.

Nitro-compounds ; Reduction of —— by Zinin's method. R. Willstätter and H. Kubli. Ber., 1908, **41**, 1936—1940.

By employing Zinin's method of reducing aromatic nitro-compounds with ammonium sulphide, but working only in the cold, good yields of the corresponding aryl-hydroxylamines are obtained. For example: 20 grms. of nitrobenzene are dissolved in 120 c.c. of absolute alcohol, and the solution saturated first with ammonia and then with hydrogen sulphide. After standing overnight, 200 c.c. of ether are added, the precipitated polysulphide filtered off, and the filtrate washed with water and evaporated, towards the end, in a vacuum. The residue, after rubbing with benzene and washing with light petroleum, consists of pure phenylhydroxylamine. *p*-Tolylhydroxylamine and *a*-naphthylhydroxylamine are prepared in a similar manner. When the latter is oxidised with anhydrous silver oxide, it yields *a*-nitrosonaphthalene.—J. C. C.

Guaiacol ; Acid phosphoric esters of ——. V. Auger and P. Dupuis. Compt. rend., 1908, **146**, 1151—1153.

Previously only neutral guaiacol phosphate was known ; the authors have obtained acid phosphates containing one and two molecules of guaiacol per molecule of phosphoric acid by the following methods. On boiling phosphorus oxychloride with guaiacol, a mixture of guaiaco-phosphoryl dichloride, diguaiaco-phosphoryl monochloride, and neutral guaiacol phosphate is obtained in varying proportions, depending on the experimental conditions. The corresponding acids are obtained on hydrolysing the chlorides. Diguaiacol-phosphoric acid is more conveniently prepared by the action of phosphorus oxychloride in the cold on a mixture of guaiacol and pyridine. A third method is the addition of the calculated quantity of alcoholic sodium ethoxide to the neutral guaiacol phosphate, whereby a mixture of the ester-acids is obtained which are easily separated with the aid of their calcium or copper salts. Guaiaco-phosphoryldichloride is a colourless oil, b.p. 170—180° C., which yields when hydrolysed with water, monoguaiacol-phosphoric acid, $CH_3O.C_6H_4.OPO(OH)_2$; this forms fine deliquescent needles, m. p. 94° C., and yields neutral calcium and copper salts which are insoluble in water. Diguaiaco-phosphoryl chloride is a colourless oil, b. p. 258° C. at 15 mm., which is slowly hydrolysed by water to diguaiacol-phosphoric acid, $(CH_3O.C_6H_4O)_2 : PO.OH$. This crystallises in colourless orthorhombic plates, m. p. 97° C., and forms soluble crystalline sodium, calcium, and copper salts.—E. F. A.

Resorcinol ; Melting point of ——. C. T. Bennett. Pharm. J., 1908, **80**, 758.

Pure resorcinol, recrystallised from benzene, melts at 110° C. The U.S.P. 1900, erroneously gives the m.pt. as 119° C. The Ph.G.IV. states that the m.pt. should be 110 to 111° C. ; commercial samples are found to have this melting point.—J. O. B.

Cholesterol and cholic acid, and a common decomposition product of the same. H. Schroetter, R. Weitzenböck, and R. Witt. Monats. f. Chem., 1908, **29**, 245—254.

Although it is generally believed that cholesterol and cholic acid have an analogous structure, no proof of this view has yet been afforded. By the action of concentrated sulphuric acid in presence of a small quantity of mercury on the two compounds, followed by treatment of the soluble portion of the reaction-products with strong nitric acid, the authors succeeded in obtaining a common decomposition product. This was isolated in the form of white needles, melting at 228°—230° C., of the composition, $C_8H_6O_7$. Further examination of the compound showed that it is a tribasic acid, in all probability a hydroxycyclopentadiënetricarboxylic acid, thus affording a further argument in favour of the terpenic character of cholesterol.—A. S.

Diamyl ether, and ethers of higher alcohols ; New method for the preparation of ——. G. Schroeter and W. Sondag. Ber., 1908, **41**, 1921—1925.

The authors describe a method for the production of ethers by means of methionic acid. This substance is gently heated with amyl alcohol for several hours, and then the diamyl ether is distilled off. As the methionic acid can be used again, a very satisfactory yield of the ether is obtained. A good yield of diamyl ether can be obtained by heating amyl alcohol and concentrated sulphuric acid to about 140° C., for several hours, and distilling with steam.—F. Shdn.

Fatty acids ; Hydrates of —— determined by the viscosity of their solutions. D. E. Tsakalotos. Compt. rend., 1908, **146**, 1146—1149.

The viscosities of formic, acetic, propionic, and *n*-butyric acids have been measured in aqueous solutions of varying strengths. Whereas in the free state, formic acid has a higher viscosity than its homologues, in aqueous solutions containing 1 mol. of acid to 1 mol. of water, formic acid has a viscosity considerably below that of the other acids. The viscosity coefficients of the system, formic acid and water, are a little below those calculated by the law of mixtures ; the coefficients of the systems of the other acids are considerably above the calculated, and their viscosity curves show maxima corresponding in each case to the concentration of 1 mol. of acid to 1 mol. of water. These results indicate that whereas acetic, propionic, and *n*-butyric acids form molecular compounds with a molecule of water, no such compound exists in the case of formic acid.—E. F. A.

Chloral and its hydrates. C. van Rossem. Z. physik. Chem., 1908, **62**, 681—712.

Pure chloral melts at −57°·5 C., and boils at 97° C. under a pressure of 740 mm. Three hydrates of chloral exist :— 1. A *semihydrate*, $2C_2HCl_3O,H_2O$, very slowly forming from its components, very gradually dissociating when melted. Its true m.p. is about 49° C., the highest observed m. p. 80° C. 2. The ordinary *monohydrate*, existing in two pseudo-symmetrical modifications, slowly dissociating when melted. True m. p. 47°·4 C., highest observed m. p. 54° C. 3. A *heptahydrate*, or compound of the monohydrate with 6 molecules of water, forming very rapidly and melting at the constant temperature of —1°·4 C. The boiling-point curve (at 740 mm.) of mixtures of chloral and water shows a minimum at about 75 molecules per cent. of chloral, but no indication of chloral hydrate. Throughout, the composition of the vapour differs only slightly from that of the mixture distilled. When mixtures of chloral hydrate and water are heated in sealed tubes, separation takes place ; the minimum temperature of this is 172°·5 C. for 60 mol. per cent. of chloral, but this curve also shows no indication of the existence of chloral hydrate.—J. T. D.

Light ; Chemical action of ——. XIII. G. Ciamician and P. Silber. Ber., 1908, **41**, 1928—1935.

The authors have continued their work on the action of light on certain saturated, cyclic ketones (this J., 1908, 469). Dihydrocarvone after several months' exposure yields an acid, $C_{10}H_{18}O_2$, which is readily converted into a lactone. An aldehyde was also formed. Carvone when exposed to light, yielded an isomeride, $C_{10}H_{14}O$, which melts at 100° C., and boils at 206·5° C. This substance forms an oxime melting at 126°—128° C., and a semicarbazone melting at 239° C., and is soluble in all ordinary solvents with the exception of water. Unlike carvone and dihydrocarvone, it is stable towards permanganate.—F. SHDN.

Mercuric cyanide; Preparation of ——. E. Rupp and S. Goy. Apoth-Zeit., 1908, **23**, 374.

THIRTY-ONE grms. of sodium cyanide, in fine powder, are mixed with 50 c.c. of water and added gradually, with constant stirring, to 90 grms. of mercuric sulphate. The mixture suddenly evolves considerable heat. Should the sandy precipitate of mercuric cyanide not be free, after a short time, from yellow basic mercuric sulphate, a little more sodium cyanide must be added, and the mixture boiled, until the yellow colour disappears. The solid mass which forms when the mixture cools, is rubbed down, and treated in an extraction apparatus with about 200 c.c. of hot 95 per cent. alcohol. After distilling off the solvent, the residue is crystallised out from boiling water. The salt thus prepared is pure, and forms long white needles, which afford clear solutions.—J. O. B.

Mercuric salts in aqueous solution; Rapid method for the determination of ——. S. G. Liversedge. Analyst, 1908, **33**, 217—218.

THE method suggested depends on the solubility of mercuric iodide in ether, and is particularly useful for the determination of small quantities of mercury. In the case of *liquor hydrargyri perchloridi* B. P., 25 c.c. of the solution are placed in a separating funnel, and a 5 per cent. solution of potassium iodide is added, drop by drop, until no further precipitate is produced, an excess being avoided. A few drops of phosphoric acid are added to reduce the solvent action of the potassium iodide, and the mercuric iodide is then extracted by shaking out the mixture several times with ether. The ethereal extracts are washed three times with a little water, transferred to a weighed flask, the ether distilled off, and the residue of mercuric iodide, after being dried for one hour in the water-oven, is weighed. The weight of mercuric iodide found multiplied by 0·597 gives the amount of mercuric chloride in the quantity of solution taken.—W. P. S.

PATENTS.

Bromo-valeric acid menthol ester. E. Sprӧngerts, Assignor to Ver. Chininfabr. Zimmer und Co., Frankfort on Maine, Germany. U.S. Pat. 888,857, May 26, 1908.

α-BROMOVALERIC acid menthol ester is prepared by causing the acid to act upon menthol under the influence of heat, the product of the reaction being treated with alkali, and distilled with superheated steam. The ester is a colourless oil which boils with slight decomposition at 162°—167° C. under a pressure of 20 mm.—J. F. B.

Carbon chlorides; Process for making ——. H. S. Blackmore, Mount Vernon, N.Y. U.S. Pat. 889,573, June 2, 1908.

CARBON halides are made by exposing a carbide of a metal or of hydrogen, *e.g.* acetylene, to the action of a halogen-generating composition under conditions suitable for the reaction, and maintaining the temperature below the dissociating point of the carbon halide desired.—J. F. B.

Camphene; Process of making ——. A. Steiner, Assignor to Chemical Works formerly Sandoz, Basle, Switzerland. U.S. Pat. 890,465, June 9, 1908.

SEE Eng. Pat. 10,783 of 1907; this J., 1908, 643.—T. F. B.

Tartaric material; Process for treating crude —— in order to render the colouring matter insoluble. V. Garin and F. David. First Addition, dated March 30, 1907, to Fr. Pat. 374,276, Apr. 12, 1906 (this J., 1907, 778).

WHEN the proportion of albuminous matters in the crude tartar is too low in comparison with that of the colouring matters, substances such as blood, white of egg, gelatin, glue, casein, beer yeast, etc., may be mixed with the tartar before the addition of the formaldehyde, and the mixture then thoroughly dried at a temperature not exceeding 140° C.—J. F. B.

Borneol; Preparation of acetates of ——. P. J. Leemans. Fr. Pat. 386,347, Jan. 18, 1908.

BORNYL and isobornyl acetates are prepared by the action of an acetate on pinene hydrochloride in presence of a large excess of glacial acetic acid and of fused calcium chloride or a bisulphate of an alkali metal. The reaction takes place at the boiling temperature. Anhydrous acetates of lead, magnesium, mercury, etc., may be used, but in the case of acetates of metals which yield insoluble chlorides, the latter should be removed, and the reaction completed in presence of anhydrous potassium or sodium bisulphate.—J. F. B.

iso-Bornyl esters; Manufacture of ——. Clayton Aniline Co. Fr. Pat. 386,552, Jan. 25, 1908. Under Int Conv., July 19, 1907.

PINENE hydrochloride is heated with a fatty acid in presence of metallic zinc, preferably in the form of a powder. Example: 100 parts of pinene hydrochloride, 300 parts of glacial acetic acid, and 30 parts of zinc dust are gently boiled under a reflux condenser or heated in a water-bath until a sample, when made alkaline with sodium hydroxide, yields an oil which is free from chlorine. The operation is generally complete after about 20 hours; the excess of acetic acid is then removed, and the isobornyl acetate is separated and distilled under reduced pressure. It is claimed that by this process the production of resinous matters is practically avoided.—J. F. B.

Iron arsenate; Process for the manufacture of soluble preparations containing colloidal ——. Kalle und Co. Ger. Pat. 185,197, June 17, 1902.

AN aqueous ammoniacal solution of iron arsenate is treated with an aqueous solution of the alkali or ammonium salts of protalbinic or lysalbinic acids (Ger. Pats. 129,031 and 132,322), or with a solution of alkali salts of albumoses (Ger. Pat. 133,587), the precipitate produced is filtered off, and the filtrate is evaporated to dryness *in vacuo.* The product does not evolve ammonia on treatment with sodium carbonate.—A. S.

Iron preparation easily soluble in water and alcohol; Process for obtaining an ——. E. Laves. Ger. Pats. 194,940 and 195,120, July 5, 1906.

(1). NEUTRAL salts of pyrophosphoric acid are added to iron albuminate in a dry or moist condition. From the product, neutral stable solutions of iron albuminate can be prepared. (2). Iron albuminate, in a dry or moist condition, is mixed with neutral salts of glycerophosphoric acid or pyrophosphoric acid, in addition to the ferric saccharate (or mixture of ferric hydroxide and sugar) mentioned in Ger. Pat. 173,013 (see this J., 1907, 33). —A. S.

Dithioglycollic acid; Process for the preparation of ——. Kalle und Co. Ger. Pat. 194,039, July 1, 1905

SALTS of chloracetic acid are treated with sodium disulphide in presence of water, the temperature being kept sufficiently low to prevent any considerable separation of sulphur.—A. S.

Nitrosobenzene and other nitroso-compounds ; Electrolytic preparation of ——. O. Dieffenbach. Ger. Pat. 192,519, Nov. 5, 1905.

Nitro-compounds, especially nitrobenzene, can be reduced to nitroso-compounds electrolytically, without a diaphragm, if the electrolyte be kept neutral. The reduction can also be performed with a diaphragm, provided the current be passed alternately in opposite directions, the electrolyte in each compartment being kept neutral. Phenylhydroxylamine is first formed at the cathode, and as soon as the current is reversed, it is oxidised to nitrosobenzene.—T. F. B.

Amylamine ; Process for the preparation of ——. Chem. Werke vorm. Dr. H. Byk. Ger. Pat. 193,166, April 11, 1906.

Good yields of amylamine are obtained by distilling leucine (α-aminoisobutylacetic acid) or isoleucine (β.β-methylethyl-α-aminopropionic acid) *in vacuo*.—A. S.

Diacylates ; Process for the preparation of —— from glycerol and the higher monobasic fatty acids. F. Ulzer, J. Batik and R. Sommer. Ger. Pat. 189,839, July 17, 1906.

Fatty acids containing from 16 to 22 atoms of carbon, or mixtures of these acids, are heated *in vacuo* with excess of glycerol, at the boiling point of the latter. It is stated that only small quantities of monoacylates are formed in the process.—A. S.

Phosphoric acid esters ; Process for the preparation of —— from phosphorus pentoxide and diglycerides of fatty acids or of their bromine or iodine derivatives. F. Ulzer and J. Batik. Ger. Pat. 193,189, July 17, 1906.

To a mixture of 2 mol. proportions of the diglyceride and 1 mol. proportion of phosphorus pentoxide, 1 mol. proportion of water is added gradually, with agitation and cooling, and the reaction is completed, if necessary, by heating for a short time on the water-bath. The reaction proceeds smoothly according to an equation of the type :

$$2C_3H_5(OH)(CO_2C_{17}H_{35})_2+P_2O_5+H_2O=2C_3H_5(CO_2C_{17}H_{35})_2O.PO(OH)_2.$$

—A. S.

Santalol ester of camphoric acid ; Process for the preparation of the neutral ——. J. D. Riedel A.-G. Ger. Pat. 193,960, Sept. 9, 1906.

A neutral alkyl ester of camphoric acid is heated with santalol. The product exhibits both the bactericidal action of camphoric acid and the therapeutic properties of santalol.—A. S.

Carbonic esters of protocatechuic aldehyde ; Preparation of cyclic ——. H. Pauly. Ger. Pat. 193,543, Sept. 13, 1906. Addition to Ger. Pat. 190,788, May 8, 1906. (See this J., 1908, 471).

Dichloropiperonal is converted into the cyclic carbonic ester of protocatechuic aldehyde by treatment with concentrated sulphuric acid.—T. F. B.

Halogen-alkyl esters of carboxylic acids ; Process for the preparation of ——. E. Merck. Ger. Pat. 192,035, Sept. 16, 1906.

Halogen-alkyl esters of carboxylic acids of the general formula, $X.(CH_2)_x.O.CO.R$ (X = halogen, R = a hydrocarbon residue substituted or not) are prepared by heating together at temperatures above 100° C., and with exclusion of water, salts of the carboxylic acids and excess of a dihalogenide of the type, $X.(CH_2)_x.X$. Bromo-γ-propyl benzoate, bromo-ε-amyl benzoate, bromo-ε-amyl *p*-nitrobenzoate, bromo-ε-amyl salicylate, and bromo-ε-amyl anisate have been prepared by this method.—A. S.

Acylbenzoic acids from phthalic anhydride, hydrocarbons, and aluminium chloride ; Preparation of ——. G. Heller. Ger. Pat. 193,961, Sept. 19, 1906.

Acylbenzoic acids (*e.g.*, α-naphthoylbenzoic acid or anthracylbenzoic acid) can be prepared by the action of phthalic anhydride and aluminium chloride on a multinuclear hydrocarbon in presence of a hydrocarbon which reacts easily under such conditions (*e.g.*, benzene). The process cannot be carried out directly, as in the case of benzoylbenzoic acid.—T. F. B.

Diamino- and alkylated diaminobenzoylalkamines ; Preparation of ——. A. Einhorn. Ger. Pat. 194,365, Sept. 30, 1906.

m-p-Diamino- and alkylated diaminobenzoic acid alkamine esters are obtained : (1), by treating the aminobenzoic acids with alkamines ; (2), by reduction of the corresponding dinitro- or nitro-amino-compounds ; (3), by heating the aminobenzoic acid halogen-alkyl esters with amines ; (4), by heating the diaminobenzoic esters with alkamines. The products possess powerful local anæsthetic properties.—T. F. B.

Gallic acid and ferments ; Preparation of compounds of ——. E. Wörner. Ger. Pat. 198,305, Sept. 30, 1906.

Compounds of gallic acid and ferments are precipitated by acidifying a solution of a ferment to which animal galls have been added. The compounds possess fermentative power.—T. F. B.

Cantharinic acid derivative containing iodine and mercury ; Process for the preparation of a ——. A. Klein. Ger. Pat. 193,219, Nov. 15, 1906.

Neutralised cantharinic acid, or tincture of cantharides, is heated with a large excess of mercuric chloride and powdered iodine, and the excess of free iodine removed from the product.—A. S.

Mono- and dichlorohydrin from glycerin and hydrochloric acid ; Preparation of ——. C. F. Böhringer und Söhne. Ger. Pats. 197,308, Nov. 20, 1906, and 197,309, Dec. 15, 1906.

Increased yields of mono- and dichlorhydrins can be obtained from glycerin and hydrochloric acid gas at a low temperature, or hydrochloric acid solution at higher temperatures, by the addition of a small quantity of an organic acid, *e.g.*, acetic acid.—T. F. B.

Anthranil ; Preparation of ——. Kalle und Co. Ger. Pat. 194,364, Nov. 28, 1906.

The di-mercury derivative of *o*-nitrotoluene (see Fr. Pat. 370,522 ; this J., 1907, 276) is converted into anthranil by treating with concentrated hydrochloric acid and subsequently decomposing the product with water.—T. F. B.

o-Nitrosobenzyl alcohol and anthranil ; Preparation of ——. Kalle und Co. Ger. Pat. 194,811, Dec. 11, 1906.

The volatile portion of the product of reaction of alkalis on *o*-nitrotoluene in presence of steam, is isolated, and the dried distillate is treated with a metallic salt (*e.g.*, mercuric chloride) to precipitate the *o*-nitrosobenzyl alcohol, whilst from the filtrate, anthranil is obtained by heating with concentrated hydrochloric acid.—T. F. B.

o-Ketone ethers ; Preparation of ——. E. Hess. Ger. Pat. 197,804, Dec. 1, 1906.

Claisen's process of preparing *o*-ketone ethers, $RR'C(OR'')_2$, cannot be used technically owing to the difficulty in obtaining the formiminoethers. In the present process, other iminoethers are used, *e.g.*, acetonitrile and benzyl cyanide. The nitrile is mixed with an equimolecular amount of absolute alcohol, and the calculated quantity of dry hydrochloric acid is passed in. After standing for 24 hours, the hydrochloride of the iminoester is dried over sulphuric acid and caustic potash, and treated with the ketone and alcohol. After 8 days, the solution is diluted with ether, the ammonium chloride removed, and the solution poured into acidified, ice-cold water. The ether is finally distilled and dried over calcium chloride.—T. F. B.

Choline ; Process for the preparation of —— *from lecithin.* J. D. Riedel A.-G. Ger. Pat. 193,449, Dec. 22, 1906.

Lecithin is warmed with sulphuric acid.—A. S.

Dialkylaminodimethylethylcarbinol halogen alkylates and their benzoyl derivatives ; Preparation of ——. J. D. Riedel, A.-G. Ger. Pat. 195,813, Feb. 16, 1907.

Alkyl halides are allowed to act on dialkylaminodimethylethylcarbinol or its benzoyl derivative. The products are stated to be of therapeutic value, and to be less poisonous than the analogous derivatives of choline.—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Patent.

Colour photography ; Process for obtaining, without ruling, a polychrome screen for ——. Soc. Anon. des Plaques et Papiers Photographiques A. Lumière et ses fils. Fr. Pat. 386,147, Jan. 11, 1908.

Two-thirds of the surface of a sheet of glass, coated with gelatin, is covered with a fatty ink, which acts as a temporary reserve, in lines, bands, circles, etc. ; the screen is now bathed in a solution of dyestuff (*e.g.*, violet) and coated with a varnish, the solvent of which does not dissolve the ink, and the resin being insoluble in at least one solvent of the ink. The screen is warmed gently, and treated with such a solvent of the ink, thus leaving one-third of the surface coated with varnish. One-half of the whole surface is now coated with the ink, the screen is dyed green, for example, varnished, and treated with the ink solvent. One-third of the surface now remains colourless ; this is now dyed red, and the varnish removed from the other portion of the screen. After coating with collodion, etc., the screen is ready to receive a sensitive emulsion.—T. F. B.

XXII.—EXPLOSIVES, MATCHES, &c.

Explosives ; Law for transportation of —— *in the United States.* [T.R.]

The following is the text of a Bill "to promote the safe transportation in interstate commerce of explosives and other dangerous articles," which has been signed by the President :—

"Be it enacted, &c., that it shall be unlawful to transport carry or convey any dynamite, gunpowder or other explosive between a place in any foreign country and a place within the United States, or a place in any State, Territory or district of the United States, and a place in any other State, Territory or district thereof, on any vessel or vehicle of any description operated by a common carrier, which vessel or vehicle is carrying passengers for hire ; provided, that it shall be lawful to transport on any such vessel or vehicle small arms ammunition in any quantity, and such fuses, torpedoes, rockets or other signal devices as may be essential to promote safety in operation, and properly packed and marked samples of explosives for laboratory examination, not exceeding a net weight of one-half-pound each, and not exceeding twenty samples at one time in a single vessel or vehicle ; but such samples shall not be carried in that part of a vessel or vehicle which is intended for the transportation of passengers for hire ; and, provided further, that nothing in this section shall be construed to prevent the transportation of military or naval forces with their accompanying munitions of war on passenger equipment vessels or vehicles.

"Sec. 2. That within ninety days from the passage of this Act the Interstate Commerce Commission shall formulate regulations for the safe transportation of explosives, and said regulations shall be binding upon all common carriers engaged in interstate commerce which transport explosives by land, and violations of them shall be subject to the penalties hereinafter provided. The Interstate Commerce Commission, on its own motion or upon application made by any interested party, may make changes or modifications of the regulations for the safe transportation of explosives, made desirable by new information or altered conditions, and such changed regulations shall have all the force of the original regulations. The regulations for the safe transportation of explosives referred to in this section shall be in accord with the best known practicable means for securing safety in transit, covering the packing, marking, loading, handling while in transit and the precautions necessary to determine whether the material when offered is in proper condition to transport. The regulations for the safe transportation of explosives shall take effect three months after their formulation and publication by the Interstate Commerce Commission, and shall be in effect until reversed, set aside or modified.

"Sec. 3. That it shall be unlawful to transport, carry or convey liquid nitroglycerine, fulminate in bulk in dry condition, or other like explosive between a place in a foreign country and a place within the United States or a place in one State, Territory or district of the United States and a place in any other State, Territory or district thereof, on any vessel or vehicle of any description operated by a common carrier in the transportation of passengers or articles of commerce by land or water.

"Sec. 4. Every package containing explosives or other dangerous articles when presented to a common carrier for shipment shall have plainly marked on the outside thereof the contents thereof, and it shall be unlawful for any person to deliver, for interstate or foreign transportation, to any common carrier engaged in interstate or foreign commerce by land or water, or to cause to be delivered or to carry any explosive or other dangerous article, under any false or deceptive marking, description, invoice, shipping order or other declaration, or without informing the agent of such carrier of the true character thereof, at or before the time such delivery or carriage is made.

"Sec. 5. That every person who knowingly violates, or causes to be violated, any of the foregoing provisions of this act shall be deemed guilty of a misdemeanor, and upon conviction thereof shall be punished for each offence by a fine not exceeding two thousand dollars or by imprisonment not exceeding eighteen months, or by both such fine and imprisonment, in the discretion of the court.

"Sec. 6. That this act shall take effect immediately, and all acts or parts of acts in conflict therewith are hereby repealed, except Section 4422 of the Revised Statutes of the United States, which shall remain in full force and effect."

Nitrogen in cellulose nitrates ; Method for the determination of ——. M. Busch and S. Schneider. Z. ges. Schiess- und Sprengstoffwesen, 1, 232.

Diphenylendanilodihydrotriazole or "nitron" (this J., 1905, 289, 291) is used to precipitate the nitric acid radical in cellulose nitrates as nitron nitrate. The method, which is applicable also to the analysis of nitrating acid mixtures and waste acids, is as follows : To 0·29 grm. of cellulose nitrate are added 5 c.c. of 30 per cent. sodium hydroxide solution and 10 c.c. of 3 per cent. hydrogen peroxide. The mixture is heated for some minutes on the water bath until solution is complete. 40 c.c. of water and 10 c.c. of hydrogen peroxide are then added, and the liquid is heated to 50° C. After adding 40 c.c. of 5 per cent. sulphuric acid and heating to 80° C., 12 c.c. of a 10 per cent. solution of "nitron" in 5 per cent. acetic acid are added. The mixture is cooled for 1 to 2 hours in ice-water, and the precipitate filtered off into a Neubauer crucible. The precipitate is sucked dry, washed 4 times with 10 c.c. of ice-water, and dried for 45 minutes at 110° C. It is weighed as the nitrate, $C_{20}H_{16}N_4.HNO_3$, and the percentage of nitrogen calculated, using 0·0373 as factor. The results by this method agree closely with those obtained with the nitrometer.—W. S.

Patent.

Explosives ; Treatment and preservation of ——. F. M. Hale. Fr. Pat. 386,423, Jan. 21, 1908.

With the object of preventing deterioration or premature decomposition of smokeless powders and high explosives—containing nitroglycerin, nitrocellulose or allied substances—especially after storing in warm or damp places, it is proposed to keep such explosives for a time in a partial or complete vacuum at a certain temperature, the time, temperature and degree of vacuum depending on circumstances. Acid fumes yielded by the explosive may be absorbed by alkaline substances placed in the vacuum chamber.—J. W. G.

XXIII.—ANALYTICAL CHEMISTRY.

APPARATUS.

Iridium crucibles ; Use of —— in chemical operations. W. Crookes. Royal Soc. Proc., 1908, A, 80, 535—536.

The author shows that crucibles of pure iridium possess properties which make them of great advantage in laboratory work instead of platinum. Crucibles of wrought iridium are as hard as steel and remain almost unaffected by any reasonable mechanical treatment. Brightly-polished iridium oxidises superficially with a bluish colour when heated to redness, but is reduced again on raising the heat. When heated for some time over a Bunsen burner insufficiently supplied with air, the iridium crucible is unaffected, and the carbon deposit may be easily burnt away, leaving the metal uninjured. The crucible does not blister and is unaffected by sulphur in the gas. When boiled in *aqua regia* for several hours there is no appreciable loss in weight. Microcosmic salt was fused in the crucible for four hours with additions of carbon ; a mixture of magnesium pyrophosphate and carbon was ignited in it ; and phosphoric acid and carbon were heated together in it for some hours, in all cases without apparent action on the metal. Silica and silicates, with a reducing agent, can be strongly heated without affecting the crucible. Caustic potash fused at a red heat does not attack the metal so strongly as it would platinum. Lead may be boiled away at a white heat in the crucible without affecting it. Zinc and acid zinc chloride (soldering liquid) were heated in the crucible so that the zinc could "wet" it. The zinc was then volatilised. It was found that the metal was superficially attacked. Copper heated for some time in the crucible makes the metal brittle, but when burnt off at a high heat, the iridium changes to its original condition. Nickel, gold, and iron can be kept liquid in the crucible for some time without injury to the vessel. Rhodium is proved to be practically as resistant in all cases as iridium and its cost would be less on account of its lower density.—W. S.

Patents.

Calorific value of gases ; Apparatus for the determination of the ——. F. R. Schönberger. Fr. Pat. 386,294, Jan. 16, 1908.

The method is based on the fact that the speed of conflagration of a gas is in a determinate proportion to its calorific value and also depends on its pressure.

The apparatus consists of a burner and a regulating valve, which controls the inflow of gas from the source of supply into a receiver. To the receiver is attached a manometer tube. The height of the flame and the gas pressure are read off on graduated scales attached to the burner and the manometer tube, the pressure being regulated by the aforesaid valve until the flame is on the point of extinction.—J. W. G.

Moisture content of grain and other substances ; Apparatus for the rapid determination of the ——. E. Brown and J. W. T. Duvel, Washington, U.S.A. Eng. Pat. 1636, Jan. 23, 1908. Under Int. Conv., March 2, 1907.

See U.S. Pat. 848,616 of 1907 ; this J., 1907, 554.—T. F. B.

INORGANIC—QUALITATIVE.

Copper and iron ; Detection of ——. M. Delépine. Bull Soc. Chim., 1908, 3, 652—654.

Alkali dialkylthiosulphocarbamates derived from secondary amines, from diethylamine upwards, give intense colorations with copper, iron, and some other metals, and can therefore be used to detect small quantities of these in aqueous solution. The reagent is prepared by mixing two molecular proportions of the secondary amine with one of carbon bisulphide and diluting with water or alcohol to a 1 per cent. solution. A few drops of this are added to the solution to be tested, which is then shaken with a little redistilled ether. A few c.c. of redistilled benzene are then added, and the mixture shaken. After standing, the benzene is decanted into a crucible, and, if the solvent is yellow, the operation is repeated. The benzene is now evaporated, and the residue treated with two drops of nitric acid and strongly heated. The remaining oxide will dissolve entirely in a drop of nitric acid if it is copper oxide, but only partly if iron oxide. In the former case, on evaporating the copper nitrate solution to dryness, an intense yellowish-brown coloration is obtained with the reagent. In the latter, a few drops of water are added, and if copper is present, the solution is poured off and tested as before. The residue is rendered soluble by heating with a trace of potassium bisulphite, and one or two drops of thiocyanate and a little ether added, when a rose colour is produced.—J. C. C.

Nickel and cobalt ; Simultaneous detection of ——. H. Grossmann and W. Heilborn. Ber., 1908, 41, 1878—1880.

The solution containing nickel and cobalt is concentrated, freed from any excess of acid which may be present, and excess of ammonia added. 10 to 20 c.c. of a 10 per cent. solution of sucrose and the required quantity of dicyandiamidine sulphate solution, and sodium hydroxide solution are now added in succession. In presence of large quantities of nickel and small quantities of cobalt, a well-crystallised yellow deposit of nickel dicyandiamidine rapidly settles out, and the solution changes to deep red or reddish-violet, which is characteristic for cobalt. When large quantities of cobalt are present together with small quantities of nickel, the precipitation of the latter as the yellow crystalline compound takes place only after some time, the precipitation being facilitated by shaking.
—W. S.

INORGANIC—QUANTITATIVE.

Arsenic and antimony associated with copper ; Iodometric determination of ——. F. H. Heath. Amer. J. Science, 1908, **25**, 513—519.

To the solution, containing the arsenic or antimony, in the higher condition of oxidation, and copper, are added 1 to 2 grms. of citric acid, followed by 3 grms. of potassium iodide to precipitate the copper, when not more than 0·3 grm. is present in a volume of 50 c.c. The free iodine is titrated with sodium thiosulphate solution. The cuprous iodide is filtered off on asbestos, 1 c.c. of liquid bromine is added to the filtrate, and the solution boiled in an Erlenmeyer flask. After the free iodine is volatilised, and the solution has become clear, which may have to be facilitated by addition of more bromine and re-boiling, the solution is concentrated to about 60 c.c., then diluted to 100 c.c., 2 grms. of potassium iodide added, and the solution again concentrated to a volume of 50 c.c. Sulphurous acid is added to the cooled solution until colourless, using starch as indicator. After dilution to 100 c.c., iodine solution is added and then dilute sulphurous acid from a pipette until the liquid is just bleached. The solution is neutralised with sodium or potassium carbonate, and the arsenic or antimony titrated with standard iodine solution in the usual way.—W. S.

Vanadic acid ; Volumetric determination of ——. T. Warynski and B. Mdivani. Ann. Chim. analyt., 1908, **13**, 209.

Vanadic acid may be titrated directly by means of a solution of stannous chloride, the reaction proceeding according to the equation :—$SnCl_2+V_2O_5+2HCl=SnCl_4+V_2O_4+H_2O$. The titration is best performed in hydrochloric acid solution in the cold, but if sulphuric acid be used, the solution may be warmed. The solution of stannous chloride should contain about 2 per cent. of the salt, and the indicator used consists of an aqueous solution of ammonium molybdate, which gives a blue coloration in the presence of even traces of stannous salts.—W. P. S.

Gas liquors ; Analysis of ——. M. Mayer and H. Hempel. *See* III.

Helianthin [*Methyl Orange*] *; Action of dilute nitric acid on* ——. J. J. Fox. *See* IV.

Iron and vanadium [*in ferrovanadium, etc.*] *; Volumetric determination of* ——. T. Warynski and A. Mdivani. *See* X.

Gold ores ; Assay of telluride ——. G. Borrowman. *See* X.

Mercuric salts in aqueous solution ; Rapid method for the determination of ——. S. G. Liversedge. *See* XX.

ORGANIC—QUALITATIVE.

Glucuronic acid and its derivatives in presence of pentoses and in urine ; Simple test for ——. B. Tollens. Z. Ver. deut. Zuckerind., 1908, 526—528.

The deposit obtained by heating glucuronic acid with naphthoresorcinol and hydrochloric acid (see page 698) gives a solution in ether which shows a blue fluorescence by reflected, and a blue to red colour by transmitted light, and also shows an absorption band the centre of which is slightly to the right of the D-line. The sugars give discoloured ethereal solutions, which show no band near the D-line ; hence, the reaction may be used to detect glucuronic acid (and euxanthic and urochloralic acids) in presence of these compounds. A quantity of glucuronic acid lactone or substance under examination (not larger than a grain of millet) is mixed with 5—6 c.c. of water in a test-tube, treated with 0·5—1 c.c. of a 1 per cent. alcoholic solution of naphthoresorcinol and a volume of hydrochloric acid (sp. gr. 1·19) equal to that of the liquid. The whole is heated to boiling, and kept gently boiling for one minute, allowed to stand for 4 minutes, and then cooled under the tap. An equal volume of ether is added, the whole being well shaken. The ethereal layer (the separation of which may be accelerated by addition of more ether or a few drops of alcohol, if necessary) is examined in the spectroscope. Three to five mgrms. of glucuronic acid lactone in 5 c.c. give, in water, a very strong absorption band, and in presence of dextrose, arabinose, or urine, the band is still very decided. The method is much simpler and more trustworthy than those previously described.—L. E.

Sugars ; Colour and spectrum reactions of ——. B. Tollens and F. Rorive. *See* XVI.

Bacteria ; Use of saline solutions to differentiate ——. *Separation of B. typhosus and B. coli.* A. Guillemard. *See* XVIII*B.*

ORGANIC—QUANTITATIVE.

Saponification value ; Determination of the ——. N. Rusting. *See* XII.

Turpentine and turpentine substitutes. J. H. Coste. *See* XIII*B.*

Hide powder ; Standardisation of ——. J. G. Parker and A. T. Hough. *See* XIV.

Tannin analysis ; Circular to members of International Commission on ——. H. R. Procter. *See* XIV.

Saturations ; Determining alkalinity in ——. J. Bohle. *See* XVI.

Refractometric determination of dry substance [*in sugar products*]. (1). Prinsen-Geerligs. (2). E. O. von Lippmann. *See* XVI.

Invert sugar ; Reduction of cuprous oxide in the determination of ——. V. Staněk. *See* XVI.

Reducing sugars ; Bang's method for the determination of ——. H. Jessen-Hansen. *See* XVI.

Malt extract ; Difference between analytical and practical yields of ——. O. Pankrath. *See* XVII.

Wormwood oil (*essence of absinthe*) *; Detection and determination of* —— *in liqueurs.* X. Rocques. *See* XVII.

Alcohol ; Indirect determination of —— *by the refractometer.* A. Frank-Kamenetzky. *See* XVII.

Boric acid in " liquid eggs " ; Determination of ——. A. E. Parkes. *See* XVIII*A.*

Steam distillation and recovery of amyl alcohol. H. D. Richmond. *See* XVIII*A.*

Nitrogen in cellulose nitrates ; Method for the determination of ——. M. Busch and S. Schneider. *See* XXII.

Trade Report.

Effect of the English Patent Law on German industry. Reuter, June 25, 1908.

The " Bund der Industriellen " has presented a petition to the Imperial Chancellor, the Federal Council, and the Reichstag, pointing out that the time limit fixed for fulfilling the provisions of the new English patent law—whereby the patented article must be manufactured in a " sufficient quantity by August 28 "—most seriously injures German interests. The petition proposes :—

(1.) To secure through diplomatic channels the extension of the time limit from August 28 to at least a year hence.

(2.) To put into force similar measures against English patents in virtue of the German patent law, which admits of retaliatory measures.

(3.) To open negotiations with the British Government with a view to removing as soon as possible compulsory manufacture of patented articles by placing the inhabitants of both countries on an equal footing on the lines of the agreement reached between Germany and Switzerland.

New Books.

Memoirs of the Geological Survey, England and Wales. The Coals of South Wales, with special reference to the Origin and Distribution of Anthracite. By Aubrey Strahan, M.A., D.Sc., F.R.S., and W. Pollard, M.A., D.Sc., &c. Assisted by E. G. Radley. Wyman and Sons, Limited, Fetter Lane, London, E.C. E. Stanford, 12, 13 and 14, Long Acre, London. W. and A. K. Johnston, Ltd., 2, St. Andrew Square, Edinburgh. Hodges, Figgis and Co., Grafton Street, Dublin. 1908. Price 1s. 6d.

8vo volume, containing 74 pages of subject matter, with alphabetical index, and numerous maps, charts, &c. The matters treated of in the work are comprised under the following heads :—I. Historical and introductory. II. Sequence of the Coal Seams. III. Analytical methods and table of analyses. IV. Accuracy of coal analyses. V. Comparison of different bands of the same seam, and of different samples from the same seam in the same locality. VI. Comparison of different seams in the same locality. VII. Classification of coals. VIII. Origin of anthracite.

Journal of the Municipal School of Technology, Manchester. Vol. 1, Part I.

Small 4to volume containing 143 pages devoted to investigations undertaken by members of the staff of the School. It contains, *inter alia,* the paper on the mercerisation of cotton, by Julius Hübner and W. J. Pope. (See this J., 1904, 404).

A Pocket Handbook of Minerals designed for use in the Field or Class-room, with little reference to Chemical Tests. By G. Montague Butler, Assistant Professor of Geology and Mineralogy, Colorado School of Mines, United States Deputy Mineral Surveyor. First Edition. John Wiley and Sons, New York. 1908. Price $3.00. Chapman and Hall, Limited, London. Price 12s. 6d.

16mo volume, containing 291 pages of subject-matter, with 89 illustrations, and an alphabetical index, followed by 5 folded tables, preceded by a page of explanations. The minerals referred to are classified as follows :—I. Native elements (Tellurium-, gold-, and platinum-iron groups). II. Sulphides of semi-metals and molybdenum. III. Sulphides, &c., of the metals. IV. Sulpho-salts. V. Halogen salts. VI. Oxides. VII. Anhydrous oxides of the semi-metals. VIII. Anhydrous oxides of the metals. IX. Hydrous oxides. X. Anhydrous carbonates. XI. Hydrous carbonates. XII. Anhydrous silicates. XIII. Hydrous silicates. XIV. Titano-silicates. XV. Niobates and tantalates. XVI. Phosphates, arsenates and vanadates. XVII. Borates. XVIII. Uranates. XIX. Anhydrous sulphates, chromates, etc. XX. Hydrous sulphates. XXI. Tungstates and molybdates. XXII. Hydrocarbons. XXIII. Commercially important ores. XXIV. Retail prices of cut gems. XXV. Values of metals and minerals. XXVI. Moh's scale of hardness. XXVII. Von Kobell's scale of fusibility. XXVIII. Determinative Tables.

Spectrum Analysis. By John Landauer, LL.D. Authorised English Edition by J. Bishop Tingle, Ph.D., Professor of Chemistry in the McMaster University, Toronto. Second Edition. Rewritten. John Wiley and Sons, New York. 1907. Price $3.0. Chapman and Hall, Limited, London. Price 12s. 6d.

8vo volume, containing 208 pages of subject-matter, with 49 illustrations, and an alphabetical index. The subject-matter is classified as follows :—I. Introductory, Historical. II. Physical properties of light. III. Spectroscopes. IV. Spectroscopic instruments for special purposes. V. Spectroscopic adjuncts. VI. Spectra. VII. Spectra of the elements VIII. Absorption spectra. IX. The solar spectrum. X. Other celestial bodies.

Synthetic Inorganic Chemistry. A Laboratory Course for First Year College Students. By Arthur A. Blanchard, Ph.D. First Edition.

12mo volume, containing 89 pages of subject-matter, classified according to the following scheme :—I. Introduction for the student. II. Metals of the alkali and alkaline earth groups. III. Elements of the third group of the periodic system. IV. Heavy metals of the first two groups ; V. Elements of the fourth group ; and VI. Elements of the fifth group of the periodic system. VII. Heavy metals of the sixth, seventh, and eighth groups of the periodic system. At the end of each chapter follows a set of general questions.

The Theory of Ions. A Consideration of its Place in Biology and Therapeutics. By William Tibbles, M.D., LL.D., &c Rebman Limited, 129, Shaftesbury Avenue, London. 1908. Price 2s. 6d. net.

12mo volume, containing 128 pages of subject-matter and an alphabetical index. The subject-matter is arranged according to the following classified scheme :—I. The ions. II. Ions in biology. III. Evolution of organic matter. IV. Influence of ions on the organism. V. Influence of ions in oxidation and immunisation.

Annual Statement of the Trade of the United Kingdom with Foreign Countries and British Possessions, 1907. Volume I. [Cd. 4,100]. Price 5s. 7d.

This is the first volume of the statement of the oversea trade of the United Kingdom for the year 1907, and contains abstract tables showing the total imports and exports of every article which is separately enumerated in the official classification, as well as detailed tables showing the quantity and value of the imports and exports of each article from and to each country, figures being given in each case not only for the year 1907, but for each of the four preceding years.

Mines and Quarries : General Report and Statistics for 1906. Part IV. Colonial and Foreign Statistics. [Cd. 4,145.] Price 1s. 8d.

This part of the Report includes statistics relating to persons employed, output, and accidents at mines and quarries in the British colonies and in foreign countries during 1906.

Royal Commission on Canals and Waterways. Volume IV. Returns supplied to and prepared by the Royal Commission on Canals and Waterways, 1907, comprising the History, the Extent, the Capital of, and the Traffic and Works on the Canals and Inland Navigations of the United Kingdom. [Cd. 3,719.] Price 7s. 2d.

Report on the Trade in Imports and Exports at Irish Ports during the Year ended 31st December, 1906. [Cd. 4,126.] Price 10½d.

Besides tables showing in detail the total quantities and estimated values of commodities imported into and exported from 47 ports of Ireland for the years 1905 and 1906, the report contains appendices with extracts relating to Irish trade with foreign countries, taken from the Consular Reports for 1906, a table of agricultural produce imported into the United Kingdom in 1906, and diagrams showing the monthly fluctuations in the number of cattle and the quantities of butter and eggs imported into the United Kingdom, and exported from Ireland, during 1906.

Patent List.

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

Applications.

13,013. Watson. *See under* XVII.

13,360. Dixon and Middleton. Pyrometers or apparatus for measuring high temperatures. June 23.

13,563. Dudgeon (Cockerill). Centrifugal apparatus for purifying blast furnace, generator, or other gases.* June 25.

13,572. Anderson and Meikle. Evaporators. June 27.

Complete Specifications Accepted.

13,720 (1907). Rappold. Kilns or furnaces with travelling hearths. June 24.

14,528 (1907). Volland. Apparatus for drying materials. June 24.

15,406 (1907). Petersen. Packing material for reaction chambers, towers, &c. June 24.

18,112 (1907). British Thomson-Houston Co. (General Electric Co.). Vapour condensers. July 1.

21,933 (1907). Felt. Compressing, purifying, drying, and cooling air and other gases. July 1.

25,493 (1907). Sebastian. Drying apparatus. July 1.

26,590 (1907). Bucb. Gas-fired furnaces. June 24.

10,221 (1908). Neef. Centrifugal drying apparatus. July 1.

II.—FUEL, GAS, AND LIGHT.

Applications.

12,809. Otto-Hilgenstock Coke-Oven Co. (Otto und Co.). Removing tar from hot gases from coke ovens, gas retorts, etc.* June 15.

12,856. Scott-Smith. *See under* X.

12,955. Hammond and Cash. Manufacture of gas.* June 17.

12,968. Kuzel. Manufacture of filaments for electric glow lamps from refractory material in the colloidal state. [Addition to No. 28,154 of 1904.]* June 17.

13,029. Lowden, and Westinghouse Metal Filament Lamp Co. Metal filaments for electric incandescent lamps. June 18.

13,200. Dingler. Process for making combustible gas. [Ger. Appl., Sept. 5, 1907.]* June 20.

13,563. Dudgeon (Cockerill). *See under* I.

Complete Specifications Accepted.

8947 (1907). Allgem. Elektricitäts - Ges. Incandescence bodies especially for lighting and heating. June 24.

13,550 (1907). Bentley and Hopkinson. Removing tar and other impurities from producer or like gas. June 24.

14,341 (1907). Ries. Gas retort furnaces. July 1.

14,678 (1907). Cowper-Coles. Production of smokeless fuel. July 1.

17,252 (1907). Jaubert. Gas generators. June 24.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

Applications.

13,011. Chapman. Lubricants. June 18.

13,252. Heinemann. *See under* XVI.

13,675. Noad and Townsend. Treatment of hydrocarbon oils and the like.* June 27.

IV.—COLOURING MATTERS AND DYESTUFFS.

Applications.

12,787. Ellis (Chem. Fabr. vorm. Sandoz). Manufacture of yellow dyes suitable for wool. [Addition to No. 3373 of 1908.] June 15.

12,810. Basler Chem. Fabr. Manufacture of a violet vat dyestuff. [Ger. Appl., July 1, 1907. Addition to No. 344 of 1908.]* June 15.

12,811. Imray (Meister, Lucius, und Brüning). Manufacture of the "black-red article." June 15.

12,877. Fowler. Extraction of lac-dye from shellac. June 16.

13,057. Imray (Soc. Chem. Ind. in Basle). Manufacture of sulphurised vat dyestuffs of the anthracene series.* June 18.

13,103. Weizmann, Bentley, and Clayton Aniline Co. Manufacture of colouring matters of the naphthacene-quinone series. June 19.

13,499. Stephen and Rahtjen. Production of compounds of α-isatinanilide and its homologues with sulphurous acid.* June 25.

Complete Specifications Accepted.

14,248 (1907). Newton (Bayer und Co.). Manufacture of azo colouring matters. July 1.

17.676 (1907). Ulrichs. Manufacture of dyes. July 1.

19,548 (1907). Newton (Bayer und Co.). Manufacture of a sulphur dyestuff. July 1.

23,410 (1907). Newton (Bayer und Co.). Manufacture of a dyestuff of the gallocyanine series. July 1.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

Applications.

12,913. Wörner. Centrifugal drum apparatus for dyeing, etc.* June 16.

13,020 and 13,021. Hart. Rendering ramie and other fabrics water-repellent and permanently colouring the same without dyestuffs. June 18.

13,203. Raw and Sumner. Purifying, disinfecting, and treating fibrous and similar substances. June 20.

13,226. Hanson. Dyeing machines. June 22.

13,261. Kelsey. Treating and refining vegetable fibres, yarns, fabrics, etc. June 22.

13,273. Holmes. Treatment of fibrous materials. June 22.

13,616. Cross. Manufacture of artificial threads and films of cellulose. June 27.

Complete Specification Accepted.

28,057 (1907). Dowie. Treatment of wool-combers' effluents. June 24.

VII.—ACIDS, ALKALIS, AND SALTS.

Applications.

12,812. Watson, Ashall, and United Alkali Co. Manufacture of copper sulphate. June 15.

12,866. White. Manufacture of green oxides and the like of chromium. June 16.

12,980. Eberhard. Increasing the mobility and reactivity of water-glass. [Ger. Appl., June 17, 1907.]* June 17.

13,207. Mond Nickel Co., Hirtz, and Cowap. Manufacture and application of cobalt compounds. June 20.

13,569. Cunnington. Manufacture of double alkaline carbonates. June 27.

13,570. Cunnington. Manufacture of alkaline salts of sodium or of allied metals. June 27.

Complete Specifications Accepted.

12,110 (1907). New Salt Synd., Ltd., and Royston. Melting and purifying salt. July 1.

15,140 (1907). Whitehouse. Production of ammonia and chlorine or hydrochloric acid. July 1.

13,946 (1907). Crowther. Manufacture of basic ferric sulphate. June 24.

14,414 (1907). Watson. *See under* XVIII*B*.

27,790 (1907). Helbig. *See under* XI.

VIII.—GLASS, POTTERY, AND ENAMELS.

Application.

13,179. Salamon, and The Exploration Co., Ltd. Preparation of china clay. June 20.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Applications.

12,887. Klauser (Cavazzani, Bianchi, & Co.). Artificial building stone.* June 16.

12,977. Lake (Pavin de Lafarge). Utilising furnace slag in the manufacture of cement. June 17.

13,440. Poths. Rotary kilns for burning cement.* June 24.

13,447. Glover. Kiln employed in the manufacture of Portland cement. June 24.

Complete Specifications Accepted.

14,452 (1907). Latham. Utilisation of old plaster casts and other hydrated sulphate of lime. July 1.

17,222 (1907). Ducker. Method of making tile and similar articles. June 24.

X.—METALS AND METALLURGY.

Applications.

12,825. Down and Morgan. Rotary roasting furnace. June 16.

12,856. Scott-Smith. Gas producers for making steel. June 16.

12,962. Lockwood and Samuel. Treatment of ores, etc. June 17.

13,120. Pearlite Steel Co., and Charlier. Treatment of low grade steels. June 19.

13,134. Usine Genevoise de Degrossissage D'Or. *See under* XI.

13,146. Dor-Delattre. Extracting dust and fumes produced in zinc furnaces, etc. [Ger. Appl., July 16 1907.]* June 20.

13,194. Carrick and Pattison. Pyritic smelting.* June 20.

13,366. Whitcombe. Apparatus for separating or grading metals, ores, etc., in wet recovery processes. June 23.

13,492. Imbert. Treatment of zinc ores.* June 25.

13,513. Armstrong. Furnaces for obtaining zinc and lead. [Addition to No. 20,543 of 1904.] June 25.

13,563. Dudgeon (Cockerill). *See under* I.

13,666. Levy. Removing the electrolytic nickel or other metallic coating of metallic surfaces.* June 27.

Complete Specifications Accepted.

14,194 (1907). Lang. Treating the surface of aluminium. July 1.

14,806 (1907). Norris. Concentration of metallic ores. July 1.

15,039 (1907). Jensen (Mühlinghaus). Treatment of tin ores or tin slag. June 24.

26,131 (1907). Moore and Heskett. Direct reduction of iron ore and subsequently treating same for the manufacture or wrought iron and steel. June 24.

26,810 (1907). Ruthenburg. Concentration of ores containing wolfram. July 1.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

Applications.

13,134. Usine Genevoise de Degrossissage D'Or. Electrolytic cells for separating the constitutents of a mixture of metal or an alloy. [Swiss Appl., June 21, 1907.]* June 19.

13,257. Helberger. Electric furnaces.* June 22.

13,502. Knowles. Electric furnaces. June 25.

Complete Specifications Accepted.

8445 (1907). Gröndal-Kjellin Co., and Härdén. Electric furnaces. June 24.

18,111 (1907). British Thomson-Houston Co. (General Electric Co.). Electric insulating material. June 24.

27,790 (1907). Helbig. Oxidising atmospheric nitrogen by electricity. July 1.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

Application.

12,983. Benzinger. Cleansing composition. [Ger. Appl., July 24, 1907.]* June 17.

Complete Specification Accepted.

14,414 (1907). Watson. *See under* XVIII*B*.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES INDIA-RUBBER, &c.

(*A*.)—Pigments, Paints.

Application.

13,458. Barton. Manufacture of red lead. June 24

Complete Specifications Accepted.

14,188 (1907). Marchand, Lafontaine, Archambault, St. Mars, and Cherrier. Paint. June 24.

15,339 (1907). Ouden. Manufacture of an anti-fouling paint. July 1.

(*B.*)—Resins, Varnishes.

Application.

12,877. Fowler. *See under* IV.

(*C.*)—India-Rubber.

Application.

13,599. Hyatt. Reclamation of waste rubber and vulcanite. June 27.

XIV.—TANNING, LEATHER, GLUE, SIZE, &c.

Applications.

12,799. Nance. Tanning and treatment of hides and skins.* June 15.

13,517. Petrie. Treatment of leather. June 25.

Complete Specification Accepted.

27,882 (1907). Justice (Knight and Lightband). Leather. July 1.

XV.—MANURES, &c.

Applications.

13,193. Thompson (Engle, Walker, & Main). Method of making fertilisers.* June 20.

13,600. Robinson and Dixon. Fertilisers. June 27.

XVI.—SUGAR, STARCH, GUM, &c.

Application.

13,252. Heinemann. Conversion of carbohydrates into hydrocarbons. June 22.

Complete Specification Accepted.

21,381 (1907). Bing. Washing starch out of potato mash, maize mash, and the like. July 1.

XVII.—BREWING, WINES, SPIRITS, &c.

Applications.

13,013. Watson. Apparatus for drying and similarly treating brewers' and other by-products and substances.* June 18.

13,035. Epstein. Fermented liquids. June 18.

13,528. Melhuish. The priming of malt liquors.* June 25.

Complete Specification Accepted.

23,787 (1907). Bristow. Treatment of malt grain for brewing. June 24.

XVIII.—FOODS; SANITATION, WATER PURIFICATION; AND DISINFECTANTS.

(*A.*)—Foods.

Applications.

12,780 and 12,781. Loring. Ageing, conditioning, and bleaching flour. June 15.

13,135. Humphries. Treatment of flour. June 19.

Complete Specifications Accepted.

1247 (1908). Von Skorzewski. Manufacture of a vegetable product. July 1.

1343 (1908). Schwickerath. Manufacture of a proteose preparation from fish. July 1.

(*B.*)—Sanitation; Water Purification.

Complete Specifications Accepted.

14,414 (1907). Watson. Destructive distillation of sewage sludge for the recovery of ammonia and oil, and utilisation of the residue. June 24.

15,305 (1907). Bell and Bell. Filtration or purification of water, sewage, etc. June 24.

16,239 (1907). Linden. Purifying or clarifying water or effluent. June 24.

17,389 (1907). Malabar. Filtering or purifying sewage, trade liquids, etc. June 24.

17,607 (1907). Macherski and Koperski. Improvement or refinement of liquids. July 1.

XIX.—PAPER, PASTEBOARD, &c.

Applications.

13,592. Armitage and Ibbetson, Ltd., and Woodburn. Gelatining or glazing paper, cardboard, etc. June 27.

13,616. Cross. *See under* V.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

Complete Specifications Accepted.

16,152 (1907). Hoering. Ferro-albumen and ferro-casein compounds. June 24.

5674 (1908). Badische Anilin und Soda Fabrik. Manufacture of camphene. June 24.

6019 (1908). Wetter (Knoll und Co.). Pharmaceutic preparations from digitalis leaves. July 1.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Complete Specification Accepted.

20,740 (1907). Gateau. Photographic emulsion for pigment printing. June 24.

XXII.—EXPLOSIVES, MATCHES, &c.

Application.

13,574. Bailey. Blasting agents. June 27.

Journal of the Society of Chemical Industry.

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†Sir Wm. H. Perkin, LL.D., Ph.D., F.R.S.	1884—1885.
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Thomas Tyrer	1895—1896.
†Edward Schunck, Ph.D., F.R.S.	1896—1897.
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Edward Divers, M.D., D.Sc., F.R.S.	1905—1906.
Eustace Carey	1906—1907.
Sir Boverton Redwood, D.Sc.	1907—1908.

† Deceased.

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Official Notice.

At the COUNCIL CHAMBER, WHITEHALL.
The 17th day of June, 1908.

BY THE LORDS OF HIS MAJESTY'S MOST HONOURABLE PRIVY COUNCIL.

Whereas there was this day read at the Board certain By-laws made by the Society of Chemical Industry at a General Meeting of the Society held on the 15th day of June, 1908:

And Whereas it is provided in the Charter of the Society that By-laws made by the Society shall not commence or have effect until they have been submitted to and allowed by the Lords of the Council:

Now therefore their Lordships, having taken the said By-laws into consideration, are pleased to allow the same, as set forth in the Schedule to this Order.

A. W. FITZ ROY.

SCHEDULE referred to in the foregoing Order.

SOCIETY OF CHEMICAL INDUSTRY.

Incorporated by Royal Charter
17th day of June, 1907.

BY-LAWS.

As amended and passed by an Extraordinary General Meeting of the Society held on June 15th, 1908.

Part I.—PRELIMINARY.

Short Title and Commencement.

(1.) These By-laws made pursuant to the Charter may be cited as "Society of Chemical Industry By-laws, 1908," and shall come into operation so soon as they may be allowed by the Lords of His Majesty's Most Honourable Privy Council.

By-laws divided into parts.

(2.) These By-laws are divided into parts as follows (that is to say):—

Part I.—Preliminary.
Part II.—Members.
Part III.—The Council.
Part IV.—Local Sections.
Part V.—The Journal.
Part VI.—Financial.
Part VII.—Meetings.
Part VIII.—Miscellaneous.

Application of Interpretation Act.

(3.) The "Interpretation Act, 1889," or any subsisting statutory modification thereof, shall apply to these By-laws.

Interpretation.

(4.) In and for the purposes of these By-laws terms and words and expressions to which meanings are assigned by the Charter or the Act made applicable thereto have the same respective meanings, unless there be something in the subject or context repugnant to such construction.

"The Charter" means the Charter granted the 17th day of June, 1907, as amended or extended by supplemental or additional Charters granted to and accepted by the Society after the date aforesaid.

"By-laws" means any by-laws of the Society made and allowed pursuant to the Charter.

"Commencement of By-laws" means the day when the By-laws come into operation under the Charter.

"Committee" means any Committee duly appointed by the Council, and where qualified by any prefix means the Committee appointed as aforesaid for the purposes denoted or indicated by such prefix or other the meaning assigned thereto under the By-laws.

"Treasurer" means the person appointed pursuant to the By-laws as Honorary Treasurer of the Society.

"Foreign Secretary" means the person appointed pursuant to the By-laws as Honorary Foreign Secretary of the Society.

"The Secretary" means the Secretary of the Society appointed by the Council, or the person acting in that capacity by the direction of the Council pursuant to the By-laws.

"The Editor" means the Editor of the Journal appointed by the Council, or the person acting in that capacity by the direction of the Council pursuant to the By-laws.

"Sectional Officers" means the Chairman and Hon. Secretary of the several Local Sections.

"Member" means any Member of the Society.

"The Schedule" means the Schedule of Forms annexed to the By-laws

"The Register" means the Register of the Society of 1881, continued as the Register of the Society pursuant to the By-laws.

Forms.

(5.) The forms set forth in the Schedule, and such other forms as the Council may from time to time authorise, shall be used in the several cases to which they are applicable, with such amendments, alterations, or additions thereto, if any, which the Council may from time to time determine, and all notes and directions printed thereon shall be read and construed as part of such forms, and be observed accordingly, but it shall be sufficient if the forms are substantially followed, and no act or proceeding shall be invalid merely by reason of any formal defect.

Part II.—MEMBERS.

Proposal of Candidate.

(6.) Every person desirous of being admitted as a Member of the Society shall be duly proposed as a candidate for admission upon Form (A) set out in the Schedule, or such other form as the Council may from time to time prescribe. The proposal form shall be signed by two Members, to one of whom at the least the candidate shall be known personally, and every candidate shall make and subscribe the declaration therein contained—that, if elected, he agrees to be bound by the Charter and By-laws and by any Regulations made thereunder, and to further the objects of the Society.

Election of Members.

(7.) All proposal forms of Candidates, duly signed and subscribed as hereinbefore provided, received by the Secretary prior to the issue by him of notice convening an Ordinary Meeting of Council, shall be considered thereat, and the Council may in their absolute discretion, by resolution passed by a majority of those present, elect or postpone the election of any candidate as a Member of the Society, or may refuse to elect any candidate whom they consider to be not a fit or proper person to be elected as aforesaid, and upon such election may also decide whether any Member so elected shall be required to pay for the year then current the whole or any proportionate part of the annual or other subscription or other fee hereafter provided, and thereupon the Secretary shall give notice of such election and decision to the Member elected as aforesaid, and upon such notice and the payment of the said subscription or other fee, the person so elected shall, pursuant to the Charter and By-laws, become and continue to be subject to all the duties and obligations, and entitled to all the rights and privileges of a Member.

Register of Members.

(8.) The Register of the Society of 1881 shall become, and the Council shall cause the same to be continued as, the Register of the Society by the entry therein by the Secretary, or other person authorised by the Council, of the names of all persons elected Members as hereinbefore provided, together with the date of their several elections, and sufficient particulars of their several professions or occupations and addresses, and such particulars shall be amended or corrected as occasion may require, and the Council may cause to be printed, and sent without any charge therefor to each Member, a list of the names and respective addresses of all Members then appearing in the Register.

Entrance Fee.

(9.) Except as otherwise decided by the Council, every Member shall, upon notice of his election, in addition to a subscription for the current year in which he is elected, or any payment in lieu thereof, pay to the Treasurer, or other person appointed by the Council to receive Members' fees or subscriptions, an entrance fee of One Guinea, or such other amount as may for the time being be prescribed by Regulations.

Annual Subscription.

(10.) Every Member shall on the first day of January in each year pay to the Treasurer, or other person as aforesaid. the sum of One pound five shillings, or such other sum as the Council may prescribe by Regulations, and every Member shall upon his election pay the like amount as his subscription for the year current in which he is elected, or such proportionate part thereof as may be decided by the Council, but in lieu of any such payment a Member may compound for that and all future payments, as hereinafter provided.

Life Compositions.

(11.) A Member, upon his election, or any other Member whose subscription is not in arrear, may at any time compound for all annual subscriptions by payment to the Treasurer, or other person as aforesaid, the sum following (that is to say):—

(*a*) A Member whose age does not exceed 30 years, the sum of £25.

(*b*) A Member whose age exceeds 30 years, the sum of £20, less such sum as is ascertained to be equal to one-fourth part of the total of the sums which have been paid by such Member as annual subscriptions after reaching the age of 30 years.

But before accepting any compounding payment the Council may require from any Member desirous of compounding such evidence of his age as they may think fit.

Subscriptions in Arrear.

(12.) Any Member whose annual subscription, payable on the first day of January, is unpaid on the first day of March next following, shall, while remaining subject to the duties and obligations, not be entitled to any of the rights of a Member until such subscription shall be paid, and upon the first day of May the Secretary shall give notice to all Members whose subscriptions are so in arrear, and shall furnish a list of such notices to the Council at the next ensuing Ordinary Meeting thereof, and if the Council shall then so direct, shall by further notice require such Member to pay the said arrears by a date to be fixed by them; and if any Member on the next ensuing thirty-first day of December shall continue in arrear, such Member shall cease to be a Member, and his name shall then be removed from the Register by the Secretary, but without prejudice to the right of the Council to recover any such arrears or to enforce any duty or obligation to which, as a Member, he may have become liable at the time of such removal, in any Court of competent jurisdiction, and if the Council shall so direct, the name of any Member removed as aforesaid shall be published in the Journal. Notwithstanding anything in this By-law provided, the Council in the exercise of their sole discretion may, having regard to the circumstances in which the subscription of any Member shall be in arrear as aforesaid, postpone or remit the payment thereof, and continue such Member in full enjoyment of all rights of Membership as if such subscription had not at any time been or continued in arrear.

Certain Disqualifications of Members in Arrear.

(13.) A Member who has not paid before the first day of March any fee or subscription payable and due by him shall be disqualified for nomination as President, Vice-President, and Ordinary Member of Council, and to continue in any such office, and to become or remain an *ex-officio* Member of Council, and to sign the form of nomination of an ordinary Member of Council.

Resignation of Members.

(14.) Any Member may at any time determine his Membership by notice in writing to that effect, sent to the Secretary not later than the thirty-first day of December in any year, but such notice in order to operate as a determination shall be accompanied by payment of any subscription or fee which at the date of the notice shall have become payable by the Member, and which remains unpaid in respect of Membership for that year.

Suspension or Determination of Membership by Council.

(15.) Any Member in respect of whom a complaint of misconduct is made to the Council, which complaint, the Member first having had an opportunity of being heard, is sufficiently established, in the opinion of the Council, may, by resolution of the Council as hereinafter provided, be suspended from rights of Membership for such period as the Council may decide, or the Council may in like manner decide that his Membership shall be determined, and thereupon such Member shall cease to be a Member, and his name shall be removed from the Register; and in the event of it being brought to the notice of the Council that any Member has been adjudged by a Court of competent jurisdiction in the country in which he is alleged to have committed an offence to be guilty of an offence which in Great Britain or Ireland would be an indictable offence punishable alone by imprisonment, then, except such offence may be regarded as a political offence, the Council may order his name to be removed from the Register, and thereupon he shall cease to be a Member. A resolution of the Council as aforesaid shall not be passed unless twelve or more Members of the Council are present at the meeting at which it is proposed and not less than two-thirds of those present vote in favour of such resolution.

Introduction of Visitors.

(16). Every Member shall be at liberty to introduce, at any meeting of a Local Section at which the Member introducing is entitled to be present, such visitors as the rules of the Local Section may prescribe. Every such visitor shall enter his name in a book provided for that purpose, and may take part in but shall not vote at the meeting, but the Committee of the Local Section may, in consequence of any special circumstances relating to any such meeting, suspend the said liberty by notice given either in the notice convening the meeting, or at a reasonable time prior to the holding thereof.

Restriction on use of Distinctive Title or Initials.

(17.) Any Member who shall persistently use after, or in conjunction with, his name, letters or initials which purport to indicate or convey that Membership of the Society confers upon him any degree, qualification, or authority to practise in any profession or calling, or a right to use any distinctive title, after notice from the Secretary authorised by resolution of the Council to discontinue such use, may be deemed by the Council to be guilty of misconduct, but this By-law shall not prevent any Member from *bona fide* subscribing or describing himself as a Member of the Society or any office bearer thereof.

Re-admission of a former Member.

(18.) Any former Member whose Membership has ceased or been determined under any provisions of the By-laws, may apply for re-admission to Membership, and such application shall be considered and decided upon by the Council at the next ensuing Ordinary Meeting thereof in all respects as if it were a proposal for Membership of the Society, and if such application be granted, then after notice thereof by the Secretary to the applicant, and upon making such payments and complying with such conditions, if any, which the Council may decide, the applicant shall be re-admitted to Membership, and shall again become subject and entitled to all the duties, obligations, and rights of a Member. A resolution of the Council under the provisions of this By-law shall not be effective unless there shall be present not less than twelve Members of the Council, three-fourths of whom at the least shall vote in favour of such resolution, and any resolution as aforesaid, if the Council in like manner so determine, may be published in the Journal.

PART III.—THE COUNCIL.

Constitution.

(19.) The Council shall consist of:—

(*a*) Twenty-five elected Members of Council, comprising:—
  (i.) A President;
  (ii.) Twelve Vice-Presidents;
  (iii.) Twelve ordinary Members of Council;
(*b*) *Ex-officio* Members of Council, comprising:—
  (iv.) The Sectional Officers;
  (v.) The Treasurer, the Foreign Secretary;

all of whom shall be Members of the Society.

The elected Members of Council, except Members appointed to fill casual vacancies, shall be elected by ballot at the time, in the manner, and for the respective periods prescribed by the By-laws, and all Members of Council in office at the commencement of the By-laws shall in their several capacities continue in office, but subject to all incidences, whether as to powers, duties, retirement, re-election, nomination, election, or otherwise, as if they had been elected and were holding office pursuant to and under the several provisions of the By-laws applicable thereto.

The President.

(20.) The President shall be nominated from amongst the Members by the Council, and such member so nominated shall be submitted by the Council for election at the Annual General Meeting in manner hereinafter provided. He shall retire from office at the next ensuing Annual General Meeting, and shall be eligible for re-election, but a Member who has been elected or appointed President two years or one year and a part of another year in succession, shall not be eligible for election as President before the Annual General Meeting next but one ensuing after his last retirement. A retiring President not nominated for re-election shall be nominated by the Council as one of the four Vice-Presidents to be submitted for election at the next ensuing Annual General Meeting.

Vice-Presidents.

(21.) The Vice-Presidents shall be nominated from amongst the Members by the Council, and such Members so nominated shall be submitted by the Council for election at the next ensuing Annual General Meeting in manner provided by the By-laws.

Four Vice-Presidents shall retire from office at each Annual General Meeting, none of whom shall be eligible for election as a Vice-President or an ordinary Member of Council before the Annual General Meeting next ensuing after the said retirement, but a Member appointed Vice-President to fill a casual vacancy shall not, upon the expiration of the term for which he is so appointed, be ineligible as aforesaid.

All Vice-Presidents shall retire in rotation in accordance with the seniority of their respective terms of office, and if in ascertaining which four of them shall retire as aforesaid it shall appear that there is equality of term of office in the case of more than four of them of the highest degree of seniority, or in the case of two or more of them of a lower degree of seniority required to make up four retiring Vice-Presidents, the Council shall decide which of them having such respective equality of term shall retire.

A Vice-President nominated as President in accordance with the last preceding By-law shall, upon election as President, vacate the office of Vice-President, and the vacancy thereby created shall be deemed to be a casual vacancy.

Ordinary Members of Council.

(22.) Ordinary members of Council shall be nominated from amongst the Members by the Members, and such Members so nominated shall be submitted by the Council for election at the next ensuing Annual General Meeting in manner prescribed by the By-laws.

Four ordinary Members of Council shall retire from office at each Annual General Meeting, none of whom shall be eligible for election as an ordinary Member of Council before the Annual General Meeting next ensuing after the said retirement, but an ordinary Member of Council appointed to fill a casual vacancy shall not, upon the expiration of the term of office for which he is appointed, be ineligible as aforesaid.

All ordinary Members of Council shall retire in rotation, in accordance with the seniority of their respective terms of office, and if in ascertaining which four of them shall retire as aforesaid it shall appear that there is equality of term of office in the case of more than four of them of the highest degree of seniority, or in the case of two or more of them of a lower degree of seniority required to make up the four retiring ordinary Members of Council, the Council shall decide which of them having such respective equality of term shall retire.

An ordinary Member of Council nominated either as President or as Vice-President in accordance with the last two preceding By-laws respectively shall, upon election as President or Vice-President, as the case may be, vacate the office of ordinary Member of Council, and the vacancy thereby created shall be deemed to be a casual vacancy.

Qualification of an ordinary Member of Council.

(23.) An ordinary Member of Council shall be nominated by ten or more Members upon Form (B) in the Schedule, a copy of which form shall be furnished by the Secretary upon the written or verbal request of any Member, but a Member shall not be eligible to sign more than one such nomination form, and the Member nominated shall sign the declaration set forth on the form. A nomination shall be declared invalid by the Council if:—

(*a*) The Member thereon nominated is disqualified for election, or ineligible to be elected, as provided by the By-laws.
(*b*) The nomination is not made on the authorised printed form, or substantially not in the manner directed thereon.
(*c*) The nomination form is signed by less than ten Members not disqualified, or not ineligible to nominate as provided by the By-laws.
(*d*) The nomination form is not received before or upon the day appointed therefor.
(*e*) The Member nominated has not signed the declaration printed upon the form.

A Member whose nomination aforesaid is declared to be invalid shall receive notice thereof from the Secretary and shall not be submitted for election.

Council to Notify all Vacancies and Nominations by them.

(24.) In every year the Council shall cause a list to be prepared setting forth the names of all Members of the Council, showing which of them are due to retire at the next ensuing Annual General Meeting, and which (if any) of them are eligible for re-election, and such list shall be approved by the Council at any meeting thereof, not less than two months prior to the Annual General Meeting aforesaid, and the Council shall at the same meeting nominate the Members to be submitted to such meeting for election as President and Vice-Presidents respectively, and shall also appoint Members as Treasurer and Foreign Secretary respectively to take the places of the Treasurer and Foreign Secretary who will retire at the said General Meeting. The said list, together with the names of the Members nominated and appointed as aforesaid, shall be printed as a notice to Members, which notice shall contain a statement inviting Members to nominate the ordinary Members of Council to be elected at the said General Meeting, and appointing a day before or upon which such nominations shall be received by the Secretary according to Form (B) in the

Schedule, and the said notice, as approved, shall be sent to all the Members with, or in, the next issue of the Journal.

Nomination of ordinary Members of Council.

(25.) All nomination forms of ordinary Members of Council received by the Secretary shall be considered by the Council at the meeting thereof next ensuing after the date appointed for their delivery, and the Members whose nominations are not then declared to be invalid, together with the Members nominated by the Council as President and Vice-Presidents respectively, shall be submitted for election at the next ensuing Annual General Meeting. But if the number of Members nominated or not nominated validly shall be less than the number of vacancies, the Council shall thereupon nominate such Members as are requisite to make up the number required, and in that event, and also whenever the nominations considered and not declared to be invalid by the Council are equal to the number of vacancies, although the names of Members nominated in either case shall be submitted to the General Meeting, no ballot shall be taken thereon.

Election of Council.

(26.) The election of all elected Members of Council, in whatever capacity, shall, except as provided by the By-laws, be by ballot taken upon the first day of each Annual General Meeting, and shall be conducted in manner and otherwise subject to such Regulations relating thereto as the Council may make, but a Member may record his votes either by delivering his ballot list personally or by post at the said General Meeting in accordance with the Regulations.

The Council in every year shall cause to be prepared, and shall send to all the Members not less than twenty-one days before the Annual General Meeting, a ballot list of the Council, showing the names of all Members thereof in their several capacities, and which of them are to retire, and setting forth separately thereon the names of Members in each class or capacity of elected Members submitted for election, and also the names of the Treasurer and Foreign Secretary appointed by the Council to succeed the retiring Treasurer and Foreign Secretary, and the name of the retiring Auditor respectively. The ballot list shall be according to such form as the Council may from time to time authorise.

Meetings of Council.

(27.) One Ordinary Meeting of the Council at the least shall be held every month to transact such business relating to the affairs of the Society as may be necessary, except that if the Council so decide an Ordinary Meeting of the Council need not be held during the months of August and September, but a Special Meeting of the Council may be convened by the President at any time and shall be convened by the Secretary whenever he shall receive a notice signed by not less than seven Members of Council calling upon him to convene such meeting, and stating the matter to be considered thereat, and notice thereof shall be given to all Members of the Council as and in the manner provided by the Standing Orders of the Council, and no other business shall be considered at such Special Meeting of Council. Except where otherwise provided by the Charter or the By-laws, any seven Members of the Council shall constitute a quorum.

Standing Orders of Council.

(28.) Subject to any of the provisions of the Charter or the By-laws, the Council may for the due and proper regulation of its own proceedings make Standing Orders, and subject to any provisions therein contained, and relating thereto, may at any time add to, alter, amend, or rescind such Standing Orders.

Appointment of Committees.

(29.) Subject to the provisions of the Charter and the By-laws, the Council may appoint Committees from amongst themselves, and may delegate any of their powers to such Committees, and in furtherance of other the objects of the Society, may also appoint Committees composed wholly of Members of the Council, or of Members of the Society, or partly of Members of the Council and partly of Members of the Society, and may fix the quorum and make rules for regulating the proceedings of any of the Committees aforesaid. The President shall be a Member of all Committees, and the Secretary, unless the Council shall otherwise decide, shall act as Secretary to each Committee appointed as aforesaid.

Resignation of Member of Council.

(30.) Any Member of the Council may resign his office by notice in writing to the Secretary of such his desire, and upon the acceptance thereof by the Council he shall cease to hold his said office, but not until then.

Vacation of Office of Member of Council.

(31.) The office of any Member of the Council, whether elected or *ex-officio*, shall be deemed to be vacated for any of the following reasons:—

(*a*) If any such Member ceases to be a Member of the Society, or his Membership thereof becomes suspended for any period, or determined as provided by the By-laws.

(*b*) If any such Member becomes bankrupt, or suspends payment, or compounds with, or makes an assignment of his property for the benefit of his creditors.

(*c*) If any such Member becomes a lunatic or is declared of unsound mind.

Casual Vacancies.

(32.) Any vacancy in the elected Members of Council, from whatever cause occurring, between any two Annual General Meetings, shall be filled by the Council at a Council Meeting, at which not less than twelve Members of Council are present and vote. The Member appointed to fill a casual vacancy shall retire at the time when the person in whose stead he is appointed would in due course have retired if the office held by him had not become vacant, but the Member appointed shall be eligible for re-election unless it be otherwise provided in the By-laws.

Honorary Treasurer.

(33.) The Council shall appoint a Member as Honorary Treasurer of the Society, who shall, subject to the direction and control of the Council, receive and give receipts, and account for all subscriptions, fees, and other payments payable or due to or by the Society, and shall cause to be made, and shall, as occasion may require, submit to the Council a statement of the income and of current payments or expenditure which are, or ought to be, made by the Council, and shall prepare or cause to be prepared, in sufficient time to be submitted to the Annual General Meeting, a balance sheet showing the income and expenditure, and all liabilities and assets and investments of the Society for the year ending the thirty-first day of December prior to the said General Meeting, and as far as possible a general statement of the financial affairs of the Society for the year then current.

Honorary Foreign Secretary.

(34.) The Council shall appoint a Member as Honorary Foreign Secretary of the Society, who shall, subject to the direction and control of the Council, have the management of such correspondence of the Society with Departments of State or Corporate Bodies, Societies, or persons of or in foreign countries as occasion may require, and he shall report to the Council on all matters connected therewith or relating thereto.

Appointment of Treasurer and Foreign Secretary.

(35.) The Treasurer and Foreign Secretary shall be appointed annually at the meeting of the Council at which the President and Vice-Presidents are nominated, and except when appointed to fill a casual vacancy, shall remain in office from the next ensuing Annual General Meeting after their respective appointments, until the Annual General Meeting next following, and during such period shall be *ex-officio* Members of the Council. Any casual vacancy in either of the said offices shall be filled by the Council as soon as may be after the occurrence of the vacancy, but the Member appointed to fill such casual vacancy shall retire at the next ensuing Annual General Meeting after his appointment, and either of the said offices shall be deemed to be vacated for any of the reasons provided by the By-laws for the vacation of office of Member of Council.

The Secretary.

(36.) The Council shall appoint an officer who shall be "The Secretary of the Society of Chemical Industry" at such remuneration and subject to such terms and conditions as they may from time to time decide, and may in their discretion determine the appointment of any such Secretary, and appoint another Secretary.

The Editor.

(37.) The Council shall appoint an officer who shall be "the Editor of the Journal," at such remuneration as they may from time to time decide, and may in their discretion determine the appointment of any such Editor and appoint another Editor. The Editor appointed need not be a Member, but shall be responsible to the Council, and subject thereto, and to the directions of any Committees delegated by the Council to manage or conduct the preparation or publication of the Journal, shall have the conduct of the literary management and the preparation of all matter, the editing, and the printing and publication of the Journal, and the organisation, control and direction of such literary or other staff as may be engaged on the Journal for the time being.

Council may make Regulations.

(38.) The Council, may except as otherwise provided by the Charter, make Regulations for carrying into effect the Charter and the By-laws, and for the general management of the affairs of the Society, but a regulation shall not become operative until confirmed by a resolution passed by a majority of the Members present at a General Meeting at which such regulation has been submitted for consideration, and notice of such intended submission shall be given in the notice for such General Meeting, and any regulations so confirmed may be altered, amended, or repealed after notice given as aforesaid at an ensuing General Meeting summoned for that purpose in manner provided by the By-laws.

Mode of conducting Proceedings of Council.

(39.) Subject to other provisions of the By-laws relating thereto, all meetings of the Council, or of any committees appointed by them, whether as regards the time and place of meeting, notices thereof, the order, mode, or manner of conducting the business thereat, or any other matter or thing relating to such meetings, shall be respectively regulated in accordance with the Standing Orders for the time being of the Council or rules made applicable to the said committees, which Standing Orders and rules respectively the Council in their discretion from time to time are hereby empowered to make, alter, or vary.

Part IV.—LOCAL SECTIONS.

Formation of a Local Section.

(40.) A Local Section may be formed by the Council, subject to the provisions in that behalf in the Charter, whenever thirty or more Members residing in or otherwise identified in interest with a place, locality, or district, whether situate within or without Great Britain or Ireland, make application in writing to the Council, signed by such Members, to cause a Local Register to be made for that purpose, and represent to the Council that the establishment of such Local Section will further more efficiently the objects of the Society. If the Council, upon consideration of such application, consider that it would be expedient to form such Local Section, they may require the signatories to form a provisional committee, and to submit draft rules under which the business of the Local Section is intended to be managed and conducted, and may provisionally approve such draft rules with any modifications thereof which to the Council may seem requisite or desirable, and upon such provisional approval, to elect a committee and officers as hereinafter provided. Upon notice to the Council that such committee and officers have been elected at a meeting of any of the signatories and any other Members numbering in the whole not less than thirty, and that the draft rules approved by the Council as aforesaid have been adopted at such meeting, the Council shall allow the adopted rules as the rules of the said Local Section, and from the date of such allowance the said Local Section shall be deemed to be constituted in accordance with the Charter and By-laws.

Existing Local Sections Ratified.

(41.) Every Local Section to the formation of which the Council of the Society of 1881 or the Council had consented prior to and which remains in existence at the commencement of the By-laws, shall be deemed to be duly constituted, and may so remain and be continued subject to the By-laws, and as if it had come into existence thereunder.

Rules of a Local Section.

(42.) The rules of every Local Section shall contain the following provisions :—

(i.) That the business of the Local Section shall be conducted by a Committee chosen from Members on the Register of the Local Section, consisting of a Chairman, Honorary Secretary, and ordinary Members of Committee as provided by Rules.

(ii.) That any Member of the Society, whether resident at or otherwise interested in the place or locality where the Local Section is constituted, shall, upon application to the Honorary Secretary, be entitled to have his name entered upon the Register, and to become and remain a Member thereof upon payment of the annual sectional subscription, if any, for that and each succeeding year during which he remains a Member of the Local Section, without any entrance fee and without being elected.

For defraying the expenses of a Local Section, the Council may require that all Members thereof shall pay an annual sectional subscription not exceeding ten shillings, or the nearest monetary equivalent thereof when not payable in British coinage.

Alterations of Rules.

(43.) Amendments in, alterations of, or additions to the rules of a Local Section shall be submitted to the Council, and shall not become operative or of any effect unless and until they have been allowed by the Council, and notice of such allowance has been given by the Secretary.

Expenses of Local Section.

(44.) The expenses of a Local Section shall be defrayed out of the annual sectional subscriptions of the Members of such Section, but the Council in its discretion may defray the whole or may make a grant in aid thereof out of the General Funds of the Society, and a Local Section shall not pay, or incur, any expenses except reasonable sums for the printing, stationery, advertising, reporting, and postage required for conducting the business, and the hire of rooms for meetings thereof without the previous sanction in writing of the Council, and an account of all expenses paid or incurred by a Local Section during the year preceding the thirtieth day of June, shall on or before the fifteenth day of November in each year be sent to the Council.

Communications to Local Sections.

(45.) The Committee of a Local Section, in furtherance of the objects of the Society, may invite or receive communications from any person, whether a Member of the Society or not, upon any subject coming within the scope of the said objects, and such communications may be made by the reading of an essay or paper, or the delivery of a lecture at a meeting of the Members of the Local Section, and every such communication shall, before or after such meeting, as the circumstances may require, be sent to the Council for their consideration, and the Council may in their discretion, subject to any condition or to any by-law or rule relating thereto, cause the same, with or without any discussion thereon, or any condensed abstract thereof, to be published in the Journal.

Sectional Officers ex-officio Members of Council.

(46.) The Chairman and Honorary Secretary of every Local Section, duly constituted, shall become, and remain, during their respective terms of office *ex-officio* Members of the Council.

Restriction on Communications by Local Sections.

(47.) Neither the Committee of a Local Section nor any meeting thereof shall cause to be published, or authorise or countenance the publication of any notice upon any matter or subject whatsoever, either in the name of the Society or in the name of the said Committee or Section, to the general public, but all such notices or communications necessary or desirable to be made, and all correspondence and communications between a Local Section and any corporate or public body or other Society, except it relate wholly to the ordinary business of such Local Section, shall be conducted through or shall be subject to the express sanction of the Council.

Cessor of a Local Section.

(48.) The Council may, at a special meeting called for that purpose, declare by resolution that a Local Section shall be suspended in operation, or shall be dissolved :—

- (*a*) If it shall appear that the further continuance of the Section is not in accord with or conducive to the interests of the Society, or the furtherance of its objects.
- (*b*) Whenever three-fourths of the Members of the Local Section vote in favour of a resolution, proposed at a meeting called for the express purpose, that it is desirable such Section shall be suspended or dissolved.

PART V.—THE JOURNAL.

Conduct of the Journal.

(49.) The Journal shall be under the sole conduct and management in all respects of the Council, but they may at any time, subject to any rules and regulations made by them in reference thereto, appoint from amongst the Members any Committees which seem to them desirable to assist in such conduct or management, and subject as aforesaid, shall be at liberty to delegate any of their duties or functions as regards the Journal to any such Committee. The Council may also, in addition to the Editor, appoint upon and subject to such terms, and at such reasonable remuneration as they may decide, any contributors, sub-editors, abstractors or other person to assist in the compilation, preparation, and publication of the Journal, any of whom may or may not be Members.

Prior Right of Publication.

(50.) It shall be a condition of acceptance of every communication made to any meeting of the Society, or of a Local Section, or submitted to the Council for publication in the Journal, whether made by a Member or not, that, unless there shall have been a previous agreement to the contrary, the Society shall thereby become entitled to a prior right of publication thereof, in whatever form the Council decide to make such publication in the Journal, for three months after its acceptance, and if the person by whom the communication is intended to be made is not a Member, he shall be informed of this condition by notice in writing from the Secretary, or the Honorary Secretary of the Local Section.

Publication of Journal.

(51.) The Council shall cause the Journal to be published and sent to the Members at least once in every month, upon such dates as they may think fit, and they may sell, or present gratuitously, or exchange copies, for any part thereof to or with any State or public department, or any institution, library, society, corporate body, company, or person whatsoever.

Contents of Journal.

(52.) Nothing shall be printed or published in the Journal the printing and publication whereof has not been authorised by the Council, or any Committee appointed by them, subject to the By-laws, and acting in such respect for and on behalf of the Council, but the Council or such Committee may authorise the printing and publication of any matter or thing coming within or relating to the objects of the Society, and the proceedings thereof or communication thereto, or of or to any Local Section, in such manner as they may determine, and may also accept and publish for payment any advertisements of which they may not disapprove, and all payments made therefor, or for any copies of the Journal sold as aforesaid, shall be credited to the cost of preparing, editing, printing, publishing, and distributing the Journal.

PART VI.—FINANCIAL.

Financial Management by Council.

(53.) The administration of the Funds, and of all financial matters of or relating to the Society, shall be conducted and managed by the Council, who shall act as a general Committee of Finance, but they may delegate any of their duties or functions in respect thereof to Committees composed of Members of and appointed by the Council, subject to the Standing Orders thereof, and such Committee shall act only subject to the control of the Council, and of any rules made by them in that behalf.

Annual Balance Sheet.

(54.) The Council shall receive and consider and may adopt the Annual Balance Sheet and General Financial Statement submitted by the Treasurer, and the report of the Auditors thereon, as provided by the By-laws, and shall, whether adopted or not, cause the Balance Sheet, Statement, and Report aforesaid to be printed and sent to all the Members as a notice under the By-laws, and such notice shall be sent not later than the thirtieth day of June in every year.

Financial Business at Ordinary Meeting of Council.

(55.) The Council shall, at each Ordinary Meeting thereof, receive, consider, and determine upon the reports of all Committees appointed by them upon all matters whatsoever of or relating to the finances of the Society, and shall receive and consider, and may adopt the statement prepared by the Treasurer, as provided by the By-laws, and shall authorise all payments amounting to five pounds and upwards which are or ought to be made, and the cheques to be drawn therefor, and may or shall do and perform all other acts and things relating to the financial administration of the Society which by the Charter or By-laws they have authority or are required to do at such meeting.

Receipts and Payments.

(56.) All moneys due or payable to the Society shall be paid to and received by the Treasurer, or other person in that behalf appointed by the Council, and a receipt for every such payment shall be given in the name of the Society by the said Treasurer or other person. All moneys received as aforesaid shall be paid forthwith into the account of the Society kept at such bankers as may for the time being be appointed by the Council to be the bankers of the Society, and no sum of money payable on account of the Society amounting to £5 and upwards shall be paid except by a cheque authorised to be drawn on the said account by the Council, and every such cheque shall be signed by two members of the Council and countersigned by the Secretary.

Borrowing Powers.

(57.) Notwithstanding anything contained in the By-laws, the Council may at any time, in the exercise of their discretion, borrow money temporarily, and may pay interest thereon, and may charge the property, assets, and investments of the Society, so far as they are enabled lawfully so to do, for the repayment and payment of such borrowed money and interest respectively.

Investments.

(58.) All entrance fees and life compositions, and all donations, bequests, and endowments, unless given subject to any other condition, or otherwise provided by any Deed of Trust relating thereto, shall, and all funds of the Society not needed immediately for the ordinary purposes thereof may be invested in the name of the Society or in the names of three Members of the Society who shall not be Members of the Council in any securities in which Trustees are from time to time authorised to invest by virtue of the Trustee Act, 1893, or any subsisting statutory modification thereof, with power, upon the authority and by the direction of the Council, from time to time to sell or vary such securities, and the Council may also from time to time place money on deposit with the bankers of the Society.

Auditor.

(59.) The Members present at the Annual General Meeting shall elect as Auditor of the Society, at such remuneration as the meeting shall determine, an Accountant who shall be a member of the Institute of Chartered Accountants in England and Wales, or a firm of Accountants the partners whereof are members of the said Institute, and the person or firm so elected shall, on election, become and remain the Auditor of the Society until the next Annual General Meeting, and then shall cease to be Auditor unless re-elected at such General Meeting.

Duties of Auditor.

(60.) The Auditor shall have access at all reasonable times to all the accounts and books of account in anywise relating to the income and expenditure and otherwise the financial affairs of the Society, and shall report upon the Balance Sheet prepared by the Treasurer to be submitted to the Annual General Meeting, as provided by the By-laws, and shall certify as to the correctness or otherwise of the liabilities, assets, and investments of the Society as existing upon the thirty-first day of December prior to the General Meeting at which the said Balance Sheet is to be presented, and his report and certificate as aforesaid, whatever its nature, shall be printed and sent to all the Members accompanying such Balance Sheet.

Casual Appointment and Removal of Auditor.

(61.) If at any time between two Annual General Meetings the office of Auditor becomes vacant, the Council may appoint an Auditor possessing the qualifications aforesaid, who shall remain in office until the next ensuing Annual General Meeting, and the Members may at any time after an Annual General Meeting, by a resolution passed by a majority of two-thirds of the votes of Members present and voting at an Extraordinary General Meeting at which not less than thirty Members are present and vote, remove any Auditor from office, and may, by a resolution passed by a majority of the votes of Members present and voting at such meeting in number not less than aforesaid, elect in manner provided by the By-laws for the election of a Trustee, and at such remuneration as the meeting may then determine, any person or firm qualified to act as aforesaid.

PART VII.—MEETINGS.

Annual General Meeting.

(62.) The Annual General Meeting for the transaction of the ordinary general business of the Society shall be held at such place and time in every year as the Council may determine.

The ordinary annual business of the Society shall comprise :—

The Election of :—

Members of the Council; the Auditor;

And any other officers provided by the Charter or By-laws, to be elected at such meeting.

The reception and adoption of the Annual Report of the Council, and the Balance Sheet, Statement of Investments, and Financial Statement of the Treasurer submitted by the Council, together with the Auditor's report thereon.

And may include :—

An Address by the President.

Any communications accepted by the Council, and the discussion of the same if deemed desirable.

Conferences or discussions between the Members, or between Members and persons who are not Members, and visits to and inspection of works, manufactories, and other places of interest to the Members in furtherance of the objects of the Society.

Such other business as may be necessary and of which notice, according to the By-laws, has been duly given.

Extraordinary General Meeting.

(63.) The Council may, whenever they so decide, call an Extraordinary General Meeting of the Society, and such meeting shall be called by them on receiving a requisition in writing so to do signed by not less than thirty Members, and stating the object of the proposed meeting, but business other than that for which the meeting was called shall not be discussed or transacted at an Extraordinary General Meeting.

Notices of General Meetings.

(64.) Notice of the day, hour, and place of the commencement of any Annual General Meeting, shall be sent to all the Members three months at the least before such commencement. In the case of an Extraordinary General Meeting not less than fourteen days' notice thereof shall be sent either with or in the next succeeding issue of the Journal after the decision of the Council to call such meeting, or after the Council meeting next following the date upon which the requisition relating thereto was received by the Secretary. The business to be considered at any such Extraordinary General Meeting shall be set forth on the said notice.

Quorum at General Meetings.

(65.) The business of an Annual General Meeting shall not commence until the Members present at the meeting number thirty or upwards.

The business for which an Extraordinary General Meeting is called shall not commence until the Members present at the meeting number thirty or upwards, and if within one hour after the time appointed for the commencement of such meeting the said number of Members are not present together, the meeting shall be thereupon and thereby dissolved.

Conduct of Business at Meetings.

(66.) Subject to the provisions of the By-laws relating thereto, the order of and the manner of conducting the business, and the way in which Members may record their votes thereat, or any other matter or thing of or relating to a General Meeting of the Society not provided for in the Charter or By-laws, shall be regulated by rules made from time to time by the Council, but such rules or any addition thereto, alteration, amendment, suspension, or rescission thereof, shall, before becoming operative, be submitted to and approved at an Annual General Meeting.

Notice of Motion at Annual General Meeting to be given.

(67.) A Member wishing to bring before the Annual General Meeting any motion not relating to the ordinary annual business of the Society as aforesaid, shall give notice to the Council not less than two months before such Annual General Meeting, and no motion shall come before the meeting unless notice thereof has been so given, and on receipt of such notice of motion the Council shall give notice thereof in the next issue of the Journal.

Chairman of Meetings.

(68.) At all meetings of the Society the President for the time being, and in his absence a Vice-President, who has served as President, shall be Chairman, or in the absence of both, the Chairman shall be elected from among other Vice-Presidents present, or if none be present, from among the Members of Council present, or in the absence of all of them, then from among the Members present.

Minutes to be Evidence.

(69.) Minutes shall be made in proper books, to be provided for the purpose, of all resolutions and proceedings of meetings of the Society or of the Council, or of each Local Section, and of any committee appointed by the Council or a Local Section, and every Minute signed by the Chairman of the meeting to which it relates, or by the Chairman of a subsequent meeting, shall be sufficient evidence of the facts stated therein.

PART VIII.—MISCELLANEOUS.

Notices to Members.

(70.) Any notice required by the Charter or the By-laws to be given to Members, whether relating in anywise to the affairs of the Society, or of a Local Section, may be a written or printed notice, and may be sent to Members either separately or in, or with, or if printed may be printed under the heading of "Notices," as part of the next issue of the Journal, as the Council may direct, and any notice shall be deemed to have been duly sent to a Member when such notice, or the Journal in which it is sent, or printed, and addressed to the last address of the Member appearing in the Register, has been put into the post. All notices shall be signed by the Secretary.

Provisions as to Register.

(71.) The Register shall be kept by the Secretary, subject to the direction of the Council, and the last address of any Member entered therein shall for the purpose of all notices and otherwise be deemed to be the address of that Member, but a Member may at any time, by notice in writing to the Secretary, require his address last entered in the Register to be altered.

Award of a Medal by Society.

(72.) The practice of the Society of 1881 awarding a medal periodically to a person selected by the Council of that Society as the recipient thereof may be adopted and continued by the Council, and the Council in its discretion may for such purpose apply the funds of the Society, subject to the following conditions (that is to say):—

(*a*) The medal shall be called "the Medal of the Society of Chemical Industry," and shall not be awarded more frequently than once in every two years.

(*b*) The recipient of the medal shall be a person who, in the opinion of the Council, has rendered conspicuous service to Applied Chemistry by research, discovery, invention, or improvements in processes, or to the Society in furtherance of its objects, and may or may not be a Member, and may be of any nationality.

(*c*) More than one medal shall not be awarded in any year.

(*d*) The presentation of the medal shall be made to the recipient either in person or proxy at the Annual General Meeting for that year in which the Council decides to award the medal, and the name of the recipient and the said service in respect of which the medal is awarded shall be notified to the Members in the notice of such General Meeting.

And the proposal to award a medal shall be considered at any meeting of the Council held after previous notice of such proposal, at which not less than twelve Members thereof are present and vote, and a resolution to so award shall not be passed unless three-fourths of the said Members vote in favour of the resolution, but if so passed at the same or another meeting, and in the same manner, the Council shall consider and decide upon the recipient, but the name of a recipient shall not be mentioned in the notice of any meeting as aforesaid.

Library.

(73.) Every paper, map, plan, drawing, or model presented to the Society shall become the property of the Society, except the presentor thereof shall stipulate to the contrary at the time of presentation, and all such, together with all publications presented to or purchased by the Society, and a set of bound copies of all issues of the Journal and indices thereof published by the Society of 1881, or the Society, shall be kept upon the premises of the Society for the use of the Members, in charge of a Librarian or other person appointed by the Council, and shall not be removed from such premises or kept elsewhere except upon the authority of the Council.

Pensions.

(74.) The Council may, with the consent of a General Meeting, make such provision for pensioning retired officers and servants receiving remuneration in respect of their several offices and services as to the Council may seem just.

Custody of Certain Books.

(75.) The Register and all Minute and Account books, or other books dealing with or recording the conduct of the business of the Society, except the business transacted by a Local Section, shall be kept upon the premises of the Society in the custody of the Secretary or other person appointed by the Council for that purpose, and shall not be removed from the said premises or kept elsewhere except by the authority of the Council.

Custody of Charter Deeds and Securities.

(76.) The Charter and all deeds, securities, and other documents of title shall be deposited for safe keeping with the bankers of the Society, who shall, whenever required, produce them for purposes of inspection and verification to the Auditor.

Custody and use of Common Seal.

(77.) The Common Seal of the Society shall be kept in such custody as the Council may for the time being determine, and such Seal shall not be affixed to any document or instrument except by order of the Council, and in the presence of two Members thereof, and every such document or instrument when sealed shall be signed by the two Members of the Council in whose presence the Seal was affixed, and countersigned by the Secretary.

Indemnity of Officers.

(78.) All Members of the Council, the Auditor, Secretary, Editor, and other officers shall be indemnified by the Society in respect of all losses and proper expenses incurred by them in or about the discharge of their respective duties, except such as may arise from their own respective wilful default, and none of them shall be liable for any other Member of the Council, Auditor, Secretary, Editor, or other officer, or for joining in any receipt or document, or for any act of conformity, and for any loss or expense caused to the Society except in the case of the like default.

Alteration of By-laws.

(79.) A new By-law, or the alteration, suspension, or repeal of any existing By-law, may be proposed at any time by the Council, and shall be proposed by them after receipt of a requisition so to do signed by at least fifty Members. The proposal made shall in all cases be set forth in the notice of the meeting at which it is to be considered and decided.

THE SCHEDULE mentioned in these By-laws.

FORM A.

The
SOCIETY OF CHEMICAL INDUSTRY.
Founded 1881. Incorporated by Royal Charter 1907.

Palace Chambers, 9, Bridge Street, Westminster, S.W.

We, the undersigned Members of the Society of Chemical Industry, hereby propose
(Candidate's Name in full)............................
as a fit and proper person to become a Member of the Society of Chemical Industry.

For Names *only* of Members recommending the Candidate.
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....
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....

And I, the said Candidate for Membership, hereby undertake that, if elected, I will be bound by the Charter and By-laws and by any Regulations made thereunder and will further the objects of the Society.

(Signature of Candidate)..........................

Address to which the Candidate wishes the Society's Publications to be sent, and which is to be entered in the Society's Register.
....
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....

Profession or Business Occupation. .... Date ....

EXTRACT FROM THE BY-LAWS RELATING TO MEMBERS.
By-laws 6, 7, 9, 10, 12, and 14.

FORM B.

SOCIETY OF CHEMICAL INDUSTRY.

......................19

We, the undersigned Members of the Society, do hereby nominate ....
of ....
....................................as a candidate for election as a Member of Council of the Society.

(SIGNED)

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and I the said......................am willing to stand for election, and if elected will endeavour to attend the Council Meetings and do all in my power to promote the welfare of the Society.

SIGNATURE ....

Sealed the fifteenth day of June, 1908, in the presence of :—

L.S.

BOVERTON REDWOOD, *President.*
THOMAS TYRER, *Hon. Treasurer.*
CHARLES G. CRESSWELL, *Secretary.*

Liverpool Section.

Meeting held at the University, on Thursday, March 12, 1908.

DR. J. T. CONROY IN THE CHAIR.

HURTER MEMORIAL LECTURE.

THE STRUCTURE OF THE ATOM.

BY SIR OLIVER LODGE, D.SC., F.R.S.

The atom of matter, sometimes called the ultimate atom, has been the object of frequent speculation, and likewise the subject of much scientific scepticism. In my youth, chemists usually guarded themselves, when they used the term atom, from being supposed necessarily to imply that such things really existed. And when they depicted a possible arrangement of atoms in a molecule, by means of a graphic formula, it was always in an apologetic spirit, as if such representation conveniently expressed some part of the facts, without necessarily representing anything really existent in nature. This scepticism was in some sort wise, no doubt, but in my judgment was carried too far. If a graphic formula conveniently represented some of the facts, it must be because it genuinely corresponded to something real and true. That it was a complete or adequate representation no one could imagine; but that it was worthy of being favourably regarded for whatever was true in it, without being subject to constant detrimental criticism, I fully believe. How *could* the formulæ correspond to reality when they were only diagrams drawn upon flat paper? They certainly could not; but these drawings might have been regarded as plane *projections* of a grouping in space, and an effort might have been made to conceive the real groupings which could be thus imperfectly represented. Had there been faith in the reality and genuine character of some such grouping, the attempt to realise what it might be really like would have been made far sooner than it was, for the idea of such an attempt is an obvious one;—the merit of those who have now at last properly worked at it (Van t'Hoff and others) consists in the way they have elaborated the details and applied them in a consistent manner to explain the properties of a great variety of compounds and their allotropic forms.

So also the bare idea of "survival of the fittest" was an obvious one—the narrative of every shipwreck and most fires and colliery disasters contain examples of it; the idea and its tendency could be, and were, conceived clearly by a naturalist in the space of some two hours. The major merit is held to belong to the careful elaboration of details, and the patient scrutiny of theory in the light of a vast number of facts, over a period of thirty years. But this work would not have been undertaken if there had been fundamental scepticism as to the existence of species. The existence and problem of species was the stimulating factor.

The old idea of species has been modified, however—there is nothing absolute about it now, as there was when each was thought to be a special creation. And similarly the idea of an atom has changed—there is nothing ultimate about it now, as there was when it was thought that the atom of each element was a special creation. The notion of evolution has invaded both departments of knowledge; and atoms are seen, in some cases at least, to merge into one another, and to be resolvable into other and still simpler units. But, in spite of all that, the atom always was and shall remain a useful conception; and the arrangement of atoms in a molecule, as now depicted by chemists, in all probability corresponds with something quite genuinely real. I see that Prof. Larmor suggested the other day, in Manchester, that such arrangement may directly determine crystalline form; and that a study of crystals may be one of the clues to real molecular structure. This notion should be pressed and examined for all it is worth. The fear lest any hypothesis may become too fixed and binding is wholesome, but it goes too far when it exerts a deleterious influence on thought and discovery. If we could dissect out and examine a molecule, it is highly unlikely that we should find anything static—a frozen rigid assemblage of atoms grouped in the way we depict; but it seems to me extremely likely that the actuality, when we find it, will kinetically resemble and correspond to so many features in our present static representation that we shall have to admit such representation as a genuine step in the direction of truth. And a step is always a thing to be *taken*, not to be criticised and boggled over. Each step upward, if properly taken and utilised, makes the next step on more accessible and easier. And if it happens to be a false step, too weak to bear any weight, we shall ascertain the fact most quickly by frankly treading or even jumping upon it.

At present we are dealing, however, not so much with the chemical structure of the molecule as with the physical structure of the atom.

This lecture is given in memory of our friend the late Dr. Hurter of Widnes, who among all the technical or industrial chemists of my acquaintance stood out as one who earnestly strove to realise with his mind's eye the inner working of things beyond even the aided organs of sense; and who, whether in the study of scientific photography or of electrolysis or other parts of physical chemistry, endeavoured to picture to himself as clearly as possible *what* it was that was really happening in the atomic and molecular domain. He gave two memorable papers to the Physical Society of the University College on these subjects, and his patient and persevering search for accurate knowledge must have impressed everyone who heard him.

Attempts to visualise the actual processes occurring in nature are wholly legitimate, and if persisted in long enough are nearly always fruitful. It is the glory of science to take what is superficially complex and empirical and confused, and to convert it, by long-continued critical and imaginative inspection, into something orderly and systematic and intelligible; probing into the hidden nature of the working, and disentangling from the obvious or phenomenal, that which, though unperceived by the senses, is really far more accessible to mental grasp. Every such generalisation is a step in the direction of unification, and leads us on toward that ultimate unity, and in a sense simplicity, which is the object of all philosophy and of a great part of science. For the multifarious appearances around us are probably all going to be resolved into the movements and groupings of an immense number of precisely similar elements. Our business is to ascertain what those elements are, how in each case they are grouped, by what means they are connected, and how they act upon each other. And then we may further inquire how far they are influenced by some other aspects of the universe, beyond the material range, outside the familiar categories of matter and ether and electro-magnetism and mechanics.

Chemical Affinity.

One of the salient discoveries of the last century, on which sufficient stress is seldom laid, is the discovery that chemical affinity and electrical attraction are one and the same—that the electric force between charged bodies is really chemical action at a distance, and that the chemical combination of atoms and molecules is due to their electrical attraction. Even what is called residual affinity, or latent valency, or molecular combination, can be thus explained also; for the "bond" of the chemist is thus seen not to be an indivisible unit, but to be made up of a bundle of lines of force, some of which are available for taking hold in a number of minor directions. And thus the phenomenon of "mass-action" becomes completely intelligible. And in this same way the at-first-sight surprising dissociation of salts, by the mere fact of dilute solution, is explained likewise. The fact of physical cohesion, the linking together of saturated chemical compounds into a mass with mechanical tenacity, the whole subject of "strength of materials" in fact, seems explicable also on this doctrine of residual affinity or subordinate electrical attraction between molecules. For tenacity, though great enough in the aggregate, is a small force per unit, and is incomparably smaller than the forces specifically known as chemical. Just as gravity, though eclipsing them all when planetary masses are concerned, is trivial when compared with cohesion for bodies of ordinary size, and is practically infinitesimal among atoms and molecules.

For a first instance of this, take the gravitational attraction of earth and moon: the force needed to hold the moon in, while whirling round the earth once a month, would tear asunder a steel rod 400 miles thick. For a second instance take the tenacity of 30 ton steel: holding itself together with a force of 30 tons weight per square inch, or, expressed in c.g.s. measure, $\frac{30 \times 10^9}{6{\cdot}5}$ dynes per sq. cm. Reduce this to the force across a molecular section, and it becomes $\frac{5 \times 10^9}{10^{16}} = 5 \times 10^{-7}$ dynes per pair of molecules. But if these molecules were electrically charged, and operated likewise at molecular distances, the force between them would be $\left(\frac{3{\cdot}4 \times 10^{-10}}{10^{-8}}\right)^2 = 10^{-3}$ dynes per pair of molecules; which is 2000 times as great. Not wholly incomparable therefore; but great enough to give the observed tenacity as a small outstanding or residual phenomenon.

Residual Affinity and Cohesion.

Residual affinity need not be a mere indefinite appellation, it can be precisely defined. It represents the internal force between saturated molecules, holding a group of them together, condensing them into smaller compass than they would otherwise occupy, reducing their tendency to fly away from each other—condensing them in extreme cases into a liquid. It therefore produces the same sort of effect as external pressure produces, and it may be defined as equal to the external pressure which would produce the same condensation or compression on the same number of molecules of a perfect gas. A perfect gas has no residual affinity, its molecules are quite independent of each other. It does not, indeed, accurately obey Boyle's law as usually stated, because the molecules occupy a certain fraction of the whole volume—not all the space occupied is free; but it obeys the law, $p(v-b) = \mathrm{RT}$, where b represents the aggregate molecular bulk, reckoned as cubes not spheres. An imperfect gas or vapour, however, with a residual affinity, K, obeys the law, $(p+\mathrm{K})(v-b) = \mathrm{RT}$. And this K is known as "Laplace's molecular pressure" or internal force. But K is not constant, it increases with the square of the concentration; hence by Van der Waals it was written as $\frac{a}{v^2}$, thus giving us the famous and well-known Van der Waals' expression, which more or less approximately embodies the properties of gases, vapours, and liquids. A measure of K can be made by compression experiments, though of course in any substance for which K is great the compressibility is small. A first approximation is the incompressibility or elasticity of volume, that is $-v\,dp/dv$; but this is mixed up with the quantity b, and so K is not to be disentangled by incompressibility alone. A better mode of estimating it is by the energy of disgregation of a liquid: in other words, by the work that is needed to pull the molecules asunder from their cohesive attraction—that molecular attraction which has liquefied the substance—and to scatter them as vapour:—in other words by determining the latent heat of evaporation. For instance, at $t°$ C. this is well known to be for water $607 - 0{\cdot}7t$ calories per grm. and interpreting this in energy units by multiplying by J, (that is by $4{\cdot}2 \times 10^7$,) it becomes, for water near the ordinary boiling point, $540 \times 42 \times 10^6 = 23{,}000 \times 10^6$ ergs per c.c., that is $23{,}000 \times 10^6$ dynes per square centimetre or 23,000 atmospheres, or a quantity of that order of magnitude. No wonder then that there should be both chemical and physical evidence that in the liquid state water molecules are liable to cling together into prodigious aggregates, and that the substance has a remarkably high specific inductive capacity.

An increase of molecular cohesion tends to raise the boiling point, and likewise the surface tension, as in the case of mercury. The critical point likewise depends largely upon the value of K; and if K is zero liquefaction is impossible.

The smallness of residual affinity between the molecules of helium and other members of the argon group of gases explains why they so strongly resist liquefaction; but whether they liquefy or solidify first, depends of course merely on whether their boiling point is above the freezing point or not. In a vacuum, the freezing point of water is above its boiling point, and accordingly, in a vacuum, ice only evaporates and does not liquefy: an observation made by Carnelley. To liquefy helium the pressure would have to be increased; though whether it would be possible to do it then remains to be seen. It would be more easy to try the experiment first with neon. (See A. W. Porter, "Nature," 12 March, 1908.)

But how can we measure the residual affinity or molecular cohesion for a thing not in the liquid or the solid form? How can we measure it for a nearly perfect gas? Joule and Thomson devised a way. The gas is cooled and compressed as much as possible, so as to give the molecular attraction every chance; and then suddenly let go, the cold of expansion being observed. If the pressure could really be reduced suddenly to zero there *need* be no cooling, because then no work of expansion would have to be done. All that would then be observed would be the residual cooling due to the molecular attraction. But as this is impracticable, the plan adopted must be to compare the cold of expansion with the heat of compression, and see if they are the same. If, when a gas expands say to double its volume without doing any work, the temperature is the same after expansion as before—when local eddies and rushes have subsided—the gas is a perfect gas, and Laplace's K or Van der Waals' $\frac{A}{v^2}$ is zero. For such gases as hydrogen and helium this is very nearly true, but not quite; and it is this residual affinity or molecular cohesion which in the last resort must be depended on to liquefy or solidify them. All liquefaction depends upon this term, and upon nothing else. External pressure cannot do it, for directly that is relieved the compressed gas completely recovers. But if there is any trace of molecular cohesion, then it exhibits signs of imperfect elasticity, or a more or less permanent set. It is most noticeable when the concentration is excessive, for, as said before, it depends on the square of the concentration, $K = A\rho^2$.

This is the basis of Lord Kelvin's determination of absolute zero. A perfect gas without cohesion would obey the law $p(v-b)=RT$, and the temperature at which its pressure became zero would be the absolute zero. At any temperature above that its molecules would have some movement, and would accordingly by bombardment exert some pressure.

The absolute temperature would be the reciprocal of its coefficient of expansion per degree at constant volume, $T = p\frac{dT}{dp}$, and could be so measured. But as no such gas exists, experiments have perforce to be made on an imperfect gas, and a correction applied for the amount of its imperfection. In this way Joule and Thomson determined that the absolute zero lay between 273° and 274° C. below the freezing point of ordinary water—more exactly it came out 273·2°—a determination which has a real and living interest now that Dewar and others are constantly working down to within a small number of degrees above this ultimate limit, below which it is impossible to go.

It must be for ever impossible, because at that temperature bodies possess no heat, and therefore cannot have any removed. I do not say that the atoms possess no energy—far from it—their energy of internal constitution need not necessarily have been affected; but they possess none of the unorganised energy of molecular motion which we call heat: each molecule, as a whole, at absolute zero, is at rest.

Electrical view of Matter.

Our present attempt to see into the structure of the atom is by resolving it into an assemblage of electric charges, most of them of minute specified size, and all of one sign, called electrons; though the complete aggregate must possess also an equal charge of opposite sign, so as on the whole to be neutral, except in so far as an outstanding unit or two may convert it into a monad or a dyad ion. How the negative charges are arranged, and what form the equal positive charge or charges may take, are problems still awaiting solution, to complete this part of the theory of matter.

Comparatively early speculation and calculation on this subject are contained in a remarkable paper by Lord Kelvin, published in the Phil. Mag., 1901, under the title "Æpinus atomised." It is reproduced in the volume of Baltimore Lectures as Appendix E. To him also we owe the first attempt to work out the statics of an atom according to a simple conception whose major consequences can be traced with comparative ease: viz., that of a spherical portion of uniform positive electricity in which minute negative charges are sown like specks: being attracted towards the centre of the sphere according to the law of direct distance, and repelling each other according to the inverse square law. (See Fig. 1 below.)

Various interesting groupings can be easily calculated as stable patterns; and they tend to become more stable if they revolve regularly round the centre or if sustained by a central group or particle. But although the distribution and properties of such groups is profoundly suggestive and interesting, the behaviour of atoms consisting of a mass of positive electricity with even a single electron inside them became instructive in the hands of Lord Kelvin.

Thus equal and similar neutral atoms of this kind (the positive charge equalling the negative in quantity, not in size), would exert no force on each other, till they touched and partially interpenetrated: then they would attract and cohere. But they would not presumably interfere with or damage each other, and when separated would be as neutral as before. But if one sphere were distinctly smaller than the other, though equally charged, the neutrality would not continue. The more concentrated would be the more powerful. Pressed together the electron at the centre of the larger one would be much displaced, and under certain conditions would actually be absorbed and retained by the smaller sphere, so as to be carried away by it when they separated again. Thus, after the collision, one of the atoms would have become positive, by losing its negative electron; and the other would be negative, by having acquired one too many. The likeness exhibited, by the phenomena of such a presentation or model, to contact electricity, and to the strong electrification produced between insulators when pressed or rubbed together is obvious.

A sphere of positive without negative nucleus, brought near or in contact with an equal sphere possessing one, would not be able to rob it; nor could a big one ever take the nucleus from a smaller one. But one which was even a little smaller, any size less than 0·89 the diameter of the bigger one, would, if it approached close enough, pull the electron completely out and assimilate it itself.

It is confessedly unlikely that any atom should have only one electron; but that which it is fairly easy (not too easy) to calculate for this simple case would happen in modified fashion in more complex cases, when the electrons were more numerous; and a vast number of possibilities suggest themselves, such as with ingenuity can be made to account for a great variety of the fundamental facts of chemistry. Ingenuity such as is needed for this difficult work, which at present is only in its infancy, has been conspicuously displayed in various well-known writings of Professor J. J. Thomson.

Meanwhile to return to Lord Kelvin:—Where there are more than one or two electrons in the atom, constituted as supposed above, they distribute themselves in stable form as follows:—

Three form a plane equilateral triangle.

Four are at the corners of a regular tetrahedron.

Five may be stable if four are in a plane at the corners of a square and one centrally perpendicular to the plane of the square; but they are more certainly stable if three are in a plane, and two are on its central perpendicular, one on each side.

Six are stable at the corners of a regular octohedron; they are also possibly stable in a plane if one is at the centre and five at the corners of a pentagon.

Eight can be at the corners of a cube, but with insecure stability, unless there are some at the centre too.

Twenty, at the corners of a regular dodecahedron, would either have to be *constrained* to lie on a spherical surface or else would have to be well sustained by repulsive forces from the interior.

The calculation for space-distribution becomes complicated, and most attention has been paid to distribution in a plane: wherein the criteria for stability, as depending either on central repulsion or on centrifugal force due to regular rotation, has been admirably worked out by J. J. Thomson in a methodical and very instructive way. A typically instructive and simple case is that of four electrons revolving round the centre. So long as they are revolving above a certain angular speed they are stable when at the corners of a square; but if the speed falls below a critical value, this grouping becomes unstable and they fall, with a convulsion and emission of energy, into a statical position of equilibrium at the corners of a tetrahedron. It is in a direction typefied by this simple example that some of us are looking for an explanation of spontaneous radioactivity.

Theory of Electrons.

The whole idea of being possibly able to express matter in terms of electricity is, however, one that needs reiterated explanation and emphasis. The mode in which the electrons themselves have been weighed and counted, I will not here again enter into. It may be taken as known; and if not, it can be found described in many places—among others in my book called "Electrons." But the fundamental fact on which is based the notion that matter may be an electric phenomenon, is deserving of more expanded and repeated notice; and part of this lecture must be devoted to that. For to the superficial eye nothing could be more distinct than matter on the one hand and electricity on the other. Anyone would suppose that an electric charge, whatever it is, must be a mere appanage or decoration of matter, and that by no conceivable ingenuity could it be thought of as constituting the substance of matter itself. Benjamin Franklin—whose ideas concerning electricity have in many respects become so singularly justified—would, I conjecture, have been profoundly interested, but somewhat astonished and probably sceptical, if such an idea could in his day have been authoritatively mooted. If so, it would be one of the many instances when ultra and exaggerated scepticism concerning truth and reality fails to be justified by events. Unless indeed even the present tendency be discounted, and sceptics prefer to wait till future times for a more thorough justification of these theories before even tentatively accepting them:—a legitimate though not a prolific or fertile attitude.

Electric Mass.

The attribution of the material property of "mass" or *inertia* to electricity entirely depends upon the magnetic properties of an electric charge in motion. *The magnetic properties of an electric charge in motion.* In that sentence I have mentioned the three fundamental attributes, or manifestations, or phenomena, of the material universe:—Electric charge, Magnetic field, and Mechanical motion; or Electric force, Magnetic force, and Mechanical force. These three vectors are essentially perpendicular to each other, and correspond to the three dimensions of space. They also correspond to the three chief known properties of the ether of space, which is the substratum or material basis of all activity. We do not yet know the constitution of this continuous and omnipresent medium, but it is certainly so constituted that each of these three vectors is physically possible at any point in space; and moreover it is so constituted that wherever two of them exist, the third springs into being—at right-angles to both.

A charge in motion constitutes a current—"current" is our shorthand expression for charge in locomotion—and a current is always and essentially surrounded by a magnetic field. A magnet in motion generates a current in conductors, and an electromotive force in insulators. A varying magnetic field does the same, for its lines are then in lateral motion. A magnetic pole in the neighbourhood of an electric charge, even when stationary, sets up a theoretical spin in the ether, round the line joining them—a hypothetical spin which can display itself by its gyrostatic action.

The result is that when a charge is in motion, the magnetic field due to the motion, when once generated, tends to preserve and prolong that motion, so that mechanical force is needed to obstruct or stop the moving charge. Similarly to accelerate or set in motion any electric charge involves the generation of a magnetic field, and therefore requires the application of mechanical force and the expenditure of energy. No such force is necessary so long as the motion is steady, no more than if the motion was zero; but directly the motion changes, whether in the way of increase or of decrease, force is immediately exerted: nor can there be any kind of change produced in the motion, either in magnitude or direction, save by the exertion of force. In other words, an electric charge in motion, not acted on by any force, will continue to move in a straight line with a uniform velocity. And if a force acts upon it, the acceleration produced is exactly proportional to the force.

Thus the reaction between electric and magnetic fields precisely simulates all the effects of mechanical or Newtonian inertia. It is an acceleration-coefficient, not a velocity-coefficient; it is not of the nature of resistance or viscosity but it is of the nature of mass. But when I say simulates—I would rather say that it accounts for, or rationalises, or carries one step further on, the otherwise blank and bald idea of Newtonian inertia.

The first two of Newton's Laws of Motion are thus obeyed by electricity. Is the third law obeyed likewise? I say yes; but the answer is not so simple and easy. The peculiar condition of an advancing wave-front has to be taken into account, and we have to admit that an ethereal wave advancing with the speed of light may possess attributes which hitherto have been thought to belong only to matter, and may—indeed must—sustain the reaction of a stress whose other end acts upon the source. So that light or radiation of any kind must exert a pressure and must be the seat of a stress;—a fact which, predicted by Maxwell, has now indeed been directly and experimentally observed.

If somehow there should be acceleration without the action of any material body, then waves are generated in the ether; and the mechanical force essential to the action is supplied by the reaction of the train of ether waves. It is a singular but very important case: the wave-front seems to represent adequately some of the properties of matter, and the generation of such a wave-front is the inevitable consequence of either accelerated or retarded or curved motion of an electric charge. This and this alone is the source of ethereal radiation.

To pursue this subject would lead us into the intricacies of spectrum analysis, which has already begun to throw light upon atomic constitution, but what little I propose to say on that subject will come better later.

Leaving this as a digression, and returning to electric inertia, it may be truly said that an electric charge has the property which we know as mass or inertia; and it becomes a possibility that no other mass or inertia need or does exist. This is the chief basis of the electric theory of the nature of matter. It is one of the foundations on which the notion that an atom of matter is built of electric charges must fundamentally rest.

But, admittedly, the extra mass of any ordinary charged body, due to the charge, is excessively and absurdly small. The mass depends not only on the charge but also on its concentration; in other words, on the charge and its potential. It is in fact proportional to the electrostatic energy of the charge. The mass or inertia of an electric charge is such that, if moving with the velocity of light, its kinetic energy would equal the electrostatic energy of the charge at rest. In other words, considering the charge uniformly distributed through a sphere of radius, a, $\frac{1}{2}mv^2 = \frac{1}{3}e\frac{e}{ka}$; but it is known that $v^2 = \frac{1}{\mu k}$, so $m = \frac{2}{3}\frac{\mu e^2}{a}$, a simple formula which is the sheet-anchor of the electrical theory of matter.

To build up an atom out of a reasonable number of electrons, therefore, the charge of each electron must be excessively concentrated, that is to say, must occupy exceedingly small bulk, so that an electron's intrinsic potential may be high—comparable indeed to a million volts: an astonishing value, which reduces itself to only a few volts at any distance comparable with molecular dimensions. It is indeed possible to specify the bulk of an electron which will enable us to say that its mass is wholly of the electrical kind. Every experiment made—both direct and indirect—goes to confirm the extraordinary smallness and consequent penetrating power of electrons.

At one time, not so long ago, we were in doubt about the size of atoms; some few may perhaps have been in doubt as to whether such a phrase had a legitimate meaning. I hope that this unnecessary scepticism is now set at rest, and that everybody admits the estimate of size or molecular magnitude which we owe to the genius of Lord Kelvin, among others. The extreme minuteness of the atom can be brought home to the imagination in many ways; but one striking way is to point out that in spite of the extreme rarity or dilution of the gold chloride dissolved in sea water—estimated at 1/50th grain per ton, or say one part in a thousand-million—so that it appears not to be possible to extract it economically—yet that in every cubic millimetre drop of that liquid, the number of gold atoms amounts to several hundred millions. And the number of atoms of radium in any 50 c.c., or say a half pint, of sea water* or of ordinary rock is about the same.

Yet in spite of their excessive minuteness we know of one definite structure which can only be about ten or a dozen molecules thick—namely the soap bubble on the point of bursting, in the region which shows itself to the eye as a black or non-reflective spot.

Waves of light are excessively small things, of which a hundred thousand only span an inch, and yet waves of light are coarse unwieldy things compared with atoms; so that the fineness of microscopic vision must break down in the attempt actually to see the atoms, although by more or less indirect means there is some hope that the larger kind of molecular aggregates may some day become in a manner visible, by the diffraction and other effects which they cause in a beam of light. Moreover, the excessively thin ether pulse known as an X-ray appears to be distinctly thinner than molecular dimensions, since it is able to pass through a mass of material with only a moderate amount of loss.

But although the atom is so minute, it is huge compared with an electron; and if it be true, in any sense, that an atom is mainly composed of electrons, they must be as far apart from each other inside the atom, in proportion to their size, as the planets of the solar system are in proportion to their size.

The porosity of matter so constituted is extreme, and the ultimate specks of which even an atom is composed are as it were few and far between. Though an atom may perhaps contain thousands altogether, it consists mainly of intervening space in which there is nothing but continuous unmodified ether.

That is the kind of picture which we are beginning to form in our minds, not dogmatically but as a guide to investigation; it forms a mental image of which we can trace some of the consequences, so as to be able to check and amend it by observation and experiment.

It is on this basis that I have been led to attribute so excessive a density or massiveness to the ether—that is to say, on the supposition that it is of ether that the electrons are really composed, that they are, as it were, "singularities" or some kind of structure or strain or motion-centre in the ether, differing from it only in the circumstance of their arrangement, not in their density or concentration. A really continuous fundamental medium cannot be either rarefied or condensed: it must be uniformly everywhere. Accordingly, whatever density a discrete aggregate of scattered particles may possess, the density of the continuous medium, which composes them and fills up all the intervening spaces, must be greater, and may be immensely greater.

The reason why matter appeals to us so clearly and strongly is because our present bodies are composed of it, and because our sense-organs have been evolved to respond to its various motions; but matter turns out to be a mere faint misty modification of the great medium itself; and, compared with it, is like a gauzy cobweb or mist or a milky way. I repeat this because I believe it will be found to be a fact of profound significance—a significance as yet undreamed of—significance which could only at present be dealt with in terms of speculation, a thing desirable to avoid until we can adduce a more substantial foundation for it.

Electron History.

It may be convenient now to trace some stages in the history of the discovery of the electron, or separate physical unit of electricity: that is to say stages in the discovery that electricity is not a continuous medium, but consists of particles or atoms—truly indivisible particles so far as we know at present—and that an ordinary electric charge, as we know it experimentally, is due to either the gain or the loss by a body of some of those particles; also that the particles can exist in some cases apart from matter, either in the interstices between the atoms, or in free space away from matter altogether.

The first inkling of the discovery of the atomic nature of electricity dates back to Faraday and his experiments in electrolysis. The indivisible atomic charge—the charge of a monad ion—was then practically measured, at least as soon as the size of the atom was known; and an "atom of electricity" was spoken of, both by Maxwell and by Helmholtz. In amount, measurement indicates that it consists of $3{\cdot}4 \times 10^{-10}$ electrostatic unit, some uncertainty affecting the second significant figure. On this basis, Dr. Johnstone Storey gave to these unit charges their name "electron," and speculated ingeniously on some of their properties. Then J. J. Thomson found that in the rarefied air of a vacuum tube these charges were loose, flying as cathode rays; and identically the same, no matter what was the kind of residual matter in the tube. It was in this state that their mass was measured, and found to be a thousand times less than the previous material minimum—the hydrogen atom. Then Zeeman found that their orbital motion was the source of all bright line spectra—that is to say, that they emitted radiation, carving the ether into waves.

The conduction of electricity is due to the procession of electrons and positive charges; and the good conducting power of metals, whether for heat or for electricity, is supposed to be due to a crowd of electrons freely permeating the interstices between the atoms, being handed on from one to another so readily that they are practically dissociated or free in vast numbers. And the long-known connexion between heat conductivity and electric conductivity is found to be thus rationally and quantitatively accounted for.

Furthermore, the regular gradation of electric properties exhibited by the elements in Mendeléef's classification can be stated electrically, in a way that certainly suggests an approximation to the truth. Each octave has an electro-positive and an electro-negative end, the most extreme members being at the ends, and an almost neutral body in the middle, of each series; and in the step from the extreme electro-positive of one octave to the extreme electro-negative in the next, an intermediate halting place of a neutral and quite inert body is now known, by the discovery of the argon-krypton-xenon series. (See diagram 4 below.)

The atoms of the electro-negative set are those which can easily make room for, and have acquired, extra electrons—more than properly belong to their constitution; these are the non-metals, and are chemically active on that account. The atoms of the electro-positive variety are those which easily lose, and

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*Joly estimates the proportion of radium in sea water as 2×10^{-14} *Phil. Mag.*, March, 1908.

have lost, some of their electrons—thereby becoming good conductors by reason of the loose electrons which they have let go; these are the metals. A strong electric attraction naturally exists between members of the electro-negative and the electro-positive group, because they are oppositely charged; and the clinging together of these atoms, under electric attraction, constitutes chemical combination. Conducting power usually disappears after combination, except the variety of it which may be brought about by the dissociation or breaking up of the compound molecules.

The epithets positive and negative, which from the electrical point of view seem so interchanged and inconvenient, from the material point of view get right again. For the atom which is hungry for more electrons and has absorbed them is electro-negative; while the atom which has a surplus and has extruded some is electro-positive. A tetrad can be either the one or the other. In methane the carbon is presumably acting as a negatively charged body. In carbon tetrachloride the carbon is presumably acting as a positive. Chlorine seems to have much more residual affinity than hydrogen has, and accordingly the molecules tend to cling together, and the substance is a liquid instead of a gas.

Once more I repeat that the term in Van der Waal's famous formula, $\frac{a}{v^2}$, or Laplace's K, is the liquefying force, and is a measure of this outstanding affinity; it is determined by the latent heat of evaporation, or to some extent by the boiling point and the critical point.

Spectra.

The critical and numerical examination of a bright-line spectrum, both when free and when under magnetic influence, is one of the most powerful means of detecting the internal structure of an atom; and although the subject is a difficult one, considerable progress in this direction is evidently going to be made: indeed, has already been more than begun. There are, however, a good many outstanding difficulties and some puzzles to be overcome, showing that our ideas, though probably true as far as they go, are as yet incomplete and require either modifying or supplementing; or most likely both.

Another means of examination, likewise dependent on their ethereal connection, is the mode in which they absorb and disperse light. Definite or bright-line spectra are now supposed to be due to the constituent electrons of an atom; while confused or continuous spectra are supposed to be due to more general dissociated electrons, with no individual atomic constitution or precise geometrical grouping. Bright-line spectra are to continuous spectra somewhat as polarised light is to common light—a more definite accurate precise metrical thing. One result of the theory, and one that could be tested, is that any substance that gives a bright-line spectrum ought to be a non-conductor. And *vice versâ*, as long as a thing is a non-conductor it should give a bright-line spectrum. Any trace of a continuous spectrum must be associated with some amount of electric conductivity, that is to say, with the production of loose or dissociated electrons in addition to the tight or continuous ones

Gases and many vapours, as is well known, are in the strict sense non-conductors, and their spectrum does consist of bright lines.

The effect of a magnetic field applied to a bright-line source, in tripling or otherwise complicating the lines and causing the constituents to emit definitely polarised light, has been triumphantly accounted for, and was indeed, in part predicted, by the electron theory as elaborated by Lorentz. The explanation is so complete and satisfactory that there can be no reasonable doubt of its truth; and experiments made on those lines are leading to a kind of atomic astronomy, whereby the orbits of electrons and their perturbations can be examined into and mathematically expressed,—a theory begun some time ago by Johnstone Storey.

The gradation of the more specially chemical properties, exhibited by each octave of Mendeléef's series, can also be incipiently accounted for by the electric theory: the valency increasing from 1 up to 4 in the middle of the octave, and then decreasing again down to —1. And the peculiar properties of the quadrivalent atom, whereby it can cling together in groups, and give all the compounds of organic chemistry, comes out as a rather natural property. (See diagram 4 below.)

Even the peculiarities observed in the spectrum of the different elements in each group show some indication of yielding to a rational theory; for, as has been already said, mechanical stability requires that the elements shall arrange themselves in rings, with a given number of electrons in each ring. And wherever a ring of three or of any other fixed number occurs, it is natural to suppose that certain properties, especially certain radiational properties, will be associated with that particular number. This same number will occur in the corresponding member of higher and higher groups—fresh rings being added as the atomic weight increases—but the numbers in the inner rings will repeat themselves in octaves, so as to reproduce something of the old properties, together with new properties in addition, due to the extra complexity. (See diagrams 2, 3, and 4.)

It should be understood that the visible and plentiful radiation which furnishes a spectrum can hardly be due to the gentle emission of waves from isolated and free atoms in regular revolution: some violence is needed to generate radiation in conspicuous amount. They require to be shaken or jogged; just as a bell does not sound when merely waved about—it requires to be struck. *Sufficient* acceleration will always make it sound. Plentiful radiation is only emitted, therefore, when atoms clash together, as they do when they chemically combine, or as they may be made to do by that considerable quickening of their motion which we call a great rise of temperature.

Visible light seems to be due to the banging and clanging of molecules, much as X-rays are due to the violent impact of electrons on a target. The system is then shaken, and the atom emits for a short time its characteristic waves. The stopped electron only emits a single thin shell.

Atomic Structure.

But now returning to the actual internal structure of the atom—is there anything definite that we can say concerning that? Assuming that the mass of the atom is due to an assemblage of electrons, can we say anything clear and distinct concerning the way in which those electrons are arranged, and can we descry what they are doing among themselves? First of all, it is certain that the arrangement is not stagnant or quiescent: it must be full of internal energy. Lord Kelvin, indeed, surmised that the energy was statical, akin to the energy of gunpowder or a compressed spring. To me and others it seems far more likely that it is kinetic, analogous to the energy of a flywheel or of the planets in their orbits. But that there is a great store of intra-atomic energy we know, from the fact that some atoms every now and then explode and fire off a projectile from time to time, just as a loaded and repeating gun may fire off a cannon ball or a bullet. This energy may, as hinted, be due to motion already existing among the parts of the atom, or it may be due to some unexplained static force held locked until some trigger or detent is pulled, and then suddenly liberated. Both are possible modes of statement, but the latter evidently leaves more in a state requiring further explanation than the former does. Some, as we have said, think that the energy is static or potential, others that it is more likely to be kinetic: but whatever the nature of the energy, there is no valid doubt as to its amount. And it is enormous. Not so great as, nor even comparable with, the energy in the same bulk of the ether of space, but still enormous, and entirely eclipsing the insignificant amount corresponding to chemical combination, which is all that we have so far learnt to utilise. The energy of heavy atoms is greater than the energy of light atoms, in proportion to their atomic weight, but the intra-atomic energy stored up inside the atoms of a gramme even of hydrogen is 10^{19} ergs. That is to say, is enough to raise a weight of a thousand tons 60 miles high; or, otherwise expressed, enough to convert 300 tons of ice into high-pressure steam. Even a slight rearrangement of constitution, emitting only a minute fraction of this energy in the process, may therefore be depended on to give powerful radiation, and amply accounts for the phenomena exhibited by radium and its congeners.

The occasional disruption or explosive break-up of an atom, can readily be stated in terms of the electric theory; and the fact that a revolving electron must radiate away its energy, thereby reducing the motion of one of the rings sooner or later to a condition of instability, must necessarily lead at intervals to a catastrophe and rearrangement—the rearrangement being perceptible to us as the appearance of a different element, and the catastrophe making itself apparent by ejection of some discarded constituent, with all the phenomena of radioactivity.

Not that the theory of radioactivity is at all as yet complete; but the lines on which an explanation is to be sought, and the theory elaborated, are fairly clear.

When I consented to give this lecture in memory of Dr. Hurter, it was with the idea of trying to show how promisingly an incipient explanation of the properties associated with the chemical series of elements had been begun by J. J. Thomson, on the lines of the kinetic hypothesis. But it is hardly possible to give an intelligible account of this matter, by the method of oral exposition, in any reasonable time. Nor is the theory as yet so complete and satisfactory that we have any confidence in maintaining it to be certainly a step in the direction of the truth. It may be that it leads off the track—I do not think so—but I could not bring it forward with the same confidence as I bring forward more general and less detailed considerations. Suffice it to say that Thomson has made a heroic attempt to exhibit Mendeléef's series, and the gradation of properties among the so-called elementary bodies known to chemistry, and some of the peculiarities of their spectra, on the lines of a set of revolving rings of electrons obeying mechanical laws and spinning in regular orbits inside a uniform positive charge. (See diagram 3 below.)

Evolution.—The notion of atomic evolution would suggest that complex atoms were formed by the falling together of simpler ones; or by the gradual growth of complexes by assimilation of electrons. This process has not yet been observed. What has been observed is the converse process—the disintegration and gradual collapse of some more massive atoms, and the emission by them of lighter materials. But some indirect evidence that the inverse or constructive process may also occur is furnished by electroscopic examination of the nebulæ. For, just as we regard these as the probable parents of solar systems, so we must notice that the elements of which they are composed are the most simple ones—those of very small atomic weight: Hydrogen, helium, and the like. Hence it is natural to think that just as the cloud contracts into suns and planets, so its atomic materials coalesce into heavier elements.

If it be asked why is nothing known lighter than hydrogen, the answer must perhaps be sought in the comparative instability and short life of any *very* small collection of electrons; for the radiating power of a very few would be considerable, even without collisions. But the most likely answer is that the grouping has acted as a unit and fallen together into aggregates, of which the more stable and permanent ones are recognised by us as the chemical elements. Some of them are not very permanent, however. Polonium, actinium, radium, and others, have a lifetime that can be measured; and even that of uranium can be estimated. Probably in time we shall know something about the genealogy and vitality of the whole chemical population.

Uncertainty and vagueness still hover round the conception of the positive charge. The negative electron or corpuscle is now a fairly familiar object, of the roadside, so to speak; but the positive unit, which is probably best not called an electron, still lurks in holes and corners, and either by reason of sluggishness, or for some other reason, resists being dragged out into the light of day.

Progress is being made, however, and during the next decade one of the most promising and repaying lines of advance will be a quest into the nature and properties of the unit positive charge.

Diagram 1.

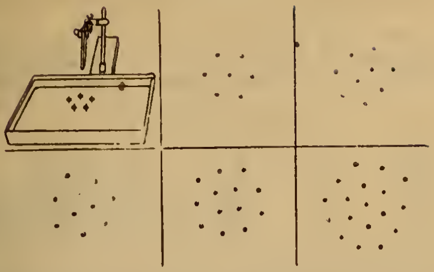
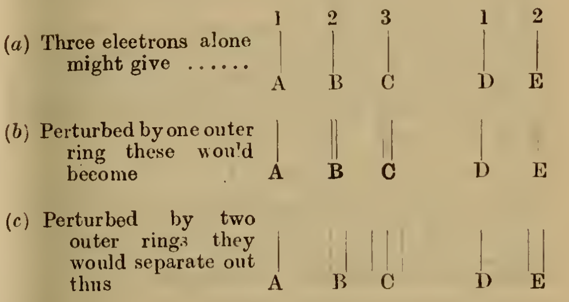


Diagram 1 shows the arrangement of a number of magnets floating on water and attracted by a large magnet, centrally situated, high up. These roughly imitate the electrons in a sphere of uniform positive electricity, save that they are forcibly constrained to keep on a plane. This artificially increases their stability; but even when they have freedom to move in a third dimension the same amount of stability can be attained, provided they are rapidly revolving—as electrons almost certainly are.

Diagram 2.

Spectrum to be expected from three revolving electrons, in atoms of higher and higher atomic weight.

They have nine degrees of freedom and therefore may be expected to give nine bright lines. But in simple cases some of these could be coincident.


1 2 3 1 2
(a) Three electrons alone might give ......
A B C D E
(b) Perturbed by one outer ring these would become
A B C D E
(c) Perturbed by two outer rings they would separate out thus
A B C D E

Fresh lines would also be added to correspond with the extra rings.

Diagram 2 shows the spectrum to be expected from a group of three electrons, grouped as an equilateral triangle, which in the aggregate have nine degrees of freedom. But in the simplest case some of the lines will be coincident (corresponding to equal roots of an equation) and accordingly we may suppose that only five lines appear, as in 2*a*, some of which are double and others triple.

Surrounding the triangular group with a large ring of electrons is equivalent to stepping up, by greatly increasing the atomic weight, so as to reach a corresponding member in the next higher series; and the perturbation of the triangular grouping when now set vibrating will resolve the component lines a little, and give Fig. 2*b*.

Stepping to the corresponding member of the next higher series, it gives the same lines because it again contains a triangular group; but now the separation of the lines is more thorough, giving Fig. 2*c*. Other lines are, no doubt, added by the extra rings, but these have no relation to the ones characteristic of the triple group.

Diagram 3 shows a set of hypothetical rings, such as may readily occur, corresponding to a complete Mendelejeff family of higher and higher atomic weight. The similarity of properties is emphasised by the repetition of the inner rings; the rise of atomic weight and corresponding modification of properties is a consequence of

DIAGRAM 3.

Hypothetical reason for gradation and similarity of properties.

Approximate substance.	Total number of electrons in atom.	Arrangement in successive rings.
Be	11	3 8
Mg	24	3 8 13
Ca	40	3 8 13 16
Zn	60	3 8 13 16 20
Sr	84	3 8 13 16 20 24
Cd	110	3 8 13 16 20 24 26
Ba	140	3 8 13 16 20 24 26 30

the extra and outer ring. The whole table, and the substances specified in the first column, are only here to be regarded as typical or suggestive of the kind of thing that may be looked for, not as a statement of what has been found.

Diagram 4 exhibits the converse arrangement: showing in a typical or representative manner all the neighbouring elements of a single Mendelejeff series—the one welding link being the possession of twenty in the outer ring. Among those at the top of the list, the 20 is barely stable and is liable to shed one of its electrons, becoming thereby positively charged. Those at the bottom could easily take another on without difficulty, and often do—becoming negatively charged.

The valency exhibits a regular gradation from +1 through +2, +3, ±4, to −3, −2, −1. And the extremes of the series have the valency 0. A permanent change in the number of the outer ring carries one over into the next series and the valency suddenly changes from the active valency, −1, to the equally active valency, +1; stepping, as we now know, through 0 as an intermediate step over the discontinuity.

This hasty treatment by no means does justice to the whole conception, but it may suffice as a hint or indication, as much as at present is legitimate; and it may have the effect of sending students to the original sources which he must read with critical appreciation but without slavish acceptance.

DIAGRAM 4.

Typical group, or Mendelejeff family, on electric theory.

Type of Substance.		Total number of Electrons in atom.	Arrangement in Successive rings.	Valency.
? H		58	19 16 13 8 2	– i
He	Ne	59	20 16 13 8 2	0
Li	Na	60	20 16 13 8 3	+ i or – vii
Be	Mg	60	20 16 13 9 3	+ ii or – vi
B	Al	62	20 17 14 9 3	+ iii or – v
C	Si	63	20 17 13 10 3	+ iv or – iv
N	P	64	20 17 13 10 4	– iii or + v
O	S	65	20 17 14 10 4	– ii or + vi
F	Cl	66	20 17 14 10 5	– i or + vii
Ne	A	67	20 17 15 10 5	0
Na	K	68	21 17 15 10 5	+ i
Mg	Ca	69	21 18 15 10 5	+ ii
&c.				&c.

The substance indicated is only typical, and either of the first two columns may be taken as representing the group typified. The second column really comes below the first, and leads on a third, etc. They are put together in the table for compactness. The total number of electrons given does not correspond to any particular element necessarily, but this number would adjust itself in the rings shown. The actual total number may be much greater.

Appendix on absolute temperature.

The elementary argument about the definition of absolute temperature in terms of a perfect gas can be put thus:—A perfect gas is one whose molecules action each other, and on the walls of the containing vessel, solely by bombardment. Simple mechanics shows that such a substance exerts a pressure

$$p=\tfrac{1}{3}\rho u^2 \; ; \; \dots\dots\dots\dots\dots\dots \; (1)$$

and whenever it expands, all the work done is against external pressure. The heat in such a body is solely the energy of its irregular or unorganised molecular motion; and the temperature of such a body can be defined as simply proportional to the heat, or equal to the heat divided by a capacity-constant, mc.

If the gas has to expand against external pressure more heat must be supplied to allow for the external work done, $\int p\,dv$; the capacity being now called mc' if the pressure is constant. Consequently, if the gas be heated at constant pressure from absolute zero up to the temperature T, the heat required can be expressed as $\mathrm{H}=mc\mathrm{T}+pv=mc'\mathrm{T}$; wherefore—

$$p=\rho(c'-c)\mathrm{T} \; \dots\dots\dots\dots\dots\dots \; (2)$$

which may be called the characteristic equation of the substance. Comparing this with the first equation, we see that—

$$u^2=3(c'-c)\mathrm{T} \; \dots\dots\dots\dots\dots\dots \; (3)$$

which constitutes a definition of absolute temperature in terms of the characteristic constant, $c'-c$; the "3" having reference to the three dimensions of space.

Actually to determine T we can employ equation (2) and get rid of the constant say by measuring the increase of pressure when the gas is heated at constant volume.

This gives $\frac{dp}{p}=\frac{d\mathrm{T}}{\mathrm{T}}$, or $\mathrm{T}=\frac{d\mathrm{T}}{dp}=\frac{1}{a} \; \dots\dots\dots \; (4)$

the reciprocal of the coefficient of expansion. In other words the expansibility of a perfect gas is simply the reciprocal of its absolute temperature.

This is consistent with the form of characteristic equation which allows for molecular bulk, though not for molecular forces, $p\,(v-b)=\mathrm{RT}$.

For a slightly imperfect gas there is the cohesion or molecular-attraction term to be attended to as well, and its characteristic equation is $(p+\mathrm{K})\;(v-b)=\mathrm{RT}$, which for constant volume warming gives

$$\frac{dp}{p+\mathrm{K}}=\frac{d\mathrm{T}}{\mathrm{T}}$$

$$\text{or } \mathrm{T} = p\,\frac{d\mathrm{T}}{dp}+\mathrm{K}\,\frac{d\mathrm{T}}{dp}$$

$$\text{or } \mathrm{T} = \frac{1}{a}\left(1+\frac{\mathrm{K}}{p}\right) \dots\dots\dots\dots\dots\dots \; (5)$$

where a is the coefficient of expansion as measured on a constant-volume thermometer, showing that a small correction-factor must be applied, depending on the incipient cohesion or intermolecular attraction, represented by Laplace's K or Van der Waals' $\mathrm{A}\rho^2$.

To get K we must perform an irreversible operation, say a sudden expansion, δv, under adiabatic conditions, and observe the resulting small change of temperature $\delta\mathrm{T}$. If this operation is performed in a rigid vessel, so that no external work is done, the cooling will be due to internal work only; and the energy change can be expressed either as $\mathrm{K}\delta v$ or as $mc'\delta\mathrm{T}$, when eddies have subsided.

But instead of δv we may write $-\frac{v}{p}\delta p$ since the temperature is nearly constant, so that $\mathrm{K}= -\rho c'p.\frac{\delta\mathrm{T}}{\delta p}$ (6)

Hence, denoting by θ the small observed change of temperature corresponding to the change of pressure, π, and substituting in equation (5), we get finally as an expression for the absolute temperature of the gas experimented on, $\mathrm{T} = \frac{1}{a}\left(1 - c'\rho\frac{\theta}{\pi}\right) \; \dots\dots\dots\dots \; (7)$

To interpret this numerically:—The quantity $c'\rho$ will be recognised as the atomic heat, which is nearly the same constant for all ordinary gases, and equal in c.g.s. energy units to

$0{\cdot}2375 \times 0{\cdot}001293 \times (42 \times 10^6) = 0{\cdot}001294 \times 10^6$ ergs per c.c.

The observed change of temperature per atmosphere, observed as the final result of the irreversible Joule and Thomson expansion, was, for air, about a fifth of a degree, or more exactly 0·208°; so that

$$\frac{\theta}{\pi} = \frac{0{\cdot}208}{10^6} \text{ degrees per sq. cm.}$$

Hence the dimensions of the whole term, $c'\rho\ \theta/\pi$, come out right, as a pure number (being in fact obviously a ratio of two energies when ρ is written m/v); and for air the correction factor equals $1 + 0{\cdot}001294 \times 0{\cdot}208 = 1{\cdot}00027$.

At zero centigrade the expansibility of air was measured by Regnault as 0·0036706, wherefore the absolute temperature corresponding to zero centigrade is, in accordance with equation (7),

$$\frac{1{\cdot}00027}{0{\cdot}0036706} = 273{\cdot}17.$$

Journal and Patent Literature.

Patent Specifications may be obtained by post by remitting as follows:—
English.—8*d.* each, to the Comptroller of the Patent Office, C. N. Dalton, Esq., Southampton Buildings, Chancery Lane, London, W.C.
United States.—1s. each, to the Secretary of the Society.
French.—1 fr. 25 c. each, to Berlin et Cie., 56, Rue des Francs-Bourgeois, Paris (3e.).

I.—PLANT, APPARATUS, AND MACHINERY.

Patents.

Evaporators, freshwater distillers, feed water heaters, and the like. J. P. Halket, London. Eng. Pat. 15,164, July 1, 1907.

In order to avoid the necessity for the complete stoppage of the apparatus when the heating devices have to be withdrawn for cleaning, the latter are arranged as a number of separate coils or sets of "field-tubes," each coil or set being attached to a separate cover or lid, through which the inlet and outlet pipes pass, and which are fixed to the cover of the vessel. The heating elements are arranged in a ring and project down into the vessel, being supported from the cover of the latter. Each element has a separate, easily detachable connection to a steam-supply pipe and condensed water delivery pipe, arranged round the neck of the vessel. If it is necessary to clean or repair any element, the only delay caused is the time necessary to withdraw one or more elements and to close the opening with a blank cover. The apparatus may then be set to work again till the repaired heaters are ready to be replaced.—W. H. C.

Concentrating lyes [*especially soda-lyes*]. O. Venter, Chemnitz, Saxony. Eng. Pat. 26,935, Dec. 5, 1907.

The liquid to be concentrated is caused to trickle as a thin film over several vertically disposed heating surfaces, and a current of dry air, previously freed from carbon dioxide, is caused to flow in the opposite direction. The heating surfaces are arranged in a chamber with gilled heating pipes below and which has a layer of lime below the gilled pipes.—W. H. C.

Concentrating lyes. O. Venter, Chemnitz, Saxony. Eng. Pat. 27,482, Dec. 12, 1907. Under Int. Conv., June 17, 1907.

The claim is for the form and arrangement of the heating surfaces in a vacuum vessel. Two sets of inclined heating surfaces, over which the liquid to be concentrated trickles, are arranged one above the other. The lower is of smaller size and is inclined at a smaller angle than the upper. As the volume of the liquid decreases owing to the concentration, the speed with which, and the surface over which, it flows is less as the lower heating surface is smaller and less inclined than the upper. The dimensions are so arranged that the thickness of the film remains constant.—W. H. C.

Treating liquids; Apparatus for ——. W. F. M. Goss, La Fayette, Ind., Assignor to United States Distillation Co., Indianapolis, Ind. U.S. Pat. 890,227, June 9, 1908.

The supply pipe of a series of tubular treating chambers is arranged so that it passes through each chamber in succession and forms a continuous conduit for the liquid. It is provided, in each chamber, with a float-valve, which allows the liquid to enter any chamber in which the level of the liquid has fallen below a predetermined height.—W. H. C.

Furnaces for melting metals, glass, or the like, and for roasting or calcining ores, salt cake, or the like. L. Le B. Mount, London. Eng. Pat. 18,417, Aug. 14, 1907.

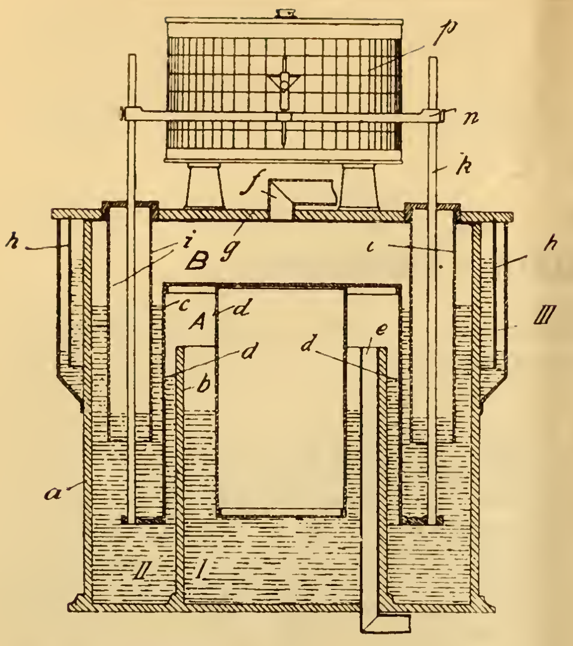
In these furnaces, which are provided with recuperators, it is arranged that the cold air enters the coolest part of the recuperator, and leaves the hottest part, *i.e.*, the part where the hot waste gases enter the recuperator from the furnace proper. The walls in the recuperator, forming a series of vertical flues through which the hot waste gases pass horizontally, are hollow and "are built of tiles placed diagonally in oblique courses so as to maintain the joints closed by gravity whilst providing for movement due to expansion." The air required for combustion in the furnace passes through the hollow spaces of the walls and is thus heated. The solid ends of the recuperator "are built of wedge-shaped bricks which are retained in position by means of an inverted arch." The furnace is provided with three crowns, so arranged as to form two partly-annular passages of approximately the full width of the crowns. The hot air from the recuperator passes through the lower annular passage to the furnace proper, whilst the waste gases, after passing the recuperator go through the upper annular passage and thence to the exit flues. The thrust, due to expansion, upon adjacent abutting work, such as the crown proper of the furnace and end walls, is taken up by suitable tiles or bricks arranged to leave spaces between them, sand or other suitable material being spread between the layers of tiles or bricks to prevent them sticking, and to enable them to yield easily to thrust due to expansion, without disturbing or deranging the adjacent brickwork.
—W. C. H.

Centrifugal separators; Drums of ——. W. E. Lake, London. From Aktiebolaget Separator, Stockholm, Sweden. Eng. Pat. 25,405, Nov. 15, 1907.

The curved vertical plates forming the liner of the separator are held in position by one or more sets of bars, bands, or links which pass either obliquely, or alternately vertically and horizontally, through holes in the plates. The object of the invention is to allow the plates to be widely separated for cleaning purposes.—W. H. C.

Measuring differences of pressure of two gases and the like; Hydrostatic differential manometer for ——. I. von Geldern, Düsseldorf, Germany. Eng. Pat. 23,304, Oct. 22, 1907.

The apparatus consists of a vessel, *a*, divided by the pipe, *b*, into two compartments, I and II, filled with glycerin. A bell, *c*, having a buoyant chamber, *d*, floats in the glycerin, and the vessel, *a*, is provided with a cover, *g*, luted in the glycerin of the outer chamber, III, by the pipe, *h*, and carrying two pipes, *i*, which dip into and are sealed in the glycerin in chamber, II. The space in which the greater pressure exists is connected by the pipe, *e*, with the space, A, and that in which the lesser pressure exists by the pipe, *f*, to B. The movement of the float-vessel is communicated through the liquid seal by the rods, *k*, which pass through the pipes, *i*, to the bar *n*,



which operates the pen on the recording drum, *p*, or a pointer on an indicator which is not shown in the figure. —W. H. C.

Centrifugal drying apparatus ; Continuous —— especially for saccharine materials. A. Günther. Fr. Pat. 386,014, Jan. 6, 1908.

The improvements claimed consist essentially in making the feed-pipe movable up and down, so that the material to be dried has a longer or shorter passage through the apparatus, and in providing a series of compartments, each having all its walls perforated except one, and through which the material passes before entering the basket proper of the machine.—A. S.

Cooling and liquefying gases and apparatus therefor. G. Hildebrandt, Berlin. Eng. Pat. 25,517, Nov. 18, 1907.

See Fr. Pat. 384,139 of 1907 ; this J., 1908, 396.—T. F. B.

Ice and cold ; Production of ——. E. C. R. Marks, London. From The Seay Internat. Ice and Refrigeration Machinery Co., Philadelphia, Pa., U.S.A. Eng. Pat. 25,806, Nov. 21, 1907.

The claim is for the use of a solid absorbent, anhydrous ammonium thiocyanate, for the anhydrous ammonia. Two absorbing and generating vessels are used which are mounted so as to be rotated on hollow trunnions and provided with coils through which a heating or cooling medium can be circulated through one of the trunnions. The ammonia enters and leaves the vessel through the other trunnion. Supposing one of the vessels to be charged with solid absorbent, and the other with absorbent saturated with ammonia, in which case it is liquefied, the method of working is as follows. A current of heating fluid is circulated through the coils in the liquefied mass; ammonia vapour is given off and the absorbent solidifies, the heat given out on solidification helping to drive off the ammonia. The ammonia vapour passes from the generator through a water-cooled refrigerating coil where it is liquefied, and thence through the coils of the refrigerator or ice-machine, where it is expanded and cools the contents. From the refrigerator the ammonia vapour passes to the other absorber, through the coils of which a cooling medium is circulated, and is absorbed by the solid absorbent, which liquefies and dissolves in the liquid ammonia, the heat becoming latent on fusion assisting the absorption. By reversing, from time to time, the direction in which the ammonia travels, the process becomes continuous.—W. H. C.

Moistening air ; Apparatus for ——. P. Kestner, Lille, France. Eng. Pat. 494, Jan. 8, 1908.

The air is passed through a slightly conical tube, which narrows towards the outlet, and is moistened by a number of water-spraying jets placed one behind the other in the tube, with the jets pointing in the direction in which the air is flowing and preferably centrally disposed with regard to the tube.—W. H. C.

Retort. C. F. McKenna, New York. U.S. Pat. 890,788, June 16, 1908.

The claim is for a vessel or retort provided with a removable cover having a tube by which it is connected to a receiver, with a valved inlet tube, and with an internal electric heating device, the terminals of which pass through the bottom of the vessel.—W. H. C.

Dry-kiln. A. J. Uphus, Assignor to The American Wood Extract Co., Seattle, Wash. U.S. Pat. 890,944, June 16, 1908.

A kiln chamber having inlet and outlet pipes communicating with the atmosphere, is surrounded on all sides by communicating flues. Steam is conveyed into the chamber by a perforated pipe and is discharged from the chamber either through the surrounding flues or directly into the air.—W. H. C.

Drying and carbonising kiln ; Continuously-operating ——. R. Bock, Prague-Smichow, Austria-Hungary. U.S. Pat. 891,456, June 23, 1908.

See Fr. Pat. 382,220 of 1907 ; this J., 1908, 152.—T. F. B.

Oven with gas chambers and regenerator hearths. E. Schmatolla. Fr. Pat. 386,694, Jan. 23, 1908. Under Int. Conv., Sept. 10, 1907.

A heating chamber is built above the generator, with lateral regenerator chambers, packed with bricks, on either side. The heating chamber communicates with the generator and regenerators by central as well as lateral flues placed between the heating chamber and the regenerators. The reversal of the latter is accomplished by moving a simple box made of refractory material over the ends of the flues which communicate with the air, the regenerators and the main flue, the arrangement being similar to a slide-valve. The heating chamber is extended upwards to form a receptacle for the raw material. As the material in the heating chamber commences to frit together, fresh material is introduced from above. The object is to force the hot gases to pass through the materials and to prevent them from passing between the roof of the heating chamber and the top of the material on the hearth. Larger furnaces are provided with two sets of flues and reversing boxes.—W. H. C.

Filter. P. J. Donovan, Grass Valley, Cal. U.S. Pat. 891,048, June 16, 1908.

Two concentric drums, the innermost of which is a filter drum, are mounted on a horizontal shaft so that they can be rotated. A number of paddles are also mounted on the shaft within the inner drum. The ends of the paddles bear against the interior face of the inner drum and are provided with valves which can be operated from without. A vacuum can be produced in the annular space between the drums by a pipe which passes through the shaft at one end, and air can be forced into the interior of the inner drum through a pipe which passes through the other end of the shaft.—W. H. C.

II.—FUEL, GAS, AND LIGHT.

Bueb vertical [gas] retorts. H. G. Colman and A. E. Broadberry. Report to the Carbonisation Committee of the Institution of Gas Engineers. J. Gas Lighting, 1908, **102**, 807—817.

The report gives the results of the investigation of the working of vertical retorts at Dessau and describes the working of the installations at Berlin (Mariendorf and Oberspree) (compare the following abstract). The installation tested at Dessau comprises ten 4-metre retorts, set in two rows of five; the section of the retorts is oblong with rounded corners, tapering from 22½ × 9 in. at the top to 27¼ × 13¾ in. at the bottom; the bottom mouthpiece is arranged about 8 ft. clear of the floor. The coal used was unscreened New Pelton; the average charge was 9½ cwt., and the carbonizing period 9½ to 10 hours; the test lasted three days, and on the second day steam was admitted to the retorts during the last hour of carbonisation. The average results of the three days' working were :—Coal carbonized, 34·575 tons; gas made, 394,520 cubic feet; gas made per ton, 11,410 cubic feet; average illuminating power of collected samples, 16·10 candles; average calorific power of collected samples, 602 B.Th.U. gross, 540 B.Th.U. net. (All figures are corrected to 60° F. and 30 in. barometer.) The coal carbonised whilst working with steam was not directly measured, but the results of carbonisation with and without steam, calculated by an indirect method, are given below, together with the results of exhaustive tests made at Mariendorf and at Zürich by Bunte :—

[A. Make per ton, in cubic feet. B. Make per retort per day, in cubic feet. C. Illuminating power, in candles. D. Calorific power, in B.Th.U. E. Nitrogen in gas, per cent. F. Actual weight of coke, percentage on coal used.]

	Dessau 4-metre retort. New Pelton coal.		Mariendorf 4-metre retort. Silesian coal.		Zurich 4-metre retort. Saar coal.	
	Without steam.	With gentle steaming.	Without steam.	With copious steaming.	Without steam.	With copious steaming.
A ..	11,259	11,680	11,400	13,810	12,180	13,820
B ..	13,072	13,560	14,563	15,827	14,392	15,458
C ..	16·45	15·37	15·90	12·16	9·11	6·23
D ..	604	596	585	537	591	561
E ..	2·9	2·6	1·1	1·3	—	—
F ..	16·25		14·6	14·1	13·9	15·0

The composition of the gas, collected in a test-holder connected by 1 in. piping to the gas main near the meter, was fairly uniform, typical analyses being as follows: Without steam—carbon dioxide, 0·8; unsaturated hydrocarbons, 2·9; oxygen, 0·2; carbonic oxide, 5·5; methane, 29·9; hydrogen, 57·5; nitrogen, 3·7 per cent.: and with steam—carbon dioxide, 1·0; unsaturated hydrocarbons, 2·9; oxygen, 0·3; carbonic oxide, 6·6; methane, 28·7; hydrogen, 57·4; nitrogen, 2·9 per cent. The nitrogen in the gas was determined directly, and attention is directed to the small quantity present in view of the yield of gas per ton of coal, 9 per cent. of nitrogen being common with horizontal retorts. The authors were given the following average figures for tar, ammonia, and cyanogen: Tar, 9·8 to 10·2 gallons per ton of coal; ammonia, 26·1 lb. of sulphate per ton; cyanogen, 2·87 lb. of crystallised sodium ferrocyanide per 10,000 cubic feet. Compared with the results given by horizontal or inclined retorts, the coke was harder and larger and contained less breeze; the tar contained a larger proportion of oils distilling below 170° C., between 170° and 270°, and between 270° and 350° C., and contained less naphthalene (3·6 per cent. of the dry tar) and very much less "free carbon" (0·4—0·6 per cent.). The liquor was of low strength, and contained very much less ammonium thiocyanate. The advantages of the vertical system, in the authors' opinion, are: Low labour charges, low cost of repairs to the retorts and to their mechanical equipment; high quality of coke and absence of breeze; the satisfactory yield, purity, lighting and heating value of the gas; increased yield of ammonia; and the thinness of the tar and consequent absence of retort-house troubles. (See also this J., 1908, 325.)—A. T. L.

Dessau [*Bueb*] *vertical* [*gas*] *retorts; Recent experience with the* ——. A. F. P. Hayman. J. Gas Lighting, **1908, 102,** 795—802.

The author describes the progress made by the Dessau system in Germany, and compares the results with those formerly obtained with inclined retorts. Fourteen German towns, including Berlin (two installations), Dortmund, and Cologne, have in operation 888 Dessau retorts; in addition there are installations at Zürich (100 retorts), and at Barcelona (150 retorts), the total production of gas by this system on the Continent being 5000 million cb. ft. per annum. Particulars are given of results obtained at Berlin (Mariendorf and Oberspree) and at Cologne (compare preceding abstract). The calorific value of the gas can be kept very uniform, and at Mariendorf the variations are only from 550 to 560 B.Th.U. The gas from vertical retorts contains less carbon bisulphide (compare this J., 1908, 152) and less cyanogen than the gas from inclined retorts, and naphthalene washers are not required. The retorts are worked almost without tools, and very little labour is required; at Mariendorf, with a production of 1,250,000 cb. ft. of gas daily, there are two men per eight-hour shift. In charging the retorts, the coal, separated in the bunkers into nuts and fine coal, is fed in two parallel streams, the nuts forming a column which aids the free passage of the gas. The maximum temperature of the furnace is kept between 1300° and 1500° C. The discharge of coke is perfect. Ascension pipes are cleaned once a week, and the retorts are scurfed every 6 or 7 weeks by slightly opening the bottom mouthpiece and allowing a slow draught to burn off the carbon without overheating. The residuals are of increased value, as compared with inclined retorts, owing to the decreased amount of breeze (from 6·5 to 1·5 per cent. on the coal carbonized), the improved quality of the tar, and the greater yield of ammonia. Comparing vertical and inclined retorts in a plant carbonizing 100 tons of coal daily, the value of residuals and cost of labour per ton of coal carbonized is given as follows :—

	Inclined.		Vertical.	
	s.	d.	s.	d.
Coke produced, less coke used for fuel	10	3·5	11	2·0
Breeze	0	3·9	0	0·9
Tar	0	10·8	1	3·0
Ammonia	1	3·9	1	7·2
Totals	12	10·1	14	1·1
Carbonizing wages..	0	9·4	0	5·0

The paper also includes diagrams showing the arrangement of retort house No. 1 at Mariendorf.—A. T. L.

Continuous carbonisation in vertical retorts. H. W. Woodall. J. Gas Lighting, 1908, **102,** 802—7.

The author describes the experimental installations at Poole of the Woodall-Duckham vertical retorts for continuous carbonisation, which preceded the erection at Bourne Valley of four settings, each of four retorts. This plant was started in January, 1907, and is running satisfactorily. The retorts are 25 feet long and of oval cross-section, 24 × 10 in. at the top and 30 × 22 in. at the bottom; they are made by machine in short sections. The combustion-chamber was at first arranged 4 feet below the top of the retorts, but this has since been altered and placed as near the top as possible. The retorts are charged from the hoppers by means of feed rolls, one roll serving two adjacent retorts. The charge rests on a plate beneath the retort, and the coke is discharged regularly over the edges of this plate by pushers making one double stroke per hour. The coke falls into a hopper, from which it is withdrawn by a scraper-conveyor working through a water-seal; the coke is immersed in water for about 15 seconds. The production of gas during the present year averaged, per ton of coal, 13,190 cb. ft., testing 14·1 candles on Carpenter's No. 2 "Metropolitan" burner after passing through oxide only. An improved discharging arrangement, which avoids passing the coke through a water-seal, is now in operation at Poole. The charge rests against a curved plate, which forms an extension of one side of the retort at its lower end and guides the coke into a self-sealing rotary discharging drum. The discharge is controlled by the rotation of an "extracting roller," comprising a horizontal spindle with radial arms, which is arranged at the lower edge of the curved plate and above the discharging drum. Among other advantages of the continuous system it is pointed out that a coal which swells in the retort can be used, since space is allowed by the removal of coke at the bottom, and the supply of fresh fuel ceases until the fuel column at the top of the retort descends.—A. T. L.

Patents.

Coking ovens. D. Wright, Wigan. Eng. Pat. 13,292, June 8, 1907.

A conduit fitted with a valve for each oven is carried along the top of the series of ovens. When any oven is being charged, the gases therefrom are led away through this conduit and into the hydraulic main, after passing through one or more of the adjoining ovens. From the hydraulic main the gases are passed to the usual scrubbers for the recovery of by-products and finally back to the ovens or to a furnace of any kind.—J. W. H.

Cleaning or washing smoke or gases. J. Black and A. H. and H. Lennox, Newcastle-on-Tyne. Eng. Pat. 15,172, July 1, 1907.

In the apparatus described in Eng. Pat. 14,675, of 1907 (this J., 1908, 617), swing dampers are provided at one end of the casing. When these dampers are turned into a vertical position, they form a vertical passage at one end of the casing, through which the smoke passes without traversing the compartments formed by the horizontal partitions. When the dampers are in a horizontal position, the smoke is compelled to pass in a zig-zag course through the above-mentioned compartments.—W. H. C.

Oven with compartments for the gasification of coal and the roasting of minerals and other bodies. H. Ries. Fr. Pat. 386,554, Jan. 25, 1908. Under Int. Conv., Jan. 26, 1907.

The inclined working chambers have heating flues between them and are supported on solid piers, which extend down to the foundations and have their upper ends gathered over to form corbels. The gas- and air-supply flues terminate just below the spring of the corbels, so that the zone of maximum temperature is just below the latter, which are consequently highly heated and communicate the heat to the sole of the working chambers. In this way the necessity for a flue beneath the sole is obviated.—W. H. C.

Gas-producer. G. Westinghouse, Pittsburg, Pa., Assignor to Westinghouse Machine Co. U.S. Pat. 890,951, June 16, 1908.

The claim is for a producer chamber with up and down draught inlet ports for the blast. The gas is taken off through a vertical water-jacketed pipe, provided with ports, which extends upwards into the centre of the generator from the bottom, and is protected at the top by a water-jacketed hood.—W. H. C.

Incandescence bodies; Process of preparing —— from artificial silk for gas lighting. Cerofirm-Ges. m. b. H. Fr. Pat. 386,549, Jan. 25, 1908.

Certain substances are added to the bath of hydrogen peroxide in which the mantles are immersed after being impregnated with salts of cerium and thorium, in order that both the rare earths may be converted into insoluble bodies. For this purpose organic acids and their salts are recommended.—W. H. C.

Filaments for lighting and heating by gas or by electricity in the open air; Process and apparatus for the continuous manufacture of ——. G. Michaud and E. Delasson. Third Addition, dated Jan. 16, 1908, to Fr. Pat. 378,665, June 10, 1907 (this J., 1907, 1131).

The filament after extrusion from the tube, and before it enters the infusible tube where it is heated by the electric arc, is exposed to the heat of several oxy-hydrogen blowpipes, which are arranged in a ring, so that the flames converge upon the filament.—W. H. C.

Filaments; Methods of producing refractory electric conductors, particularly metallic ——. The British Thomson-Houston Co., Ltd., London. From General Electric Co., Schenectady, U.S.A. Eng. Pat. 15,367, July 3, 1907.

Carbon filaments are packed with an oxide of tungsten (WO_3, W_2O_5) in a refractory vessel and fired in a vacuum furnace. These oxides vaporise in the vacuum without complete decomposition, and penetrating the filament, become reduced to metal. The resulting filament appears homogeneous under the microscope and may be used in electric incandescence lamps.—J. W. H.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

Petroleum from Alsace; Optical examination of ——. M. A. Rakusin. Petroleum, 1908, 3, 948—951.

Biot in "the 18th century" described a lævorotatory petroleum ("le naphtha"), and the author therefore anticipated that petroleum from Biot's native province, Alsace, might also show a lævo-rotation. The crude petroleum, from Pechelbronn, was an almost odourless, colourless liquid, free from dichroism. It had a specific gravity of 0·8012 at 15° C., and its rotation was +2° in the saccharometer ($l = 200$ mm.). On fractional distillation it yielded distillates, the specific gravity, &c., of which showed a regular increase, and all of which were slightly dextro-rotatory. The residue, which was nearly solid, was soluble in petroleum spirit (benzine) and in benzene. The author concludes that crude Alsace petroleum is rich in paraffins and highly carbonised, (*i.e.*, rich in asphaltic or resinous substances), its "carbonisation constant" being $k = \frac{1}{32}$ per cent. The occurrence of lævo-rotation has been mentioned by Engler in the case of Java oil, and by Jones and Wootton in the case of petroleum from Borneo (this J., 1907, 919), but the origin of Biot's lævo-rotatory oil remains unknown.
—C. A. M.

Roumanian petroleum; The "cracking" process in the working-up of ——. G. Kraemer. Petroleum, 1908, 3, 894—895.

The author shows that by distillation under pressure, as in the "cracking" process, the high-boiling constituents of Roumanian petroleum yield large quantities of gases —carbon dioxide and monoxide, methane, etc.—and considerable quantities of unsaturated hydrocarbons, which on subsequent treatment with sulphuric acid, are almost entirely converted into tarry products. He recommends that the ordinary method of distilling should be followed only for the obtainment of the fractions up to the lighting oils, and that the higher-boiling constituents should be distilled under strongly diminished pressure in vertical retorts. In this way the distillation can be carried so far that only a residue of asphaltum is left, without fear of any considerable decomposition.—A. S.

Patents.

Ammonium sulphate; Producing —— from gases of the dry distillation of organic substances. H. Koppers, Essen-Ruhr, Germany. Eng. Pat. 2399, Feb. 3, 1908.

Steam carrying the ammonia, formed in the process of dry distillation, is mixed with an inert gas such as nitrogen, so that the partial pressure of the steam is reduced to such an extent that its condensation point falls considerably below the temperature of the sulphuric acid in which the ammonia is absorbed. In this way the steam is not condensed, and ammonium sulphate separates in the form of an almost neutral solid salt. The "ammonia water" also formed by dry distillation, is first treated with lime and steam in suitable stills, and the steam and ammonia evolved are then treated as above. Before coming into contact with the sulphuric acid, the gaseous mixture may be heated so as to vaporise the water of reaction formed in the acid bath.—O. R.

Wood-distilling apparatus. Z. E. Fiveash and C. B. Leonard, Rawles Springs, Miss. U.S. Pat. 890,418, June 9, 1908.

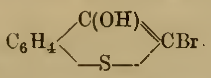
The claim is for an inclined retort provided with doors at each end, with a "heater" pipe having its lower portion perforated, and with a distillate pipe communicating with the upper portion of the chamber. The wood is brought by a trough conveyor and is discharged into a hopper situated above the upper end of the retort and from which the latter is charged. The residue left in the retort after distillation is discharged from the lower end into a second trough conveyor.—W. H. C.

Oils and greases for lubricating machinery. Eng. Pat. 20,059. *See* XII.

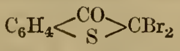
IV.—COLOURING MATTERS AND DYESTUFFS.

Indigoid dyestuffs. I. P. Friedlaender. *II.* A. Bezdzik and P. Friedlaender. *III.* P. Friedlaender and R. Schuloff. Monatsh. Chem., 1908, **29**, 359—393. (Compare this J., 1908, 398.)

A useful account of the present state of knowledge of the indigoid dyestuffs is given. The following are new methods of preparing Thioindigo (2 : 2-bisthionaphtheneindigo). (1) By adding sodium acetate to an alcoholic solution of monobromo-oxythionaphthene,

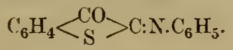


In a similar manner 2 : 4-dibromo-α-naphthol is converted into bis-4-bromo-2-naphthalene-indigo. (2) By heating 2-dibromo-3-ketodihydrothionaphthene



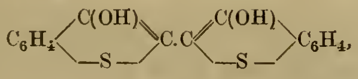
$$C_6H_4<\substack{CO\\ S}>CBr_2$$

either alone or in nitrobenzene solution to 140—150° C. (3) By passing a current of hydrogen sulphide through a glacial acetic acid solution of thionaphthenequinoneanilide,

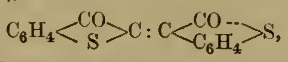


$$C_6H_4<\substack{CO\\ S}>C{:}N.C_6H_5.$$

Thioindigo White

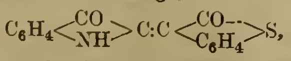


is obtained by oxidising oxythionaphthene with ferric chloride or by reducing Thioindigo with alkaline sodium hydrosulphite and subsequently acidifying. It is practically insoluble in water but readily soluble in the ordinary solvents or dilute caustic soda. The diacetyl derivative is prepared by boiling Thioindigo with glacial acetic acid and acetic anhydride, and adding zinc dust until the colour is discharged. 2 : 3 Bisthionaphthene-indigo (Thioindirubin),



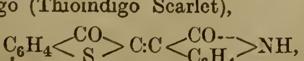
$$C_6H_4<\substack{CO\\ S}>C:C<\substack{CO\text{--}\\ C_6H_4}>S,$$

is obtained by condensing equal parts of oxythionaphthene and thionaphthenequinone in glacial acetic acid solution with the addition of a little hydrochloric acid. It forms red needles melting at 205—207° C. 3-Thionaphthene-2-indole-indigo,



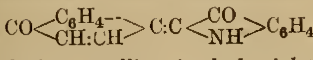
$$C_6H_4<\substack{CO\\ NH}>C{:}C<\substack{CO\text{--}\\ C_6H_4}>S,$$

obtained by condensing indoxyl and thionaphthenequinone in glacial acetic acid solution with addition of a little hydrochloric acid, consists of violet-black, shining needles melting at 247—250° C. 2-Thionaphthene-3-indole-indigo (Thioindigo Scarlet),



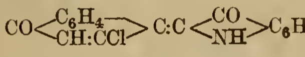
$$C_6H_4<\substack{CO\\ S}>C{:}C<\substack{CO\text{--}\\ C_6H_4}>NH,$$

is prepared by the same process from oxythionaphthene and isatin. It forms red needles which do not melt up to 270° C With alkaline sodium hydrosulphite it gives a pale yellow vat from which textile fibres are dyed a fast scarlet. 2-Thionaphthene-2-indole-indigo (this J., 1908, 398) is more conveniently prepared by condensing isatin chloride with oxythionaphthene in benzene solution, preferably in presence of phosphorus oxychloride. It may also be obtained by condensing oxythionapthene and α-isatinanilide either by heating in petroleum or by boiling with acetic anhydride. An improved method of preparing 2-naphthalene-2-indole-indigo (this J., *loc. cit.*) consists in condensing α-naphthol and α-isatinanilide in acetic anhydride solution. In the preparation by the use of isatin chloride, an isomeric dyestuff of the constitution,



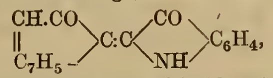
$$CO<\substack{C_6H_4\text{--}\\ CH{:}CH}>C{:}C<\substack{CO\\ NH}>C_6H_4,$$

is formed, which crystallises in dark violet prisms. By condensing isatin chloride with 2-chloro-α-naphthol, a dyestuff of the formula,

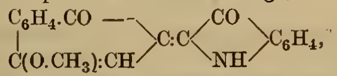


$$CO<\substack{C_6H_4\text{--}\\ CH{:}CCl}>C{:}C<\substack{CO\\ NH}>C_6H_4,$$

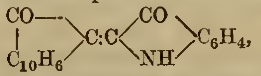
is obtained. This is very similar to the preceding one. 1-Naphthalene-2-indole-indigo,



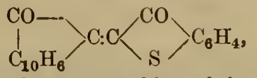
prepared by condensing isatin chloride with α-naphthol in benzene solution, forms blackish violet needles. 4-Methoxy-2-naphthalene-2-indole-indigo,



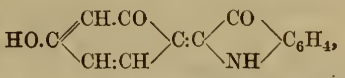
is formed by condensing isatinanilide with 4-methoxy-α-naphthol in acetic anhydride solution. Bluish-black needles are obtained which give greener and purer blue solutions than the unsubstituted dyestuff. On boiling with caustic soda it yields 1-hydroxy-4-methoxy-2-naphthaldehyde. Acenaphthene-indole-indigo,



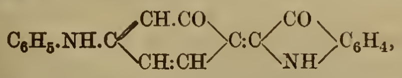
results from the condensation of acenaphthenequinone and indoxyl in glacial acetic acid solution. Alkaline reducing agents convert it into a vat from which textile fibres are dyed reddish-violet. Acenaphthenethionaphtheneindigo,



produced by condensing oxythionaphthene and acenaphthenequinone in glacial acetic acid solution with addition of a few drops of hydrochloric acid, crystallises in brick-red needles and on reduction furnishes a vat from which textile fibres are dyed red. 4-Hydroxybenzene-2-indole-indigo,



is obtained by condensing isatin chloride with resorcinol in benzene solution. It forms bronzy, dark violet needles. 4-Methoxybenzene-2-indole-indigo, prepared similarly from resorcinol monomethyl ether, forms brownish-violet needles melting at 162° C. 4-Diphenylamine-2-indole-indigo,



is prepared by condensing isatin chloride and *m*-hydroxydiphenylamine in benzene solution. It forms violet needles and gives a yellowish vat with sodium hydrosulphite. 3-Hydroxybenzene-2-indole-indigo, obtained from catechol and isatin chloride, forms violet-black needles melting at 245° C. It dyes cotton mordanted with iron or chrome greenish-blue. 3 : 4-Dihydroxybenzene-2-indole-indigo, prepared from pyrogallol and isatin chloride, forms blackish-violet needles. It gives bluish-violet shades on chrome- or iron-mordanted cotton.

—J. C. C.

Picric acid; Oxidation by means of ——. Action on aniline —— formation of indulines. A. Bacovescu. Buletinul de Chimie, 1908, **10**, 3—5. Chem. Zentr., 1908, **1**, 2034—2035.

On heating aniline with picric acid at about 225° C., with or without the addition of concentrated hydrochloric acid, a dark brown product is obtained easily soluble in chloroform, and partly soluble in ether. By means of the solvents mentioned, two different substances, probably indulines, can be separated, the one of a greyish-black and the other of a brownish colour. Both give blue solutions in concentrated sulphuric and glacial acetic acids, and are precipitated on addition of water. When sulphonated with fuming sulphuric acid at about 160° C., they yield products soluble in alkalis and partly soluble in water.—A. S.

Pyranol salts related to brazilein und hæmatein; Synthesis and constitution of certain ——. W. H. Perkin, R. Robinson, and (in part) M. R. Turner Chem. Soc. Trans., 1908, **93**, 1085—1115.

Brazilin, hæmatoxylin, and their derivatives. Part IX. On brazilein, hæmatein, and their derivatives. P. Engels, W. H. Perkin, and R. Robinson. Chem. Soc. Trans., 1908, **93**, 1115—1162.

Rosocyanin. [Detection of boric acid by means of turmeric]. L. Clarke and C. L. Jackson. *See* XXIII.

PATENTS.

Leucogallocyanine corresponding with pyrogallol; Manufacture of the ——. Farbw. vorm. L. Durand, Huguenin, und Co., Huningen, Germany. Eng. Pat. 1334, Jan. 20, 1908. Under Int. Conv., Jan. 21, 1907.

The leucogallocyanine obtained as described in Eng. Pat. 21,415 of 1898 (this J., 1899, 827) or 7835 of 1905 (this J., 1905, 885) in the form of a salt (hydrochloride, sulphate, etc.), is heated with water to about 100° C., in presence or absence of sodium acetate, sulphate, or bisulphate, or hydrochloric acid. The process may be combined, in one operation, with the reduction of the gallocyanine as described in the patents mentioned. (See also Fr. Pat. 369,835 of 1906; this J., 1907, 195).—A. S.

Gallocyanine dyestuff; Manufacture of a ——. Farbw. vorm. L. Durand, Huguenin und Co., Hüningen, Germany. Eng. Pat. 2306, Feb. 1, 1908. Under Int. Conv., Feb. 14, 1907. Addition to Eng. Pat. 1334 of 1908.

A leucogallocyanine of the same properties as that described in Eng. Pat. 1334 of 1908 (see preceding abstract) is obtained when the salts formed by the ordinary gallocyanine with acids are heated with water in presence or absence of a metallic chloride or free hydrochloric acid.—J. C. C.

Amido-naphthol-disulphonic acid; Manufacture of an ——. Chem. Fabr. Griesheim-Elektron, Frankfurt a/M., Germany. Eng. Pat. 3655, Feb. 18, 1908. Under Int. Conv., Feb. 18, 1907.

1-Amino-2-naphthol-4-sulphonic acid can be sulphonated by introducing 239 parts into 1200 parts of monohydrated sulphuric acid, adding 350 parts of sulphuric acid containing 25 per cent. of anhydride, and heating the mixture to 50° C. until the product is completely soluble in water. The liquid is then poured into ice water, and the acid sodium salt of the disulphonic acid separated as a pink powder by adding common salt to the solution. The same disulphonic acid can also be obtained by heating 1 part of 1-amino-2-naphthol-4-sulphonic acid with 5 parts of monohydrated sulphuric acid to 100° C., care being taken that this temperature is not exceeded. The acid formed is probably the 4.6-disulphonic acid.—P. F. C.

Sulphur dyestuff; Brown —— and process of making same. G. List, Offenbach-on-the-Maine, Assignor to Chem. Fabrik Griesheim-Elektron, Frankfort-on-the-Maine, Germany. U.S. Pat. 889,936, June 9, 1908.

Brown sulphide dyestuffs are obtained by melting aromatic *m*-dinitro-compounds of the general formula, $C_6H_3X(NO_2)_2$, where X is the atom or group, H, CH_3, Cl, $NH.C_6H_5$, $NH.C_6H_4.CH_3$, S., with glycerin and alkali polysulphides. Unmordanted cotton is dyed in brown shades. Special mention is made of chlorodinitrobenzene.—J. C. C.

[Quinoline] dyestuff; Yellow ——. E. Meyer, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U. S. Pat. 890,588, June 9, 1908.

p-Chloroquinaldine is condensed with phthalic anhydride and the resulting quinophthalone treated with sulphonating agents. The sodium salt of the product is a yellow powder giving a yellow solution in concentrated sulphuric acid and dyeing wool and silk from an acid bath in greenish-yellow shades.—J. C. C.

Vat dyestuff [from indanthrene]; Process for producing a ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 385,892, Jan. 2, 1908. Under Int. Conv., April 18, 1907.

See Ger. Pat. 198,024 of 1907; following.—T. F. B.

Vat dyestuff of the anthracene series; Preparation of a green —— [from indanthrene]. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 198,024, April 19, 1907.

According to Scholl (this J., 1907, 193) indanthrene, on treatment with nitric acid, yields nitrodinitrosotrihydroxy- or tetranitrotetrahydroxy-anthraquinoneazine. It is now found that if the reaction be carried out in nitrobenzene solution, a vat dyestuff is obtained which gives green shades on cotton.—A. S.

Anthracene derivatives; Production of ——. Farbenfabr. vorm. F. Bayer und Co. 1st Addition, dated Jan. 16, 1908, to Fr. Pat. 372,676, Dec. 18, 1906. Under Int. Conv., Mar. 6, 1907.

Sulphonic acids of the acetyl derivatives of secondary alkylamino- or arylamino-anthraquinones mentioned in the chief patent (this J., 1907, 523) can be transformed into anthrapyridones by boiling them with alkaline condensing agents (dilute caustic soda). 1-Acetylmethylaminoanthraquinone-5-sulphonic acid thus yields a dyestuff giving yellow shades on wool. The anthrapyridone prepared from 1-acetylmethylaminoanthraquinone-4-sulphonic acid dyes wool in yellow, and that from 1 - acetylmethylamino - 4 - methylaminoanthraquinone-5-sulphonic acid in bluish-red shades.—J. C. C.

Anthraquinone derivatives; Process of making halogenated ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 386,599, Jan. 27, 1908. Under Int. Conv., May 16, and June 11, 1907.

When anthraquinonesulphonic acids are treated with halogens, the sulphonic acid groups are replaced by the latter. The two groups of a disulphonic acid may thus be replaced step by step, giving rise to a halogenated monosulphonic acid, and finally to a dihalogen derivative. The operation is carried out by dissolving the sodium salt in water, adding hydrochloric acid, and, after heating to 100° C., passing a stream of chlorine or adding a solution of sodium chlorate. When bromoderivatives are required, the potassium or sodium salt of the sulphonic acid is heated with water and bromine to 180—190° C. under pressure.—J. C. C.

Diphenylnaphthylmethane dyestuffs; Preparation of new ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 386,814, Feb. 1, 1908. Under Int. Conv., July 24, 1907.

Dyestuffs fast to alkalis are obtained by condensing tetra-alkyldiaminodiphenylcarbinols with 1-naphthol-3 : 8-disulphonic acid or 1-naphthol-3 : 6 : 8-trisulphonic acid and oxidising the resulting leuco-bases. The dyestuff prepared by condensing tetramethyldiaminodiphenylcarbinol with 1-naphthol-3 : 8-disulphonic acid in presence of 40 per cent. sulphuric acid, and oxidising the resulting leuco-base with lead peroxide, dyes wool greenish-blue. The dyestuff prepared similarly from 1-naphthol-3 : 6 : 8-trisulphonic acid dyes wool in bluish-green shades, as do the analogous dyestuffs obtained by the use of tetra-ethyldiaminodiphenylcarbinol.—J. C. C.

Vat [thioindigo] dyestuff ; Red —— and process of making same. A. Grob, Assignor to Basle Chemical Works, Basle, Switzerland. U.S. Pat. 891,690, June 23, 1908.

See Eng. Pat. 344 of 1908 ; this J., 1908, 399.—T. F. B.

Indigo ; Production of stable chloro-derivatives of ——. Ges. f. Chem. Ind. in Basle. Fr. Pat. 386,841, April 19, 1907.

See Eng. Pat. 9546 of 1907 ; this J., 1908, 116.—T. F. B.

β-Naphthylindigo ; Production of halogen derivatives of ——. Soc. pour l'Ind. Chim. à Bâle. Fr. Pat. 386,858, April 23, 1907.

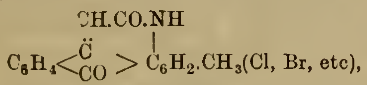
See U.S. Pat. 872,227 of 1907 ; this J., 1907, 1274.—T. F. B.

Indoxylic compounds ; Process of producing ——. H. Labhardt, Mannheim, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U. S. Pat. 891,708, June 23, 1908.

See Eng. Pat. 12,243 of 1906 ; this J., 1907, 88.—T. F. B.

Anthraquinone series ; New products of condensation of the —— and dyestuffs derived therefrom. Badische Anilin und Soda Fabrik. Fr. Pat. 386,606, Jan. 27, 1908. Under Int. Conv., May 13, Aug. 2, Aug. 9, and Dec. 28, 1907, and Jan. 18, 1908.

When acetylaminoanthraquinones containing a substituent such as CH_3, Cl, Br, etc., in the 2-position are treated with condensing agents such as sodium ethoxide, alcoholic soda, pyridine and caustic alkali, ammonia, aromatic bases, such as aniline and *p*-toluidine, etc., new products are formed which are usually yellow and are not decomposed by sulphuric acid at 80° C. 1-Acetylamino-2-methylanthraquinone and its derivatives undergo this condensation simply on heating. The compounds, which have the constitution



$$\begin{array}{l} \qquad\quad CH.CO.NH \\ \qquad\qquad\qquad\quad | \\ C_6H_4<\begin{matrix}\ddot{C}\\CO\end{matrix}>C_6H_2.CH_3(Cl,\ Br,\ etc), \end{array}$$

are termed 2-methyl (chloro, bromo, etc.), anthrapyridones. If the position 2 is not substituted, condensation does not take place. Those derivatives which contain a halogen atom in the 4-position to the amino-group readily exchange this for an arylamino-group when heated with an aromatic amine. On sulphonating the resulting arylaminoanthrapyridones dyestuffs are obtained which dye wool in very fast red shades. Further, when 4-chloro (or bromo)-2-methylanthrapyridone is condensed with 2-amino- or 2 : 6- or 2 : 7-diamino-anthraquinone, vat dyestuffs are obtained giving red shades. These may also be directly prepared by condensing 4-chloro (or bromo)-2-methyl-1-acetylaminoanthraquinone with 2-amino- or 2 : 6- or 2 : 7-diamino-anthraquinone. An alternative process is to condense 4-amino-2-methylanthrapyridone with the 2-halogenated or the 2 : 6- or 2 : 7-dihalogenated anthraquinone.—J. C. C.

Vat dyestuffs of the anthraquinone series ; Preparation of blue ——. Badische Anilin und Soda Fabr. Ger. Pat. 198,025, June 23, 1907.

A diaminodianthraquinonylamine containing at least one amino group in an ortho position to a carbonyl group, is treated with acetic anhydride or glacial acetic acid in presence of concentrated or fuming sulphuric acid. Dyestuffs are obtained which give clear blue shades on cotton from a hydrosulphite vat. The process can be applied to all anthraquinone derivatives consisting of two anthraquinone nuclei united by one or two imino groups, and containing at least one amino or monosubstituted amino group in an ortho position to a carbonyl group.—A. S.

Sulphide dyestuffs ; Process for preparing ——. Act.-Ges. f. Anilinfabr. Fr. Pat. 386,847, April 20, 1907.

See Eng. Pat. 9011 of 1907 ; this J., 1908, 71.—T. F. B.

Tanning materials, dyewoods, beetroots, &c. ; Lixiviation of ——. Fr. Pat. 306,820. *See* XIV.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

Keratin molecule ; Position of the sulphur atom in the ——. O. Baudisch. *See* XXIV.

Animal fibres ; Reducing power of ——. G. Ulrich. Z. physiol. Chem., 1908, **55**, 25—41.

On mordanting wool with potassium bichromate and sulphuric acid, compounds of chromic acid and of chromic oxide, of a more or less brown colour, are fixed on the fibre. On increasing the proportion of sulphuric acid, the deposits have a greener shade and are richer in compounds of chromic oxide. The reduction is effected by the products formed by the gradual hydrolysis of the fibre-substance by the acid. In practice formic and lactic acids are used, with the view of accelerating the reduction. Experiments on the action of formic acid on chromic acid, showed that a tolerably high reaction-velocity is attained only at very high concentrations of formic acid: for instance, even with 500 mols. of formic acid per mol. of chromic acid, the reduction is not complete after boiling for one hour. Experiments in presence of wool showed that the formic acid has little influence on the reduction process, the conversion of the chromic acid into compounds of chromic oxide being caused, even in its presence, by the products formed by hydrolysis of the fibre substance. The *rôle* played by formic acid in the mordanting process is that of accelerating the absorption of chromium compounds by the fibre.—A. S.

Patents.

Artificial silk and the like ; Manufacture of machinery suitable for the preparation of ——. W. P. Dreaper, Felixstowe. Eng. Pat. 13,868, June 15, 1907.

In the production of artificial silk by the Thiele process (Eng. Pat. 8083 of 1902 ; this J., 1903, 550), the solution of cellulose, as it issues from the jets, is first led into a comparatively weak solution of the precipitating reagent, and the newly-formed thread, as it passes on its course, is afterwards brought into contact with a more concentrated solution of the precipitant. This may be effected as follows :—In the long outer tube, into which the jet of cellulose solution is discharged, a shorter, inner tube is introduced, which surrounds the jet and extends for a short distance along the path of the thread. The more dilute solution of the precipitant enters this inner tube above the jets by a supply pipe, and thus a fresh solution of constant strength is kept in contact with the newly-formed thread. The more concentrated solution of the precipitating reagent is introduced into the upper end of the outer tube and flows in the same direction as the more dilute solution, with which it gradually mixes.—P. F. C.

Cellulose ; Manufacture of threads or filaments of ——. A. Lecoeur, Rouen, France. Eng. Pat. 18,936, Aug. 22, 1907.

See Fr. Pat. 381,939 of 1907 ; this J., 1908, 221.—T. F. B.

Volatile solvents used in the manufacture of artificial silk ; Recovery of ——. O. Bucquet. Fr. Pat. 386,833, Feb. 3, 1908.

See Ger. Pat. 196,699 of 1907 ; this J., 1908, 558.—T. F. B.

Bleaching seed-cotton ; Apparatus for ——. J. B. Brennan, Sherman, Texas. U.S. Pat. 884,359, April 14, 1908.

The cotton to be treated is drawn through a flue and delivered into a receiving box. This in turn delivers it on to an endless travelling band, consisting of a number of parallel wooden rods, by which the cotton is carried horizontally through a casing containing the bleaching agent and finally dropped into a receiving bin. The ends of this casing are provided with flexibly mounted leaves for preventing the free escape of the bleaching

agent. During its journey, the cotton is sifted, and the waste falls through the openings in the travelling band on to the floor of the casing. Means are provided for collecting this waste and delivering it into a hopper.
—P. F. C.

Colour printing on half-wool fabrics. O. Ostersetzer, Grünberg, Germany. Eng. Pat. 25,801, Nov. 21, 1907.

When half-wool goods, which have been uniformly dyed with easily reducible dyestuffs, are printed with the usual coloured discharges, and steamed, the shade obtained upon the cotton is less intense than that obtained upon the wool, especially in those cases where the fabric has previously been treated with chlorine. It is proposed to dye the cotton with dyestuffs (sulphide dyestuffs, for instance), which are not readily reduced, and the wool with such as are easily discharged. In the example given, the cotton is dyed with Thiogen Black B2R (liquid) in the cold, and the wool is afterwards dyed at the boil with Naphthalene Blue. When printed with a reducing paste containing Thioflavine T, and steamed, the ground shade on the cotton is less affected than is that upon the wool and acts as a mordant, assisting the fixation of the basic dyestuff and tending to keep the coloured discharge on the cotton and wool fibres more uniform in shade.
—F. M.

Drying proofed and like fabrics; Apparatus for ——. J. Spenle, Salford. Eng. Pat. 17,780, Aug. 3, 1907.

The apparatus is intended for the drying of fabrics which have been coated with rubber, guttapercha, pyroxylin, etc., where an efficient recovery of the solvents is desired. Steam chests or pipes are arranged vertically in the drying chamber, for drying the fabric by contact or radiation, the material being led over rollers in such manner that the face side is not touched until it is dry. The walls of the drying chamber are cooled by means of water pipes or a jacket, and cooling pipes may also be placed in the chamber, so that the vapours of the volatile solvents condense on these cold surfaces and the liquid trickles down into troughs or receptacles. The top of the chamber is heated to prevent any condensation there, and risk of damage to the fabric from drops of solvent.
—F. M.

VII.—ACIDS, ALKALIS, AND SALTS, AND NON-METALLIC ELEMENTS.

Copper and nitric acid; Interaction of —— *in presence of metallic nitrates considered with reference to the existence of hydrates in solution.* E. H. Rennie, A. J. Higgin, and W. T. Cooke. Chem. Soc. Proc., 1908, **24**, 141—142.

The authors find that in most cases the addition of metallic nitrates greatly accelerates the dissolution of copper in nitric acid, but that nitrates such as those of rubidium and cæsium, cause considerable retardation. They consider that these effects are due to the withdrawal of water or nitric acid from the solution by the salts, and the consequent concentration or dilution of the acid, and regard their results as confirmatory of the views now generally held that conbination takes place between solvent and solute. They find, moreover, that the accelerations produced by the nitrates of any one group of metals decrease as the atomic weights of the metals increase. When copper nitrate is added to the nitric acid, the dissolution is greatly accelerated. Hence the view that the autoacceleration always observed when copper is dissolved in nitric acid is due to nitrous acid, requires to be modified, the accumulation of copper nitrate in the solution being an important factor in the progress of the change. In discussion V. H. Veley said the results obtained by the authors might in some cases be due, not to the nitrates *per se*, but also to the nitrous acid or nitrites formed therefrom. Thus, when the conditions are such that copper dissolves in nitric acid (containing nitrous acid), copper nitrite is initially formed, which is subsequently converted into the nitrate. It appeared to him that it would be of interest if the authors were to extend their investigations to metals other than copper, such as mercury, which dissolves initially as mercurous nitrite, yielding mercurous nitrate and, finally, mercuric nitrate under certain conditions. Silver and bismuth behave generally as copper. W. C. Reynolds pointed out that nitric acid, with or without the presence of nitrates, has no action on copper, if free from nitrous acid, even in the case of much stronger acid than that referred to. The removal of the nitrous acid could be effected in a few seconds at the ordinary temperature by adding a trace of sodium peroxide to the acid solution—the addition of carbamide was not so effective. The alkaloids, morphine, and especially brucine, afford colour tests for the presence of nitrous acid in such acid solutions, and the addition of either should cause no coloration for some hours in the absence of nitrous acid (Reynolds and Sutcliffe, this J., 1906, 512). Some of the apparently anomalous results of the authors might be due to the varying amount of the "trace" of nitrous acid present. H. E. Armstrong said that, whilst he was in accord with the authors that salts exercised a "concentrating effect," he did not think that the acceleration observed was due to the direct withdrawal of water from the nitric acid; the acid used was too dilute and the proportion of salt too small to account, on such an assumption, for the effects produced. It was, however, well known that the dissolution of copper was dependent on the presence of nitrous compounds, and he was inclined to think that salts produced their effect by modifying the condition of these compounds in solution. From this point of view, the observations were most striking and valuable as throwing fresh light on the changes involved in the dissolution of metals in presence of nitric acid. As to the influence of copper nitrate, it was to be remembered that the heat of dissolution of copper in nitric acid is a negative quantity, and that, from this point of view, copper nitrate is a more effective solvent of copper than the acid.

Phosphoric acids; Hydrates of the ——. H. Giran. Compt. rend., 1908, **146**, 1270—1272.

The freezing-point curve of mixtures of orthophosphoric acid and water shows two minima at 22·5° and —81° C., corresponding respectively to eutectics of the composition, $H_3PO_4+0{\cdot}135H_2O$ and $H_3PO_4+2{\cdot}305H_2O$, and one maximum at 29° C., corresponding to the hydrate, $2H_3PO_4,H_2O$. Pyrophosphoric acid also shows two minima, at 23° and —75° C., corresponding to the eutectics, $H_4P_2O_7+1{\cdot}25H_2O$ and $H_4P_2O_7+6{\cdot}87H_2O$, and one maximum at 26° C., corresponding to the hydrate, $2H_4P_2O_7,3H_2O$. These points are less distinctly marked than those of the orthophosphoric series, and the hydrate is less stable, and readily passes into the ortho-condition; measurements of the heats of formation of the two are in accord with this. No eutectics nor hydrates of metaphosphoric acid could be differentiated by this method.
—J. T. D.

Phosphoric acid in phosphates; Volatilisation of —— *by means of a current of chlorine and carbon tetrachloride.* P. Jannasch and W. Jilke. J. prakt. Chem., 1908, **78**, 21—28.

The authors have effected several improvements in their method for the quantitative removal of phosphoric acid from phosphates by heating them in a current of chlorine and carbon tetrachloride (this J., 1907, 1164). From 0·3 to 0·4 grm. of the substance is ground in an agate mortar with fine quartz powder and transferred to a small quartz or carbon boat, which is placed in a combustion tube. After heating to dull redness and finally to bright redness, the phosphoric acid was completely removed from the phosphates of calcium, sodium, and potassium. The authors found that a current of carbon tetrachloride alone also brought about this decomposition. When ferric phosphate is used, ferric chloride sublimes and is carried along with the phosphorus chloride. The ferric chloride can be completely held back by packing a 15 cm. length of the combustion tube with glass wool, and allowing this portion of the tube to project beyond the furnace.—F. Shdn.

Orthoses and microclines; Differentiating the chemical character of ——. P. Barbier. Compt. rend., 1908, **146**, 1330—1332.

THE author has examined the alkalis in felspar, by decomposing the rock by means of hydrofluoric and sulphuric acids, treating the aqueous solution of the sulphates by milk of lime, filtering, converting into chlorides by means of barium chloride, and removing excess of barium and calcium by ammonium carbonate. The alkali chlorides are then examined spectroscopically; if but little rubidium is shown at this stage and uncertainty exists, any of the chlorides present are concentrated by precipitating platinum salt equivalent to about one-fifth of the potassium present, and washing the precipitate with cold water till about one-third is dissolved. The chloride obtained from the residue will show the rubidium lines if any sensible proportion be present. In this way the author has found that orthoses always contain lithium or rubidium, sometimes both, while microclines contain neither.—J. T. D.

Oxalate of potassium and ammonium; Double ——. P. Barbier. Bull. Soc. Chim., 1908, 3, 725—726.

IF a concentrated solution of normal potassium oxalate be added to a slightly ammoniacal saturated solution of ammonium carbonate, a double salt is precipitated, the composition of which is indicated by the formula, $KNH_4C_2O_4$. The salt crystallises in fine white shining needles. If normal sodium oxalate be used instead of normal potassium oxalate, a corresponding sodium double salt is not precipitated.—J. A.

Water glass. F. Mylius. Sprechsaal, 1908, 41, 140—142.

FROM a study of F. Kohlrausch's electrical conductivity measurements in dilute solutions of sodium hydroxide and silicic acid (Z. physik. Chem., 1893, 12, 773) and the author's own investigations, it is shown that combination takes place up to the limit, $2SiO_2 : Na_2O$, any further quantity of silica being merely dissolved. It is found that alcohol and sodium chloride have both the same effect on water glass solutions in increasing the viscosity and in producing a precipitate on cooling. The precipitate formed is due to the presence in water-glasses of impurities such as calcium, aluminium, and iron compounds. A perfectly pure compound of alkali and silica gives no precipitate with these reagents even on cooling to zero; but on heating, a precipitate of a polysilicate is formed when the proportion of silica exceeds by the slightest amount 2 to 1 of alkali. Those alkali silicate masses, the polysilicates, which give precipitates with sodium chloride solutions should be termed "water glasses," whilst those which are not precipitated should be known as alkali silicates.—W. S.

Barium sulphate; Colloidal ——. A. Recoura. Compt. rend., 1908, **146**, 1274—1276.

A SOLUTION of 1 grm.-mol. of sulphuric acid in 6 litres of glycerin was exactly neutralised by gradual addition of barium ethylate in alcoholic solution. No precipitate was formed, and the solution could be diluted to ten times its volume with water without causing precipitation. In this dilute solution, precipitation occurred spontaneously, though gradually, after 1—4 days at the ordinary temperature; boiling at once caused the deposition of the whole of the barium sulphate. Immediate precipitation was also caused by solutions of almost all metallic salts (except mercuric chloride and barium salts), and by polybasic acids (except boric acid). Monobasic acids caused gradual precipitation, except acetic acid, which had no effect. Immediate precipitation was caused by potassium or sodium hydroxide, gradual precipitation by baryta or ammonia. Barium salts not only caused no precipitation themselves, but greatly hindered or altogether prevented precipitation by other electrolytes. These colloidal solutions can also be formed by the reaction of barium salts on other sulphates, all in glycerin solution, and their stability is increased by the presence of excess of barium salt.—J. T. D.

Sulphur; Colloidal ——. M. Raffo. Z. Chem. Ind. Colloide, 1908, 2, 358—360.

COLLOIDAL sulphur can be readily obtained in large quantities by pouring a concentrated solution of sodium thiosulphate into strong sulphuric acid of sp. gr. 1·84, which is kept cool. If, on the other hand, the acid is poured into the thiosulphate solution, insoluble sulphur is obtained. 50 grms. of sodium thiosulphate dissolved in 30 c.c. of water are slowly poured, with stirring, into 70 grms. of sulphuric acid (sp. gr. 1·84) which is externally cooled. Hydrogen sulphide is first evolved and is followed by large quantities of sulphur dioxide, whilst a precipitate is formed which is at first almost white and later lemon-yellow in colour. 30 c.c. of water are then added, and the whole shaken and warmed for 10 minutes to 80° C. on the water-bath. Insoluble sulphur is then removed by filtration through glass wool. On cooling the filtrate, light yellow sulphur is again deposited and the whole is allowed to stand for twelve hours in a cool place; it is again warmed and filtered from sulphur, and these operations are repeated until all the insoluble sulphur is removed. A turbid yellowish-white substance should remain, which yields a perfectly clear yellow liquid on warming. The sulphur is caused to settle by cooling, separated in a centrifuge and washed with a very little cold water. It is then dissolved in as small a quantity of water as possible and neutralised with sodium carbonate, which causes the greater part of the sulphur to settle; this is again separated in a centrifuge and forms a sediment of almost pure soluble sulphur and a liquid containing about 1 per cent. of colloidal sulphur and up to 6 per cent. of sodium sulphate. The precipitated sulphur is soluble in distilled water, a solution containing 4·58 per cent. of sulphur and 1·48 per cent. of sodium sulphate being obtained. This solution became turbid in 30 minutes and afterwards deposited the greater part of the sulphur. It was found that solutions containing about 1 per cent. of sulphur only were more stable, even though they contained the same quantity of sodium sulphate. Purer solutions can be obtained by dialysis, but become less stable, and when practically all the sodium sulphate has been removed, only traces of sulphur remain in solution. Apparently a colloidal solution of sulphur in absolutely pure water cannot exist. The solutions of sulphur obtained are perfectly clear, have an astringent taste, and smell of hydrogen sulphide. On cooling they become turbid and deposit sulphur, which redissolves on warming. At the boiling point they deposit sulphur in a whitish, amorphous form insoluble in carbon bisulphide. Bone charcoal removes the sulphur on warming, and it is also precipitated on adding certain salts, such as sodium and potassium nitrates and chlorides and potassium sulphate. It is not precipitated by ammonium nitrate, sulphate, or chloride, or by sodium sulphate. Neutral concentrated solutions become turbid in a few hours and deposit amorphous sulphur, which in time forms rhombic and monoclinic crystals; the un-neutralised solutions, unless very strong, do not change when kept in closed vessels for several months.—E. F.

Chromium; Magnetic oxides of ——. J. Shukoff. Compt. rend., 1908, **146**, 1396—1397.

WHEN chromium trioxide is heated to 330° C. it begins to decompose with evolution of oxygen and rise of temperature; the oxides produced exhibit magnetic properties to extents varying with their composition and with the temperature of their production. That exhibiting the strongest magnetic character had a composition corresponding to the formula, $2CrO_3,Cr_2O_3$, and was prepared at 505°—520° C. An oxide of the same composition, but prepared at a temperature below 485° C. showed a magnetic character less than this in the ratio of 1 : 70. Another oxide, prepared from chromyl chloride, of composition approaching the formula, $2CrO_3,7Cr_2O_3$, was also strongly magnetic, and is being further investigated.—J. T. D.

Chlorine, bromine, and iodine; Separation of —— *by means of hydrogen peroxide.* P. Jannasch. J. prakt. Chem., 1908, 78, 28—34.

25 c.c. of a solution containing 0·2—0·5 grm. of potassium iodide in addition to other halogen salts, are placed

in the apparatus described in a previous paper (this J., 1906, 1176), then not more than 3 c.c. of acetic acid and 5 c.c. of hydrogen peroxide are added. The flask is heated over a micro-burner, and the iodine distilled over with a current of carbon dioxide and retained in an ammoniacal solution of hydrazine sulphate, where it is estimated as silver iodide. When the iodine has been completely removed, the bromine in the liquid is determined by the method previously described (*loc. cit.*). The liquid remaining is largely diluted, and the chlorine determined by precipitation as silver chloride.—F. SHDN.

Hydrogen persulphide. I. Crude hydrogen persulphide. II. Hydrogen trisulphide. III. Hydrogen disulphide. IV. Constitution of hydrogen disulphide and trisulphide, and the chemistry of sulphur compounds. I. Bloch and F. Höhn. Ber., 1908, **41**, 1961—1985.

THE crude hydrogen persulphide, which formed the raw material for the investigation, was prepared from sodium polysulphide. 100 grms. of commercial crystallised sodium sulphide were heated for 3 hours on the water-bath with different quantities (18—56 grms.) of purified flowers of sulphur, a slow current of hydrogen being led through the mixture. On treating the products with water, solutions were obtained containing polysulphides corresponding to Na_2S_2, Na_2S_3, Na_2S_4, and Na_2S_5 respectively. To obtain the hydrogen persulphide, the solution of the sodium polysulphide was in each case diluted to 1 litre, and allowed to flow, in a thin stream, into a large beaker containing an excess of hydrochloric acid diluted with ice (1 of acid of sp. gr. 1·19 : 1 of ice), and cooled externally by means of a freezing mixture: the temperature was kept between —10° and 0° C., and the acid stirred continuously. The yellow oil which gradually separated, was collected, and dried with calcium chloride over which dry hydrochloric acid gas was led for some time. It is important to work in an atmosphere of hydrochloric acid in order to obviate the effect of the alkalinity of the glass vessels. The crude hydrogen persulphide thus obtained is a yellow oily substance of sp. gr. 1·625—1·697, with an odour reminiscent of sulphur chloride and camphor. It gradually decomposes at the ordinary temperature, finally with separation of crystallised sulphur. It is decomposed by alkalis and more slowly by water, but is more stable in presence of acids. It is completely soluble in benzene, toluene, chloroform, and carbon bisulphide, but is decomposed more or less readily by the other common organic solvents. Its solubility in benzene is a criterion of its purity. In presence of condensing agents it combines with aldehydes and ketones. Its composition was determined by heating a weighed quantity in a test-tube in a slow current of hydrogen, passing the gas through a second heated test-tube, and then absorbing the hydrogen sulphide formed in concentrated potassium hydroxide solution. It was found that the products prepared from the different polysulphides yielded from 16·85 to 22·48 per cent. of hydrogen sulphide, but were in all cases evidently mixtures. The crude hydrogen persulphide was subjected to distillation *in vacuo* in an apparatus through which a current of dry hydrochloric acid gas had been previously passed. Three fractions were collected, and the middle one gave, on analysis, figures corresponding exactly to hydrogen trisulphide, H_2S_3. This is a liquid which is light yellow at the ordinary temperature, but colourless at lower temperatures, and in the form of drops. It has the sp. gr. 1·496 at 15° C. and solidifies at —52° to —54° C. It is much more readily inflammable than the crude hydrogen persulphide, burning with a pale blue flame. Chemically it acts as a reducing and sulphurising agent, but is also capable of effecting oxidation. If, in the fractional distillation *in vacuo*, the first receiver were suitably warmed, and the second receiver strongly cooled, there collected in the latter, a colourless liquid much more volatile than hydrogen trisulphide, and much more easily decomposed by contact with glass, paper, dust, etc. This proved on analysis to be pure hydrogen disulphide, H_2S_2. It has the sp. gr. 1·376, and is distinguished from the trisulphide in that it distils undecomposed at the ordinary pressure, the chief portion passing over at 74°—75° C. The vapours of the disulphide strongly attack the eyes and mucous membrane. In the last part of the paper the constitution of these compounds and of other derivatives of sulphur is discussed.—A. S.

Arsenic trichloride; Ammoniacal ——. Besson and Rosset. Compt. rend., 1908, **146**, 1266—1267.

WHEN arsenic trichloride at —20° C. is exposed to ammonia gas at the same temperature, a yellow solid is formed having the composition $AsCl_3,4NH_3$. This sublimes with decomposition *in vacuo* at 200° C., forming a yellowish solid of the composition, $2AsCl_3,7NH_3$ (the substance formerly described by Rose). Liquid ammonia reacts on the solid, $AsCl_3,4NH_3$, forming ammonium chloride and a white insoluble substance approaching in composition to the imide, $As_2(NH)_3$. Arsenic trichloride in excess also reacts on the substance, $AsCl_3,4NH_3$, forming complex products which have not yet been investigated.—J. T. D.

Silica from tungstic anhydride; Separation of ——. E. Defacqz. Compt. rend., 1908, **146**, 1319—1320.

THE mixture is heated in a porcelain boat in a stream of hydrogen till the tungsten is completely reduced. After cooling, the boat is transferred to a bent tube provided with the necessary condensing apparatus, a stream of pure dry chlorine is passed through, and the boat heated till all the tungsten is volatilised as chloride and oxychloride. The silica is weighed, and tested for tungsten after fusing with potassium bisulphate. The contents of the tube and condensers are washed out with weak ammonia, and the tungsten in the liquid is determined by known methods. The method is one of general applicability.—J. T. D.

Nitrate of soda statistics. Shipments, consumption, stocks, and prices, from 1906 *to* 1908. W. Montgomery and Co., London. June 30, 1908. [T.R.

		1906.	1907.	1908.	1906.	1907.	1908.
Shipments from South American Ports to all parts for the six months ending 30th June	Tons				710,000	738,000	966,000
Ditto do. for the twelve months ending 30th June	,,				1,644,000	1,729,000	1,854,000
Afloat for Europe on 30th June	,,				220,000	162,000	361,000
Stocks in U.K. Ports :—							
Liverpool	Tons	5,000	6,000	5,600	10,000	18,000	17,000
London	,,	1,000	3,700	3,200			
Out Ports	,,	4,000	8,300	8,200			
Stocks in Continental Ports on 30th June	Tons				39,000	113,000	75,000
Consumption in U.K. for the 6 months ending 30th June	,,				71,000	75,000	62,000
Do. in Continent do do.	,,				852,000	870,000	963,000
Do. in U.K. for the 12 months do.	,,				105,000	112,000	99,000
Do. in Continent do do.	,,				1,121,000	1,153,000	1,233,000
Do. in United States do do.	,,				338,000	354,000	318,000
Do. in other Countries do do.	,,				40,000	42,000	55,000
Do. in the World do. do.	,,				1,604,000	1,661,000	1,705,000
Visible supply on 30th June (including the quantity afloat for Europe and stocks in U.K. and Continent)	,,				269,000	293,000	453,000
Price on 30th June	per cwt.				10/10½	11/-	9/10½

Boron nitride and calcium boride; Preparation of ——. A. Stock and W. Holle. Ber., 1908, **41**, 2095—2099.

A funnel tube, provided with a glass fibre for keeping clear its capillary ending and regulating the rate at which the contained liquid should drop out, was passed through a cork in a wide T-tube, through the side-tube of which a rapid stream of hydrogen was passed. The T-tube passed through the cork of a wide-mouthed vessel of about 150 c.c. capacity, containing about 25 c.c. of liquid ammonia, and furnished with a wide side-tube which was connected with a potash-tube. Boron bromide was placed in the funnel tube and allowed to drop into the ammonia (the hydrogen preventing access of ammonia gas to the end of the funnel tube and consequent blocking by formation of boramide). Boramide and borimide sank in the liquid ammonia, while ammonium bromide dissolved in it. The surplus ammonia was allowed to evaporate, and the amide heated to 750° C. in a porcelain tube in a stream of ammonia gas. From pure materials this method yields pure boron nitride. The substance acts very slowly on cold water, but is completely, though slowly, decomposed and dissolved by boiling water. The boron used was prepared by Moissan's method from boron trioxide and magnesium; attempts to substitute calcium were unsuccessful as far as boron is concerned, but yielded almost pure calcium boride, CaB$_6$.—J. T. D.

Patents.

Acetic acid; Preparation of —— from calcium acetate. J. G. Behrens. Fr. Pat. 386,734, Jan. 30, 1908. Under Int. Conv., Aug. 13, 1907.

Calcium acetate is distilled with a mixture of sulphuric and acetic acids at a pressure below 600 mm. A yield of acid, almost theoretical, is thus obtained.—F. Sodn.

Acids; Process for the separation and concentration of ——. [*Purification of sulphuric acid*]. C. Kaesmacher. Fr. Pat. 386,783, Jan. 31, 1908.

The invention relates more particularly to the concentration of sulphuric acid and its separation from nitric acid without diluting it. To this end, the acid is made to pass continuously down a tower of glazed stoneware, filled with refractory material, where it meets an ascending current of purified air, heated to 260° C. or other suitable temperature. From the top of the tower the air, carrying with it water vapour and the more volatile acids, may be led to a condenser, or direct to a pyrites burner, for use in making sulphuric acid. Concentrated acid issues from the bottom of the tower. —F. Sodn.

Nitrogen compounds from carbides; Manufacture of ——. A. G. Bloxam, London. From Soc. Gen. per la Cianamide, Rome. Eng. Pat. 5314, March 5, 1907.

A small portion only of the carbide is heated to the temperature at which interaction with nitrogen takes place, after which the reaction proceeds spontaneously until the whole mass of carbide has been converted. The required local heating may be electrical, chemical, or physical, or, instead of heating a portion of the carbide, the nitrogen, under pressure, if desired, may be heated above the reaction temperature, and then brought into contact with the carbide. The nitrogen may be mixed with other gases, such as oxygen or chlorine, and it may also be supplied in the form of ammonia. To loosen the carbide mass and form channels for the easier passage of the gases, the carbide may be incorporated with organic matter such as linen, paper, etc., the carbonisation of which produces the desired effect. The latter may also be obtained by mixing with the carbide, chlorides, sulphates, sulphides, or the like, of alkali metals, alkaline-earths, or of the earths.—O. R.

Nitrous gases; Utilisation of ——. K. Birkeland, Christiania. Eng. Pat. 25,632, Nov. 19, 1907.

Nitrous gases mixed with air and steam are brought into contact with a cyanamide, *e.g.*, calcium cyanamide, with formation of calcium and ammonium nitrates. The product may be used as a fertilizer and does not deteriorate by keeping. It may also be used as a source of ammonium nitrate and nitric acid, by adding to its solution ammonium sulphate, and filtering from the precipitated hydrated calcium sulphate. The filtrate contains only ammonium nitrate, which may be recovered as such, or converted into nitric acid and ammonium sulphate by distillation with sulphuric acid.—O. R.

Nitrite of soda; Process for the manufacture of ——. H. Gouthière et Cie., Reims, France. Eng. Pat. 6655, March 25, 1908. Under Int. Conv., March 27, 1907.

Sodium nitrate is fused, and then reduced to the nitrite by the action of copper, added in the form of "cementation" copper, or "precipitates of copper." The sodium nitrite is extracted from the copper oxide formed, by boiling water, from which it is separated by crystallisation.—W. C. H.

Sodium carbonate and hydrogen sulphide from sodium sulphide; Manufacture of ——. G. W. Johnson, London. From Verein Chem. Fabr., Mannheim, Germany. Eng. Pat. 23,217a, Oct. 21, 1907.

See Fr. Pat. 383,136 of 1907; this J., 1908, 282.—T. F. B.

Cuprammonium solution; Manufacture of ——. G. L. Schaefer, New York, and A. Schaefer, Basel, Switzerland. U.S. Pat. 884,298, April 7, 1908.

Copper chips are subjected to the action of air and ammonia at a temperature changing alternately between —4° C. and +8° C., and to the solution so obtained the requisite amount of cupric sulphate and alkali are added. It is stated that 8—8·5 parts of a solution prepared in this manner containing about 8 to 12 per cent. of ammonia and 45—50 grms. of copper per litre will dissolve 1 part of cellulose.—O. R.

Chemical process. [*Manufacture of stannic chloride*]. C. E. Pellew and D. W. Whipple, Assignors to Columbia Process Co., New York. U.S. Pat. 884,756, April 14, 1908.

In the presence of mercury or of mercuric chloride, metallic tin or stannous chloride may be rapidly converted into stannic chloride by the action of chlorine gas. The reaction is carried out in aqueous solution, and the stannic chloride hydrate (SnCl$_4$,5H$_2$O), is recovered by crystallisation.—J. W. H.

Reactions; Apparatus for effecting ——. [*Manufacture of stannic chloride*]. E. A. Sperry, Brooklyn, N.Y. U.S. Pat. 885,391, April 21, 1908.

The apparatus is designed for the manufacture of anhydrous stannic chloride or similar salts by reactions involving the use of chlorine. A horizontal cylinder, jacketed for steam or water to control the temperature, is provided with a two-speed agitator and with a feeding device consisting of a hopper having a conveyor screw which can also act as a plunger, and also with suitable pipes for the admission and discharge of the gases. The cylinder is connected with a chlorine supply and with condensing plant. Anhydrous stannic chloride is first admitted to the cylinder, and tin-bearing material added. The agitator is set to work at its high speed, and chlorine gas led in. The temperature is kept down by the water jacket and tin-bearing material continually added. Finally, the agitator is set to work at the low speed, steam is admitted to the jacket, and the anhydrous stannic chloride distilled off and deposited in suitable condensers. —J. W. H.

Stannic chloride; Preparation of —— from minerals and waste tin. H. Brandenburg. Fr. Pat. 386,594, Jan. 27, 1908.

The finely-divided mineral, or other material, containing tin, is heated with a reducing agent, such as wood-charcoal, hydrogen, etc., at such a temperature that the metal produced remains disseminated in a state of fine division. The powder is then treated with dry chlorine, under pressure, if desired, so as to give anhydrous stannic chloride, which can be purified by fractional distillation. The chief advantage claimed is the use of material rich in tin, without isolation of the metal.—F. Sodn.

Aluminium oxide; Preparation of ——. F. W. Morris, Victoria, B.C. U.S. Pat. 890,084, June 9, 1908.

Material containing aluminium is treated with sulphuric acid, and the impure aluminium sulphate, thus obtained, is electrolysed. A solution of the salt of an alkali metal, *e.g.*, sodium chloride, occupies the cathode compartment of the cell, and the aluminium sulphate occupies the anode compartment. The resulting electrolysed solution, containing aluminium hydroxide and sodium hydroxide, is evaporated, and the residue calcined and lixiviated, in order to separate the aluminium oxide.—F. Sodn.

Aluminates; Manufacture of ——. O. Dieffenbach, Griesheim, Assignor to Chem. Fabr. Griesheim-Elektron, Frankfort, Germany. U.S. Pat. 891,677, June 23, 1908.

See Fr. Pat. 367,728 of 1906; this J., 1906, 1146.—T.F.B.

Sulphur dioxide of commercially uniform temperature and concentration; Method of producing —— and apparatus for the treatment of gases containing sulphur dioxide. J. L. Tufts, Boston, Mass. U.S. Pats. 891,115 and 891,116, June 16, 1908.

In order to produce sulphur dioxide of commercially uniform temperature and concentration, gases containing small and variable proportions of the oxide, as obtained from a pyritic smelting furnace, are made to pass through a dust separator, to an equalising chamber filled with refractory material, where both temperature and concentration are rendered more nearly uniform by the admission of varying quantities of air. The gases are then utilised in a burner for the combustion of sulphur, and thereby the concentration of the sulphur dioxide is increased, and a further equalisation of temperature secured.—F. Sodn.

Briquettes; Manufacture of —— from pyritic minerals, for the preparation of sulphur dioxide. J. S. Robeson. Fr. Pat. 386,695, Jan. 23, 1908.

Waste sulphite liquor, from the manufacture of paper pulp, is used as a binding agent in making briquettes from pyrites, or other material containing sulphides, in fine powder, the liquor being first neutralised by caustic alkali or milk of lime, and concentrated *in vacuo* to a density of about 30° B. The briquettes obtained are hard and not hygroscopic, and moreover, the organic matter, introduced with the sulphite, aids combustion, and the yield of sulphur dioxide is increased.—F. Sodn.

Arsenic; Removal of —— from liquids and gases. O. Jonas, Griesheim, Assignor to Chem. Fabr. Greisheim-Elektron, Frankfort, Germany. U.S. Pats. 891,703 and 891,775, June 23, 1908.

See Fr. Pat. 376,931 of 1907, and addition thereto; this J., 1907, 1047.—T. F. B.

Sodium sulphate; Manufacture of —— [from sodium silicate]. L. P. Basset. Fr. Pat. 386,682, Jan. 3, 1908.

Sodium sulphate is obtained: (1), by fusing a mixture of sodium silicate and calcium sulphate at a red heat, and lixiviating the product, or by passing steam over a red-hot mixture of sodium chloride, silica, and calcium sulphate; (2), by incorporating calcium sulphate with a solution of sodium silicate, and dissolving out the sodium sulphate formed.—F. Sodn.

Chlorine; Manufacture of —— by the Deacon process. O. Dieffenbach. Ger. Pat. 197,955, June 3, 1906.

Double compounds or mixtures of cupric chloride with other chlorides, such as common salt, are used as contact substances, whereby the volatility of the copper salt is diminished, so that it is possible to work at higher temperatures. The double compound of cuprous chloride produced by the reaction can be heated to 510° C. without perceptible volatilisation.—A. S.

Furnaces for melting metals, glass, etc. Eng. Pat. 18,417. *See* I.

Concentrating lyes. Eng. Pats. 26,935 and 27,482. *See* I.

Ammonium sulphate; Producing ——. Eng. Pat. 2399. *See* III.

Chlorates; Electrolytic preparation of ——. Fr. Pat. 386,129. *See* XIA.

VIII.—GLASS, POTTERY, AND ENAMELS.

Glazes; Solubility of lead ——. C. Beck. Z. angew. Chem., 1908, **21**, 1351.

Experimental glazes were prepared by melting together lead oxide and silicic acid in varying molecular proportions, and incorporating with them 5 per cent. of borax, 5 per cent. of boric acid, and 5 per cent. of calcium oxide. 2 grms. of the finely powdered silicates were shaken in a thermostat at 25° C. for 2 hours in 100 c.c. of 4 per cent. acetic acid and 1 per cent. nitric acid. Lead monosilicate dissolved easily in these acids, but the disilicate only gave up a small quantity of lead, and the higher silicates still less. A 4 hours' shaking only caused a little more lead to go into solution than a 2 hours' shaking. Only small quantities of lead were removed by a second treatment of the silicates with the dilute acids. The addition of the above-mentioned chemicals in all cases increased the solubility. The reason why the glazes, especially the highly silicious ones contain easily soluble lead compounds is that in the molten condition the glazes undergo a partial thermolytic decomposition. On solidifying, this condition becomes fixed, the glazes thus containing a larger or smaller amount of lead oxide and monosilicate, which are easily soluble in the dilute acids at 25° C. Results similar to the above were obtained by boiling the test pieces for half an hour in 4 per cent. acetic acid, except that at the higher temperature the pure disilicate was dissolved, and the amount of soluble lead compounds thus increased. By this acid treatment clay coated with these lead silicate glazes behaved like the powdered glazes. After boiling two or three times in 4 per cent. acetic acid, appreciable quantities of lead were still dissolved. Lead silicates in the powdered or in the granular condition are not conductors of electricity until heated sufficiently to become softened and coherent. The softening point can be determined by noting the temperature at which the mass begins to conduct a current. Two thick platinum wires dipping into the mass of glaze, act as electrodes, the circuit including a milli-ampère meter; and the temperature is read by means of a thermo-couple. The softening temperature is lowered by addition of boric acid and borax, and raised by addition of lime.—W. C. H.

Minerals, etc.; Decomposition of ——. J. H. Walton, jun., and H. A. Scholz. *See* XXIII.

Patents.

Glass; [Electrical] Manufacture of ——. A. G. Bloxam, London. From Siemens und Halske, Akt.-Ges., Berlin. Eng. Pat. 9563, May 2, 1908.

The glass mass is melted by heating by electrical induction, the molten mass in the crucible forming the secondary circuit of a transformer. The induction furnace may consist of a vaulted annular pot or crucible, surrounding the iron core of the transformer, and provided with working openings. In order that the same crucible may be used for melting and refining, it may be subdivided into refining chambers by small bridges dipping into the molten mass in the usual way.—W. C. H.

Pottery ovens, kilns, or furnaces; [Gas] Firing of ——. H. A. Humphrey, London. Eng. Pat. 16,690, July 20, 1907.

In these gas-fired ovens, the products of combustion pass through ports in the floor of the oven into flues which open into a regenerator. The products then pass into a separate recuperator chamber, containing pipes which conduct the gas to the oven. At the same time the air passes to the oven through a second separate recuperator chamber and regenerator, which have been previously

heated by products of combustion. The direction of flow of the products of combustion and gas and air is controlled by a suitable arrangement of valves. When it is required "to change over," the hot products are diverted to the second set of chambers. The gas is shut off from the first recuperator, and passed through the second; and the air is shut off from the second regenerator and passed through the first regenerator. The valve arrangements can be simplified by passing the air through the separate recuperator chamber and regenerator in series in this way. As a modification the air may be passed outside one of the recuperators, and then through the regenerator chamber on its way to the furnace; at the same time the products of combustion pass out first through the other regenerator chamber, and then through the other recuperator chamber. By another modification, which avoids the use of dampers to control the regenerators, the air and gas are admitted alternately to one side or the other of the oven, instead of all round the oven.
—W. C. H.

Earthenware and the like; Drying ——. W. E. Lake, London. From Erste Deutsche Blumentopfwerke, G.m.b.H., Sufflenheim, Germany. Eng. Pat. 22,193, Oct. 8, 1907.

The apparatus is of the type in which the ware to be dried is carried on trucks through a tunnel drying chamber. The rear end of each separate truck is provided with a screen of canvas, sheet metal, or the like. These screens divide the upper part of the drying chamber into a number of compartments, and the object of the arrangement is to cause hot, dry air to pass repeatedly over the ware, whilst moisture-laden air descends to the lower part of the chamber and escapes directly through the exit flue, without coming into contact with the ware to be dried.
—W. C. H.

Furnaces for melting metals, glass, etc. Eng. Pat. 18,417. *See* I.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Minerals, etc.; Decomposition of ——. J. H. Walton, jun., and H. A. Scholz. *See* XXIII.

Patents.

Fire-resisting; Rendering combustible materials ——. S. Gousseff, St. Petersburg. Eng. Pat. 3368, Feb. 14, 1908.

Combustible material, especially wood and the like, is rendered fire-resisting by applying to it one or more coats of a paint or colour composed of aluminium sulphate, zinc chloride, powdered talc, milk, and linseed oil varnish, with or without the incorporation of dry colouring matter. Before this coating is applied, the material may be primed with a coating of an oily mass composed of linseed oil varnish and solutions of zinc chloride, aluminium sulphate, and gum, with or without the incorporation of a dry colouring matter. As a filling for the material, the pasty mass obtained by incorporating a substance made from zinc chloride solution, linseed oil varnish, and glue, by boiling with the same, driers, talc powder, and dry zinc white, with the addition of dry colouring matter if required, may be used. As a cheap protection against rotting and risk of fire, the material may be coated simply with a body colour obtained by incorporating colouring matter with a water colour made from zinc chloride solution, aluminium sulphate solution, talc, and zinc oxide.
—W. C. H.

Cement; Manufacture of ——. K. Müller, Lüneburg, Germany. Eng. Pat. 17,562, Aug. 1, 1907.

The cement is composed of a mixture of calcium sulphate, burnt magnesia, and magnesium sulphate, to which mixture an alkali silicate is added.—W. C. H.

Plaster, cement, and the like; Manufacture of ——. W. E. Lake, London. From Sackett Plaster Board Co., New York. Eng. Pat. 7091, March 31, 1908.

Plaster, cement, or similar material is fed from a hopper, through a feed-box, on to an endless band, the upper part of which "sags" sufficiently to dip into a liquid bath (*e.g.*, water). By this means a layer of the material is carried, without agitation, through the liquid, and the speed of the band is adjusted to ensure the saturation of the mass. The feed-box is provided with an adjustable gate, the lower edge of which is serrated, so that the layer of material deposited on the band has a loose and uneven surface, which ensures a more rapid and complete saturation of the material. (See also Eng. Pat. 7789 of 1899.)—W. C. H.

Cement from highly basic blast-furnace slag; Process of making ——. A. Müller. Fr. Pat. 386,835, Feb. 3, 1908. Under Int. Conv., Feb. 9, 1907.

See Eng. Pat. 3294 of 1907; this J., 1907, 1282.—T. F. B.

X.—METALS AND METALLURGY.

Calcium silicide for the purification of steel or other metals. H. Goldschmidt. Electrochem. and Metall. Ind., 1908, **6**, 244.

Calcium silicide is recommended by the author as an effective purifying agent for steel, nickel, bronze, etc. Most other reagents leave traces of themselves in the metal owing to their not separating completely into the slag. Calcium silicide reduces the last traces of sulphur, forming calcium sulphide, while the silicon combines with the slag. An important feature of the reagent is that it is free from carbon.—J. W. H.

Alloys [ferro-silicons]; New applications of electro-metallurgical ——. A. Jouve. Faraday Soc., June 23, 1908. [Advance copy.]

The new applications consist in the use of high percentage ferrosilicons for the manufacture of apparatus which is practically unaffected by acids and other chemicals, such as cyanides and thiocyanates. The author states that it is now possible to obtain apparatus of all kinds and descriptions made from these alloys, in spite of their great fragility and excessive shrinkage when cast under ordinary conditions. The alloy is used either direct from the electric furnace in which it is made, or is remelted in an oil or crucible furnace. "Metals for corrective purposes" are added directly to the metal in the casting ladle, and aluminium also is usually added to raise the temperature of the bath and to increase the fluidity. When ready, the ladle is carried quickly to the mould, and the metal poured in the usual way. As soon as the casting has solidified, it is turned out into warm casting sand in order to anneal it, and it is then ready for use. These alloys, which have been called "Métillures," have been used for dishes, pipes, etc., weighing as much as one ton.—O. F. H.

Titanium [in ferrotitanium]; Determination of ——. G. W. Wdowischewski. Eng. and Mining J., 1908, **85**, 1200.

The alloy is dissolved in moderately dilute sulphuric acid, the solution treated with nitric acid, and after filtering off the silica, tartaric acid and ammonia are added. The iron is now precipitated with hydrogen sulphide, filtered off, the tartaric acid in the filtrate decomposed by addition of more nitric acid, and heating, and then ammonia added to the colourless solution, whereupon titanic acid is precipitated in the form of white flakes free from iron.—A. S.

Lime as a rust-preventing agent. Gieseler. Tonind.-Zeit., 1908, **32**, 890.

Comparative tests under varied conditions showed that for preventing the rusting of iron, slaked lime applied as a coating, 3—4 mm. thick, is more effective than vaseline, linseed oil, and many of the special so-called rust-preventing paints.—A. S.

Silver oxide, ammoniacal ; Explosion produced by ——. C. Matignon. Bull. Soc. Chim., 1908, **3**, 618—619.

An ammoniacal solution of silver oxide (silver nitrate, alkali, and ammonia), after standing for 24 hours, gave rise, through the formation of silver nitride (NAg_3), or products intermediate between this and the oxide, to a violent explosion. The substance had been deposited on the glass at the surface of the liquid, and, owing to the evaporation of the latter, had become dry. The same reagent is used in silver plating, but the solutions are mixed only as required, and the silver oxide is immediately reduced by invert sugar.—J. C. C.

Copper-smelting ; Losses of copper and silver in the direct process of ——. W. Stahl. Metallurgie. 1908, **5**. 353—355.

The author determined the quantities of metal lost in smelting mixtures of sulphide and oxide ores to anode copper, in a reverberatory furnace with acid hearth. The smelting of each charge required 16—18 hours, and the subsequent poling and casting 6—8 hours ; the highest temperature reached was about 1350° C. The copper and silver contained in the hearth, flue-dust, and slags were recovered and brought into account. Altogether, 1117·57 metric tons of ore were used, containing on an average, 74·46 per cent. of copper and 0·224 per cent. of silver, *i.e.*, 832·117 tons of copper and 2501·857 kilos. of silver. The quantities lost were 10·844 tons of copper and 62·773 kilos. of silver, or, 1·303 per cent. of the copper and 2·5091 per cent. of the silver present, of which only 0·159 per cent. of copper could be found in the slag produced during the smelting.—A. G. L.

Lead ; Determination of —— in alloys. W. Elborne and C. M. Warren. Chem. News, 1908, **98**, 1.

The process which the authors recommend for the estimation of lead in alloys is based on the fact that lead chloride is insoluble in absolute alcohol, whereas the chlorides of antimony, tin, arsenic, bismuth, iron, nickel, cobalt, manganese, copper, zinc, cadmium, aluminium, and magnesium are all soluble. 1 grm. of the alloy in fine shavings is placed in 50 c.c. of concentrated hydrochloric acid contained in a flask, and a slow current of chlorine gas is passed through the liquid in the cold for about 24 hours, the flask being shaken from time to time. When solution of the alloy is complete, the liquid is transferred, in small quantities at a time, to a small weighed porcelain dish and evaporated to dryness on the water-bath. The residue, after drying in a desiccator, is treated with absolute alcohol, quickly stirred with a glass rod, and the supernatant liquid immediately poured off through a dry weighed filter paper. This operation is repeated three or four times, the last amount of alcohol being allowed to remain in contact with the residue for 5 minutes before pouring off. The dish and contents together with the filter paper are finally dried in a water-oven at 100° C. for three hours and the residue weighed as lead chloride.—W. S.

Zinc ores ; Concentration of mixed sulphide ——. O. L. Kowalke. Amer. Electrochem. Soc., April—May, 1908. Electrochem. and Metall. Ind., 1908, **6**, 241.

Iron pyrites is usually removed from zinc ores by treatment with a magnetic separator after roasting to convert the sulphide into a magnetic form. Experiments were conducted by the author to determine the temperatures and other conditions of roasting with a view of increasing the efficiency of the process. The pyrites (marcasite) was heated electrically in a porcelain tube surrounded by a graphite resistor. It was found that it was not necessary to roast marcasite to a homogeneous mass to obtain a magnetic product. A loss of sulphur of from 3 to 12 per cent. produced particles with superficial magnetic properties. Under reduced pressure the temperature required for a particular effect was lowered. In a neutral atmosphere sulphur begins to come off at 510° C., and the roasting may be stopped at a little over 600° C. In an atmosphere of hydrogen, marcasite can be reduced to metallic iron.
—J. W. H.

Calcium alloys for alumino-thermic work. O. P. Watts and J. W. Breckenridge. Amer. Electrochem. Soc., April—May, 1908. Electrochem. and Metall. Ind., 1908, **6**, 237—238.

In the aluminothermic reaction of Goldschmidt the heat available for melting the reduced metal and the slag is the difference between the heats of oxidation of the aluminium and the metal to be reduced. The authors have prepared a series of alloys of aluminium, calcium, magnesium, and silicon, with the hope of obtaining reducing agents which would have a higher heat of oxidation than aluminium, and the mixed oxides of which would form a more fluid slag. All the prepared alloys containing over 25 per cent. of calcium or magnesium were readily pulverised. The reductions by aluminium-calcium-magnesium alloys were, under all conditions, of a violent nature, attributed by the authors to the vaporisation of calcium and magnesium. By adding calcium in the form of calcium silicide, successful reduction was obtained without projection of any of the materials. This fact may be due to the lower heat of the reaction rather than to the non-vaporisation of the calcium.—J. W. H.

Arsenic and bismuth ; Tellurides of ——. H. Pélabon. Compt. rend., 1908, **146**, 1397—1400.

Melted tellurium readily dissolves arsenic, and the freezing-point falls to a minimum of 329° C. at 25 atoms per cent. of arsenic, rises to a maximum of 362° (compound As_2Te_3), falls slightly to 355° at 45 atoms per cent., and remains at 358° for all mixtures containing more than 50 atoms per cent. of arsenic. The compound, As_2Te_3, forms long needles, silver-white with a tinge of yellow. The mixtures containing more than 50 atoms per cent. of arsenic lose arsenic when heated.

Bismuth-tellurium mixtures show a fall in freezing-point from tellurium (458° C.) to a eutectic with about 15 per cent. of bismuth (410° C.), then a rise to the compound, Bi_2Te_3 (583° C.), a steady fall to a eutectic with about 99 per cent. of bismuth (263° C.), and then a final rise to 270° C., the melting-point of bismuth.—J. T. D.

Alloys, solid ; Method for the measurement of rate of change in ——. (Prelim. note.) G. D. Bengough. Chem. Soc. Proc., 1908, **24**, 145—146.

The method consists in heating portions of the metastable alloy at a selected temperature for various lengths of time. The portions are then quenched in water to stereotype as far as possible the phases present at the selected temperature. Photomicrographs are made at a magnification determined by the coarseness of the crystalline structure. From the entire negative, an enlargement is made on bromide paper, the degree of enlargement again depending on the coarseness of the structure. The relative proportions of the phases present may then be determined by cutting them out separately and weighing. Curves are plotted with axes representing time and percentages of any given constituent, showing the rate of change at the selected temperature. Tests made on the uniformity of the bromide paper used for the enlargement and on the difference in weight between portions of the paper which printed black and white respectively have shown that the errors due to these causes are negligibly small when compared with some others inherent in the process. Duplicate measurements of the percentage of one of the constituents in a copper-zinc alloy gave the following results :

Alloy.	Proportion of *a*-constituent.	Mean.
Cu, 60 per cent. Zn, 40 ,,	I. 67·3 II. 67·7	67·5
Another specimen of same alloy	I. 67·5 II. 67·7	67·6
Another specimen annealed 7 hours at 540° and slowly cooled	I. 89·2 II. 89·3	89·25

By careful selection of typical portions of the alloy, and with crystalline structures suitable to the method, the limit of accuracy appears to be about ± 0·25 per cent. Comparative tests have been made to ascertain how far planimetric measurements of the areas of the phases after enlargement agree with the results obtained by the method described:

Alloy.	Proportion of *a*-constituent.	Mean.
Cu, 60 per cent. Zn, 40 ,, ...	By planimeter 59·2; 58·5	58·85
	By weighing 59·6; 60·0	59·8
Same, annealed at 640° and slowly cooled .	By planimeter 64·6; 64·2	64·4
	By weighing 65·3; 64·6	64·95

The planimeter gives the lower result in both cases, for a reason not yet ascertained. The actual proportions of the *a*-constituent in the above experiments have no significance; they depend on the rate of cooling adopted in the various experiments. The particular alloys used have merely been chosen to test the method of measurement proposed. Huntington and Desch (this J., 1908, 508) consider the planimetric measurement of the areas to be more accurate, and preferable to weighing. The author considers the weighing method to be preferable for many kinds of structure, and to be susceptible of considerable accuracy. He is using it for the measurement of rate of change in copper-zinc alloys.

[*Nipponium*] *A new element in thorianite.* M. Ogawa. J. Coll. Science Imp. Univ., Tokyo, 1908, **25**, Article 15.

A NEW element has been discovered in thorianite, reinite (a tungsten ore), and molybdenite. For its separation from thorianite, the finely-powdered mineral was treated repeatedly with boiling concentrated nitric acid, the residue (about 3 per cent.) boiled with concentrated hydrochloric acid, and after decanting off the solution, treated with hydrofluoric and sulphuric acids in order to remove silica. After igniting, and fusing with potassium bisulphate, the product was dissolved in cold water, the solution diluted, boiled, filtered, treated with hydrogen sulphide, and again filtered. The filtrate was oxidised with nitric acid, treated with ammonia, and the precipitate dissolved in dilute hydrochloric acid. The solution was treated with oxalic acid, filtered, ammonia and ammonium sulphide added, and the black precipitate formed, dissolved in dilute hydrochloric acid, and reprecipitated by ammonium sulphide in presence of ammonium carbonate, any uranium still present thus remaining in solution. The precipitate was again dissolved in dilute hydrochloric acid, reprecipitated by ammonia in presence of excess of ammonium chloride, then again dissolved, and the solution nearly neutralised with sodium carbonate and boiled with sodium thiosulphate. The precipitate was dissolved in hot concentrated hydrochloric acid, and after filtering off the separated sulphur, the solution was reprecipitated with sodium thiosulphate, and the precipitate again dissolved in concentrated hydrochloric acid. The solution was evaporated to expel the excess of acid, heated with sulphuric acid, and a saturated solution of potassium sulphate added. After 24 hours, the solution was filtered, evaporated to a small bulk, crystals of potassium sulphate and alum removed, and the greenish mother-liquor mixed with 90 per cent. alcohol. The alcoholic liquid was filtered, and ammonia added, whereupon a pale yellow precipitate, consisting of the hydroxide of the new element, was obtained. One kilo. of thorianite yielded a few centigrms. of the oxide of the new element. From reinite, a better yield, 1 decigrm. from 200 grms., was obtained. The finely-powdered mineral was fused with a mixture of sodium carbonate and potassium nitrate, the product treated with water, filtered from ferric oxide, and the filtrate saturated with carbon dioxide, a brown precipitate, soluble in dilute hydrochloric acid, being produced, apparently identical with that obtained under similar conditions from the oxide separated from thorianite. Powdered reinite was also digested with hot *aqua regia*, the yellow solution evaporated to dryness, and the residue extracted with water acidified with hydrochloric acid. The filtered solution was saturated with hydrogen sulphide, filtered, evaporated, oxidised, and treated with ammonia. The precipitate was redissolved in dilute hydrochloric acid, boiled with sodium thiosulphate to remove iron, reprecipitated with ammonia, and the precipitate ignited, and heated in a gaseous current of chlorine and carbon tetrachloride, whereby the new element was obtained in the form of a slightly volatile chloride. Molybdenite probably contains a still larger proportion of the new element than does reinite. The powdered ore was roasted, the residue digested first with dilute ammonia, and then with dilute hydrochloric acid. The acid solution was nearly neutralised with ammonia, and saturated with ammonium chloride. After standing for some time, and filtering, the solution was treated with hydrogen sulphide, filtered, boiled, and ammonia and hydrogen peroxide added. The precipitate was dissolved in dilute hydrochloric acid, the solution boiled with sodium thiosulphate, and the hydroxides again precipitated. The precipitate was ignited, fused with sodium carbonate and potassium nitrate, and the product dissolved in water, and acidified with hydrochloric acid. Ammonia produced only a slight turbidity, due to aluminium, in this solution, but after reduction with zinc, the hydroxide of the new element was precipitated abundantly by ammonia in presence of ammonium chloride. The ammoniacal solution obtained by treating the roasted ore with ammonia, also contained a portion of the new element. It has not been found possible to prepare well-crystallised salts of the new element, for which the name, *nipponium*, and the symbol, *Np*, are proposed. The freshly-precipitated hydroxide is almost white, with a pale yellow tinge; it is somewhat less soluble in alkalis than aluminium hydroxide. When dried at 100° C. it becomes nearly black; and on igniting, leaves a dark brown oxide, insoluble in acids, which when fused with potassium bisulphate, gives a product soluble in water. The solution of the hydroxide in hydrochloric acid is yellowish-green. It gives a chocolate-brown precipitate on boiling with sodium thiosulphate; a greenish-black precipitate with ammonium sulphide, insoluble in excess of the reagent; a yellowish-brown precipitate with potassium chromate in presence of acetic acid; no precipitate with potassium iodide. The solution of the chloride gives a characteristic line in the green-blue part of the spectrum, having a wave-length of 4882, besides two feebler lines. The anhydrous chloride obtained by heating the oxide in a gaseous current of chlorine and carbon tetrachloride, gives a pale green aqueous solution. Nipponium apparently exists in two stages of oxidation. The lower, basic oxide is found with alumina in the ordinary course of analysis, and can only be separated from the latter by conversion into the anhydrous chloride as already described. The higher, acidic oxide is similar to molybdenum trioxide, and can be reduced to the lower oxide by zinc and hydrochloric acid. The equivalent weight of nipponium is about 50, and the author considers that the metal probably fills the gap between molybdenum and ruthenium in the periodic system.—A. S.

Minerals, etc.; Decomposition of ——. J. H. Walton, jun., and H. A. Scholz. *See* XXIII.

Draft regulations proposed for factories in which the process of casting brass is carried on; Report on the ——. W. Wills. [Cd. 4154.] Price 2½d.

THE following proposed regulations embody the modifications recommended, as a result of the inquiry held at the end of 1907 and the beginning of this year, into the draft regulations made by the Home Secretary in June, 1907:—

Whereas the casting of brass or any alloy of copper with zinc has been certified in pursuance of Section 79 of the Factory and Workshop Act to be dangerous, I hereby in pursuance of the powers conferred on me by that Act make the following Regulations and direct that they shall come into force on the day of , 1909, and shall apply to all factories in which the casting of brass is carried on, with the following exceptions:

(i) The Regulations shall not apply to a sand-casting shop having an air-space equivalent to 2500 cubic feet for each of the persons employed nor to any other casting-shop having an air-space equivalent to 3500 cubic feet for each of the persons employed. Provided—

(*a*) that provision is made for the egress of the fumes during casting by inlets below and outlets above of adequate size, and

(*b*) that a notice in the prescribed form, giving the prescribed particulars, shall be kept affixed at or near the entrance of the casting shop and that a copy thereof shall be sent to the Inspector of the district.

(*c*) that the conditions of exemption stated in such notice are not departed from;

(ii) So much of Regulation 1 as requires that exhaust draught shall be maintained during the process of casting shall not apply in the case of strip or solid drawn tube casting or any other class of casting which the Secretary of State may certify on that behalf, provided that—

(*a*) the exhaust draught cannot be so maintained without damage to the metal (proof of which shall be upon the occupier); and

(*b*) the exhaust draught is put into operation immediately after the casting; and

(*c*) provision is made for the egress of fumes during casting, by inlets below and outlets above of adequate size.

(iii) Where it is proved to the satisfaction of the Chief Inspector of Factories that by reason of exceptional features in the construction or situation of a casting shop or by reason of the infrequency of the casting or the small quantity or the nature or composition of the metal cast or other circumstances, all or any of the Regulations are not necessary for the protection of the persons employed, he may by certificate in writing (which he may in his discretion revoke) exempt such casting-shop from all or any of the provisions of the same, subject to such conditions as he may by such certificate prescribe.

In these Regulations (including the above provisions and exemptions)—

"Brass" means any alloy of copper and zinc.

"Casting" includes the pouring and skimming of brass.

"Casting-shop" means any place in which casting of brass is carried on.

"Sand-casting" means casting in moulds prepared by hand in sand or loam or sand and loam.

"Sand-casting shop" means a place in which no kind of casting other than sand-casting is carried on.

"Pot" includes any crucible, ladle or other vessel in which the brass is skimmed or from which it is poured.

"Employed" means employed in the casting-shop in any capacity.

"Persons employed" means the maximum number of persons at any time employed.

It shall be the duty of the occupier to observe Part I. of these Regulations, and the conditions contained in any certificate of exemption.

It shall be the duty of all persons employed to observe Part II. of these Regulations.

Part I.

Duties of Occupiers.

1. Casting of brass shall not be carried on unless the following conditions are complied with:—

(*a*) There shall be an efficient exhaust draft operating by means either of (i.) a tube attached to the pot, or (ii.) a fixed or moveable hood over the point where the casting takes place, or (iii.) a fan in the upper part of the casting shop, or (iv.) some other effectual contrivance for the prompt removal of the fumes from the casting shop and preventing their diffusion therein. The exhaust draught shall be applied as near to the point of origin of the fumes as is reasonably practicable having regard to the requirements of the process, the maintenance of the exhaust draught during the process of casting, and (as regard casting shops in use prior to . . .) the structure of the premises, and the cost of applying the exhaust draught in that manner.

(*b*) There shall be efficient arrangements to prevent the fumes from entering any other room in the factory in which work is carried on;

(*c*) There shall be free openings to the outside air so placed as not to interfere with the efficiency of the exhaust draught.

2. There shall be provided and maintained in a cleanly state and in good repair, for the use of all persons employed, a lavatory, under cover, (i.) with a sufficient supply of clean towels, renewed daily, and of soap and nail brushes, and (ii.) with either

(*a*) A trough with a smooth, impervious surface, fitted with a waste pipe without plug, and of such length as to allow at least two feet for every five such persons, and having a constant supply of warm water from taps or jets above the trough at intervals of not more than two feet; or

(*b*) At least one lavatory basin for every five such persons, fitted with a waste pipe and plug or placed in a trough having a waste pipe, and having either a constant supply of hot and cold water, or warm water, laid on, or (if a constant supply of heated water be not reasonably practicable) a constant supply of cold water laid on and a supply of hot water always at hand when required for use by persons employed.

3. No female shall be allowed to work, in any process whatever, in any casting shop.

Part II.

Duties of Persons employed.

4. No person employed shall leave the premises or partake of food without carefully washing the hands.

5. No persons employed shall carry on the pouring of brass without using apparatus provided in pursuance of Regulation 1 (*a*).

6. No person employed shall in any way interfere without the knowledge and concurrence of the occupier or manager with the means provided for the removal of fumes.

Tin industry of Bolivia. Eng. and Min. J., June 27, 1908. [T.R.]

In 1907 Bolivia exported 27,677,781 kilos. of barrilla, assumed to average 60 per cent. of metallic tin. This output was contributed principally by the departments of Potosi and Oruro. Exports are taxed on the basis of the London price, and yielded an income of 1,403,571 bolivars[*] to the treasury. The output of 1907 had a value of 29,892,003 bolivars. The output of 1906 was 29,373,538 kilos. of barrilla valued at 35,248,246 bolivars.

The department of Cochabamba made its first production, amounting to above 37 tons in 1906, and in 1907 more than doubled its first year's output. Oruro, on the other hand, suffered a decline of 20·4 per cent. in output, due principally to the disarrangement of the market.

Antimony refining works at Wuchow, China. Board of Trade J., July 2, 1908. [T.R.]

Antimony refining works have recently been established at Wuchow, the funds having been provided by the Provincial Government, which has assumed the sole right of buying antimony in the Province of Kwangsi. The price paid for the ore at Wuchow is heavy, owing to the difficulty of bringing it from the mines in the far west of the Province, being some 80 to 120 taels (about £9 12s. to £14 8s.) per ton, and the minimum price at which the works will be able to dispose of the refined product at Wuchow, without loss or profit, will be about 225 taels per ton, including the royalty of 5 per cent. to the Provincial Government, but excluding export duty. The latter will raise it to something over 230 taels (£28 12s.), but as the present price paid at Shanghai is said to be 448 taels per ton, there is an ample margin of profit. It is stated that when working at full pressure the works will be able to produce 1,300 tons of pure metal annually. Work was started experimentally last year, but is only carried on spasmodically at present, owing to the difficulty of obtaining good coal at a cheap rate. Now, however, coal mines have been opened in the north-east of the Province, and it is stated that coal of a suitable quality and price will shortly be obtainable.

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[*] N.B.—12 bolivars = £1.

PATENTS.

Gilded or silvered surfaces ; Process for producing ——. G. A. Bauer, Erlangen, Germany. Eng. Pat. 4385, Feb. 26, 1908. Under Int. Conv., Mar. 7, 1907.

FINELY divided precipitates of gold or silver are first obtained by adding electrolytes to colloidal solutions of the metals produced by means of organic substances of high molecular weight, *e.g.*, starch or albumin. Thus, for silver, a solution of 300 grms. of silver nitrate in 1·5 litres of water is mixed with 400 grms. of dextrin and 400 grms. of sodium hydroxide dissolved in 10 litres of water ; after standing for about one hour, a mineral or organic acid, or an acid alkali phosphate is added to precipitate the silver. In order to coat a surface, *e.g.*, a paper band, with the silver precipitate, the moist mass is stirred up with a gelatin solution, and applied once or twice in a thin layer on the surface to be silvered. This silver layer is then dried and polished. In the case of gold, the procedure is similar, but a dilute solution of sodium carbonate is used, and a reducing agent, *e.g.*, formaldehyde or hydroxylamine, is added to the dextrin solution. The mixed dextrin-soda- and gold chloride solution assumes a red colour, and by standing longer and the addition of an electrolyte, the gold is precipitated in the desired condition. The precipitated metal is kept in the moist state, and is applied to the surface to be coated after mixing with gelatin, the subsequent drying and polishing being carried out as usual.—A. G. L.

Ores ; Process and apparatus for treating ——. F. T. Snyder, Oak Park, Ill., U.S.A. Eng. Pat. 13,254, June 7, 1907.

SEE U.S. Pat. 859,134 of 1907 ; this J., 1907, 879.—T. F. B.

[*Flotation processes.*] *Ore concentration ;* [*Apparatus for* ——]. T. J. Hoover and H. L. Sulman, London. Eng. Pat. 13,268, June 7, 1907.

THE present invention describes apparatus suitable for carrying out the flotation processes claimed in Eng. Pats. 12,778 of 1902, and 7803 and 26,712 of 1905 (this J., 1903, 870 ; 1905, 1177 ; and 1906, 184, 890 and 1009). The apparatus consists of two vertical pipes connected at the bottom so as to form a U-tube. One of the pipes is connected with a feed for the mixture of ore-pulp, oil, and water, whilst the other discharges into a spitzkasten or the like, in which the metallic minerals float, whilst the gangue sinks. The ore-pulp may be made to entangle air in flowing down the first pipe, by passing it through an inclined perforated plate placed at the top of the pipe ; or else, air, carbon dioxide, etc., may be supplied to the pulp at the bottom of the second pipe. In either case, a portion of the gas dissolved by the water under the increased pressure existing at the bottom of the U-tube will be liberated as the pulp discharges under atmospheric pressure into the spitzkasten, and this gas will attach itself preferably to the oiled metallic particles and aid their flotation.—A. G. L.

Concentration of ores ; Dry ——. H. M. Sutton, W. L. and E. G. Steele. Dallas, Texas. Eng. Pat. 21,063, Sept. 23, 1907. Under Int. Conv., Sept. 22, 1906.

THE invention constitutes an improvement on Eng. Pat. 17,561 of 1905 (this J., 1906, 1100). Dry powdered ore is distributed on an inclined pervious surface through which a current of air is passed upwards, whilst the table is reciprocated longitudinally. The upper surface of the table is absolutely free from riffles of any kind, while on the lower surface, means are provided to render the air current decreasingly effective transversely, or increasingly effective longitudinally, or both.—A. G. L.

Filters for separating solutions from ore pulp. C. L. Buckingham, Denver, Colorado. Eng. Pat. 6414, Mar. 23, 1908.

THE apparatus consists of a long V-shaped tank, provided with a feed hopper at one end, an overflow spout at the other end, and a discharge-valve for ore at the bottom. In the upper part of the tank is placed a series of filters or screens, set at an angle in the direction of flow, so that, as the pulp travels from the hopper to the overflow spout, the ore is deflected towards the bottom of the tank, some of it depositing on the lower side of the filters, whilst the clear liquid passes through the filters and overflows at the spout.—A. G. L.

Crucible furnaces for melting steel ; Gas-fired ——. F. C. Siemens, London. Eng. Pat. 17,788, Aug. 3, 1907.

INSTEAD of embedding the crucibles in coke as usual, they are placed in a bed of incombustible and refractory material, *e.g.*, dolomite, silica, magnesite, bauxite, or slag, according to the temperature necessary and the material of which the crucibles are made.—A. G. L.

Smelting furnace. E. A. A. Grönwall, Ludvika, Sweden. U.S. Pat. 891,248, June 23, 1908.

SEE Eng. Pat. 9799 of 1906 ; this J., 1906, 850.—T. F. B

Steel ; Manufacture of ——. O. Massenez, Wiesbaden Germany. Eng. Pat. 27,489, Dec. 12, 1907.

THE invention is a modification of Eng. Pat. 19,053 of 1904 (this J., 1905, 501). Pig-iron, containing more than 1 per cent. of silicon and more than 1 per cent. of phosphorus, is first blown in a basic-lined converter with the addition of lime and iron ore in such quantities that a highly acid and fluid slag is produced, which is poured off immediately the whole of the silicon has been oxidised. About two-thirds of the quantity of lime which would be needed to form tetrabasic phosphate with the phosphorus in the metal, is then added, and the blow continued until only 0·3—0·5 per cent. of phosphorus is left in the metal, a slag very rich in phosphoric acid and poor in iron oxide being produced. The metal is then transferred to a basic-lined open-hearth furnace, where the remainder of the phosphorus is removed, after adding lime and iron ore, the slag obtained being re-treated in the blast-furnace for iron and phosphorus. To facilitate removal of the phosphorus, the oxidised metal may be re-carburised before the last stage, either by placing pig-iron in the open-hearth furnace, or by adding anthracite or coke to the charge in the converter, just before pouring.
—A. G. L.

Steel alloys ; Process for the manufacture of ——. W. Rübel, Hamburg, Germany. Eng. Pat. 28,207, Dec. 21, 1907.

SEE Fr. Pat. 381,091 of 1907 ; this J., 1908, 128.—T. F. B.

Steel ; Method of refining ——. A. Hiorth, Christiana, Norway. Eng. Pat. 3173, Feb. 12, 1908. Under Int. Conv., Feb. 16, 1907.

STEEL is refined by blowing vaporised sodium into the molten metal.—A. G. L.

Metals [such as iron-copper alloys]; Method of casting ——. H. W. Lake, London. From G. H. Brabrook, Taunton, Mass., U.S.A. Eng. Pat. 20,195, Sept. 10, 1907.

Before the metal is run into the mould, the inner surface of the latter is coated with phosphorus, preferably by spraying on to it a mixture of kerosene and amorphous phosphorus.—A. G. L.

Alloys; Process for the production of exactly measured —— and of articles of all kinds from the same. H. Kuzel, Baden, Austria. Eng. Pat. 207, Jan. 3, 1908. Under Int. Conv., Jan. 7, 1907.

See Fr. Pat. 385,699 of 1907; this J., 1908, 690.—T. F. B.

Tantalum; Process for hardening ——. Siemens und Halske A.-G., Berlin. Eng. Pat. 6050, Mar. 18, 1908. Under Int. Conv., Mar. 26, 1907.

Tantalum is hardened by melting it with tantalum containing oxygen, *e.g.*, partially oxidised tantalum, in proportions ascertained by preliminary experiments with the materials to be used.—A. G. L.

Solvent for metals. E. C. Broadwell, Chicago, Ill. U.S. Pat. 884,705, April 14, 1908.

The solvent is designed for the treatment of ores, or the refining of metals, the latter being subsequently recovered by electrolysis. The solvent consists of the sulphonic acids of aromatic hydrocarbons or their hydroxy-compounds, in aqueous solution. For dissolving noble metals, a solution containing a nitrosulphonic acid and a haloid salt, *e.g.*, sodium chloride, is used.—A. G. L.

Antimony; Process for the recovery of —— from ores, concentrates, tailings, and slimes. J. R. Masson, Wandong, Victoria, Australia. U.S. Pat. 890,432, June 9, 1908.

Antimony is removed from material containing it [as sulphide] by means of a solution of sodium hydroxide, from which it is precipitated, as sulphide, by the addition of sulphuric acid. The sulphide is mixed with sand and converted into chloride by a stream of chlorine, and the chloride is washed out, and pure antimony precipitated from the solution, by adding to it a more electropositive metal.—F. Sodn.

Antimonial ores; Process for treating ——. H. L. Herrenschmidt. Fr. Pat. 386,107, April 5, 1907.

The process is intended for the treatment of antimony ores containing arsenic. The lump ore is roasted at a low temperature, about 400° C., with the production of a mixture of antimony oxide and arsenious acid, together with sulphur dioxide, the roasting furnace being connected with a series of condensers and a reaction tower where the antimony compounds are freed from arsenic. The fine ore is boiled under pressure with an alkaline solvent, such as sodium carbonate and lime, and the solution so obtained is used to dissolve out the arsenic from the mixture of antimony oxide and arsenious acid. The alkaline arsenical liquor is treated with the sulphur dioxide from the roasting operation in order to precipitate the antimony which it contains.—O. F. H.

Slag from tin-smelting furnaces; Process for the treatment of ——. G. T. Holloway, London. U.S. Pat. 891,477, June 23, 1908.

See Eng. Pat. 12 of 1907; this J., 1908, 338.—T. F. B.

Ores or other similar material; Process for the metallurgical treatment or fusion of ——. K. Birkeland. Fr. Pat. 386,059, Jan. 9, 1908.

The heating is accomplished entirely or principally by means of gases heated to a very high temperature by means of the electric arc. The temperature to which the gases are raised is sufficiently high to cause dissociation, and in that state they are used in the furnace. Steam may be used by thus heating it to above the dissociation temperature and then passing it over carbon in order to obtain a mixture of hydrogen and carbon monoxide. —O. F. H.

Furnaces for melting metals, glass, etc. Eng. Pat. 18,417. *See* I.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(*A.*)—ELECTRO-CHEMISTRY.

Electro-chemical reactions. Mercury cathodes in nitric acid. J. W. Wilkinson. Amer. Electrochem. Soc., April—May, 1898. Electrochem. and Metall. Ind., 1908, **6**, 229.

By electrochemical reduction of nitric acid using a copper cathode, ammonia is set free, whilst with a mercury cathode, hydroxylamine is obtained. Both metals on being dissolved in nitric acid liberate nitric oxide. Turrentine (this J., 1907, 474) has proved that this difference between chemical and electrochemical action does not occur in the case of copper provided that copper ions are in solution. The author now shows that also with mercury in solution, the same products are obtained both chemically and electrochemically. Generally, electrochemical and chemical reactions yield the same products under the same conditions.—J. W. H.

Copper anodes in chloride solutions. S. Dushman. Amer. Electrochem. Soc., April—May, 1908. Electrochem. and Metall. Ind., 1908, **6**, 232.

When copper is used as an anode in hydrochloric acid, it passes into solution both as a cupric and a cuprous salt, in proportions varying with the conditions. At the surface of the anode there is a chemical equilibrium between the cupric and the cuprous ions, and also between the metallic copper and the electrolyte. The equilibrium constants of these reversible reactions and also the change of concentration at the electrode have been investigated. —J. W. H.

Turpentine; Electric distillation of ——. F. T. Snyder. *See* XIII*B*.

Patents.

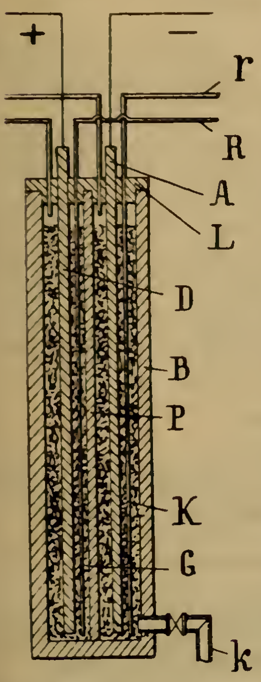
Furnace; Electric arc —— with concentration of energy. L. Clerc and A. Minet. First Addition, dated Jan. 10, 1908, to Fr. Pat. 382,437, Sept. 30, 1907 (this J., 1908, 232).

A movable lateral wall of the furnace is provided with a ledge for carrying the crucible, so that the latter may be withdrawn or brought approximately to the centre of the arc. A second form is described, in which a tube of refractory material is supported by a shoulder-piece in a suitable opening in the cover of the furnace. The lower end of the tube is slightly tapered, thus supporting the crucible and preventing it from slipping through the tube.—B. N.

Chlorates; Electrolytic preparation of —— from chlorides. R. von Hasslinger. Fr. Pat. 386,129, Jan. 11, 1908.

When electrolytically producing chlorates from chlorides, a small quantity of free hypochlorous acid is automatically maintained in the electrolyte by the use of a porous anode. During the operation, as high a partial pressure of chlorine as possible is maintained on the surface of the electrolyte, and with suitable temperature and porosity of anode, a high efficiency can be obtained.—J. W. H.

Gas element for converting the energy of combustible or other suitable reducing substances to electric current. E. W. Jungner. Kneippbaden, Norrköping, Sweden. U.S. Pat. 885,054, April 21, 1908.



An earthenware vessel, B, is separated into two compartments by a porous non-conducting plate, P. The electrodes consist of plates, D and A, of conducting carbon, such as graphite. The plate, D, is surrounded by small pieces, G, of porous electrically conducting carbon, such as graphite, moistened with a solution of nitrosylsulphuric acid in highly concentrated sulphuric acid, and the plate, A, is surrounded by smaller pieces, K, of porous amorphous conducting carbon, such as coke or gas coal, moistened with concentrated sulphuric acid. The cover, L, is made gas-tight, and the tubes, R and *r*, convey currents of air and moistened sulphurous acid respectively. The latter is converted into sulphuric acid, which is drawn off through the valve, *k*, and afterwards reduced by carbon or similar material to sulphurous acid, this being again used in the process. The poles of the battery are connected by a suitable resistance, and a constant current is obtained, outside the battery, from D to A.—B. N.

Electrolytic apparatus. P. Borgnet. First Addition, dated Jan. 17, 1908, to Fr. Pat. 377,249, April 29, 1907 (this J., 1907, 1051).

Helical blades are fixed to the ends of the floating cathodes, in order to produce circulation of the electrolyte. The cathodes may be driven by belts, or by friction rollers placed against the upper surfaces, or the movement may be obtained by a flexible spindle attached to the cathode.—B. N.

Electric arc; Process and furnace for producing chemical reactions by means of the ——. H. F. Albihn. Fr. Pat. 386,171, Jan. 13, 1908. Under Int. Conv., Jan. 16, 1907.

In an electric arc furnace for treating gaseous mixtures, the arc is produced between annular electrodes and under the influence of a magnetic field. The magnetic field is maintained in the annular arc space, the exciting coil being placed centrally to the electrodes. When air is led through or along the space where the arc, under the influence of the magnetic field, is in continuous rotation, nitrous gases may be produced and removed before decomposition can take place.—J. W. H.

Filaments; Producing metallic —— Eng. Pat. 15,367. *See* I.

Filaments for lighting and heating. Addition to Fr. Pat. 378,665. *See* II.

Glass; [Electrical] manufacture of ——. Eng. Pat. 9563. *See* VIII.

Aluminium oxide; Preparation of ——. U.S. Pat. 890,084. *See* VII.

(*B.*)—ELECTRO-METALLURGY.

Electrolytic iron; Preparation of ——. R. Amberg. Z. Elektrochem., 1908, **14**, 326—328.

The author describes the apparatus and method used to obtain considerable quantities of pure iron directly from commercial soft iron. The electrolytic vessel consisted of a stoneware vat, 310 mm. deep and 480·31 mm. circumference, holding 30 litres of electrolyte, the latter consisting of a solution of ferrous sulphate and ammonium sulphate, or of ferrous-ammonium sulphate, with a concentration varying between 15 and 45 grms. of iron per litre: the best results were obtained when not less than 26 grms. of iron per litre were present. The anodes consisted of rods of Krupp mild steel, 50 sq. mm. in section, enclosed in strong linen bags, and having on either side cathodes of iron plate or sheet copper; the cathodes reached to within 5 cm. from the bottom of the vat, and the area immersed (on one side) in the electrolyte was 600 sq. cm. Between the anodes and cathodes were glass stirrers, which could be rotated at a speed of 160 turns per minute. The electrolyte was covered with a layer of paraffin wax dissolved in paraffin oil. The purest deposits obtained contained over 99·9 per cent. of iron. The results obtained in three of the experiments are given in the following table:—

Final concentration of electrolyte, grms. of iron per litre.	Current strength, in amperes.	E.M.F., volts.	Ampères per sq. dcm. of cathode.	Time, hours.	Yield of iron, grms.	Watt-hours, per grm.	
45	2·5	2·9	0·2	96	240	3·0	Without stirring.
30	9—6·5	2·5—4·5	0·65	72	556	3·6	With stirring.
28	5	2·5—4·3	0·4	288	1061	4·6	Without stirring.

—A. S.

Electric induction furnaces; Developments of the Kjellin and Röchling-Rodenhauser ——. J. Hardén. Faraday Soc., June 23, 1908. [Advance proof.]

In Rodenhauser's modification of the Kjellin furnace there are two or even three ring-shaped baths which are connected with one another; and between these, and connected with them, is a rectangular hearth as in a Siemens furnace, with doors back and front. Into the walls of this furnace are built two pairs of corrugated steel "conducting plates," which are covered with a mixture of magnesite, dolomite, and tar. These plates are connected with the ends of two heavy secondary copper coils, wound one round each leg of the primary; and when the furnace is working, about half the power is transmitted through the rings and half through these side plates, which become conducting when hot and when the tar is burnt out of them. The rings are covered with bricks, down to a level below the surface of the metal in the hearth, so that no slag can get from the hearth to the rings. The hearth is lined with burnt magnesite or dolomite and tar, stamped in. After the tar is burnt out (by a charge which is afterwards returned to the Bessemer converter), the charge is run in from the converter, and lime added, with plate scale from the rolling mill; the slag takes up the phosphorus, and is then made viscous by more lime and drawn off. Ferrosilicon or carbon is now added to deoxidise the bath, and more lime, which when the temperature is raised, takes up the sulphur. The power is now increased, test pieces taken out and forged, and coke powder added if necessary, till the right metal is obtained. Usually 1—1¼ hours are enough, but no harm is done to the steel by keeping it in longer. Metal containing 0·1 per cent. each of phosphorus and sulphur can thus be made to yield a product containing not more than 0·006 per cent. of phosphorus and 0·02 per cent. of sulphur. The power required, starting with a charge of molten material from the converter, averages 130 kilowatt-hours per ton of finished metal.—J. T. D.

Iron; Electrolytic refining of ——. E. F. Kern. Amer. Electrochem. Soc., April—May, 1908. Electrochem. and Metall. Ind., 1908, **6**, 242—243.

The author has made a number of experiments on the electrolytic refining of iron, using different electrolytes. Neutral ferrous silicate solutions are not suitable for refining processes since they slowly decompose and deposit silica. The deposits obtained from such solutions are smooth, solid, dull grey in colour and brittle, owing to contained silica. Good deposits are obtained from neutral solutions of ferrous sulphate or chloride containing 8 per cent. of iron. The E.M.F. required (when using a ferrous sulphate electrolyte containing 8 per cent. of iron) with a current density of 10 to 20 ampères per square foot, was 1·51 to 1·40 volts at 20° C., and 0·80 to 0·98 volt. at about 50° C. On starting the electrolysis, the deposits on the cathode peeled off and curled, owing to the presence of ferric salts in the solution. After three hours the deposits became smooth, solid, and adherent. The deposits were smoother when the electrolysis was conducted at from 40° to 60° C. than when conducted at the ordinary temperature. The deposits from neutral chloride solutions (containing iron and sodium chlorides) were finer grained than those produced from neutral sulphate solutions, and became most ductile after being heated to redness. Electrolytes containing ammonium salts gave deposits more brittle but less rapidly oxidised than those obtained from solutions free from ammonium salts.—J. W. H.

Patents.

Zinc dust; Manufacture of —— [*electrolytically*]. S. O. Cowper-Coles, London. Eng. Pat. 13,977, June 17, 1907.

The zinc is deposited electrolytically in a spongy form, and afterwards heated in a reducing atmosphere. The electrolyte, consisting of caustic soda solution, may be continuously charged with zinc from anodes containing the metal, or the regeneration may take place in a separate chamber, the electric current generated in the latter case being utilised for any suitable purpose.—B. N.

Copper from copper-bearing solutions; Recovering —— [*electrolytically*]. L. Amenábar, Coquimbo, Chili. U.S. Pat. 890,887, June 16, 1908.

The solution is repeatedly circulated through an electrolytic tank and a separator, being supplied at one end of the tank, and discharged from the bottom at the opposite end. The liquid is subjected to the action of currents of great density between an insoluble anode and a metal cathode, whereby the copper is deposited in non-coherent form and is carried from the tank with the solution. The copper is separated from the liquid, the latter being then returned to the tank.—B. N.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

Njore-njole, a new oil-fruit from Cameroon; Examination of ——. Brieger and M. Krause. Tropenpflanzer, 12 [2]; Chem. Rev. Fett.- und Harz.-Ind., 1908, **15**, 53.

Njore-njole are nuts from a giant tree growing abundantly in Ossidinge, Cameroon. The thick strong shell contains 2—3 kernels, of the size of almonds, and of sweetish taste. An edible oil can be easily pressed out in the cold. The kernels weigh 1·2—1·4 grms., and contain 62 per cent. of oil. The press cake contains 6·72 per cent. of nitrogen corresponding to 41·88 per cent. of protein. The characters of the oil are: Sp. gr., 0·9135; $n_{\mathrm{D}}^{22}=1{\cdot}4695$; saponification value, 193·05; Reichert-Meissl value, 0·66; iodine value, 93·35; solidifying point, —1 to —1·5° C.—W. S.

Patents.

Liquids [*oils, etc.*]; *Process for the improvement or refinement of* ——. T. Macherski and E. Koperski, Brest-Litovsk, Poland. Eng. Pat. 13,357, June 8, 1907.

See Fr. Pat. 377,700 of 1907; this J., 1907, 1099.—T. F. B.

Oils and greases for lubricating machinery and other purposes; Manufacture of ——. E. Ridgill, Dronfield, Derbyshire. Eng. Pat. 20,059, Sept. 9, 1907.

The lubricant is prepared by melting together stearin, 1 part; paraffin, 2 parts; resin, 3 parts; any hydrocarbon oil, 4 parts; and petroleum jelly, 3 parts. The melted mixture is then submitted to mechanical action, such as grinding, beating, or pulverising, while it is cooling, so as to form a kind of foamy liquid when quite cold.—W. P. S.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(*A.*)—PIGMENTS; PAINTS.

Phosphorescent colours; Art of making ——. W. J. Hammer, New York. Re-issue No. 12,812, June 16, 1908, of U.S. Pat. 868,779, Oct. 22, 1907.

See this J., 1907, 1206.—A. S.

Fire-resisting; Rendering combustible materials ——. Eng. Pat. 3368. *See* IX.

(*B.*)—RESINS; VARNISHES.

Turpentine; Electrothermic distillation of ——. F. T. Snyder. Amer. Electrochem. Soc., April—May, 1908. Electro-chem. and Metall. Ind., 1908, **6**, 241.

The chief constituent of turpentine, pinene, boils at 155° C., and begins to decompose at 175° C. It is necessary therefore, to distil turpentine within narrow limits of

temperature. A plant has been erected at Vancouver, B.C., for the extraction of turpentine, tar oils, etc., from saw-mill refuse. The refuse is placed in a vessel, which, by means of an overhead crane is introduced into a brickwork retort. The top of the vessel has a projecting flange which, dipping into a groove containing tar oil at the top of the retort, forms a seal. An electric current is passed through iron strips embedded in the brickwork, which is thus raised in temperature to about 250° C. In the course of four hours 90—95 per cent. of the turpentine distils off, through a condenser in which the rising vapour meets a water spray. The resin or pitch runs through perforations in the lid of the vessel and is collected in barrels from the bottom of the retort. The temperature in the centre of the vessel rises higher than outside, owing to the decomposition of some of the hydrocarbons of the wood. The vessel is then removed to an adjoining retort and connected up to a second condenser, when, without any further use of electricity the tar oil passes over as vapour and the wood tar trickles down and is collected as before. At the end of three hours, when the temperature at the centre of the retort has risen to 375° C., the vessel is removed and placed on a sand floor by which its interior is sealed. When the vessel has cooled sufficiently, the charcoal which it contains is removed. 1000 lb. of wood refuse yield: turpentine, 6·7 gallons; rosin, 168 lb.; tar oil, 5·1 gallons; tar, 68 lb.; and charcoal, 323 lb. 90 kilowatt-hours of electricity are used, costing 18 cents. One man per shift of 12 hours works the plant, unless the wood is large, when an extra man during the day shift is employed to split it.
—J. W. H.

(*C.*)—INDIA-RUBBER, &c.

Plectaneia elastica and Mascarenhasia lisianthiflora in South-West Madagascar. H. Jumelle. Caout. et Gutta-percha, 1908, **5**, 2034—2045.

THE *Vahyvanda* of the extreme south of Madagascar is identical with the *Plectaneia elastica* of the north-west of that island. The rubber, which is of a darkish colour, resembles in appearance as well as in composition the *tsongonofitra* of Analamahitso, two samples giving the following figures on analysis:—

	Vahyvanda.	*Tsongonofitra.*
Moisture	2·80	3·62
Caoutchouc, soluble in ether ..	68·62	72·50
Resins, soluble in alcohol-ether ..	6·50	11·00
Ash	1·36	2·25
Other constituents	20·72	10·63

The rubber is at present obtained from the bark of the plant by a process of pounding and maceration, the yield being only about 1 per cent. on the dried bark, but, on account of the difficulty of tapping the small stems, it is not likely that the process will be soon replaced by a tapping process. The *Kidroa* has been identified as *Mascarenhasia lisianthiflora*; it grows to a height of from 2 to 3 (rarely 4) metres, and the mean diameter of its stem is 3 to 4 cm. The plant has only been employed in the production of rubber since 1905, the method of extraction adopted being to make incisions in the branches, and to collect the latex in shallow dishes which are then left in the sun for a few hours, when the rubber coagulates. The rubber is of reddish-brown colour and very strong, but it has not much "nerve." Its composition is shown below, side by side with that of a former sample of *M. lisianthiflora* rubber from Boina:—

	Kidroa.	*M. lisianthiflora* (Boina).
Moisture	3·70	4·05
Caoutchouc, soluble in ether ..	67·32	88·17
Resins, soluble in alcohol-ether .	8·50	3·01
Ash	3·57	2·88
Other constituents	16·91	1·89

—E. W. L.

PATENTS.

Chromated glue masses [rubber substitutes]; Manufacture of elastic ——. R. Neufeld, Vienna. Eng. Pat. 22,382, Oct. 10, 1907.

IN the preparation of elastic materials from glue, glycerin, and chromium compounds, claim is made for the addition of "lead plaster," and such substances as gum tragacanth, vegetable balsams, elemi, water-glass, and vegetable fibres parchmentised by means of mineral acids, which like "lead-plaster," have the effect of increasing the tensile strength, toughness, and elasticity of the product, and prevent it from becoming hard and brittle.—A. S.

Rubber; Art of purifying ——. H. O. Chute, Cleveland, Ohio. U.S. Pats. 890,216 and 890,217, June 9, 1908.

THE rubber is purified by extraction with a solvent composed of: (1), a ketone (*e.g.*, acetone) and an acetic ester (*e.g.*, ethyl acetate); or (2), an alcohol (*e.g.*, ethyl alcohol) and an acetic ester (*e.g.*, ethyl acetate) derived from such alcohol.—A. S.

Rubber solutions; Preparation of ——. Siemens und Halske Akt.-Ges. Fr. Pat. 386,017, Jan. 8, 1908. Under Int. Conv., Jan. 19, 1907.

ETHYLENE dichloride, with or without the aid of heat, is used as a solvent for raw rubber. It has a greater solvent power, higher volatility, and lower specific gravity than other solvents, is non-inflammable, and gives off no explosive vapours, when heated.—J. W. H.

XIV.—TANNING, LEATHER, GLUE, SIZE.

Gelatin; Precipitation and rendering insoluble of ——. A. L. Lumière and A. Seyewetz. Bull. Soc. Chim., 1908 **3**, 743—750.

THE authors have sought to determine: (1), The substances which precipitate gelatin and to establish a possible relationship between them; (2), the composition of the precipitated gelatin; (3), the substances which, without precipitating the gelatin, combine with it, so that after gelatinisation the compound is no longer soluble in hot water; (4), the relationship between the last phenomena and that of precipitation. Solutions of inorganic carbonates, chlorides, bromides, iodides, sulphates, sulphides, thiosulphates, nitrates, nitrites, hypochlorites, chlorates, bromates, iodates, cyanides, thiocyanates, phosphates, borates, arsenites, arsenates, silicates, chromates, molybdates, tungstates, vanadates, ferro- and ferricyanides were prepared, varying in strength from 5 per cent. to 50 per cent., according to their solubilities, and added to a 10 per cent. solution of gelatin. Experiments were also made in the reverse manner, the gelatin solution being added to the various salt solutions. It was found that precipitation of the gelatin was effected only by phosphotungstic acid or mixtures of phosphoric acid and sodium tungstate, phosphomolybdic acid or mixtures of phosphoric acid and ammonium molybdate, chlorine water, bromine water, ferric salts (except tartrates, citrates, and their double salts), manganic, vanadic, ceric, uranic and mercuric salts, auric and platinic chlorides, and potassium permanganate. The carbonates, sulphates, nitrates, sulphites, bisulphites, and thiosulphates of the alkali metals give only a slight precipitation when in the state of a 15 per cent. solution, but the separation of gelatin is increased with higher concentrations, or the gelatin may be re-dissolved in water. It is to be noticed that the inorganic compounds, dilute solutions of which cause a separation of gelatin, are all oxidising agents, but this property is not common to all oxidising agents. Besides such organic liquids as the ketones and alcohols which are soluble in water and in which gelatin is insoluble, the only organic compounds which were found to precipitate gelatin were phenol, resorcinol, quinol (hydroquinone), catechol (pyrocatechin), gallotanic, picric and pyrogallic acids, *p*-nitrophenol, chlorophenol, monochloroquinol (adurol), acid R (2-naphthol-3.6-disulphonic acid), acid G (2-naphthol-6.8-disulphonic acid) and acid S (2-naphthol-6-sulphonic acid). It has been long known that chromic salts and formaldehyde possess the property of rendering gelatin insoluble in water at 100° C. if they are added to a gelatin solution, and this is subsequently dried, or if their solutions are brought into contact with dry gelatin. The authors have found that this property is also possessed by a large number of substances produced by air-oxidation of phenols in presence of alkalis, and notably of such bodies as the quinones, quinhydrones, and quinonechlorimide. On determining the composition and properties of the gelatin precipitated from a 10 per cent. solution and which was subsequently insoluble in water, it was found that the insolubility was due not only to oxidation, but also because the gelatin had combined with the base of the salt which had produced the oxidation. The rendering insoluble of gelatin by organic precipitants is probably accompanied by the fixation of an organic residue.—J. A.

Patents.

Tanning materials, dyewoods, beetroots, etc.; Process and apparatus for the lixiviation of ——. on the counter-current principle in a horizontal vessel. W. Wiegand and R. Rieder. Fr. Pat. 386,820, Feb. 1, 1908. Under Int. Conv., Feb. 23, 1907.

The process consists essentially in causing the material to be extracted and the solvent liquid to pass continuously through the apparatus, in opposite directions, the supply of solvent liquid being so regulated that its level is always below that of the material being extracted. The apparatus consists of a long horizontal vessel provided with a shaft on which helical segments and vertical agitator blades are mounted alternately.—A. S.

XV.—MANURES, &c.

Patents

Superphosphate; Apparatus for the manufacture of ——. G. Hövermann. Fr. Pat. 386,705, Jan. 29, 1908. Under Int. Conv., Feb. 4, 1907.

The conversion of phosphate into superphosphate is carried out in a cylindrical chamber of masonry, in the axis of which, passing through the roof, is a vertical shaft, capable of rotation and also of longitudinal movement. The lower end of the shaft is provided with cutters, which detach thin layers from the upper surface of the mass of solidified superphosphate and cause the product to pass to a vertical shoot in the wall of the chamber, after it has become broken up and dried by contact with the still hot mass of superphosphate below. The opening of the shoot may be adjusted to prevent the escape of noxious fumes with the product, these being led off from the upper part of the chamber. The shaft is regularly lowered as the mass becomes reduced in depth, and the lower end of the shaft is prevented from oscillating by means of guides touching the walls of the chamber. Claim is made for the simultaneous drying, powdering, and ejecting of the superphosphate.—F. Sodn.

Fertiliser from house refuse. G. Schroder, P. Fernandez-Krug, and W. Hampe. Ger. Pat. 198,014, Feb. 5, 1907. Addition to Ger. Pat. 176,389.

The portion of the refuse passing through a sieve of 5 mm. mesh is mixed with burnt or slaked lime or milk of lime, and the mixture allowed to stand for a long time.—A. S.

Nitrous gases; Utilisation of ——. Eng. Pat. 25,632. *See* VII.

XVI.—SUGAR, STARCH, GUM, &c.

Russian sugar industry. Z. angew. Chem., 1908, 21, 1203—1204.

For some time past the Russian sugar industry has been in a very unsatisfactory condition, owing to the production in 1906-7 having greatly exceeded the consumption.

	Production.	Consumption.	Exports.
	Million puds.	Million puds.	Million puds.
1906–7.. ..	79·730	56·000	7·911
1905–6.. ..	53·323	53·135	3·896

Note.—1 pud = 36·1 lb.

In consequence of this over-production, the Russian stocks of sugar have more than doubled. The consumption of sugar in Russia is very small—about 6 kilos. per head, as against 18·7 kilos. in Germany and 44 kilos. in England. This is owing to the very high price, which is regulated by the Government. The surtax, *i.e.*, the difference between the customs and the excise duties amounts to about 56 M. in Russia, whereas in the States which are parties to the Sugar Convention this is fixed at 4·80 M. The importation of foreign sugar into Russia is thus excluded. For the disposal of the yearly increasing production of sugar, Russia has to resort to exporting at low prices at the cost of the Russian consumers. Since, however, by a decree of the Sugar Convention, the importation of Russian sugar into the signatory States is forbidden under penalty up to Sept. 1, 1908, the export of Russian sugar is at present confined to Finland and Central Asia. In the former country Russia has the benefit of a reduction of duty of 28 per cent., so that this market is practically monopolised. The exports to Persia, etc., however, are not very considerable. In general, indeed, owing to the low world-market price of sugar, the export of Russian sugar to countries outside the Convention, is not remunerative (the cost of production being higher than in other countries), and hence the excess produced is continually accumulating. In 1906-7, this amounted to about 3,000,000 dz. (dz. = double zentner = 100 kilos.), and it is estimated to be about 5,000,000 dz. by Sept., 1908. From Sept. 1, 1908, the English market will be open to Russian sugar, but Russia must only send a quantity of 3 million dz. in the first year, and 2 million dz. in each of the following years, so that large stocks will yet remain on hand for a long time.—A. S.

Cane sugar solutions; Osmotic pressure of —— at 10° C. H. N. and H. V. Morse. Amer. Chem. J., 1908, 39, 667—680.

In an earlier paper (this J., 1907, 647) it was stated that the considerable deviation of the osmotic pressure of cane sugar solutions from the calculated gas pressure in the vicinity of 0° C., whilst the two were found to be in substantial agreement in the neighbourhood of 20° C., made it desirable to determine the pressures of these solutions at several intermediate temperatures. The measurements in the present series are undoubtedly the most accurate that have yet been made, and the corrections which it has been necessary to make for loss of concentration while the solutions were in the cells have been quite small. The results now established for a temperature of 10° C. exhibit the same peculiarities that were observed at 0° C. and 5° C., that is, the osmotic pressure considerably exceeds the calculated gas pressure. The molecular osmotic pressure diminishes slightly from the 0·1 to the 0·4 grm.-

mol. per litre concentrations and then increases with increasing concentration. At 0·1 normal concentration it is 1·053 times the gas pressure, at 0·4 normal it is 1·036 times, and at 1·0 normal it is 1·081 times the gas pressure. If the pressures at 0°, 5° and 10° C. be compared, there is some evidence of a temperature coefficient to be discovered; this will be more apparent when the results at a temperature of 15° C. are complete.—J. F. B.

Starch; Determination of —— by means of trichloracetic acid. P. Biourge. Second International Congress for the Chemistry of Sugar and Fermentation, Paris, April 6—10, 1908; Z. ges. Brauw., 1098, **31**, 277.

Trichloracetic acid is a good solvent for dissolving starch for the purpose of estimating it. The acid is used in 3 per cent. solution and at 120° C., which corresponds with a pressure of 1 atmosphere. In case other carbohydrates besides starch are present, the dissolved starch must be precipitated by baryta and alcohol or by iodine and magnesium sulphate; the baryta precipitate can then be dissolved, or the excess of baryta in the solution estimated, or the excess of iodine determined. The conditions of the precipitation by baryta are given.—T. H. P.

"*Bourgou*" (*Panicum stagninum*); *Chemical examination of* ——. E. Perrot and E. Tassilly. *See* XX.

Patents.

Soluble starch; Manufacture of a new ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 25,274, Nov. 14, 1907.

See Fr. Pat. 383,902 of 1907; this J., 1908, 415.—T. F. B.

Tanning materials, dyewoods, beetroots, etc.; Lixiviation of ——. Fr. Pat. 386,820. *See* XIV.

Centrifugal drying apparatus; Continuous —— especially for saccharine materials. Fr. Pat. 386,014. *See* I.

XVII.—BREWING, WINES, SPIRITS, &c.

Barley; Relation between starch and protein content and size of grain of ——. O. Wenglein. Z. ges. Brau., 1908, **31**, 257—261.

Wichmann has found that in barley a maximum starch content corresponds to a minimum protein content, and *vice versa*, and further that the starch content increases with the weight of the individual grain, so that this starch content can be estimated from the knowledge of the weight of 1000 grains. The author who has analysed a large number of barleys of various origin confirms these conclusions, though his results like Wichmann's earlier observations include a large number of exceptions. The grains have also been classified according to size: in general most large grains are contained in the heaviest barleys. Investigation of the relationship between the amount of protein and starch per individual grain failed to show any definite relationship, and did not confirm Wichmann's further statement that the mean starch content of the single grain increases with the mean protein content.—E. F. A.

Malt; Influence of foreign substances on the diastatic power of ——. D. Simon. Second International Congress for the Chemistry of Sugar and Fermentation, Paris, April 6—10, 1908; Z. ges. Brauw., 1908, **31**, 277.

The diastatic power of malt is increased by small quantities of acid and also by substances contained in the malt or raw grain extracts even after these are boiled. The solution of protein substances is influenced appreciably by the brewing water, and, further, in faintly alkaline solutions, proteins are precipitated which possess saccharifying power. But, when the acidity of the malt extract is reduced by the addition of sodium carbonate or ammonia, it is found that the alkaline extracts of certain malts possess higher liquefying and saccharifying powers than the pure aqueous extract.—T. H. P.

Extract [*of malt*]; *Influence of the temperature of saccharification on the —— and on the dissolved nitrogen.* Valance. Second International Congress for the Chemistry of Sugar and Fermentation, Paris, April 6—10, 1908; Z. ges. Brauw., 1908, **31**, 277.

It is found in practice that, with many malts, neither the total nitrogen of the wort nor that part of it which is assimilable by yeast depends entirely on the mashing process. Laboratory experiments confirm these observations and show further that the extract obtained when a definite end-temperature is employed depends on the nature of the malt. When fine meal is employed, practically the whole of the extract is obtained at 65° C., a higher temperature than this being without influence on the composition of the wort.—T. H. P.

Amylase and maltase; Physico-chemical investigations on ——. C. Philoche. J. Chim. Phys., 1908, **6**, 212—293, 355—422.

The study of the kinetics of enzyme actions is destined to throw considerable light on the general theory of the nature of enzymes, and the author has investigated two typical cases, *viz.*, amylase and maltase, one of which acts on a colloid and the other on a crystalloid. The velocity of the hydrolysis of starch by "absolute diastase" (amylase of malt) increases with increase in the concentration of starch within the limits of 0·5 to 2·5 per cent. With solutions containing more than 2·5 per cent. of starch, the rate of hydrolysis is independent of the concentration. "Taka-diastase" (diastase of micro-organisms) shows a similar result. The rate of hydrolysis of glycogen by malt diastase increases with the concentration of glycogen between 1 and 5 per cent., and is probably uninfluenced at higher concentrations. The rate of hydrolysis of maltose by taka-diastase increases with the concentration up to 2 per cent. of maltose; in solutions containing from 2—8 per cent. of the sugar it is constant. The rate of hydrolysis of starch is not proportional to the quantity of diastase; it is expressed by a formula of the type, $x = Bc - Ac^2$, but when c (the concentration of diastase) is very small, the term, Ac^2, becomes negligible, and the quantity of maltose formed is then practically proportional to the concentration of diastase. The hydrolysis of glycogen is influenced in the same way; the rate of the action of maltase on maltose is proportional to the concentration of the enzyme. With a concentration of 1 per 25,000 of malt diastase, the saccharification of a 2 per cent. solution of starch is practically complete in 8—9 hours; with concentrations of 1 per 1,000,000 to 1 per 250,000, the saccharification is slow but does not appear to come to a stop. In the action of malt diastase on glycogen it is necessary to employ high concentrations of the enzyme (2 per cent.) in order to obtain complete hydrolysis of a 2 per cent. solution in 26 hours. With lower concentrations (1 per cent. and under) the reaction comes to a stop; this stop is not due to a destruction or weakening of the enzyme. The glycogen which remains unsaccharified no longer gives the iodine reaction, but it is still precipitated by alcohol. With concentrations of diastase between 1 per 10,000 and 1 per 800, the quantities of maltose formed from glycogen are proportional to the concentrations of the enzyme. The maltase of taka-diastase is stable; when it has acted on maltose for 38 hours at 39° C., its activity towards further quantities of maltose is undiminished. Similarly, malt diastase which has been for 26 hours in presence of glycogen is still capable of hydrolysing further quantities of glycogen or starch with undiminished activity. In the case of maltase the values of K increase, *i.e.*, the reaction is more rapid than is indicated by the logarithmic law. The values of K_2 (Bodenstein's formula) are constant for concentrations of 2—8 per cent. of maltose. The saccharification of starch by amylase follows a more complex law. At the start the relative velocity of hydrolysis decreases until about 25—30 per cent. of the starch have been converted; after this it remains constant until the conversion reaches 90—94 per cent. If the solution be boiled at any stage and fresh diastase be added, the process continues at the same point of the curve at which it was interrupted. On the general theory of enzymes the author starts with the proposition that enzymes are colloidal and specific catalytic agents. As colloids, the solutions have a structure which may be resolved by the ultramicroscope, and the reaction will only be produced in contact with the granules, *i.e.*, at certain points which are more or less widely separated according to the concentration of the enzyme. In the case of a solution of invertase the dimensions of the granules are $0{\cdot}1\mu$, and if the solution contains 1 mgrm. per 50 c.c., they are separated by a mean distance of about $3{\cdot}6\mu$. In order that reaction may take place it is necessary that the substance to be hydrolysed should come in contact with the granules and condense there in the form of a "zone of adsorption." Enzyme action is thus divided into two distinct processes: the formation of adsorption zones and the chemical reaction; both factors influence the velocity. In the case of enzymes acting on crystalloids the rate of adsorption is very rapid, and this process does not interfere with the total enzyme action, but in the case of enzymes acting on colloids it is a very important factor; it will be a function of the rate of diffusion and the surface of the granules of the enzyme. The adsorption also depends on the nature of the bodies adsorbed and their concentration. It is also recognised that the adsorption is profoundly modified by the presence of electrolytes, acids, and alkalis, and these play a great part in enzyme reactions; especially in those in which the substance undergoing hydrolysis is also a colloid.—J. F. B.

Nitrogen; Influence of enzymes and of the duration of mashing process. D. Simon. Second Internat. Congress for the Chemistry of Sugar and Fermentation, Paris, April 6-10, 1908; Z. ges. Brauw., 1908, **31**, 277—278.

When malt is mashed, solution of the proteins is effected partly by bacterial enzymes present in the malt and partly by peptase. The action of the latter may proceed more or less far, the final products being amino-acids and ammonia, the latter appearing as ammonium salts. In order to separate the action of the bacterial enzymes from that of the peptase, measurements were made of the amounts of ammonia formed by mashing at different temperatures and for different times, firstly, with pure water, and secondly, in presence of hydrofluoric acid. It was found that when fluorine compounds are present, the ammonia content is not raised, either by prolonging the duration of mashing or by raising the mashing temperature, the peptase apparently not effecting any far-reaching degradation of the proteins. On the other hand, the proportion of ammonia does not increase with the duration of mashing when water alone is employed. At 15° C., indeed, it diminishes to an approximately constant value, and at 50° C., slowly falls. This behaviour points to the presence of several kinds of bacteria, which are unequally affected by raising the temperature or by aeration.—T. H. P.

Nitrogen [of wort]; Influence of acidity and alkalinity on the soluble and on the coagulable ——. Lagache. Second Internat. Congress for the Chemistry of Sugar and Fermentation, Paris, April 6—10, 1908; Z. ges. Brauw., 1908, **31**, 288—289.

The author has estimated the quantities of soluble and of coagulable nitrogen in worts obtained by mashing with very dilute solutions of lactic acid and of sodium hydroxide. When lactic acid is used, the amount of nitrogen remaining in solution after boiling the wort is increased considerably. The solubility of the precipitated proteins found on the surface of the grains is nine times as great in warm, dilute alkali as in water, the dilute alkaline solution becoming turbid on cooling. On treating grains with a number of different salts and acids in various concentrations, it was found that the largest proportion of nitrogen is dissolved by tripotassium phosphate, which is a faintly alkaline compound. It is possible that this affords an explanation of the opalescence often observed in the last spargings from the mash-tun.—T. H. P.

Beer; Infection of —— occurring before pitching. Roux. Second Internat. Congress for the Chemistry of Sugar and Fermentation, Paris, April 6—10, 1908; Z. ges. Brauw., 1908, **31**, 290.

The author infected with bacteria samples of the turbid wort delivered to the fermenting room and subsequently pitched them with yeast. The samples were then treated according to the author's method for detecting sarcina in beer (this J., 1908, 637). In no case was any change detected in the beer, which remained pure for an unlimited time when mixed with yeast water in a flask closed with a paraffined cork. In one single instance, that of a highly fermented beer, a very slight development of bacteria occurred. It is concluded that only in exceptional cases do organisms which produce diseases in beer have their origin in the wort.—T. H. P.

Glutin turbidity [of beer]. A. Blanchet. Second Internat. Congress for the Chemistry of Sugar and Fermentation, Paris, April 6—10, 1908; Z. ges. Brauw., 1908, **31**, 290.

Glutin turbidity, consisting of a veil-like deposition which disappears when the temperature is raised, is observed in all beers subjected to intense cold. It is caused by colloidal nitrogenous substances, to which the collective name "glutin" is given. Such turbidity is especially common in pasteurised beers, pasteurisation producing a disturbance of the solubility equilibrium of the glutin; storage of these beers at the ordinary temperature results in the gradual formation of a faint veil-like deposit, which afterwards becomes more intense, whilst, if the beer is kept for a long time, a deposit forms at the bottom. No glutin turbidity was observed with either the dark beers or the export beers examined.—T. H. P.

Beer; Normal content of sulphates in the ash of ——. A. Trillat. Second Internat. Congress for the Chemistry of Sugar and Fermentation, Paris, April 6—10, 1908; Z. ges. Brauw., 1908, **31**, 290—291.

The normal sulphate-content of a beer is derived mainly from the brewing water and, to a less extent, from the malt and hops. Small quantities of sulphates are also formed by oxidation of the sulphurous acid finding its way into the malt during kilning or used for preserving the hops, while the use of sulphites in the beer accounts for a further small amount. In estimating the normal sulphate-content of a beer, allowance must be made for the increase due to concentration of the wort during boiling and cooling, and for the diminution caused by coagulation of the proteins and by filtration of the mash; this increase and diminution roughly compensate one another. The author's experiments show that more than 2 grms. of sulphate, calculated as potassium sulphate, per litre of beer [140 grains per gallon] may be derived from the raw materials and may hence be regarded as a normal proportion. —T. H. P.

Yeasts; Part played by —— and by the vines in the formation of bouquet in wines. A. Rosenstiehl. Compt. rend., 1908, **146**, 1224—1226.

A large number of experiments, carried out on an industrial scale, furnish the following conclusions. Some exceptional vine stocks produce an ordinary wine in good years, and, under specially favourable conditions, a wine of repute. The same stocks in the majority of cases give rise to wines lacking bouquet, but if in such cases the must is sterilised and fermented with a selected yeast, a wine of good bouquet is obtained. If to this wine, sugar be added, so that after fermentation the amount of alcohol will not exceed 14 per cent., and the mixture be sterilised and fermented with a selected yeast, a wine of good bouquet is again obtained, although the proportion of best quality grape in the vintage is relatively small. A selected pure culture yeast derived from a single cell is not always able to develop bouquet in the must of a high quality vintage. This applies particularly to yeasts which have been raised in artificial musts not containing grape juice. When such yeasts are cultivated in grape juice for several generations, they again acquire the power of developing bouquet. Whatever be the origin of a yeast it does not transmit to the wine the bouquet of its original culture liquid, but develops in a particular grape must the characteristic bouquet of the class of vine from which the grape came. It is considered that the bouquet-forming substance is contained in the vine, and is different in each particular species of vine. This substance is analogous to a glucoside such as amygdalin and requires a special enzyme to effect its decomposition, and bring about the formation of bouquet. If the yeast which grows spontaneously in the must contains this particular enzyme, a bouquet will result.—E. F. A.

Wines; Influence of the temperatures of sterilisation and of fermentation of the must on the bouquet of ——. A. Rosenstiehl. Compt. rend., 1908, **146**, 1417—1420.

In order to produce wine having a good bouquet, it is best to sterilise the must and to ferment it with a bouquet-producing (anthogène) yeast at a temperature below 20° C. (68° F.). The dissemination of a perfume from a fermenting must is a sign that the temperature of fermentation is too high. A temperature as low as 13° C. (55° F.) does not prevent the production of bouquet. —T. H. P.

Colouring matter of red grapes and other vegetable organs; Origin of the ——. J. Laborde. Compt. rend., 1908, **146**, 1411—1413.

When the solid matter of the green grapes from red or white vines is treated for 30 minutes with 2 per cent. hydrochloric acid in an autoclave at 120° C., an intensely wine-red liquid is obtained, whilst the undissolved parts retain a large amount of colour which can be extracted by aqueous alcohol. The same behaviour is exhibited by the marc from white grapes after drying in the oven, and by the young shoots of the white or red vine. The colouring matters are not tannic substances, but are derived from these. The tannins of the hop, cherry, plum, etc., are endowed with similar chromogenic properties, which are, however, not found with ordinary oak tannin. If a solution of one of these tannins containing 2 per cent. of potassium hydroxide is boiled for a few seconds, and subsequently aerated, it assumes an intense wine-red coloration, which is especially marked in the case of the pips of white or red grapes; this colour persists if access of air to the liquid is prevented, but turns pale yellow if the oxidation is allowed to proceed for some hours. —T. H. P.

Malic acid in wines; Malo-lactic fermentation. W. Mestrezat. J. Pharm. Chim., 1908, 28, 13—20. (See also this J., 1907, 938).

Rosenstiehl (Rev. vitic., 29, 509) has proposed the name "malo-lactic fermentation" for the secondary fermentation which is often observed in wines and which he regards as bacterial transformation of malic acid into lactic acid and carbon dioxide. Examination of wine from the South of France shows that the disappearance of malic acid is not accompanied by the appearance of lactic acid, and, further, that the amount of carbon dioxide formed is often greatly in excess of that corresponding to the equation: $C_4H_6O_5 = CO_2 + C_3H_6O_3$ The facts established by experimental evidence are that the quantity of malic acid in musts falls to some extent during the primary fermentation, and also, though much less rapidly, during the ageing of the wine.—T. H. P.

Nitrogen of distillery residues; Utilisation of ——. J. Effront. Monit. Scient., 1908, 22, 429—434

By means of plate cultures, the author has isolated from garden soil three organisms which are capable of decomposing the nitrogenous substances of vinasse; one of these is the butyric acid ferment. Instead of using pure cultures of this organism for the production of ammonia from vinasse (this J., 1908, 241), garden soil may be mixed with the alkaline vinasse and the whole heated to 70°—80° C., for an hour; this treatment renders harmful organisms innocuous without destroying those which produce ammonia. The production of ammonia is accelerated by aëration and addition of agglutinants such as aluminium sulphate. Yeast also (*loc. cit.*, 462), may be used for the production of ammonia from vinasse. The vinasse from the distilling column is cooled to 40°—45° C., made alkaline, and treated with yeast from the distillery (1—2 kilos. per hl.), the action being allowed to continue for 3—4 days at 40°—45° C.—L. E.

Catalysis of hydriodic acid by hydrogen peroxide; Comparative influence of iron compounds and of peroxydases on the ——. J. Wolff and E. de Stœklin. *See* XXIV.

Patents.

Worts; Process for the manufacture of ——. V. Lapp, Berlin. U.S. Pat. 891,553, June 23, 1908.

See Fr. Pat. 372,878 of 1906; this J., 1907, 545.—T. F. B.

Crude spirit; Rectification of ——. A. E. Deininger. Ger. Pat. 190,784, May 23, 1905.

The crude spirit is pre-heated by the alcoholic vapours, whereby the latter are at the same time fractionated, then passes through a dephlegmator, where the "first runnings" are expelled by the ascending alcoholic vapours, and is finally heated in a still, by means of the direct and indirect heat of the vapour, without the latter coming into contact with the liquid. The apparatus is so arranged that spirit and vapour pass, separate from one another, in opposite directions, in thin streams, and in a zig-zag course.—A. S.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

(*A*).—FOODS.

Gluten; Modification of the properties of ——, *by sulphurous acid.* J. Dugast. Compt. rend., 1908, **146**, 1287—1288.

Sulphurous acid or gaseous sulphur dioxide modifies greatly the physical properties of gluten, and flours exposed to it partly or entirely lose their baking qualities. The action is specific, and not due simply to acidity. —J. T. D.

Protein substances; New method of hydrolysis of —— by means of hydrofluoric acid. L. Hugounenq and A. Morel. Compt. rend., 1908, **146**, 1291—1293.

Hydrofluoric acid of 20—25 per cent. strength, at 100° C., possesses great advantages, as a reagent for effecting the hydrolysis of protein substances, over baryta, sulphuric acid, or hydrochloric acid, which are commonly used for the purpose. The hydrolysis is complete; it is not accompanied by escape of ammonia nor by blackening; the hydrolytic agent can be completely removed by neutralisation with lime; the amino-acids are not destroyed, and any tyrosine, leucine or its congeners, glycocoll, etc., can be obtained readily; the purine bases are not altered; any carbohydrates liberated are much less altered than by sulphuric or hydrochloric acid —J. T. D.

Lactose in milk; Decomposition of —— by enzymes. A. J. J. Vandevelde. Biochem. Zeits., 1908, **11**, 61—66.

During an investigation on the enzymes of milk it was noticed that, on keeping the samples which had been treated with a solution of iodoform in acetone (see this J., 1908, 86), the lactose gradually underwent some form of decomposition or alteration. In a period of about three months the rotatory power of the milk decreased from 11°·8 to 4°·5 when observed, after treatment with lead acetate, in a 200 mm. tube; this corresponded with an apparent loss of 3·02 per cent. of lactose. The cupric-reducing power of the milk remained practically constant, as did the melting point of the osazone obtained from the sugars present, although the quantity of osazone, as found in periodical determinations, diminished until at last crystals of the osazone could not be obtained. It is thus proved that the lactose was not converted into galactose and dextrose. The same milk, when treated with formaldehyde, or when boiled, exhibited no change in its rotatory power after being kept for three months. —W. P. S.

Patents.

Liquids [fruit juices, milk, etc.]; Treatment of —— for preventing their fermentation, and apparatus therefor. E. W. Kuhn, London. Eng. Pat. 8823, Apr. 16, 1907.

The liquid is introduced into a horizontal cylinder which is mounted so as to be capable of rotating. When the cylinder is completely filled, a pressure of 20 kilos. per sq. cm. is exerted on the liquid by means of a compressing pump. The contents of the cylinder are then heated to a temperature above the normal boiling point of the liquid under treatment, this heating being effected by means of a steam or hot-air jacket surrounding the cylinder, internal tubes also being fitted in the latter. The cylinder is rotated during the heating process, and the pressure is not reduced until the contents are quite cold. The cylinder and the tubes passing through it are silvered.—W. P. S.

Milk; Modified dry ——. J. R. Hatmaker, Paris. U.S. Pat. 891,336, June 23, 1908.

See Eng. Pat. 20,339 of 1904; this J., 1905, 981.—T F. B.

Food preparations from cereals; Manufacture of —— L. C. Reese, London. Eng. Pat. 1528, Jan. 22, 1908.

About 8 parts by weight of malted cereals, 30 to 35 parts of unmalted cereals, 10 parts of bran, and 300 parts of water at a temperature of about 55° C., are mixed together in a vat provided with a stirring device. Steam is then blown into the mixture until the temperature is raised to 68° C., and, when the starch contained in the mixture has been converted, the mass is filtered, and the filtrate is evaporated under reduced pressure. The filter cake obtained is at once heated with water under pressure to a temperature of from 110° to 130° C. for several hours. The mixture is then filtered and the filtrate is added to, and evaporated with, the first filtrate obtained.—W. P. S.

Coffee; Treatment or preparation of ——. K. H. Wimmer, Bremen, Germany. Eng. Pat. 2035, Jan. 29, 1908. Under Int. Conv., Jan. 29, 1907.

See Fr. Pat. 384,233 of 1907; this J., 1908, 465.—T. F. B.

(*B.*)—SANITATION; WATER PURIFICATION.

Patents.

Effluents [containing lime]; Treatment of ——. R. L. Allen, Sandbach, Cheshire. Eng. Pat. 24,381, Nov. 4, 1907.

The effluent containing calcium hydroxide in solution, such as that from sewage which has been treated with this reagent, is diluted to about three times its volume with water taken from the stream or river into which the effluent is to be discharged, and the mixture is then treated with carbon dioxide. The object of the treatment is to prevent the formation of a precipitate when the effluent is discharged into a river.—W. P. S.

Sewage; Purification and utilisation of ——. P. Parsons, Blackburn, Lancs. Eng. Pat. 7365, April 3, 1908.

Means are described for raking or scarifying the surface of the layer of earth used in the filter beds employed in the apparatus claimed in Eng. Pat. 25 of 1907 (this J., 1908, 87). A travelling platform running on rails fixed to the sides of the filter bed may be used where it is desired to turn over the surface of the soil by hand-rakes, etc., or travelling harrows, operated from the ends of the bed, may be employed. The platform can also be utilised for distributing lime over the surface of the bed in order to neutralise the acidity of the soil.—W. P. S.

Sewage and waste waters; Apparatus for biological purification of ——. J. J. E. Douzal. First Addition, dated Jan. 16, 1908, to Fr. Pat. 385,573, March 21, 1907 (this J., 1908, 639).

The apparatus consists of two tanks, one for liquefaction and the other for oxidation. The liquefaction tank is divided by horizontal perforated discs into four superposed compartments, the crude sewage being delivered into the lowest chamber. Thus the solid matters cannot penetrate upwards through the disc until they have been resolved by fermentation. The discs have the effect of dividing the contents of the tank into layers of different densities, each layer containing the type of organism most suited to its conditions; competition between the various liquefying organisms is thus prevented. The uppermost disc consists of a layer of peat held between two sheets of perforated metal, which acts as a filter and prevents the formation of a dense head of fatty substances above the surface of the liquid. Being thus immersed in the ammoniacal liquid, the fats are saponified and dissolved. The liquid from the first tank is suitably diluted and passes to the oxidising tank, this being provided with a constant-level feeding arrangement, which prevents the over-charging of the oxidation beds. These consist of filter-beds of peat on which is disposed the contact substance, such as pieces of slag, increasing in size from the top to the bottom. The liquid filters from the first bed through the peat and falls on the second bed below. From this it trickles down a helical channel, also filled with contact substance and peat, and finally emerges at the bottom after passing through a filter of sand. The oxidation tank is continuously ventilated from below, upwards.—J. F. B.

(C.)—DISINFECTANTS.

Patent.

Paraffin oil ; Method of rendering —— emulsifiable. L. E. Common, Sutton-on-Hull, and The Hull Oil Manufacturing Co., Ltd., Hull. Eng. Pat. 16,969, July 24, 1907.

The paraffin oil is mixed with about one-fourth of its weight of a suitable fat or oil, such as cottonseed oil, previously sulphonated, and the mixture saponified by means of potassium hydroxide or other suitable alkali or alkali carbonate, preferably added in the form of a 4 per cent. lye. The resulting product gives a stable emulsion with water, and is valuable *inter alia* as an insecticide.—C. A. M.

XIX.—PAPER, PASTEBOARD, &c.

Modern papers : their preparation and examination. C. Fritzsche. Z. angew. Chem., 1908, **21**, 1134—1140.

Patents.

Fibres and rags of all colours for papermaking ; Bleaching of ——. R. Schuehmacher. First Addition, dated Jan. 7, 1908, to Fr. Pat. 373,327, Jan. 4, 1907 (this J., 1907, 713).

According to this addition the oxides of manganese deposited in the fibres, after treatment with manganates or permanganates, may be removed by liquid sulphurous acid, as well as by the substances mentioned in the original specification.—J. F. B.

Celluloid and the like ; Substitute for ——, and process of manufacturing the same. E. A. L. Rouxeville, Paris. Eng. Pat. 13,023, June 5, 1907. Under Int. Conv., June 5, 1906.

See Fr. Pat. 376,269 of 1906 ; this J., 1907, 988.—T. F. B.

Celluloid ; A new ——. A. E. Peyrusson. First Addition, dated April 13, 1907, to Fr. Pat. 374,395, April 14, 1906 (this J., 1907, 776).

The ricinoleates mentioned in the original specification may be replaced by sulphoricinoleates, which answer the same purpose, viz., as substitutes for the whole or a part of the camphor in celluloid compositions. Magnesium sulphoricinoleate is particularly suitable for blending with nitrocellulose.—J. F. B.

Cellulose derivative. E. Knoevenagel, Heidelberg, and H. Lebach, Assignors to Knoll und Co., Ludwigshafen on Rhine, Germany. U.S. Pat. 891,218, June 16, 1908.

See Fr. Pat. 373,994 of 1907 ; this J., 1907, 776.—T. F. B.

Briquettes ; Manufacture of —— from pyritic minerals, for preparation of sulphur dioxide. Fr. Pat. 386,695. *See* VII.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

Acocanthera wood and the heart-poison, ouabin. R. Müller. Z. allgem. österr. Apoth.-Ver., 1908, **46**, 319—321, 331—333, 343—345.

The first of the above three papers on the wood of *Acocanthera* and the heart poison, ouabin, gives a summary of the literature on the subject. The second paper deals with the constants of ouabäin, the active principle, as found by different observers, and its therapeutic uses. The third paper contains a botanical description by the author of the plant *Acocanthera Deflersii*, and the results of a microscopical examination of the bark and wood. —F. Shdn.

"*Bourgou*" (*Panicum stagninum*) ; *Chemical examination of ——.* E. Perrot and E. Tassilly. Bull. Soc. Chim., 1908, **3**, 740—742.

Bourgou (*Panicum stagninum*) is a sugar-bearing graminaceous plant, which is found in the marshes of the middle Niger district. The natives prepare a sugary liquid known as Koundou-hari, by extracting the crushed plant with hot water. This syrupy liquid is of a dark caramel colour, and has a sweet though at the same time, acrid taste. It is used as a beverage, either fresh or after fermentation ; and, when concentrated to a thick molasses, is sold in the African markets under the name of "Katou." An analysis of the plant showed that it contained 10·06 per cent. of saccharose and 7·41 per cent. of sugars calculated as glucose, capable of reducing Fehling's solution. When treated with emulsin, as a test for glucosides, a negative result was obtained, but with amygdalin an alteration in rotatory power, as also the production of hydrocyanic acid, proved the presence of emulsin.—J. A.

Melaleucas ; Australian —— and their essential oils. Part II. R. T. Baker and H. G. Smith. J. and Proc. Roy. Soc., N.S.W., **41**, 196—210. (See this J., 1908, 353).

Melaleuca uncinata, R. Br.—The yield of oil was 1·246 per cent. from leaves and terminal branchlets. The crude oil is faintly yellow and has a strong cajuput odour ; it would answer to the B. P. tests for cajuput oil. It is rich in cineol and contains also *d*-pinene, a sesquiterpene, and a crystalline substance, which comes over late in the distillation, but no phellandrene. It has the saponification value 3·05, is soluble in 1½ vols. of 70 per cent. (by weight) alcohol, and is dextrorotatory, $\alpha_D = +7{\cdot}2°$ in a 100 mm. tube ; sp. gr. at 15° C., 0·9259 ; $n_D^{15°} = 1{\cdot}4788$. On rectification, there were obtained : below 172° C., 4 per cent. ; between 172° and 177° C., 41·6 per cent. (sp. gr. 0·9086 at 15° C., $\alpha_D = +5{\cdot}1$, $n_D^{17°} = 1{\cdot}4695$) ; 177°—195° C., 24·8 per cent. (sp. gr. 0·9153, $\alpha_D = +2{\cdot}3°$, $n_D = 1{\cdot}4706$) ; 195°—197° C., 2·6 per cent. (sp. gr. 0·9186, $\alpha_D = +2{\cdot}1$, $n_D = 1{\cdot}4738$). From the residue, a white crystalline mass separated, which on further purification proved to be an alcohol, $C_{10}H_{18}O$, m.pt. 72·5° C., $[\alpha]_D = +36{\cdot}99$ in alcoholic solution, for which the name, *uncineol* is proposed. The oil distilling below 195° C., yielded 66 per cent. of cineol by the phosphoric acid method. The leaves of *M. uncinata* will yield either an oil rich in cineol by distilling for only two hours, or a substitute for cajuput oil by distilling for 4—5 hours : the latter method would probably prove more advantageous commercially. *M. nodosa*, Sm.—The leaves and terminal branchlets of this plant, which is known as "tea tree scrub," yielded 0·664 per cent. of a light lemon-yellow oil (reddish when distilled in iron vessels), with a terpene-like odour somewhat masked by the presence of a small amount of aldehydes, probably butyraldehyde or valeraldehyde. The crude oil had the sp. gr. 0·8984 at 15° C., $n_D^{18°} = 1{\cdot}4689$, $\alpha_D = +11{\cdot}6°$ in a 100 mm. tube. On rectification, there were obtained : 158°—172° C., 62 per cent. (sp. gr. 0·8917, $n_D = 1{\cdot}4686$, $\alpha_D = +14°$) ; 172°—183° C., 28 per cent. (sp. gr. 0·9022, $n_D = 1{\cdot}4689$, $\alpha_D = +6{\cdot}5°$) ; 183°—245° C., 5 per cent. (sp. gr. 0·9161, $n_D = 1{\cdot}4741$). The crude oil yielded 33 per cent., and the second fraction, 48 per cent. of cineol by the phosphoric acid method. The saponification value for the esters was 7·24. The oil also contains a considerable amount of *d*-pinene, and a small quantity of a high-boiling sesquiterpene, but no crystalline constituent or phellandrene. It is insoluble in 10 vols. of

70 per cent. (by weight) alcohol, but soluble in 1 vol. of 80 per cent. alcohol. The first fraction is also insoluble in 10 vols. of 70 per cent. alcohol.—A. S.

Oil of cade ; A sesquiterpene accompanying cadinene in ——. N. Lepeschkin. J. Russ. Phys.-Chem. Ges., 1908, **40**, 126—133. Chem. Zentr., 1908, **1**, 2040.

In the preparation of cadinene from oil of cade, the yield of crystalline dihydrochloride is relatively small, although the consumption of hydrochloric acid is considerable. This is owing to the presence in the oil, besides cadinene, of another sesquiterpene, which yields a liquid hydrochloride. After removing the crystalline dihydrochloride, the new sesquiterpene can be separated from the liquid by fractional distillation. It is a faintly yellow liquid of pleasant odour, boiling at 262°—266° C. at 760 mm. and at 135°—140° C. at 20 mm. ; sp. gr. at 20°/4° C., 0·9204 ; $n_D^{20°} = 1·5159$. When treated with hydriodic acid at 200° C., it behaves differently to cadinene, yielding an isomeric hydrocarbon, possibly identical with humulene, boiling at 250°—258° C., sp. gr. 0·8946 at 20°/4° C. ; $n_D^{20°} = 1·4972$.—A. S.

Phellandrene from water-fennel oil. J. Kondakow. J. prakt. Chem., 1908, **78**, 42—46. (See also this J., 1905, 1029 ; 1907, 341.)

So-called natural phellandrene, which consists of a mixture of pinene and phellandrene, when treated with hydrogen chloride in various solvents yields different products. The pinene causes the formation of *d*-bornyl chloride with more or less dipentene dihydrochloride. The other hydrocarbon yields an unsaturated monohydrochloride and a fluid dihydrochloride. These two chlorine compounds both yield an optically inactive hydrocarbon boiling at 177°—182° C.—F. Shdn.

Citronella series ; Compounds of the ——. C. Harries and A. Himmelmann. Ber., 1908, **41**, 2187—2199.

The authors have drawn conclusions respecting compounds of the citronella series by studying the behaviour of their ozonides, and consider that certain members of this series are mixtures. Citronellal-ozonideperoxide, $C_{10}H_{18}O_5$, is formed by the direct action of ozone on citronellal. It is a thick oily liquid, which passes into citronellal-ozonide when shaken with a solution of sodium bicarbonate. When citronellal dissolved in carbon tetrachloride is treated with ozone, the compound, $C_{10}H_{18}O_6$, is formed. This ozonide is a thick colourless syrup with an extremely penetrating odour, and is soluble in most organic solvents with the exception of light petroleum. When boiled with water, 25 grms. of the ozonide yielded 2 grms. of acetone and 6 grms. of β-methyladipinic acid. The ozonideperoxide of citronellic acid, $C_{10}H_{18}O_6$, is formed by passing ozone into a solution of the acid in carbon tetrachloride till the liquid no longer decolorises bromine. This substance is a thick colourless syrup, insoluble in ether and light petroleum. The corresponding ozonide of citronellic acid, $C_{10}H_{18}O_7$, is formed by passing ozone into the carbon tetrachloride solution till it is blue. 20 grms. of the ozonide when boiled with water yielded 2·6 grms. of acetone and 8 grms. of β-methyladipinic acid. Citronellol when treated with ozone, only takes up one molecule of the latter. 15 grms. of the ozonide, when decomposed, only yielded 0·8 grm. of acetone and an oil from which no definite substance could be isolated. In the decomposition of the ozonides of citronellal and of citronellic acid, the amount of acetone produced was approximately equivalent to the amount of β-methyladipinic acid.—F. Shdn.

Morindin ; Note on ——. A. G. Perkin. Chem. Soc. Proc., 1908, **24**, 149—150.

Morindin (from *Morinda citrifolia*) according to Oesterle and Tisza (this J., 1907, 1273) possesses the formula $C_{27}H_{30}O_{15}$, not $C_{26}H_{28}O_{14}$ as suggested by Thorpe and Greenall (Chem. Soc. Trans., 1887, **51**, 52), and gives an acetate, $C_{27}H_{21}O_{15}(C_2H_3O)_9$, m. p. 236—237°, readily soluble in alcohol. An examination of morindin (from *Morinda umbellata*) by the author gave results agreeing with the older formula, $C_{26}H_{28}O_{14}$ (Found, C = 55·37 ; H = 5·14). The acetyl derivative, prepared by adding pyridine to the substance in acetic anhydride and boiling for three hours, forms pale yellow needles, m. p. 246—248°, very sparingly soluble in alcohol, and possessing the formula $C_{26}H_{20}O_{14}(C_2H_3O)_8$. Morindin acetate was unaltered by long digestion with acetic anhydride, and was also formed when the method given by Oesterle and Tisza (*loc. cit.*) was employed. The sugar obtained by hydrolysis of the glucoside gave an osazone, m. p. 202—203°, sparingly soluble in alcohol, whereas that described by Oesterle and Tisza is readily soluble, and melts at 197°. Independent analyses of morindin gave C = 55·10, 55·10 ; H = 5·00, 5·20 per cent., and it thus seems likely that the morindin present in the *Morinda citrifolia* is not identical with that contained in the *Morinda umbellata*.

Aluminium chloride ; A new catalytic effect of ——. E. Boedtker. Bull. Soc. Chim., 1908, **3**, 726—729.

By acting upon chloropicrin, $C(NO_2)Cl_3$, with benzene in presence of aluminium chloride, the author found that the copious evolution of hydrochloric acid which at first took place was followed by the liberation of nitric oxide. The product of the reaction was poured into hydrochloric acid solution, washed with water and the benzene removed by distillation. By treatment with alcohol a resinous residue was obtained in which no definite compound could be identified. The alcoholic solution yielded a crop of white crystalline scales melting at 164° C. which proved to be triphenylcarbinol, and from the mother-liquor there was obtained a small quantity of crystals of triphenylmethane. Under similar conditions on adding aluminium chloride to a mixture of ethyl nitrate and benzene at the ordinary temperature, a violent reaction took place, resulting in the production of nitrobenzene. It is suggested that this is a reaction which may be applied generally for nitration, but it differs from the ordinary nitration process in that a large excess of the hydrocarbon must be employed instead of the usual large excess of nitric acid. Also, since the reaction results in the hydration of the aluminium chloride, large quantities of this salt must be used. To determine the position occupied by the nitro-group when nitration is carried out by this method, the products obtained when nitrating toluene were examined, and it was found that though *o*-, *p*-, and *m*-nitrotoluene were all produced, the nitro-group enters by preference in the ortho position. The radical of nitrous acid behaves similarly to that of nitric acid in this reaction, as a mixture of amyl nitrite and benzene in presence of aluminium chloride yielded nitrosobenzene, though only in small quantity.—J. A.

Aniline ; Heat of neutralisation of —— *by acetic or benzoic acid in benzene solution.* L. Vignon and Evieux. Compt. rend., 1908, **146**, 1316—1318.

Neither of these acids, when presented to aniline in benzene solution, forms a salt with it. On the contrary, the already formed salts when dissolved in benzene are completely dissociated.—J. T. D.

Hydrogenation of aliphatic terpene derivatives [*by means of nickel and hydrogen*]. C. J. Enklaar. Ber., 1908, **41**, 2083—2087.

Ocimene, linalool, and geraniol when reduced by passing over nickel at 130° C. according to the method of Sabatier and Senderens (this J., 1908, 642), each yield decane. These results are only obtained at a temperature of 130°—140° C., and when the hydrogen is in excess. When this temperature is maintained and a larger proportion of geraniol vapour used, the chief products are decanol, and a cyclic alcohol, $C_{10}H_{20}O$, which forms an acid phthalic ester melting at 169°—170° C., and has the sp. gr. 0·906 at 15°/4° C.—F. Shdn.

Aldehydes ; Conversion of carboxylic acids into the corresponding ——. G. Merling. Ber., 1908., **41**, 2064—2066.

The process described by the author has proved specially suitable for the preparation of aldehydes from hydroaromatic acids. It consists essentially in converting the acids into diphenylamidines, reducing these to diphenylmethylenediamino-bases, and heating the latter with dilute mineral acids, whereby they yield the aldehyde and aniline. For the preparation of the diphenylamdine the carboxylic acid is converted, in succession, into the acid chloride, the anilide, and by the action of phosphorus pentachloride, the phenylimidechloride. The latter is introduced into four times the theoretical quantity of aniline, the mixture being cooled at first, and afterwards heated for several hours on the water-bath. The product is dissolved in eight times its weight of absolute alcohol, and two or three times the theoretical quantity of sodium added gradually to the boiling solution. After diluting with water, the alcohol and aniline are removed by distillation, the residual oily diphenylmethylenediamino-base is separated from the alkaline liquid, mixed with excess of dilute sulphuric acid, and the aldehyde separated by distillation with steam, and purified by distilling *in vacuo*. Yields of from 50 to 80 per cent. of the calculated quantity are obtained. The formation of the diphenylmethylenediamino-base and of the aldehyde may be expressed by the following equations :—

$$R.C(NH.C_6H_5):N.C_6H_5+H_2=R.CH(NH.C_6H_5)_2.$$
$$R.CH(NH.C_6H_5)_2+H_2O=R.CHO+2C_6H_5.NH_2.$$

By applying the method to the Δ^1- (α-), Δ^2- (β-), Δ^3-, and Δ^4- cyclogeranic acids, the corresponding cyclocitrals were obtained. α-Cyclogeranic acid yields a mixture of approximately equal parts of α- and β- cyclocitral ; hence in this case the conversion into the aldehyde is accompanied by a displacement of the double linkage.—A. S.

Dehydrodieugenol, the product of the oxidation of eugenol by the oxidising enzyme of mushrooms or by ferric chloride. H. Cousin and H. Hérissey. Compt. rend., 1908, **146**, 1413—1415.

When a solution of eugenol in 95 per cent. alcohol is treated with a glycerol extract of *Russula delica* and afterwards subjected to the action of a current of air, the eugenol is oxidised to dehydrodieugenol, $C_{20}H_{22}O_4$, which melts at 105—106° C., and in alcoholic solution gives a blue coloration with ferric chloride. Oxidation of eugenol by means of ferric chloride also yields dehydrodieugenol, the diacetyl- and dibenzoyl-derivatives of which have been prepared.—T. H. P.

Phenols ; Messinger and Vortmann's method for determining ——. *Separation of salicylic acid.* J. Bougault. Compt. rend., 1908, **146**, 1403—1405.

The author has found this method (this J., 1890, 1070) to give good though as a rule rather high results ; but he finds that the substances, $C_6H_3I_2OI$ and $C_6H_3I.OI.CO_2K$, which are formed from phenol and salicylic acid respectively, are really mixtures of Lautemann's "red substance," $C_6H_2I_2O$, with tri-iodophenol and potassium di-iodosalicylate respectively. The ultimate result of the action of iodine on either phenol or salicylic acid is this "red substance" or tetraiododiphenylenequinone, and upon this the author bases a method for separating salicylic acid from, for example, cinnamic acid. The mixture (0·1—0·2 grm. of each) is dissolved in 50 c.c. of water containing 1 grm. of sodium carbonate, excess of iodine is added, and the mixture heated for 20 minutes on the water-bath, and finally boiled under a reflux condenser, with addition of a little iodine from time to time so as to keep it in excess. The excess is then destroyed by sodium sulphite, the precipitate of "red substance" collected on asbestos in a Gooch crucible, dried and weighed. The weight of salicylic acid is 138/344 of that of the "red substance." The cinnamic acid is extracted from the filtrate.—J. T. D.

Primary alcohols ; Action of metallic oxides on ——. P. Sabatier and A. Mailhe. Compt. rend., 1908, **146** 1376—1378.

The authors have studied the behaviour of metallic oxides on alcohols, at temperatures not exceeding 400° C. The oxides fall into four classes :—1. Those which are not reduced and exert no decomposing action on the alcohol—the alkaline-earths, magnesia, silica, titanic anhydride. 2. Those which are simply reduced to metal or to lower oxides. 3. Those which are not reduced, but which catalytically decompose the alcohols, either into aldehyde and hydrogen, or into olefine and water. 4. Those which, while exerting catalytic influence, are gradually reduced.—J. T. D.

Wood charcoal ; Decomposition of alcohols under the catalytic influence of ——. G. Lemoine. Compt. rend., 1908, **146**, 1360—1366.

Under the influence of previously-ignited wood charcoal, the vapours of alcohols of the ethylic series are decomposed, to a large extent by dehydrogenation, and not entirely by dehydration, as is the case with animal charcoal (this J., 1907, 277). Isopropyl alcohol is an exception to this, and is differentiated by its behaviour from the normal alcohol. The experiments support the view that the part played by catalytic substances is to lower the temperature at which reaction occurs.—J. T. D.

Alkyl nitrates ; Reduction of ——, *to nitrites by reducing salts in alkaline solution.* A. Gutmann. Ber., 1908, **41**, 2052—2056.

Ethyl nitrate or isoamyl nitrate, heated with an aqueous solution of arsenious acid with excess of sodium hydroxide, yields sodium nitrite and arsenate, and the corresponding alcohol. In all likelihood the alkylhydroperoxide is an intermediate product.

$$NO_2.OR+NaOH=NO_2Na+R.OOH.$$
$$R.OOH+As(ONa)_3=R.OH+AsO(ONa)_3.$$

With potassium hydrosulphide, ethyl nitrate yields potassium nitrite and ethyl hydropersulphide,

$$NO_2.OC_2H_5+KHS=NO_2K+C_2H_5.OSH,$$

for when potassium cyanide is present also, the fina products are alcohol and potassium thiocyanate

$$C_2H_5.OSH+KCN=C_2H_5OH+CNSK.$$

—J. T. D.

Ammonia and amines ; Separation of —— *by boiling absolute alcohol.* J. Bertheaume. Compt. rend., 1908, **146**, 1215—1217.

Boiling absolute alcohol dissolves 25·0 grms. of monomethylamine hydrochloride and 2·266 grms. of ammonium chloride per 100 c.c. when saturated in presence of both equilibrators, and the same alcohol at 0° C. dissolves 6·0 grms. of the amine hydrochloride and 0·65 grm. of ammonium chloride per 100 c.c. The salt which crystallises on cooling from the boiling point to 0° C. will thus contain 8·5 per cent. of ammonium chloride as a minimum, and the results show that monomethylamine hydrochloride cannot be purified by treatment with boiling alcohol. Contrary to the general opinion ammonium chloride is not insoluble in solutions saturated with methylamine hydrochloride.—E. F. A.

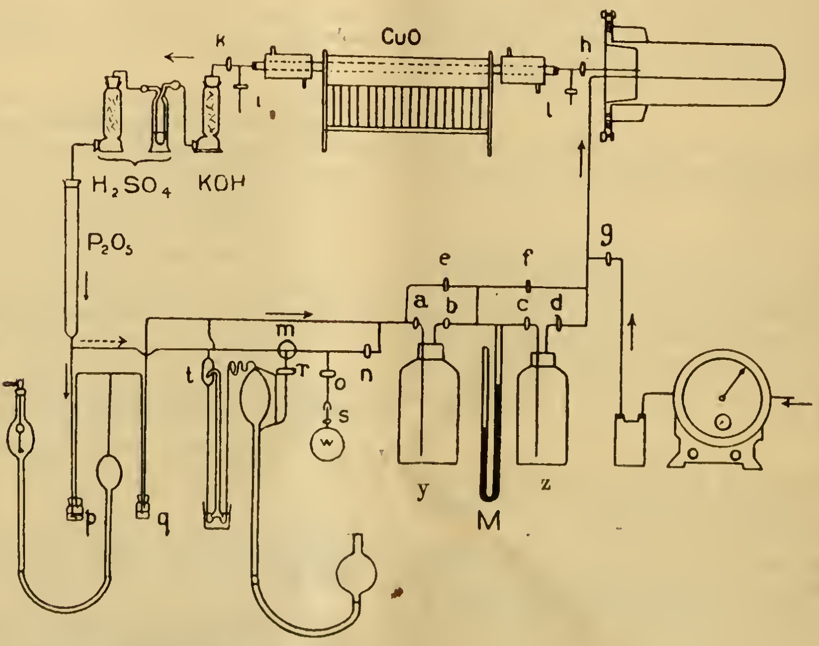
Chloro-auric acid; Action of silver nitrate on ——, and preparation of gold fulminate. J. Jacobsen. Compt. rend., 1908, **146**, 1213—1214.

CHLORO-AURIC acid, $AuCl_3,HCl$, was prepared by acting on gold, suspended in hydrochloric acid, with chlorine. It reacts with silver nitrate, forming a brown precipitate, $Au(OH)_3,4AgCl$; when this is treated with ammonia the silver chloride is dissolved and a yellow flocculent precipitate of gold fulminate remains, which detonates very violently when dry, but is more stable when moist. It is an auriamine of the composition, $Au(OH)_2NH_2$ or $AuN,2H_2O+H_2O$. When heated with potash, half the nitrogen escapes in the form of ammonia, and a flocculent brownish-black product remains, which is still more explosive. This is probably a biauriamine, $(HO)_2Au.NH.Au(OH)_2$.—E. F. A.

Silver iodide; Solubility of ——, in ammonia. H. Baubigny. Compt. rend., 1908, **146**, 1263—1265.

KNOWN quantities of potassium iodide in solution were precipitated, in tubes ready for sealing, by slight excess of silver nitrate, and the precipitated silver iodide was thoroughly washed with water by decantation, and dried. Known amounts of aqueous ammonia (sp. gr. 0·926 at 16° C.) were added, the tubes sealed, heated to 50°—60° C., and slowly cooled to 16° C. In this way the maximum amount of silver iodide was found which did not deposit any crystals after 24—48 hours. The solubility of silver iodide in aqueous ammonia of 0·926 sp. gr. at 16° C. was thus found to be 1 part in 6000.—J. T. D.

Argon; Preparation of —— from air by means of calcium carbide. F. Fischer and O. Ringe. Ber., 1908, **41**, 2017—2030.



THE method consists in passing purified air over heated calcium carbide, thus absorbing both the oxygen (with formation of lime, carbon oxides, and possibly carbon) and the nitrogen ($CaC_2+N_2=NC.NCa+C$, a reaction which the authors find to be irreversible, within the limits of temperature they used); the gas obtained on a first passage over the heated carbide being circulated over it again and again till no further absorption occurs. The arrangement of the apparatus will be understood from the diagram.

The carbide vessel, of iron about 8 mm. thick, and holding about 7 kilos. of carbide, was provided with a water-jacket at one end, and also with a water-cooled lid, through which the iron entrance- and exit-tubes were soldered; the flanges of vessel and lid were bolted together upon a rubber washer coated with Chatterton's compound. This was heated in a furnace, not shown in the figure, to a temperature of 800°C., after filling with a mixture of 90 per cent. of calcium carbide and 10 per cent. of dry calcium chloride, and all evolved gases taken away by a water-pump. Connection was then made to the apparatus as shown, and the whole apparatus evacuated by the water-pump connected at *l*. Cocks, *l*, *d*, and *f*, were now closed, *g* opened, so that air could stream through the gas-meter and the vessel for absorbing moisture and carbon dioxide into the carbide-vessel, and *h* very slightly opened so as to allow a very slow passage of air through the carbide-vessel. This was allowed to go on till the whole apparatus was full of gas at atmospheric pressure, the gas on its way from the carbide to the gas-holders passing over heated copper oxide and through the absorbing tubes to remove any carbon monoxide, hydrogen, or hydrocarbons, as well as all the carbon dioxide produced. At this stage, the cock, *g*, was closed, *d* opened, *h* fully opened, and the circulating pump set in action. This ingenious apparatus, at the bottom left-hand corner of the figure, consists of two mercury vessels connected as shown, the upper one furnished with a cork through which passes a T-tube; the side branch of the T-tube connects with the water-pump, while the upper end of the main tube is furnished with a valve, the spindle of which is joined to the glass spindle shown, provided with a small and a large bulb. The length of this spindle, the sizes of the bulbs, and the quantity of mercury are so arranged that (the pump being always in action) as the mercury flows out of the upper vessel, the spindle gradually falls, the pump drawing air through the valve, and when the mercury has completely left the vessel, the weight of the spindle closes the valve. The pump now lowers pressure in the upper vessel, and the mercury rises into it from the lower vessel. The flotation of the mercury is not enough to overcome the pressure on the valve till it has covered the upper bulb, so that the upper vessel is filled and the lower one emptied; then the valve opens, air is admitted, and the mercury falls again. Each time the lower vessel is emptied, gas is drawn through the bubble-valve, *p*, and each time it is filled, gas is driven through the bubble-valve, *q*. Thus a continuous circulation of the gas in the apparatus was kept up, as long as further diminution of pressure showed that absorption was still going on. When this ceased, cock, *b*, was closed, and by means of the Töpler pump, the gas from the whole apparatus was pumped into the main gasholder, *y*, where it was shut off. More air was now admitted, and the whole process repeated, using (with *e* open and *f* closed) the auxiliary gas-holder, *z*, only. After absorption had ceased, the gas was pumped into the main holder, and so on till this was filled. When in this way the limit of capacity of the apparatus had been reached, the gas was circulated again for several hours; then the carbide was changed, the vessel exhausted and re-connected, and the circulation kept up for two days, though no further absorption occurred. The purity of the gas obtained was ascertained by determining its density, which was found to be 19·94, by sparking with oxygen, and by the spectroscope. In the authors' experiment, on the first day 920 litres of air entered the apparatus during eight hours, in four operations, and on the second day 345 litres during nine hours, also in four operations; this volume yielded about 11 litres of argon. —J. T. D.

Helium and radio-activity in rare and common minerals. R. J. Strutt. Royal Soc. Proc., 1908, **80A**, 572—594.

The author finds that helium may be detected in nearly all minerals and that the quantity is in most cases dependent upon the traces of uranium and radium contained in the minerals, as illustrated by the following examples.

Mineral.	Helium present cb. mm. per kilo.	Ratio of helium to uranium oxide.
Samarskite	1,500,000	14
Hæmatite	700	9
Galena	2	17
Quartz	2	10

For higher helium ratios than the above, the excess of helium can, except in the case of beryl, always be connected with the presence of thorium. The experiments give no evidence that helium is produced by the radio-activity of ordinary elements.—W. S.

Patents.

Formates; Manufacture of alkali ——. Farbwerke vorm. Meister, Lucius, und Brünig, Höchst on Maine, Germany. Eng. Pat. 8012, April 10, 1908. Under Int. Conv., April 10, 1907.

Calcined commercial sodium carbonate mixed with a little more than the equivalent quantity of well dried calcium hydroxide is exposed to the action of carbon monoxide under pressure, at a temperature of about 150° C., with formation of sodium formate and calcium carbonate. When carbon monoxide is no longer absorbed, the sodium formate is separated by lixiviation from the carbonate or any excess of calcium hydroxide.—O. R.

Camphene; Process of making ——. O. C. Billeter, Assignor to Chemical Works formerly Sandoz, Basle, Switzerland. U.S. Pat. 891,033, June 16, 1908.

See Fr. Pat. 375,897 of 1907; this J., 1907, 947.—T. F. B.

Camphene; Process for the preparation of ——. Fabrique de Prod. Chim. ci-dev. Sandoz. Fr. Pat. 386,928, April 24, 1907.

See Eng. Pat. 10,783 of 1907; this J., 1908, 643.—T. F. B.

Radio-active substances from uranium, thorium, or their compounds; Preparation of ——. A. P. H. Trivelli. Fr. Pat. 386,751, Jan. 30, 1908. Under Int. Conv., Jan. 31, 1907.

Uranium, thorium, or their compounds are exposed in a vacuum to the action of cathode rays or of Röntgen rays, the action of which may be supplemented by radioactive substances disposed in the tubes.—J. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Photohaloids; Simplest method of preparing Carey Lea's ——. Lüppo-Cramer. Z. Chem. Ind. Kolloide, 1908, **2**, 360—361.

Photo-haloids are prepared by the action of colloidal silver on silver halides. It is unnecessary to prepare the colloidal silver separately, it being simpler to treat the silver halide containing a slight excess of silver nitrate with a suitable reducing agent. Only those reagents which exert a very gentle reducing action on silver salts can be used, such as iron citrate and tartrate. For example 7·8 c.c. of a 10 per cent. potassium iodide solution are precipitated with 10·5 to 11 c.c. of a 10 per cent. silver nitrate solution, and a mixture of 15 c.c. of sodium citrate (or sodium-potassium citrate) solution (1 : 3) with 5 c.c. of ferrous sulphate solution (1 : 3) is then added. The formation of reddish-brown colloidal silver is plainly visible; the precipitate is washed repeatedly with a mixture of equal parts of nitric acid of sp. gr. 1·4 and water, by which means silver is dissolved and an intensely bluish-violet photobromide remains. The corresponding photochloride and photoiodide are produced in an analogous manner. As reducing agents tannic and gallic acids in presence of alkali bicarbonate, or formaldehyde with sodium carbonate may also be used, or sodium hypophosphite, in presence of excess of silver, though it reduces pure silver halides with extreme slowness. The author considers that the above methods of preparation of silver halides confirm his view that these latter are simple adsorption compounds of silver halides with silver.—E. F.

Gelatin; Precipitation and rendering insoluble of ——. A. L. Lumière and A. Seyewetz. *See* XIV.

XXII.—EXPLOSIVES, MATCHES, &c.

Safety explosives, Grisoutine G and B, Test of a suggested alteration of ——. Dautriche. Z. ges. Schiess- und Sprengstoffwesen, 1908, **3**, 251.

The composition of the original explosives and of the suggested modifications, is shown in the following table.

	G— old type.	GG— suggested type.	B— old type.	BG— suggested type.
	Per cent.	Per cent.	Per cent.	Per cent.
Nitroglycerin	29·10	29·10	11·76	11·76
Nitrocellulose	0·90	0·90	0·24	0·24
Ammonium nitrate .	70·00	67·00	88·00	85·00
Kieselguhr..........	—	3·00	—	3·00

Comparative experiments carried out by the French War Department showed that types GG and BG withstood the effects of moisture better, while the temperature of explosion was reduced. The influence of heat was about the same. The shattering force was unaffected. The manufacture of types GG and BG was permitted. —J. W. G.

Chloroauric acid ; Action of silver nitrate on ——, and preparation of gold fulminate. J. Jacobsen. *See* XX.

Patent.

Explosives ; Weather-proof blasting ——. D. Claessen, Berlin. Eng. Pat. 2509, Feb. 4, 1908.

"Aniline-metallic compounds," such as aniline calcium chloride, or aniline copper sulphate, are added to the explosive in the proportion of, say, 5 to 10 per cent. It is stated that treatment with aniline deprives hygroscopic salts more or less of their power of attracting moisture. Special claim is made for explosives consisting of "ammoniacal saltpetre" or mixtures thereof with potassium nitrate or sodium nitrate, incorporated with such aniline metallic salt compounds.—C. A. M.

XXIII.—ANALYTICAL CHEMISTRY.

APPARATUS.

Viscosity ; Determination of —— at high temperatures. C. E. Fawsitt. Roy. Soc. Proc., 1908, **80**, A, 290—298.

A method suitable for determining the viscosity of molten masses at high temperatures is described. The apparatus consists of a circular disc of iron, platinum, fireclay, or carbon, which is attached to a steel rod about one foot long. At the other end of this rod is a chuck for holding a thin copper wire. The steel rod is weighted about 2—3 inches above the disc in order that the latter may be made to sink in the liquid. On suspending the apparatus by the copper wire, so that the disc sinks a little below the surface of the liquid, the apparatus is made to execute a series of torsional oscillations about its centre of oscillation. The amplitude of the oscillation is observed by means of a needle attached to the steel rod, and it is found that the decrease in amplitude bears a definite relation to the density and viscosity of the liquid. If the density is known, the viscosity can be calculated. The method has given satisfactory results at temperatures of 1000° C. and over.—C. E. F.

Patents.

Pyrometers or thermometers of the thermo-electric or electric resistance type. Siemens Brothers and Co., Ltd. From Siemens und Halske, Akt.-Ges., Berlin. Eng. Pat. 7910, April 9, 1908.

The claim is for coating the metal tube which encases the insulated wires with electrolytically deposited nickel or other suitable metal, in order to lessen the porosity of the tube and prevent corrosion of the wires. As an additional precaution an outer metal tube or sheath, closed at one end, is used to protect the nickel coating. —W. H. C.

Pyrometer. C Féry, Paris. U.S. Pat. 890,895, June 16, 1908.

See Fr. Pat. 304,884 of 1906 ; this J., 1906, 916.—T. F. B.

INORGANIC—QUALITATIVE.

Bromides alone or in solution with chlorides ; Delicate test for ——. J. S. Jamieson. Chem. Soc. Proc., 1908, **24**, 144.

The solution to be tested is heated to boiling with 1 or 2 c.c. of dilute sulphuric acid and 1 or 2 c.c. of potassium bichromate ; it is then cooled, and shaken with chloroform. The chloroform layer is separated, washed two or three times with water, and finally shaken with a little dilute potassium iodide solution. In the presence of a bromide, the chloroform is coloured violet, due to the liberated iodine.

The following equation probably represents the reaction :

$$6NaBr + K_2Cr_2O_7 + 7H_2SO_4 = 3Na_2SO_4 + K_2SO_4 + Cr_2(SO_4)_3 + 7H_2O + 3Br_2.$$

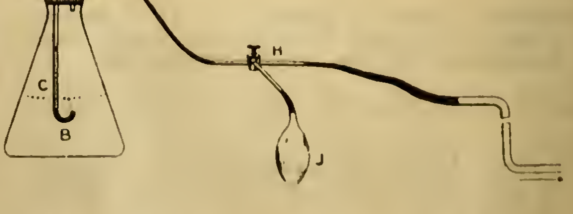
The above reaction will detect 0·5 mgrm. of sodium or potassium bromide, either free or in presence of sodium chloride.

Rosocyanin [Detection of boric acid by means of turmeric]. L. Clarke and C. L. Jackson. Amer. Chem. J., 1908, **39**, 696—718.

Rosocyanin, the substance which is produced in the test for boric acid by turmeric paper, was prepared by the authors by heating pure curcumin with boric acid and sulphuric acid in alcoholic solution, and purified by washing with water and then with ether to remove unaltered curcumin. The authors have not succeeded in crystallising rosocyanin, but have obtained it in the form of a purple powder with a yellowish-green reflex. It decomposes, without melting, between 200° and 230° C., dissolves in alcohol, forming a crimson solution, and forms salts of a beautiful blue colour. Analysis and molecular weight determinations show that it is an isomeride of curcumin, $C_{14}H_{14}O_2$, with only one hydrogen atom replaceable by metals, whereas curcumin has two. The authors conclude that the hydroxyl of curcumin which undergoes transformation in the production of rosocyanin is not that of the vanillin ring, but the less acid hydroxyl of the side chain. Rosocyanin contains no boron, and in the hope of explaining the specific part played by boric acid in its formation, the authors have investigated the intermediate products. Two of these were obtained, the more stable being a vermilion-coloured isomeride of curcumin, to which the authors give the name of *rubrocurcumin.* The other is obtained when the alcoholic solution of the products of the rosocyanin reaction is poured into ether instead of water ; it appears to be an addition compound of curcumin and boric acid and is decomposed by water. The authors contradict Emich's assertion that the blue coloration, produced by alkalis in the turmeric test for boric acid, is a specific function of cellulose ; they obtain the same blue coloration when wool dyed with turmeric is employed in the test. In the preparation of rosocyanin, acetone or glacial acetic acid can take the place of the alcohol, whilst instead of mineral acid, glacial acetic acid or a polyvalent alcohol such as glycerol or mannitol may be used ; only the boric acid is specific.—J. F. B.

INORGANIC—QUANTITATIVE.

Silver ; Volumetric determination of ——. W. R. Lang and J. O. Woodhouse. Chem. Soc. Trans., 1908, **93**, 1037—1040.



The apparatus is shown in the figure. The flask holds about 600 c.c. ; the tube, C, with the stopcock, D is about 6 mm. diameter, and E is about 4 cm. length of a thin test-tube, 10—15 mm. diameter. The bottom 8 cm. of C are filled with washed sand between two plugs of glass wool, and the bent tube, B, attached to C by rubber tubing, is also filled with glass wool. H is a three-way tap, connecting either with J, a small hand-bellows to drive liquid up the tube C, or with a water aspirator. The solution of silver to be titrated is placed in the flask, made up if necessary to about 100 c.c., $N/10$ sodium chloride solution run in in slight excess, and the whole boiled to coagulate the precipitate. A little $N/100$ silver nitrate is now run in, the cork and tubes are fitted, and air is drawn through to agitate the solution. A little of the solution is now forced into E through the glass wool and sand filter, shut off by D, and a drop of silver solution added. The whole is then sucked into the flask, followed by wash water, and the operations repeated till the next drop of silver solution fails to produce any precipitate.—J. T. D.

Minerals and industrial products; Decomposition of certain —— by means of sodium peroxide and metallic sulphides. J. H. Walton, jun., and H. A. Scholz. Amer. Chem. J., 1908, **39**, 771—789.

The decomposition of minerals for the assay of lead, manganese, chromium, tungsten, titanium, etc., by fusion with sodium peroxide possesses many advantages over the method of decomposition by acids, in which the acids used have to be removed by evaporation. The fusion is carried out in a nickel crucible with rounded corners; the mineral is intimately mixed with sodium peroxide and a quantity of a readily combustible substance to generate sufficient heat for the fusion by internal combustion when the mixture is ignited by means of a small piece of magnesium ribbon. Owing to the method of internal heating, the attack on the nickel crucible is practically inappreciable. Mixtures of sodium peroxide, zinc sulphide, and a small quantity of potassium persulphate give good results with most substances, the proportions of the ingredients being selected to give the degree of heat required for the decomposition of the particular mineral under treatment. The method is particularly applicable to sulphide ores and substances rich in silica, such as glazes, slags, and clays. With basic substances, such as franklinite and chrome iron ore, it is necessary to use iron pyrites to obtain sufficient heat; a small proportion of magnesium powder is also useful for increasing the heat. The whole operation occupies only 5 minutes, and the melt is then readily soluble in dilute acid. The substance to be decomposed must be ground very fine and passed through a 200-mesh sieve; the sodium peroxide must be free from small lumps, and the mixtures must be perfectly uniform to ensure complete decomposition. All the ingredients must be perfectly dry, otherwise premature ignition may occur.
—J. F. B.

Phosphoric acid in phosphates; Volatilisation of —— by means of a current of chlorine and carbon tetrachloride. P. Jannasch and W. Jilke. *See* VII.

Chlorine, bromine, and iodine; Separation of —— by means of hydrogen peroxide. P. Jannasch. *See* VII.

Silica from tungstic anhydride; Separation of ——. E. Defacqz. *See* VII.

Titanium [in ferrotitanium]; Determination of ——. G. W. Wdowischewski. *See* X.

Lead; Determination of —— in alloys. W. Elborne and C. M. Warren. *See* X.

ORGANIC—QUANTITATIVE.

Starch; Determination of ——. P. Biourze. *See* XVI.

Diastatic power of malt; Determination of ——. J. C. Lintner. *See* XVII.

XXIV.—SCIENTIFIC & TECHNICAL NOTES.

Mercury; Non-electrolytic solution of —— in water and other solvents. A. Christoff. Z. physik. Chem., 1908, **63**, 346—354.

The results of the investigation go to show that mercury dissolves non-electrolytically in water containing air, nitrogen, carbonic acid, sulphuric acid, or potassium hydroxide, and also in pure benzene, nitrobenzene, and alcohol. When heated to 98—99° C. pure mercury (about 16½ grms.) gave up to 3 litres of water 0·28 mgrm. and to 10 litres of water 1·12 mgrms. To prove the diffusibility of mercury vapour through water, acids, and potassium hydroxide, the dry mercury contained in a glass cup was placed in a desiccator, the bottom of which was covered with distilled water or the solution of acid or alkali. A solution of gold chloride contained in a glass cup was placed also in the desiccator at some distance from the cup of mercury and covered by a bell jar. The diffusion of the mercury fumes through the solution contained in the desiccator and up into the bell jar is readily observed by the deposition which takes place on the surface of the gold chloride solution.—W. S.

Alkali metals; Solutions of —— in liquefied ammonia. O. Ruff and J. Zedner. Ber., 1908, **41**, 1948—1960.

Ruff and Geisel have previously shown (this J., 1906, 314) that the so-called metal-ammonium compounds of Joannis and others, consist of the metal with a coating of a saturated solution of the metal in liquefied ammonia. The authors have now studied these solutions, determining their boiling points, melting points, etc. It was found that in the case of the sodium solutions, there are two liquid phases within a definite interval of temperature and within fairly wide limits of concentration. Sufficient data were accumulated for constructing the equilibrium diagram for the sodium solutions, but not for the potassium and lithium solutions. The existence of a compound of the composition, $Na(NH_3)_5$, is considered probable.
—A. S.

Keratin molecule; Position of the sulphur atom in the ——. O. Baudisch, Chem.-Zeit., 1908, **32**, 620.

It has been previously pointed out by Breinl and Baudisch that the sulphur contained in human hair can be completely oxidised to sulphuric acid by boiling with hydrogen peroxide, but this affords no proof of the mode of combination of the sulphur in the molecule, since, by breaking off the oxidation and distilling with steam, it is possible to separate the sulphur in the free state. Raikow (this J., 1905, 1088), concluded that a portion at least of the sulphur in keratin must be combined with oxygen, from the observation that wool and hair on treatment with syrupy phosphoric acid at the ordinary temperature yield sulphur dioxide. This was contested by Grandmougin, but is confirmed by the present author's experiments. He finds further that under similar conditions, viz., several weeks' treatment at ordinary temperature in the dark, the sulphur is also oxidised by neutral hydrogen peroxide (30 per cent.). At the end of five weeks the presence of sulphur trioxide was demonstrated, and this goes far to support the view that the sulphur in albuminous bodies, especially in keratin, exists in combination with oxygen. Chlorinated wool similarly treated shows no trace of formation of sulphur dioxide, indicating that chlorination exercises a direct influence on the sulphur of the keratin molecule.—R. B. B.

Peroxydases ; Study of artificial ——. J. Wolff. Compt. rend., 1908, **146**, 1217—1220.

The oxidation of pyrogallol to purpurogallin under the combined influence of the ferrocyanide of colloidal iron and hydrogen peroxide, acting as a peroxydase system, has been studied and compared with oxidation by means of a natural peroxydase. With increasing amounts of iron compound and a constant amount of hydrogen peroxide, the amount of pyrogallol oxidised is at first proportional to the colloidal iron present, subsequently the relationship is less simple, and finally an additional amount of peroxydase produces no increase in the quantity of purpurogallin formed. An increase in the amount of hydrogen peroxide also causes an increased formation of purpurogallin, up to a certain point, after which the augmentation becomes more and more feeble. The iron compound in one experiment caused the oxidation of nearly 4000 times its weight of pyrogallol. Traces of iron or copper sulphate considerably retard the oxidation, manganese sulphate is without influence. Small quantities of sulphuric acid also cause retardation, as does dihydrogen potassium phosphate. These results, obtained with an artificial enzyme, are closely in accord with the behaviour of the natural peroxydases and are not without interest in view of the widespread presence of peroxydases and of iron in living organisms.—E. F. A.

Catalysis of hydriodic acid by hydrogen peroxide ; Comparative influence of iron compounds and of peroxydases on the ——. J. Wolff and E. de Stœklin. Compt. rend., 1908, **146**, 1415—1417. (See this J., 1908, 474.)

The oxidation of hydriodic acid by hydrogen peroxide is accelerated by inorganic iron salts and also by many of the peroxydases. With the former, the acceleration produced is, at first, considerable and dependent on the amount of iron employed, but rapidly diminishes and becomes independent of the amount of the catalyst. The influence of the peroxydase is not so marked, but is proportional to the amount of the enzyme present. Colloidal iron ferrocyanide does not produce this catalytic action, which is, however, effected by iron thiocyanate. It seems that, of all the catalytic actions due to the peroxydases, the acceleration of the decomposition of hydriodic acid in presence of hydrogen peroxide must be regarded as the specific function of a particular enzyme. —T. H. P.

New Books.

Annual Statement of the Trade of the United Kingdom with Foreign Countries and British Possessions, 1907. Volume II. [Cd. 4150.] Price 3s. 4d.

This volume contains abstract and detailed tables of imports from, and exports to, each country, abstract and detailed tables of imports and exports at each port, the amount of customs revenue received at each port or place, the details of the transhipments under bond of certain articles, the account of the quantities of articles liable to customs duties remaining in bond, and the details of the transhipments of free goods on through bills of lading.

Der Betriebs-Chemiker. Ein Hilfsbuch für die Praxis des chemischen Fabrikbetriebes. Von Dr. Richard Dierbach. Zweite, verbesserte Auflage. Julius Springer's Verlag, Berlin. 1908. Price M8.

8vo volume, containing 336 pages of subject-matter with 117 illustrations, and an alphabetical index. The subject-matter is classified as follows :—General : Problems for the managing chemist. His relations with the workmen. His duties as manager. I. Materials and aids in technical management. a. Materials for apparatus, and their utilisation. b. Mechanical materials and apparatus. c. Materials, apparatus and agencies in connection with plant and machinery. d. Treatment of apparatus, to preserve working conditions. II. Rules for choice of site, building, and construction. III. The special duties of the managing chemist. a. In the laboratory. b. In carrying out processes on the large scale. c. General arrangement, in large-scale practice. IV. Arrangements for the prevention of dangers and accidents in large scale-practice. V. Varieties of operations to be conducted, such as pulverising, sifting, mixing, dissolving, lixiviating, and extracting ; shaking out, evaporating, distilling, subliming, decolorising, clarifying, crystallising, drying, etc. VI. By-products, etc. VII. Calculations and inventories. VIII. Storage, protection, packing, and dispatch of manufactured products.

Local Government Board (Medical Department). Reports of the Inspector of Foods. No. 6. On Preservatives in Meat Foods packed in Cans or Glass. Dr. A. W. J. MacFadden. Wyman & Sons, Ltd., Fetter Lane, London, E.C. ; or Oliver and Boyd, Tweeddale Court, Edinburgh ; or E. Ponsonby 116, Grafton Street, Dublin. 1908. Price 4d.

Laboratoriumsbuch für die Industrie der Riechstoffe. Von Dr. Oskar Simon. Verlag von Wilhelm Knapp, Halle a. S. 1908. Price M3.

8vo volume, containing 64 pages of subject-matter, and an alphabetical index. There are five illustrations. The text is subdivided and classified according to the following scheme :—I. General Methods of Investigation. (*a*). Physical methods. (*b*). Chemical methods. (*c*). Examination of an essential oil. (*d*). Detection in essential oils of certain frequently occurring adulterants. II. Special methods of examination of the more important perfumes. (*a*). Essential oils. (*b*). Natural and artificial agents. (*c*). Balsams and resins. (*d*). Animal raw materials.

Synthetische und Isolierte Riechstoffe und deren Darstellung. Von Dr. Rudolf Knoll. Wilhelm Knapp's Verlag, Halle a. S. 1908. Price M4.50.

8vo volume, containing 130 pages of subject-matter, and an alphabetical index of subjects. The classification of the matter is as follows :—I. General. (i) Rationale, mode of action, and intensity of perfumes. (ii), Chemical properties. (iii), Synthesis of artificial perfumes. (iv), Chemical investigation of perfumes. (v), Apparatus necessary for the preparation of artificial perfumes, etc. II. Special. (i), Hydrocarbons of the aliphatic series (ii.), Olefinic terpenes. (iii), Cyclic terpene-hydrocarbons. (iv.), Sesqui- and polyterpenes. (v), Cyclic aromatic hydrocarbons. (vi), Aliphatic alcohols. (vii), Olefinic terpene alcohols. (viii), Cyclic terpene alcohols. (ix), Cyclic alcohols (aromatic). (x), Phenols and phenol ethers. III. Aldehydes. Olefinic and cyclic aldehydes. IV. Ketones. (i), Aliphatic and cyclic ketones. (ii), Lactones. (iii), Acids and their esters. (iv), Nitrogenous perfumes. (v), Perfumes containing sulphur. (vi), Perfume compositions to imitate natural essential oils. (vii), Essential oils free from terpenes. (viii), Appendix.

Der Dampf in der Chemischen Technik. Von W. Mommer. Mit einem Vorwort von Regierungsrat von Ihering. Wilhelm Knapp's Verlag, Halle a. S. 1908. Price M3.60.

8vo volume, containing 104 pages of subject-matter with 26 illustrations. The subject-matter is subdivided and classified as follows:—I, Extent of employment and use of steam. II, Physical properties, etc., of steam. III, Fuel materials. IV, The steam-boiler. V, Piston steam-engine. VI, Steam turbine. VII, Steam-pressure cylinder. VIII. Heating by direct steam. IX, Heating by indirect steam. X, Heating apparatus. XI, Evaporation. XII, Distillation. XIII, Rectification. XIV, Extraction. XV, Drying. XVI, Various methods of utilising steam. XVII. Steam-piping and connections.

Das Erdöl, seine Verarbeitung und Verwendung. Eine gedrängte Schilderung des Gesamtgebietes der Erdöl-Industrie. Von Dr. Richard Kissling. Wilhelm Knapp's Verlag, Halle a. S. 1908. Price M5.40.

8vo volume, containing 154 pages of subject-matter with thirty illustrations. The subject-matter is classified as follows:—I, Petroleum; origin; occurrence and extent. Chemical and physical condition. Transport. II. (i), Working up and refining petroleum. (ii), Processes for working and extraction. (iii), Working up the by-products. III, Employment and uses of petroleum, and petroleum products, including paraffin wax.

Patent List.

Where a complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

Applications.

13,760. Klug. *See under* V.

13,776. Grouvelle and Arquembourg. Condensers, heaters, and evaporators. [Addition to No. 10,143 of 1902.] June 29.

14,014. Tomlinson-Haas, Ltd. (F. Haas Ges.). Apparatus for treating materials with gases for drying, bleaching, etc. July 2.

14,155. Read and Campbell. Filters. July 3.

14,256. Schmitt and Ahrens. *See under* XVIII*A*.

14,444. Alvord. Power filter press.* July 7.

14,674. Featherstone. Filters. July 10.

14,686. Ados Ges., and Metzerath. Process and apparatus for mixing liquids. [Ger. Appl., July 13, 1907.]* July 10.

Complete Specifications Accepted.

15,458 (1907). Kitchen and Von Bernuth. Furnaces and gas producers. July 15.

15,533 (1907). Lebedeff and Pomeranzoff. Regenerative furnaces. July 15.

26,052 (1907). Wiart. Instantaneously condensing vapours and gases without a cooling agent. July 15.

26,526 (1907). Jones. Pulverising liquids. July 8.

2702 (1908). Fairbrother (Moller und Pfeifer). Drying apparatus. July 8.

7094 (1907). Richards. Apparatus for condensing fumes, vapours, etc. July 15.

II.—FUEL, GAS, AND LIGHT.

Applications.

13,753. Jabs. Gas producers.* June 29.

14,165 and 14,166. Parker. Destructive distillation of coal. July 3.

14,167. Parker. Apparatus for the destructive distillation of coal. July 3.

14,168. Parker. Apparatus for the destructive distillation of coal and other carbonaceous substances. July 3.

14,169. Parker. Retorts for the destructive distillation of coal. July 3.

14,292. Fielding. Gas producer. July 6.

14,405. Berry. Suction gas plants. July 7.

14,436. British Thomson-Houston Co., Howell, and Needham. Manufacture of filaments for incandescent electric lamps. July 7.

14,558. Justice (Coal Treating Co.). Facilitating and controlling the combustion of fuel and preventing smoke. July 9.

14,588. Smith. Purification of coal and other gases. July 9.

14,604. Bolz. Gas generating furnaces.* July 9.

14,692. Bethge. Mixture for flash-lights, etc.* July 10.

Complete Specifications Accepted.

14,671 (1907). Hense. Manufacture of liquid combustibles and solvents from mineral oils. July 8.

15,458 (1907). Kitchen and Von Bernuth. *See under* I.

15,510 (1907). Deutsche Gasgluhlicht A.-G. Manufacture of illuminating bodies for electric incandescence lamps. July 8.

15,593 (1907). Claussen and Corbett. Liquid hydrocarbons for motive power, heating, lighting, solvents, etc. July 8.

17,858 (1907). Koppers. Retort furnaces for making gas and coke. July 8.

18,825 (1907). Parker, and Automobile Gas Producer Synd., Ltd. Gas producers. July 8.

1852 (1908). Lake (A.-G. f. Selas-Beleuchtung). Manufacture of mantles for incandescent lamps. July 8.

22,965 (1907). Hill and Westwood. Apparatus for making combustible heating and illuminating gas. July 15.

26,593 (1907). Ries. Manufacture of gas. July 15.

2874 (1907). Hill and Westwood. Apparatus for making heating and illuminating gas. July 15.

2700 (1908). Wynne. Liquid fuels. July 8.

3055 (1908). White. Incandescent gas mantles. July 8.

3462 (1908). Morton. Gas producers.

6026 (1908). Ross. Manufacture of incandescent gas mantles. July 15.

11,524 (1908). Siemens und Halske A.-G. Manufacture of metal electric lamp filaments free from carbon. July 15.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

Complete Specifications Accepted.

14,671 (1907). Hense. *See under* II.

25,075 (1907). D'Olivier-Mansan. *See under* IX.

IV.—COLOURING MATTERS AND DYESTUFFS.

Applications.

13,789. Imray (Meister, Lucius, und Brüning). Manufacture of pentabromindigo and an intermediate product. June 29.

14,075. Johnson (Badische Anilin und Soda Fabrik). Manufacture of colouring matters of the safranine series. July 2.

Complete Specifications Accepted.

15,204 (1907). Shillito (Aniline Colour and Extract Works). Manufacture of blue colouring matters of the triphenylmethane series. July 15.

16,246 (1907). Johnson (Badische Anilin und Soda Fabrik). Manufacture of anthracene compounds. July 8.

16,505 (1907). Badische Anilin und Soda Fabrik. Manufacture of vat colouring matters of the anthracene series. July 8.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

Applications.

13,760. Klug. Apparatus for drying textile and other materials. June 29.

13,790. Imray (Meister, Lucius, und Brüning). *See under* XX.

13,896. Freiberger. Method of figuring textiles.* June 30.

13,897. Drews. Treatment of leaves and other vegetable matter for the extraction of fibre.* June 30.

13,933. British Cotton and Wool Dyers' Assoc., and Hoegger. Cop dyeing machines. [Comprised in No. 25,696 of 1907.] July 1.

14,070. Lightowlers. Disinfecting wool in bale form. July 2.

14,123. Bryom. Dyeing aniline black on cotton cloth. July 3.

14,143. Lecoeur. Manufacture of threads and filaments of cellulose. July 3.

14,337. Johnson (Badische Anilin und Soda Fabrik). Bowking material which has been dyed or printed with vat dyestuffs. July 6.

14,593. Johnson (Badische Anilin und Soda Fabrik). Production of green, olive, and brown effects in dyeing and printing. July 9.

14,605. Lehnig. Textile product.* July 9.

14,655. Mackey. Apparatus for purifying dye-water and similar effluent. July 10.

Complete Specifications Accepted.

14,611 (1907). Turner. Fabric and method for producing the same. July 8.

14,780. (1907). Halliwell, and Mather and Platt, Ltd. Apparatus for dyeing, bleaching, and treating fibrous materials. July 8.

15,095 (1907). Hunt and Moscrop. Apparatus for bleaching, scouring, dyeing, etc., fabrics in the open condition. July 15.

15,837 (1907). Ashworth and Hall. Mercerising cloth and apparatus therefor. July 15.

16,189 (1907). Green. Production of aniline black on textile fibres and fabrics. July 15.

VII.—ACIDS, ALKALIS, AND SALTS.

Applications.

13,792. Eberhard. Increasing the mobility and reactivity of water-glass. [Additon to No. 12,980 of 1908.]* June 29.

13,820. Pochin and Richardson. Manufacture of ferric sulphate. June 30.

13,968. Dahl. Production of oxygen compounds. [Swed. Appl., July 1, 1907.]* July 1.

14,234. Gutensohn. Recovering metallic copper from sulphate solutions. July 4.

14,349. Brotherton and Wyld. Saturator for the manufacture of sulphate of ammonia. July 7.

14,372. Phillips and Phillips. Compressing solid graphite at a high temperature into a diamond. July 7.

14,707. Peniakoff. Manufacture of alkaline aluminates. [Fr. Appl., Jan. 29, 1908.]* July 10.

Complete Specifications Accepted.

16,047 (1907). Tassopoulos. Manufacture of cream of tartar. July 15.

16,067 (1907). Ramsay. Manufacture of nitric acid. July 15.

16,068 (1907). Ramsay. Manufacture of oxides of nitrogen. July 15.

16,162 (1907). Muntz and Girard. Utilising peat in producing calcium and ammonium nitrates. July 8.

25,215 (1907). Jaubert. Manufacture and purification of hydrogen. July 8.

6155 (1908). Naville, Guye, and Guye. Recovery of oxides of nitrogen diluted with air. July 8.

VIII.—GLASS, POTTERY, AND ENAMELS.

Application.

13,830. Fuchs. Production of ceramic prints.* June 30.

Complete Specifications Accepted.

12,583 (1907). Lake (Chem. Fabr. Gustrow). Manufacture of enamel. July 8.

27,714 (1907). Andris. Glass melting furnaces. July 15.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Applications.

13,941. Turner. Manufacture of artificial stone. July 1.

14,043. Lensch. Manufacture of artificial marble. July 2.

14,336. Kelly. Manufacture of cement and calcination of chalk or lime and carbon. July 6.

14,342. Berner, Frankl, and Mendelsohn. Manufacture of artificial stone. July 6.

14,619. Brearley and Moorwood. Manufacture of silica bricks, ganister, and other refractory materials. July 10.

Complete Specifications Accepted.

15,964 (1907). Thom. Manufacture of lithographic stone artificially. July 15.

25,075 (1907). D'Olivier-Mansan. Material from pitch suitable for making paving, pipes, walls, etc. July 15.

25,795 (1907). Collos Portland Cement Co. (Colloseus). Manufacture of hydraulic and like cement. July 8.

28,188 (1907). Jensen. Manufacture of cement. July 8.

289 (1908). Payne. Imitation marble and granite July 8.

5279 (1908). Ali-Cohen. Insulating, impregnating, and protective materials. July 8.

X.—METALLURGY.

Applications.

13,699. Torrini and Hoffmann. Tempering iron. June 29.

13,715. Mason. Preventing metals from rusting after they are electroplated. June 29.

13,963. Cowper-Coles. Alloys. July 1.

13,964. Witter. Recovering the volatile metals and metalloids from the products or slags of lead and copper smelters. [Ger. Appl., July 2, 1907.]* July 1.

14,093. Baraduc-Muller. Obtaining metals or steels of all qualities. [Fr. Appl., July 2, 1907.]* July 2.

14,234. Gutensohn. *See under* X.

14,297. De Bechi and Blythe. Dissolving impure tin or tin alloys. July 6.

14,399. Schumacher. Manufacture of briquettes from blast furnace dust.* July 7.

14,434. Williams. Treatment of copper ores.* July 7.

Complete Specifications Accepted.

26,322 (1907). Centralstelle f. Wissensch.-Techn. Untersuchungen. Aluminium alloys. July 15.

6028 (1908). Rousseau. Crucible furnaces. July 15.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

Applications.

13,734. Cornaro. Electrodes for electric furnaces, etc. [Ital. Appl., June 27, 1907.]* June 29.

13,779. Osmond. Apparatus for the electrodeposition of metals, etc. June 29.

Complete Specifications Accepted.

24,707 (1907). British Thomson-Houston Co. (General Electric Co.). Refractory electric conductors. July 8.

3507 (1908). Passburg. Vacuum drying and impregnating apparatus for electric cables. July 15.

5279 (1908). Ali-Cohen. *See under* IX.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

Application.

14,623. Moore-Irvine. Apparatus for the manufacture of soap, etc. July 10.

Complete Specification Accepted.

15,264 (1907). Baker. Apparatus for cooling, moulding, cutting, and drying soap, etc. July 8.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc.

(*A.*)—Pigments, Paints.

Applications.

14,157. Paton and Rowland. Paint and paint compounds. July 3.

14,338. Johnson (Badische Anilin und Soda Fabrik). Production of pigments. July 6.

Complete Specification Accepted.

2644 (1908). Knowles and Kinder. Manufacture of distemper and water paints. July 8.

(*C.*)—India-Rubber.

Complete Specification Accepted.

26,432 (1907). Roland. Elastic compositions. July 8.

XIV.—TANNING, LEATHER, GLUE, SIZE, Etc.

Applications.

13,768. Landenberger (Marwedel). Tanning process. June 29.

14,397. Pozzi and Tondelli. Obtaining artificial horn from casein. [Ital. Appl., July 8, 1907.]* July 7.

14,597 Cordingley. Process for tanning hides. July 9.

Complete Specification Accepted.

929 (1908). Case. Manufacture of leather board. July 15.

XVI.—SUGAR, STARCH, GUM, Etc.

Complete Specification Accepted.

1351 (1908). Fritsche. Production of soluble starch, and removing starch from textile materials. July 8.

XVII.—BREWING, WINES, SPIRITS, Etc.

Applications.

13,811. Hampton. Extraction of yeast from waste liquors of breweries and distilleries to render the liquids suitable for sewage disposal, and separation of yeasts from fermented liquids. June 30.

14,515. Kummle. Manufacture of beer.* July 8.

XVIII.—FOODS; SANITATION, WATER PURIFICATION; AND DISINFECTANTS.

(*A.*)—Foods.

Applications

14,249. Slavoff. Preparation of coagulated milk. July 4.

14,256. Schmitt and Ahrens Process for drying albumen and the like.* July 4.

Complete Specifications Accepted.

15,340 (1907). Ramsay. Bleaching flour. July 8.

15,700 (1907). Nussbaum. Producing acid-albuminate from albumen and albuminous substances July 15.

5810 (1908). Schou. Butter manufacture. July 8.

7732 (1908). Jung and Jung. Non-alcoholic beverages. July 15.

(*C.*)—Disinfectants.

Complete Specification Accepted.

4535 (1907). Howorth (Lutz et Cie.). Manufacture of microbicide agents. July 15.

XIX.—PAPER, PASTEBOARD, Etc

Applications.

13,994. Franz. Treatment of peat fibre and its manufacture into paper and cardboard.* July 1.

14,180. Mühlendiek. Increasing the tearing resistance of paper.* July 3.

Complete Specification Accepted.

8542 (1908). De Briailles Substitute for celluloid. July 15

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

Applications.

13,790. Imray (Meister, Lucius, und Brüning). Manufacture of organic aldehyde and ketone compounds and their employment in colour printing. June 29.

14,408. Zimmermann (Chem. Fabr. auf Actien, vorm. E. Schering). Manufacture of bornyl oxalate. July 7.

14,752. Lütkehermölle. Manufacture of isobornyl esters from pinene halogen hydrates. [Ger. Appl., July 12, 1907.]* July 11.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Application.

14,586. Fenske. Colour photography. July 9.

Complete Specification Accepted.

28,406 (1907). Mees, and Wratten and Wainwright, Ltd. Plates or screens for direct colour photography. July 8.

XXII.—EXPLOSIVES, MATCHES, &c.

Application.

13,890. Larsen. Waterproofing blasting cartridges. June 30.

Complete Specification Accepted.

12,378 (1907). New Explosives Co., and Carter. Manufacture of compressed guncotton charges. July 8.

XXIII.—GENERAL ANALYTICAL CHEMISTRY.

Complete Specification Accepted.

15,263 (1907). Kallab. Apparatus for comparing and determining colours and tints and ascertaining the components thereof. July 8.

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PROCEEDINGS

OF THE

TWENTY-SEVENTH ANNUAL MEETING.

NEWCASTLE.

Wednesday, July 22, 1908.

The Annual General Meeting of the Society was held in the Great Hall of the Armstrong College, Newcastle, on Wednesday, July 22, 1908, the President, Sir Boverton Redwood, D.Sc., in the Chair. There were also on the platform the Lord Mayor of Newcastle (Mr. W. J. Sanderson), Sir Andrew Noble, Bart., K.C.B., F.R.S., Professor Raphael Meldola, F.R.S., Professor G. A. Lebour, M.A., D.Sc., Vice-Principal of the College, Mr. N. H. Martin, Chairman of the Newcastle Section, Mr. Thomas Tyrer, Hon. Treasurer, Dr. J. Lewkowitsch, and the Secretary, Mr. Charles G. Cresswell.

The Lord Mayor, on behalf of the City Corporation and people of Newcastle, welcomed the members of the Society to that ancient city. He thought they could not have chosen a more suitable building in which to hold their meeting. Tyneside was practically the birthplace of the chemical industry, and until a few years ago they could have shown the visitors chemical factories, paper mills, and glass works, but unfortunately those industries to-day were few and far between. Nevertheless they were still deeply interested in the chemical industry, and many of the leading citizens were very closely identified with it. He therefore offered the visitors a very cordial welcome to a city full of interest.

The President said the Society of Chemical Industry had had many civic welcomes extended to it, but he was sure that on no previous occasion had kinder, more sympathetic, or more encouraging words been uttered than had fallen from the lips of the Lord Mayor, who had shown his interest in the Society by personally attending that morning to extend a welcome to them. The welcome was gratifying not only to the members of the Society present, but would be equally gratifying to the thousands of members who were unable to be with them and who would learn of the proceedings through the printed record in due course.

Professor Lebour, in the unavoidable absence of the Principal of the College, Sir Isambard Owen, through illness, also welcomed the visitors on behalf of the President and Council of the College. He said they had the greatest satisfaction in welcoming such a body as that represented by the Society of Chemical Industry. The College was a sort of centre of radio-activity; portions of themselves went to different parts of the world, and occasionally some of the particles came back to them. He was pleased to see in the Hall several old students, whom he was glad to welcome back to the scene of their former studies.

The President said it was a most agreeable compliment to be welcomed not only by the Lord Mayor but by the head of the College, and he was deeply indebted to Professor Lebour for his kindly expressions of welcome.

The Secretary read the Minutes of the Annual General Meeting at Birmingham on July 10, 1907, and also the Minutes of an Extraordinary General Meeting in London on June 15, 1908. The Secretary afterwards intimated that he had received a number of letters regretting inability to attend.

The President said immediately before that meeting he had had placed in his hands a letter from Professor W. R. E. Hodgkinson, of the Ordnance College, Woolwich. The letter read: "I regret very much that official duties prevent my attendance at the Council and Annual Meetings in Newcastle. May I ask you to present to Sir Andrew Noble our hearty congratulations from the Ordnance College, Woolwich, which I am unfortunately unable to convey personally."

The President said that the new by-laws which were rendered necessary by the Charter of Incorporation which the Society had received from the Sovereign had been duly allowed by the Privy Council. To some of them that might not appear a very important matter, but he could assure them that the drafting of the by-laws, and the bringing of them into form acceptable to the Privy Council, had entailed very heavy labour upon the Council and upon the General Secretary, and it was a matter for congratulation that at length those labours had been brought to a satisfactory conclusion. The by-laws had been duly advertised in the "London Gazette," and a print of them would be issued in the next number of the Journal. One matter arising out of the new by-laws had received consideration at the Council meeting immediately prior to that meeting. It was provided in the new by-laws that they could continue to have trustees, in whom the property of the Society was vested, or they might, now they were an incorporated body, hold the property in the name of the Society. It was impossible to decide which of the two alternative courses it was desirable to adopt until the by-laws were passed by the Privy Council. At the Council meeting held that day, it was unanimously resolved that it be a recommendation to that General Meeting that the existing trustees—those who were trustees under the old by-laws—should continue to hold office until the matter had been otherwise dealt with. He asked the concurrence of the members in that recommendation.—The motion was carried unanimously.

The President said at that point it might be convenient to make another announcement, which he felt sure would be gratifying to the members generally—it was that the second or "Subject-matter" portion of the Decennial Index to the Society's Journal was now in type. The Honorary Treasurer had handed him a communication from the printers, who stated that they would be able to commence delivery of the Index on July 31. and from that date they would send them out daily as orders came in. It would be pleasing to the Council if those members who had apparently delayed ordering the "Decennial" Index until they were within measureable distance of getting it, would send in their subscriptions forthwith. With the preparation of that Index, Mr. Renaut completed twenty-five years' connection with the Society, and they might take that opportunity of expressing their satisfaction at the way Mr. Renaut had carried out the work entrusted to him. It was only Mr. Renaut's due that they should place on record their appreciation of his services, and he therefore proposed that the Secretary send Mr. Renaut a written expression of the thanks of the Society for his twenty-five years' service in that particular matter.—The motion was carried unanimously.

The Secretary said that only sufficient nominations had been received to fill the vacancies on the new Council, and therefore it had been unnecessary to have a ballot. The new Council would be formed as follows:—

LIST OF COUNCIL 1908–1909.

President: Raphael Meldola, F.R.S.

Vice-Presidents:

Eustace Carey.
Dr. Edw. Divers, F.R.S.
Dr. J. T. Dunn.
Prof. Percy F. Frankland, F.R.S.
Arthur R. Ling.
Sir Boverton Redwood.
Walter F. Reid.
A. Gordon Salamon.
George C. Stone.
Dr. T. B. Wagner.
Charles Wightman.
R. C. Woodcock.

Ordinary Members of Council.

Prof. P. Phillips Bedson.
Prof. W. Hodgson Ellis.
Oscar Guttmann.
Henry Hemingway.
Prof. G. G. Henderson.
Prof. W. R. E. Hodgkinson.
E. Grant Hooper.
Dr. Charles A. Keane.
C. T. Kingzett.
Frank H. Tate.
Dr. Leonard T. Thorne.
Harold Van der Linde.

Sectional Chairmen and Secretaries:

Birmingham.	Harry Silvester.	F. R. O'Shaughnessy.
Canada.	Dr. Milton L. Hersey.	Alfred Burton.
Liverpool.	Max Muspratt.	W. Roscoe Hardwick.
London.	Dr. J. Lewkowitsch.	Julian L. Baker.

MANCHESTER.	R. H. Clayton (*Vice-Chairman*).	Julius Hübner.
NEWCASTLE.	C. J. Potter.	Dr. F. C. Garrett.
NEW ENGLAND.	F. E. Atteaux.	Alan A. Claflin.
NEW YORK.	Maximilian Toch.	Dr. H. Schweitzer.
NOTTINGHAM.	Oliver Quibell.	S. R. Trotman.
SCOTLAND.	D. J. Playfair.	Dr. Chas. E. Fawsitt.
SYDNEY, N.S.W.	Prof. J. A. Schofield.	T. U. Walton.
YORKSHIRE.	Prof. W. M. Gardner.	Thos. Fairley.

Honorary Treasurer :
Thomas Tyrer, Stirling Chemical Works, Stratford, E.
Hon. Foreign Secretary :
Dr. Ludwig Mond, F.R.S.
Secretary : Charles G. Cresswell, 59, Palace Chambers, Westminster, S.W.
Telegraphic Address : 59, Palatable, London.
Telephone Number : 715, Victoria.

The PRESIDENT said there were several names on the Council which gave added distinction to the Society, and he declared the elections to have been duly made.

The HON. TREASURER presented the financial statement of the Society made up to February 29, 1908, showing a balance of revenue over expenditure of £92 19s. 4d. That sum, he pointed out, was not a large margin, but he could assure the members that they were earnestly endeavouring to combine efficiency with economy.

Mr. C. J. POTTER moved, and Mr. J. M. COLLETT seconded, a vote of thanks to the Treasurer, and it was agreed to.

The Secretary read the report of the Council.

REPORT OF COUNCIL.

The number of members on the register is 4520 as compared with 4,519 at the last Annual Meeting. During the year 270 members have been elected, as compared with 321 last year, and the losses have been 269 as against 231. There were 47 deaths as compared with 42 last year.

The names of the members removed by death are :— G. H. Anderton, Dr. G. Archbold, P. T. Austen, S. Banner, Wm. Bowen, Dr. J. Clark, C. Goddard Clarke, M.P., Jos. Crowther, Dr. A. Dupré, F.R.S., Sir John Evans, K.C.B., F.R.S., Dr. T. Evans, A. E. Fasnacht, R. J. Friswell, Dr. K. M. Gokhalé, Samuel Hall, Dr. B. J. Harrington, O. Heslop, H. Hochstetter, John Hollway, P. L. Huskisson, A. E. Jessup, J. Grove Johnson, Jas. Kerr, Thos. Kier, F. H. Leeds, Jas. McCulloch, T. P. McVie, D. Marshall, Thos. Morson, E. Gordon N. North, G. Olsson, Lord Overtoun, F. J. M. Page, Sir Wm. Perkin, F.R.S., Frank Pope, Fred Render, W. A. Shenstone, F.R.S., A. E. Shorter, Dr. F. J. Smale, E. Sonstadt, Jno. Stoer, Albert Terry, G. F. Ulmer, C. Vigelius, J. D. Warren, H. Winsloe, Dr. D. Woodman.

Among these, Sir John Evans and Sir Wm. Perkin had filled the office of President of the Society, and Mr. Samuel Hall was for many years its Hon. Treasurer.

Mr. Thos. Tyrer has been unanimously elected Hon. Treasurer, in succession to the late Mr. Hall, and Mr. S. Godfrey Hall has been made one of the Society's Trustees. Under the new By-laws, the Hon. Treasurer and Hon. Foreign Secretary become officers of Council and are appointed instead of being elected.

The Hon. Treasurer's financial report was issued in the Journal for June 30th, and will be laid before the meeting.

The Journal for 1907 numbered 1302 pages without the Supplement, which is now printed separately, and this will reduce the Journal when bound up by some 40 pages.

During the past session 96 original papers with discussions have appeared in the Journal, as compared with 111 for the previous session.

The subject matter portion of the Decennial Index is now ready and will be in the hands of members shortly, thus completing the work, and the Council feels that only an increased demand for the volume will justify such a work being again undertaken.

The Patent Act of 1907, in connection with which the Society took an active part, is now in force. The 25th Report of the Comptroller-General of Patents, just issued, contains a complete statement of the provisions of the Act, which embodies very substantial reforms in the law.

The British Science Guild has attempted to secure lower postal rates for scientific and technical publications. In March last a joint deputation, on which the Society was represented by the President and Mr. Walter F. Reid, urged the Postmaster General to grant lower inland rates to scientific journals. The answer was unfavourable, but it is not regarded by the Guild as final, and the advisability of taking further steps to secure assistance for the work of Scientific and Technical Societies is now under consideration.

In accordance with the provisions of Article 37 of the Charter, new By-laws have been drafted, and, after being carefully considered at a special Council on December 6th, were submitted to the members on December 15th. On January 23rd, the Council, having taken all observations made into consideration, settled the draft, and again submitted it to the members in the Journal of January 31st, at the same time calling a General Meeting for March 13th last. At this meeting the By-laws were passed, and, after having been sealed, were presented for the approval of the Privy Council; but the Privy Council, before allowing them, required certain amendments to be made, and these, after due notice, under By-law 40 of the old By-laws, were approved at an Extraordinary General Meeting held at the Society's offices on June 15th. They were then resealed and again presented to the Privy Council, which approved them on June 17th. They were gazetted on July 7th and will shortly be issued to the members.

The Society's medal has been awarded to Sir Andrew Noble, K.C.B., F.R.S., for conspicuous services to Applied Chemistry, in connection with explosives.

The Yorkshire section has established a "Priestley" medal, to be awarded every third year to a member of the Yorkshire section for some original research.

The Hurter Memorial Lecture was this year delivered by Sir Oliver Lodge, D.Sc., F.R.S., who selected as his subject, "The structure of the atom."

The International Congress of Applied Chemistry, under the patronage of H.M. the King, will be held in London from May 27th to June 2nd, 1909. The Council trusts that members will do all in their power to render it a success, and so reciprocate the hospitality shown at Brussels, Vienna, Paris, Berlin, and Rome. It is probable that the next Annual Meeting of the Society will be held somewhat earlier than usual, in order that members may have an opportunity of attending the Congress.

The PRESIDENT invited Dr. Russell W. Moore, of New York, to move the adoption of the Council's report and the statement of accounts, and said how delighted they were to have with them so good a friend of the Society from the other side of the Atlantic.

Dr. RUSSELL MOORE moved the confirmation of the reports, and on behalf of the New York section he heartily thanked the President for his kind words and extended to the members the best wishes of their American friends.

Mr. JOHN PATTINSON seconded the motion, and spoke of the great care and attention the Council devoted to the business of the Society.

The resolution was carried.

The PRESIDENT presented to Sir Andrew Noble the Society's medal for conspicuous services to applied chemistry in connection with explosives. He explained the conditions under which the medal was awarded not more frequently than once in every two years; the person was to be, in the opinion of the Council, one who had rendered conspicuous service to applied chemistry by research, discovery, invention or improvements in processes, or to the Society in furtherance of its objects—the person might or might not be a member of the Society and might be of any nationality. The field of choice was therefore a very wide one, and the recipients of the medals in previous years had been representatives of many branches of industrial chemistry. In 1896 the medal was awarded to Mr. John Glover in respect of the Glover

Tower, and two years later to Sir William Perkin, with whose name the invention of aniline dyestuffs would ever be associated; in 1900 the medal was awarded to Dr. Schunck, in 1902 to Sir Joseph Swan, another Newcastle man, for his discoveries in photographic carbon printing, and his invention of the electric incandescence lamp; in 1904 it was awarded to a distinguished American, Ira Remsen, Principal of the Johns Hopkins University, for his researches in connection with saccharin, and in 1906 to Dr. Ludwig Mond. On the present occasion the Council had unanimously awarded the medal to another Newcastle man, Sir Andrew Noble, who was well known to them as the illustrious exponent of the principles which governed the combustion of explosives in the propulsion of projectiles. It was a happy circumstance that the Council's decision coincided with the holding of the annual meeting at Newcastle, for while Sir Andrew had a world-wide reputation, it was in that district he was most intimately known. The President dilated upon Sir Andrew's distinguished career in science, and said he was the author of a standard work on artillery and explosives, and had contributed to the proceedings of the Royal Society. In 1880 he received the medal of that Society, and in subsequent years gave to it important and valued services in contributions to the Proceedings on new explosives and experiments he had carried out regarding them.

Sir Andrew Noble, in accepting the medal, thanked the Society for the high honour which it had conferred on him, and said the medal itself would be kept by him as one of his most treasured possessions.

PRESIDENT'S ADDRESS.

Sir Boverton Redwood then delivered his presidential address. He said:—

Previous occupants of the Presidential Chair of this Society have been able to draw upon a wealth of varied knowledge and experience in the selection of subjects for their addresses. With me there is no such opportunity for choice, but I am glad to know that my one subject may most appropriately be dealt with in Newcastle, for the shipbuilding yards of the Tyne have always been prominently identified with the construction of tank steamers for the ocean transport of petroleum. It was the firm of Armstrong, Mitchell and Co., who in 1885 built, from the designs, and under the personal direction of the late Colonel Henry F. Swan, C.B., the "Gluckauf," which was the prototype of the present vessels employed in the ocean transport of oil in bulk. Since that time the Tyne has maintained its pre-eminence in this class of work, and 150 petroleum tank-steam ships, including some of the best modern examples of these vessels, have been launched from its yards. In this connection I cannot refrain from making a brief allusion to the great loss we have sustained in the death of Colonel Swan. It was to his conspicuous ability and enterprise that the evolution of the petroleum tank-steamer was largely due, and he was a man of whom Newcastle has good reason to be proud.

I derive further confidence from reflecting that the fuel aspect of the petroleum industry was deemed of sufficient importance to receive extended reference in the address of Dr. J. Emerson Reynolds in 1892, and that the subject of fuel in general was selected by Dr. George Beilby for his discourse in 1899.

My aim is to consider with you, as far as is possible within the limits of such an address, the probable trend of further development of the great industry which has sprung into existence within the past half century, in order that we may form some conclusions as to the duration of our supplies of the raw material, and in this connection it will obviously be necessary to pay some attention to the question of the origin of petroleum, as well as to alternative methods of obtaining light, heat, and motive power.

The petroleum industry was in its infancy when my acquaintance with it commenced, though the first oil well had been drilled in Pennsylvania in 1859, some 10 years previously. For some time before this, in fact from 1806, drilling operations had been systematically carried on in the same district in the United States for obtaining brine, and it is interesting to note that those who were engaged in this work regarded simply as a nuisance the petroleum which they occasionally met with in the wells. During the four decades which have since elapsed, the output of petroleum has grown to enormous proportions, not only in the United States, but also in Russia and elsewhere, and the products play a part of immense importance in supplying many of the chief wants of the world. It has, in fact, been suggested that the degree of civilisation of a country or nation may be measured by the consumption of petroleum as a lighting fluid for each unit of the population, though this is obviously only true up to a certain stage of civilisation. Unquestionably mineral burning oil has been and in some countries still is a civilising agent of great potency, extending as it does the hours available for certain classes of work and especially for profitable recreation; but the greater convenience, or less trouble attending the use of alternative illuminating agents, tends to arrest the expansion of this branch of the industry in the most highly civilised communities, and this, as we shall presently see, has an important bearing upon the commercial supply of other petroleum products.

From the most remote period of which any records exist, petroleum has attracted attention on account of its unique character. In the Scriptures we find a reference to its use as a cementing material in building operations, as well as to its employment as a combustible agent on the sacrificial altar. The early historians also allude to its medicinal properties, not only for external application, but also for internal administration, and in the remote past it unquestionably played an important part as a lubricant, as a fuel, and as a source of light, besides being employed as a waterproof coating for boats and in embalming the dead. As early as the year 1400, the Ducal Chamber granted a concession for the collection of petroleum from wells at Miano in Italy, and in 1640 the petroleum of Modena was used for lighting and medicinal purposes, and in the preparation of varnishes and paints. At one time Barbados "tar," the crude petroleum of the island of Barbados, had a place in the *materia medica* of this and other countries, and "Betton's British Oil," obtained by distillation from the bituminous sandstone of Pitchford in Shropshire, was sold for curing strains and rheumatism, at the beginning of the nineteenth century.

As far back as 1735 the refining of petroleum appears to have been understood in the Caspian region, and in 1823 a small refinery was in operation on the Caucasus "for changing black naphtha into white." Between 1810 and 1818 petroleum was distilled in Galicia, though apparently the manufacture of a burning oil refined with sulphuric acid and caustic soda was not commenced in that country until 1852, when a manufacturer of cart grease caused experiments to be made with the liquid which condensed on the cover of the vessel in which he was accustomed to heat the crude oil. In the following year Galician petroleum replaced candles for lighting the Emperor Ferdinand's North Railway. In the United States, petroleum was first distilled experimentally by Professor Silliman in 1833, though from a somewhat earlier date it had been sold in that country in a crude state as a medicinal agent under the name of "The American Medicinal Oil, Burkesville, Kentucky." According to Dr. S. P. Hildreth, who wrote in 1833, the oil was then found in such limited quantities and was in such great demand, that "a small vial of it would sell for 40 or 50 cents." About the year 1849, S. M. Kier, a druggist of Pittsburg, noticed the close similarity between the "American Oil" prescribed for the sickness of his wife and the petroleum obtained by his father from a brine well at Tarentum, and began to bottle and retail the latter oil for medicinal use, soon bringing up the sale to about three barrels daily. Finding that the production far exceeded the sale, Mr. Kier commenced about 1855 to refine the oil in a roughly constructed still. The "light wine-coloured" distillate which first came over was found useful for illuminating purposes, while the heavier product was employed for cleansing wool.

The beauty of the light yielded by refined petroleum became generally recognised at a time when there was a craving for a better illuminating agent than the fixed oils and the smoke-producing "camphine," and for many years the petroleum producer and refiner had chiefly in view the manufacture of a lighting fluid. The merits of paraffin wax as a substitute for tallow in candle-making, and of mineral lubricating oils, soon, however, became appreciated, and the American petroleum industry became firmly established on a prosperous basis when markets had thus been found for the chief commercial products. Concurrently our British shale oil industry, a monument of Scottish courage, perseverance and ability, by reason of the wonderful economies introduced, from time to time, into the processes, to meet the ever-increasing keenness of the competition of imported oils, has been steadily built up. This industry, as is well known, had its origin in the refining, in 1847, by James Young, of the crude petroleum of Alfreton in Derbyshire, to which his attention had been directed by Lord Playfair.

Petroleum had long been a source of light in civilised countries before it became an important article of commerce as fuel, and during this period the United States enjoyed a virtual monopoly in supplying it, though the local demand was met in Canada, Burma, and Galicia, by oil produced in those countries. I have a vivid recollection of the sensation created by the first accounts of the extraordinary productivity of the Baku oil wells, and when I visited that district I should probably have shared the view of those who regarded the future of the petroleum industry in America as seriously menaced if I had not known that the Russian oil yielded, in comparison with Pennsylvanian oil, less than half the proportion of what was then the primary product, viz., the burning oil. It may illustrate the position if I say that at this time I was privileged to be associated with Sir James Dewar in experimenting with a process, founded on the classical researches of Thorpe and Young, for the conversion by dissociation of the heavier hydrocarbons into compounds of lower boiling point, which would have enabled the Russian refiner to increase very largely the yield of illuminating oil; but whilst we were engaged in this work the march of events in Russia rendered our results valueless in the direction indicated, for the market value of the ostatki, obtained by distilling off about 30 per cent. of the more volatile constituents of the crude oil, quickly rose to such a point that this product became in Russia the primary one and the business was from this time essentially a fuel industry. Since those conditions prevailed, the Russian petroleum refiner has separated from the crude oil no more burning oil than suffices to give the fuel oil the desired flash-point. For some years after the petroleum industry in Russia had assumed this character, the importance of liquid fuel did not appear to be appreciated in America, and in the latter country producers continued to devote their energies exclusively to the exploitation of those petroliferous areas which yielded the more volatile descriptions of crude oil. At length, however, the liquid fuel industry became firmly established in California, where very prolific deposits of a suitable oil were found to exist, and on this basis California has rapidly advanced to the first place among the petroleum-producing States of the Union in respect of quantity of oil obtained. An additional impetus was given to this branch of the trade by the development of the oil fields of Texas, which also yielded an oil suited to the manufacture of liquid fuel. Concurrently, on the European Continent, in Galicia and Roumania, as well as in the Eastern Archipelago, and especially in Borneo, where a large area of highly productive oil territory is being worked, attention has been specially directed to increasing the supplies of fuel oil, and quite recently arrangements have been made for rendering the petroleum of Burma available as a source of liquid fuel for the British Navy.

Another highly important recent development of the petroleum industry has been the rapid extension of the use of petroleum spirit, which for convenience we may call petrol, in internal-combustion engines for the propulsion of motor vehicles. It is impossible to traverse the streets of such a city as London without realising how important a part petrol is playing and appears destined to play in facilitating locomotion; and the plaintive utterances of the Chairmen of the Railway Companies in respect of the heavy decline in suburban traffic, for which the petrol-driven motor omnibus and private motor car, no less than the electrically propelled tram-car are responsible, bear eloquent testimony to the change which has taken place. With the modern petrol racing car the extraordinary speed of over 121 miles an hour has recently been attained on the Weybridge track. The petrol engine is also very largely used in boats, and it is well known that it is the source of power in submarines, being employed directly in the propulsion of these vessels on the surface and in providing the electrical energy to drive them when submerged. The Wolseley-Siddeley petrol racing boat, only 40 feet in length with a pair of 200 h.p. engines, driving two propellors, has attained a speed of 30·2 knots. Recently this type of engine has contributed to the solution of the problem of flight by means of a heavier-than-air machine, for after having been successfully used in the propulsion of dirigible balloons, a specially light type of petrol motor enabled Mr. Henry Farman early this year to win the Deutsch-Archdeacon prize in Paris by making with his aeroplane a complete circuit round a goal, 500 metres from the starting point, whilst more recently M. Delagrange has similarly made an aeroplane flight of over 15 kilometres, remaining in the air a little over a quarter of an hour.

When we thus realise what has been accomplished through the agency of this wonderful gift of nature, we may feel some sympathy with the enthusiasts who claim that no other product has had as wide-reaching effects on our civilised life.

In placing these reflections before you I am carried back mentally to the time when I traversed India and saw what the cheap petroleum lamp means to the teeming population of that country and the East generally; I am also reminded of my first journey in Southern Russia behind an oil-fired locomotive which drew a heavy train up the steepest gradients without diminution of steam-pressure, and of my first voyage on an oil-burning steamer on the Caspian Sea, when, peering down into the stoke-hold, I saw, instead of the usual gang of grimy perspiring stokers, a single attendant occasionally glancing at the pressure-gauge and adjusting a valve, but spending most of his time in reading a newspaper. Finally I recall a visit to Paris for the purpose of a drive on a petrol motor-car before the passing of the Locomotives on Highways Act of 1896 permitted the use of such vehicles in this country.

I now ask myself, what is to be the future expansion of the more recent applications of petroleum; how far is it likely to be restricted or even arrested by insufficiency of supplies, and when will such applications be no longer possible, owing to the exhaustion of the sources of raw material?

In discussing the probable duration of our supplies, the question of the origin of petroleum cannot be ignored. If there were reason to believe that petroleum is the product of some inorganic chemical action at present in such progress as to lead to the rapid replenishment of the stores which are being depleted, we might obviously divest ourselves of anxiety as to the future, but unfortunately there seems to be no adequate basis for such a belief. It is true that in some oil-bearing localities strata exhausted of oil have been found to yield again after some years, but this can only be due to the transference of oil from other formations. It is also true that such illustrious exponents of scientific views as Berthelot and Mendeleeff have suggested that petroleum may be of purely inorganic origin, and may be the product of chemical action conceivably still going on in the earth far beneath the porous strata in which the oil is now stored; and we know from the researches of Moissan that some metallic carbides yield with water hydrocarbons resembling those of petroleum. Such views are, however, not supported by the available evidence. On the contrary this evidence points to the conclusion that petroleum has been produced from organic matter by very gradual changes which have occupied a vast amount of time, though it should be stated that in certain places, for instance in Karabugas Bay, in the Caspian Sea, in Sweden, in Sardinia, and in the eastern part of the Mediterranean, some conversion of organic matter into petroleum is actually to be seen in progress at the present time.

It is clear that the creation of commercially valuable stores of petroleum demands a special set of conditions, and that unless the whole of these conditions prevail the result is not attained. We must have the necessary organic matter to be subjected to the process of conversion, but it is equally necessary that we should have the requisite conditions for the storage and effective preservation of the petroleum, such as are afforded by a coarse-grained sandstone or dolomitised limestone, with an impervious cover rock, such as shale. Doubtless much of the petroleum formed in past ages has been lost in consequence of the absence of those conditions which are needed for the preservation of a volatile product readily displaced by water. It is easy to understand that a result dependent upon a combination of favourable conditions would be likely to be brought about only at certain periods in the earth's history, and this affords an explanation of the fact that although petroleum is met with in greater or smaller quantity throughout the whole range of the stratified rocks, it is only in certain divisions, and chiefly in the Palæozoic and Tertiary formations that it is found in commercial quantity.

Whether we regard petroleum as the product of the decomposition of vegetable matter, or of animal organisms, or of both, it is necessary to assume the existence of adequate deposits of these substances. It is not, however, difficult to account for such accumulation. In the comparatively deep and quiescent water along the margin of the land in past ages there would be abundant opportunity for the deposition not only of the remains of marine animals and plants, but also of vegetable matter brought down to the coast by the water courses, and the changes which the earth has undergone would result in the burial of these substances under sedimentary mineral matter, the deposits thus formed being ultimately, as the result of further alterations in the earth's surface, often found occupying positions far removed from the sea and sometimes beneath immense thicknesses of subsequent deposits. One of the instances referred to, viz.: that of Karabugas Bay, affords an excellent illustration of the manner in which the accumulation probably occurred. Into this closely land-locked bay organic matter is being constantly conveyed from the open sea through a very shallow entrance over the bar, and as the water of the bay is rendered more strongly saline by the active evaporation which occurs in this torrid region all life is quickly destroyed, whilst at the same time putrefactive decomposition of the remains is prevented.

For the conversion of the organic matter into petroleum a special process of decomposition is obviously needed. Rapid action evidently would not have the effect, and as explaining the absence of petroleum from strata where it might have been expected to be met with, my colleague Mr. W. H. Dalton has remarked that the common occurrence of single valves and the rare occurrence of double valves in the fossils of such strata may probably be taken as indicative of rapid decomposition as opposed to the slow, gradual, change which we believe to be essential to the formation of petroleum.

It is of importance to consider in connection with the question of the creation of further supplies, what period of time may have been occupied by the changes to which reference has been made. The age of the globe has been the subject of controversy between geologists on the one hand and physicists on the other. Among the former the view has generally prevailed that in the rocks of the earth's crust there is evidence of the operation of the same slow and quiet processes as are at work at present in transforming the face of the existing Continents; and on that basis it has been considered that a period of time which the human intellect can scarcely form any conception of must have been occupied. So strongly, indeed, was this felt to be the case that the older geologists did not attempt to measure the antiquity by any of the chronological standards of human contrivance. The champion of the physicists, the late Lord Kelvin, first took up the question in 1862. Arguing from the observed rate of increase of temperature downwards from the surface of the land, Lord Kelvin estimated that the age of the earth must be more than 20 millions of years, but less than 400 millions. This maximum he subsequently reduced to not much more than 20 millions of years. The question formed the subject of the address by Sir Archibald Geikie to the Geological Section of the British Association in 1899. The President of the Section began by admitting the propriety of restricting the geological demands for time, a point which had been insisted upon by the physicists, and pointed out that as far back as 1868 he had showed that even the phenomena of denudation, which had been most constantly and confidently appealed to in support of the inconceivably vast antiquity of our globe, might be accounted for, at the present rate of action, within such a period as 100 millions of years. It might, he continued, be said that the present scale of geological and biological processes could not be accepted as a trustworthy measure for the past. Starting from the postulate, which none would dispute, that the total sum of terrestrial energy was once greater than it is now, and had been steadily declining, the physicists had boldly asserted that all kinds of geological action must have been more vigorous and rapid during bygone ages than they were at the present time; that volcanoes were more gigantic, earthquakes more frequent and destructive, mountain-upthrows more stupendous, tides and waves more powerful, and commotions of the atmosphere more violent, with more ruinous tempests and heavier rainfall. Assertions of this kind were temptingly plausible, and were easily made. But it was not enough that they should be made; they ought to be supported by some kind of evidence to show that they were founded on actual fact, and not on mere theoretical possibility. Such evidence, if it existed, could surely be produced. The chronicle of the earth's history, from a very early period down to the present time had been legibly written within the sedimentary formations of the terrestrial crust. Let the appeal be made to that register. Did it lend any support to the affirmation that the geological processes were now feebler and slower than they used to be? If it did, the physicists, we might suppose, would gladly bring forward its evidence as irrefragable confirmation of the soundness of their contention. But the geologists had found no such confirmation. On the contrary they had been unable to discover any indication that the rate of geological causation had ever, on the whole, greatly varied during the time which had elapsed since the deposition of the oldest stratified rocks. They did not assert that there had been no variation, that there had been no periods of greater activity, but they maintained that the demonstration of such periods had yet to be made. They most confidently asserted that whatever might have happened in the earliest ages, in the whole vast succession of sedimentary strata nothing had yet been detected which necessarily demanded that more violent and rapid action which the physicists supposed to have been the order of nature during the past. Until, therefore, it could be shown that geologists and palæontologists had mistaken their records, they were surely well within their logical rights in claiming as much time for the history of this earth as the vast body of evidence accumulated by them demanded. So far as Sir Archibald Geikie had been able to form an opinion, 100 millions of years would suffice for that portion of the history which is registered in the stratified rocks of the earth.

It is interesting to compare with this estimate a recent calculation by an American geologist, Mr. George Hall Ashley, of the maximum rate of deposition of coal, based upon the observed rate of formation of peat, according to which about 100,000 years were required for the laying down of the coal of the Appalachian field.

Unquestionably the slow process by which we may assume petroleum to have been formed is in operation at the present time, and we may go so far as to say that ultimately the organic matter now being deposited on the bed of the sea in the eastern Mediterranean, for instance, may give rise to further stores of oil for the use of future generations, though whether man will still be on the earth when this deposit is elevated so as to become accessible is another question; but it must be clearly recognised that such petroleum as may now be in process of formation would replace but an insignificant fraction of that which is being used.

In this connection I take the following extract from an address by Professor J. P. Lesley, the American geologist, to the Institute of Mining Engineers, in Pittsburg, in 1886: "I am no geologist if it be true that the manufacture of oil in the laboratory of nature is still going on at the hundredth or the thousandth part of the rate of its exhaustion. And the science of geology may as well be abandoned as a guide if events prove that such a production of oil in Western Pennsylvania as our statistics exhibit can continue for successive generations. It cannot be. There is a limited amount. Our children will merely, and with difficulty, drain the dregs."

Broadly, therefore, it may be said that the creation of the stores of petroleum which now give us light and heat ceased about the time when life in its biped form first appeared on the earth, for the youngest of these stores occurs, as I have said, in the Tertiary formation. Pouchet, in his work entitled "The Universe," has given us in eloquent terms a word-picture of the earth as it then existed. In this epoch, he says, peaceful and luxuriant nature was animated for the first time with varied races of inoffensive mammals, some of singular forms, others of colossal size. The vegetation of this period exhibits a great analogy with the present flora of the temperate regions of the northern hemisphere, and in the seas were new races of molluscs in great quantity.

Having thus arrived at the conclusion that the existing deposits of petroleum cannot be expected to be supplemented to any sensible extent by fresh stores now in process of formation, we see that in respect of petroleum, as in regard to our coal fields and the Chile nitrate beds, we are living on our capital, and we are naturally led to consider how long that capital will last.

When petroleum was only retailed by the pint for use in domestic lamps, or sold by the gallon for the lubrication of machinery, a moderate quantity went far, but when we began to burn it by the ton, as a substitute for coal, an entirely different set of conditions was introduced, and the effect of this important change in the character of the industry has not yet become adequately realised. The knowledge of some of those who discourse enthusiastically on the subject of liquid fuel is not sufficiently comprehensive. Our would-be instructors appear to think that it is only necessary to bring about a better appreciation of the value of such fuel; but as a matter of fact the superiority of liquid fuel has long been fully recognised, and it is only the question of supply which troubles those who thoroughly understand the subject.

As I pointed out in evidence given before the Royal Commission on Coal Supplies in 1903, even if the whole of the world's output of petroleum were doubled, and the surplus thus created were used as fuel, this surplus would, taking into account the relative thermal efficiencies, only be equivalent to about 5 per cent. of the world's output of coal, and the Commission in their report did me the honour to quote and endorse in the following terms, the views I expressed:—

> "There has been much disposition in recent years to speak of oil fuel as if it were a serious competitor of coal, and a real substitute for it. The facts before us do not bear out that view. Dr. Boverton Redwood in his evidence has given us a valuable account of the present and prospective sources of supply of petroleum and its allied products, and while he thought there was ample scope for energy and capital in searching for and opening up fresh sources of supply, he expressed himself very strongly against the possibility of any largely extended use of petroleum as a substitute for coal. He pointed out that the world's production of coal in 1901 was 777 million tons, and that in the same year the world's production of petroleum was 22 million tons, or only 2·8 per cent. of the weight of the coal. The conclusion we have arrived at as regards the use of oil fuel in this country is that which is expressed by Dr. Boverton Redwood in answer to Question 13,559, when he said: 'I think there will be certain selected applications of liquid fuel where the advantages of employing such a fuel are especially obvious; but for anything like general employment, I cannot see where we are to look for adequate supplies.'"

Foremost amongst these selected applications is that of steam-raising in ships of war, and it is common knowledge that our Admiralty are fully alive to the importance of this. In the smaller vessels of our Navy, the torpedo boats and destroyers, remarkable results have recently been obtained by the employment of fuel oil with the new Admiralty burner, the Thornycroft destroyer "Tartar," with water-tube boilers and turbine engines of the Parsons type, having developed a mean speed on her trials of no less than 35·672 knots, whilst the difficulties at first experienced in obtaining smokeless combustion have been completely overcome. The latest destroyers with 790 tons displacement have maintained on trial a speed of 34 knots for six hours with a consumption of 11·36 tons of oil fuel per hour, whereas not more than a decade ago it required eight tons of coal to keep up a trial speed of 30 knots in vessels of about half the dimensions of the present destroyers. In respect of submarines, driven on the surface by internal combustion engines, the size of the vessels has increased from 120 to 500 tons displacement, and the speed on the surface, which represents the strategical value of the craft, is now 15 knots as compared with eight knots in the earlier vessels.

The larger vessels of the Navy, the battleships and armoured cruisers, are now all fitted to burn liquid fuel, but only as a valuable adjunct to coal, giving increased radius of action without replenishing bunkers, and providing the means of very rapidly raising steam in an emergency.

In ordinary circumstances the governing factors in determining the selection of a fuel are cost and thermal efficiency, and on this basis the preference is usually given to oil at prices up to double, or nearly double, that of Welsh Steam Coal, when the saving of labour attending its use is also taken into account.

In the belligerent marine, cost is a consideration of secondary importance, the governing factor being efficiency, for it is obvious that if one nation has a more effective fuel for her warships than others possess, that nation has an advantage, other things being equal, which may have important consequences.

It is somewhat remarkable that the United States has not hitherto shown any disposition to adopt oil fuel in her warships,* although in 1902–1903 a lengthy experimental investigation of the merits of that fuel was carried out by the United States Naval Liquid Fuel Board, the report on which (dated August 1st, 1904), is an instructive volume of 450 pages. A large number of burners were subjected to trial with Texas and California fuel oil, and the following conclusions were arrived at:—

The advantages obtainable in the use of oil are:—

(*a*) Economy of space reserved for carrying fuel.
(*b*) Ease in filling tanks.
(*c*) Rapidity of time in meeting a varying load on boiler.
(*d*) Ability to force boiler to extreme duty in case of emergency.
(*e*) Absence of smoke under light normal working conditions.
( ) Short height of stack.
(*g*) Superior *personnel* available for the operation of the burners.
(*h*) Ability to secure and maintain higher speed with oil fuel than with coal.

For marine purposes it is desirable that burners should be installed capable of effecting vaporisation of oil without the aid of any intermediary of steam or compressed air.

The question of furnace-construction is a very important one. In the extremely limited furnace-space available in marine boilers, it was found very difficult to secure smokeless combustion, and in fact in the tests made under strong forced-draught conditions dense smoke was freely emitted.

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* Since this address was written it is reported that the new destroyers of the United States Navy are to be fitted to burn liquid fuel.

The relative evaporative efficiency of oil and coal, as determined by the extended series of comparative experiments, was practically in the proportion of 15 to 10, but the actual superiority of oil was considerably greater; for in the coal experiments, unusual skill was exercised in the management of the fires, lump coal of superior quality was used, and as the tests were of comparatively short duration, there was much less loss in cleaning fires than would occur in practice; whilst, on the other hand, the oil experiments were carried out under conditions that more closely approximated to those that could be secured on board a sea-going vessel. The actual evaporative efficiency of a pound of oil as compared with a pound of coal might therefore be reported to be in the ratio of 17 to 10. In noting the comparative efficiency, for naval purposes, of oil and coal, there must, however, also be taken into consideration, the fact that a ton of oil can be stowed in somewhat less space than a ton of bituminous coal; also that in the carrying of oil the compartments can be more completely filled. The relative efficiency of oil and good steaming coal, from the naval standpoint of fuel-supply in warships, may thus be regarded as in the ratio of 18 to 10. Under more favourable conditions an even better comparative result may be obtained with oil.

It would appear from these results that we in this country have been more successful than the American experts in the solution of the problem of obtaining smokeless combustion, though our own earlier efforts in this direction were not of a more successful character than those recorded in the report referred to.

There are significant reports of large purchases of American liquid fuel by Japan, and Germany appears to be taking a paternal interest in the development of the petroleum industry of Galicia and Roumania, but the subject is one which cannot be advantageously discussed in detail, since no nation could be expected to disclose any facts beyond those which it is impossible to conceal, and we must rest satisfied with the confident belief that our Admiralty is quite prepared to take full advantage of the demonstrated superiority of liquid fuel, though the British Empire is at present obviously in a less favourable position than some other nations in respect of the control of supplies.

One great advantage possessed by liquid fuel lies in the circumstance that it can be kept in tanks for an indefinite period without deterioration, whereas coal, on prolonged storage under ordinary conditions, may lose 40 or 50 per cent. of its thermal efficiency. If I had the control of the public purse, I should not hesitate to expend a large sum in the accumulation, during times of peace, at convenient ship-fuelling centres, of large stocks of oil fuel, placing the tanks as far as possible in such positions that they could not be easily destroyed by the fire of a hostile fleet.

Let me here make a brief allusion to a most interesting and ingenious method of using liquid fuel in steam-raising, which has recently been brought to my notice. The process is the invention of Herr Brünler, and my son has seen it in practical use in an installation at Bremen, where it has been studied and favourably reported upon by Professor Raoul Pictet. The oil is vapourised and burnt under water in a suitable vessel, and the products of combustion together with the steam generated are used as a source of power in a steam engine. From an early period it has been recognised that combustion can be maintained under water, and the well-known "feu grégeois," or Greek fire, was the outcome of that knowledge; but Mr. Brünler's invention represents the first serious attempt to utilise the idea for industrial purposes. The apparatus employed is of an exceedingly simple character, merely consisting of a cylindrical water-container, connected with a number (corresponding to the number of burners employed) of smaller vessels or pockets. These pockets can be insulated from the main container by suitable valves. They can also be drained by means of drain-cocks, in order that the pilot burners may be started under ordinary atmospheric conditions. The pilot burners are employed merely to heat the vaporisers of the main burners sufficiently to induce complete combustion. When the main burners are well alight, water is introduced from the container by opening the valves, and circulation commences. The flames can be observed through glazed sight-holes provided for the purpose. No boiler of the ordinary type has hitherto been constructed in which complete combustion occurs, and chemical analysis of the products of combustion always shows the presence of unburnt material. A series of experiments with Mr. Brünler's apparatus carried out by Professor Pictet demonstrated that there was no trace of unburnt fuel in the products of combustion. Professor Pictet found that with this system 3 h.p. could be produced with the expenditure of about 2 lbs. of oil. When using any other system of steam generation, even the latest type of water-tube boiler, quite 6 lbs. of good coal would be necessary to give a similar result, and allowing for the difference in thermal efficiency between oil and coal the superior economy of Mr. Brünler's system is very marked. There are, however, several disadvantages connected with the employment of the system in its present form. In the first place it is obvious that the air needed for the combustion of the fuel must be supplied at a pressure at least equal to that of the steam in the container. This necessitates the employment of powerful and costly air-compressors which absorb a large amount of the power available. Then, again, it is requisite, in order to obtain maximum efficiency, to use a high degree of super-heat of the steam and products of combustion, which causes difficulty with the lubrication of the engine. Finally, it is evident that owing to the presence of large quantities of carbon dioxide and nitrogen as products of combustion it is practically impossible to run the engine with a vacuum, as the air-pump would need to be of such large capacity that no increase of economy would result (the volumes of steam and gaseous products in the mixture supplied to the engine are in the proportions of 7 to 3). This renders it impossible to use the system for steam-generation for turbines, as it is well known that the turbine is a most inefficient machine unless worked with a nearly perfect vacuum. An additional difficulty which has been experienced with Mr. Brünler's system arises from the circumstance that a considerable quantity of nitric acid is formed as one of the products of combustion. It is, therefore, necessary to introduce chalk, or some other neutralising agent, into the container from time to time. It may, of course, be suggested that we have here a source of nitrates which may be made of commercial value, but on the whole it is perhaps wisest to state that in its present form the invention is more interesting than practical, though there is no doubt that this system of burning liquid fuel is well worth further experimental investigation.

For some time past naval experts have had their attention directed to the possibility of the steam-engine being replaced by the internal combustion engine in our warships, and many engineers (the late Sir Frederick Bramwell among the number) have even asserted that we were within measurable distance of the time when the steam-engine would only be found in our museums.

An instructive paper on internal-combustion engines for marine purposes was read by Mr. J. T. Milton, before the Institute of Civil Engineers, in January, 1907, and this was followed by an even more instructive discussion. Mr. Milton referred to the extensive use of such engines on land and sought to show that heavy oil and producer-gas could be employed in marine work. He admitted that in respect of producer-gas, only that made from coke or from anthracite coal was available, though he considered that there was a reasonable expectation that a producer would be perfected soon which would enable bituminous coal to be used. In the course of the subsequent discussion Engineer-Lieut. W. R. Sillince, R.N., emphasised the difficult nature of the problem of making a gas-generator suitable for such use, and expressed the view that, as compared with the gas-engine, the oil-engine offered many advantages for marine purposes, though he thought that the question of the supply of suitable fuel-oil, if its use became general, would be a matter for serious consideration. He regarded the prospects of the internal-combustion engine for marine purposes as distinctly promising, but especially so in smaller sizes and up to 1000 h.p. per shaft, and he remarked that a number of internal-combustion engines were either fitted on board certain ships of the Navy or nearing completion at the makers' works, for the purpose of generating electricity, whereby it was hoped that the work of the boilers, especially in harbour, would be relieved to a considerable extent. Such engines were also, he added, used for the propulsion of service boats.

Dr. Hele-Shaw alluded to the successful results given by the 24-cylinder Antoinette petrol engine, used as a source of power in a flying-machine, and stated that this form of engine of 360 h.p. weighed only 1500 lbs., plus 160 lbs. for accessories, which worked out at 4½ lbs. per horse-power, whilst a 500 h.p. producer-gas engine for marine purposes weighed 45 tons for the engine and 20 tons for the producer, a total weight of 65 tons for the plant, the weight per horse-power being 280 lbs., or about 60 times as much as in the Antoinette engine.

Sir William White said that the general impression made on his mind by the remarks in the discussion, especially those of Mr. Dugald Clerk, and Professor Burstall, was that in the application of internal combustion engines to the propulsion of ships there would be many difficulties on the large scale which had not been of serious importance hitherto; and that those highly-experienced men did not look forward with confidence to the immediate advance of the internal-combustion engine to large powers for marine purposes, though he understood that Mr. Clerk did not mean to convey the idea that the difficulties to be faced were insurmountable. He thought that, in consequence of the inadequacy of the supply of oil fuel, producer-gas was the only available fuel, though, as an auxiliary to coal in steam-raising, oil was of the greatest value, but he pointed out that the danger attending the use of gas-producers on board ship would have to be guarded against.

Mr. A. C. Holzapfel referred to the successful use of Capitaine gas-engines on board tugs and cargo vessels running on the Rhine, and Rear-Admiral G. W. Melville, U.S. Navy, having alluded to the extensive use of the oil-engine for propulsion on canals in Holland, said that with a completely satisfactory engine working with heavy oils this source of power would be adopted in larger ships.

In a remarkable paper on the influence of machinery on the gun power of the modern warship, read before the Institution of Naval Architects in March, 1907, Mr. James McKechnie pointed out the advantages which would result from the use of internal-combustion engines for the propulsion of battleships. The paper was accompanied by plans showing the application of gas-engines with gas-producers to a battleship, and of oil-engines to a torpedo-boat destroyer, and by corresponding drawings for similar types of ships of the same size, but fitted with steam machinery. The following comparison of the weights, area occupied, and fuel-consumption of steam, gas and oil machinery for a 16,000 h.p. battleship was given :—

	Steam Engine.	Gas Engine.	Oil Engine.
I.H.P. available for propelling the ship.	16,000	16,000	16,000
Weight of machinery, including usual auxiliaries, but not deck machinery ...	1585 tons*	1105 tons†	750 tons‡
I.H.P. per ton of machinery	10·1	14·48	21·33
Area occupied by machinery, engines and boilers, or producers	7250 sq. ft.	5850 sq. ft.	4110 sq. ft.
Area per I.H.P.	·453 sq. ft.	366 sq. ft.	·257 sq. ft.
Fuel consumption in pounds per I.H.P. per hour—			
At full power ...	1·6 lb.	1·0 lb.	·6 lb.
At about ½ full power	1·66 lb.	1·15 lb.	·75 lb.

* Includes water in boilers.
† Includes water in jackets and piping, but not coal in producers.
‡ Includes water in jackets and piping.

Attention was specially directed to the benefit derived from the abolition of the boiler-uptakes and funnels, for the turrets could be so disposed, without increase in the length of the ship, as to admit of all the ten guns being fired on either broadside, thus giving an "all round fire" for all guns. In respect of the destroyer it was claimed that a sufficient quantity of fuel had been provided for to give the oil-driven vessel, at the full speed of 30 knots, a radius of action six and a half times greater than that of the steam-driven destroyer with full coal supply.

In discussing the paper, Admiral the Hon. Sir E. R. Fremantle alluded to the value of oil fuel as shown in the previous year's manœuvres under Admiral May in the following terms :—

> "When the stokers were pretty well worn out, and had used all the coal that was nearest at hand, and much labour would be necessary to fetch coal and bring it to the fires, then they were able to use the oil fuel, and I believe I am correct in saying that the four ships which had oil fuel, steamed away, even from ships with nominally greater speed."

Sir William White, having in reply to a question, been informed by the author of the paper that 800 h.p. was the greatest power in a single oil engine with which up to that time he had had to do, made the following significant remarks :—

> "Then, I hope Mr. McKechnie will not be offended if I say that it is a somewhat 'sporting' design to go on at one step to 16,000 h.p. and to give detailed weights and rates of fuel consumption for engines of that large power. Of course, I quite appreciate that Mr. McKechnie guards himself by saying that if this scheme was carried into actual design and manufacture there would have to be modifications, and very careful consideration of details. I congratulate Mr. McKechnie on his boldness in coming forward with approximate statements of weight and space, which, according to the best knowledge he has at present, he believes would suffice for the installation of gas-engines and producer in a battleship of 16,000 h.p. Two years ago a design was originated in America for twin-screw gas engines using producer gas, and the author gave complete estimates of weight and space. His figures differed a good deal from Mr. McKechnie's estimate, as might be expected, seeing that in both instances the estimates must be based on limited experience. Instead of 14·48 i.h.p. per ton of machinery, the American designer only anticipated about 11 i.h.p."

In this connection a paper on the Present Position of Gas and Petrol Engines, read by Mr. Dugald Clerk at the last meeting of the British Association, is of great interest. Mr. Clerk, whose claim to express authoritative opinions on such a subject none will dispute, asserted that the difficulties of the marine gas-engine had been greatly underrated, and he added :—

> "Mr. McKechnie indeed contemplates engines on shipboard of over 16,000 h.p. in the immediate future. I fear it will be some years before we have gas-engines of 16,000 h.p. working on land, and considerably later before we have them at work on sea."

It is true that suction-gas plant has already been successfully employed with a gas-engine on small vessels, but there are admittedly great difficulties attending the carrying out of this principle on such a large scale as the power-requirements of the battleship demands.

Having regard to the fact that in respect of supplies of coal this country is in an exceptionally favourable position, patriotism and prudence would alike dictate that preference should be given to any system of furnishing power by which coal would be put upon an equality with oil, but at present this does not seem practicable on the very large scale, and in the meantime the importance of liquid fuel will not decrease.

I venture to think that just as the incandescence mantle has enabled coal-gas to withstand the competition of electricity as a source of light, and has given it a new lease of life as an illuminating agent, so the substitution of the Parsons turbine for the reciprocating steam engine coupled with the use of liquid fuel, will delay for a long time the introduction of the internal-combustion engine as the source of power in the larger ships.

The difficulties attending the substitution of internal-combustion engines for steam engines in large ships do not attach to the use on land of stationary engines of the former type, of moderate h.p., and both gas engines and oil engines are largely replacing steam-engines as a source of power in industrial operations, but it is in the propulsion of road-vehicles that the oil-engine is playing so important a part.

In steam engines of moderate size only about 12 per cent. of the heat value of the fuel burned in the furnace of the boiler is rendered effective, whereas in the internal-combustion engine it is easy to obtain at least double that proportion in the form of work, and in the Diesel engine the return is as much as 37 per cent.

With the Diesel engine almost any kind of, mineral oil can be successfully used, but this is an engine of a special type, necessarily of heavy construction, and not well adapted for many purposes, to which the oil engine is applied. Of the usual forms of oil engines, some are constructed for use with kerosene, or even with less volatile petroleum products, but the ordinary motor-car engine needs a product which freely volatilises at common temperatures, and it is this requirement which has led to so large an increase in the demand for petroleum spirit that apprehension of failure of supplies has been created.

In a lecture on the modern motor-car and its effects, delivered at the Royal Institution in London on the 3rd April last, Lord Montagu of Beaulieu stated that he estimated that in this country a sum of over 12 millions sterling was already invested in motor-car plant and machinery, without taking into account accessory trades, which were also important financially, and that the output of the industry during the present year, in which 300,000 persons were employed, would be worth not less than 6 millions. He further stated that the estimated value of motor-cars and motor cycles in use in Great Britain was over 29 millions sterling. Still more remarkable were the figures which he gave as the estimated number of motor vehicles in the world at Christmas, 1907. The total was 346,350, 130,000 being assigned to the United States, 125,320 to the United Kingdom, 32,530 to France and 22,000 to Germany. On April 27th last there were 1,137 licensed motor omnibuses in London and 758 motor cabs. There were also 2,600 motor cabs on order. Probably each omnibus consumes about 15 gallons of motor spirit per diem, and each cab about 5 gallons. The industry is therefore a highly important one, and, as it is still growing rapidly, the maintenance of supplies of a suitable description of combustible liquid is of vital consequence.

The United States Association of Licensed Manufacturers reported that the value of the product of the automobile manufacturing industry in that country for 1907 was £21,000,000 representing an output of more than 52,000 cars. A noticeable feature of the industry was the very great predominance of gasoline vehicles, for out of the total there were only about 5,000 designed for propulsion by steam and electricity. "The Times," in commenting upon the report in the Engineering Supplement for March 4th last, remarked that in this respect the industry showed the same features as our own, for it was becoming evident that the internal-combustion engine was the motor of the future unless the price of petrol rose to such an extent as to bring electricity into serious competition with it by making use of the storage battery. As there was, however, a concentrated attention upon the subject of carburettors for the use of the heavier oils, "The Times" considered it more probable that the invention of an efficient device of such a kind would give the gas engine a new lease of life, should the demand for petrol increase to such an extent as seriously to raise the price in the market.

According to a recent report on the motor-car trade of Italy, made in accordance with the instructions of the Minister of Agriculture of that country, there were 80 motor-car works in Italy, as compared with four in Austria, 18 in Belgium, 33 in Germany, 62 in England, 111 in the United States and 205 in France.

We come now to the consideration of the important question of supplies. In the following tabular statement, in the compilation of which I have been assisted by my colleague, Mr. Arthur W. Eastlake, the world's production of crude petroleum for the years 1905, 1906 and 1907 is given. The figures for last year are to some extent estimated, as the whole of the usual statistics have not as yet been published, and some of the figures for previous years are also in the nature of estimates, as official returns of the output in certain countries are not made, but broadly, the table conveys, I believe, an accurate impression of the situation, and it will be seen how largely the world is at present dependent for supplies upon the United States and Russia. The figures, however, need explanation in order that correct deductions may be drawn from them. In respect of kerosene, the United States occupies by far the most important position, for the crude oil produced in that country yields a comparatively large proportion of that product, although California owes its position in the list to the demand for liquid fuel. On the other hand, as has also been stated, Russian petroleum is mainly a fuel oil, and a very large proportion is consumed locally in that form. The percentage of production of crude oil in the various countries also affords no guide to the relative importance of the sources of supply of petroleum spirit.

World's production of petroleum (in Imperial gallons).

Country.	Quantity.	Percentage of total.
	1905.	
United States—		
California	1,169,627,280·2	
Texas	984,485,253·1	
Ohio	571,969,633·4	
Kansas, Indian territory, and Oklahoma	420,552,190·0	
West Virginia	405,118,069·9	
Indiana	383,639,003·0	
Pennsylvania	365,197,453·0	
Louisiana	311,775456·0	
Kentucky and Tennessee ..	42,594,622·0	
New York	39,104,194·1	
Colorado	13,164,568·0	
Illinois	6,336,129·1	
Wyoming	295,805·4	
Michigan and Missouri ..	108,469·0	
	4,713,768,124·0	63·065
Russia—		
Baku Field	1,721,596,016·0	
Grozni Field	175,692,232·0	
	1,897,288,248·0	25·3839
Eastern Archipelago	256,627,506·0	3·4334
Galicia	209,189,939·4	2·7988
Rumania	159,502,923·9	2·1339
India	144,798,444·0	1·9372
Japan	46,927,083·0	0·6278
Canada	22,186,984·0	0·2968
Germany—		
Prussia and Bavaria ..	14,144,107·0	
Elsass	5,175,467·0	
	19,319,574·0	0·2584
Other countries .. .	1,749,500·0	0·0233
Italy	1,687,361·0	0·0225
Peru—Zorritos Field .. .	1,319,847·0	0·0176
United Kingdom	11,448·0	0·0001
	7,474,376,981·0	99·9994
	1906.	
United States—		
California	1,158,119,944·0	
Kansas, Indian Territory, and Oklahoma	759,935,493·5	
Ohio	517,423,827·3	
Texas	439,750,716·0	
Pennsylvania	358,888,686·0	
West Virginia	354,131,516·0	
Louisiana	317,622.705·0	
Indiana	268,494,960·2	
Illinois	153,852,779·5	
New York	43,510,660·0	
Kentucky and Tennessee ..	42,462,045·0	
Colorado	11,462,094·1	
Wyoming	244,930·0	
Michigan and Missouri ..	122,465·0	
	4,426,022,820·0	59·9308

Country.	Quantity.	Percentage of total.
Russia—		
Baku Field	1,857,568,073·0	
Grozni Field	161,561,823·0	
Bereki and Tchimion Fields.	19,263,813·0	
	2,038,393,709·0	27·6009
Eastern Archipelago	258,891,849·0	3·5055
Rumania	230,082,131·3	3·1154
Galicia	198,400,871·4	2·6864
India	140,553,122·0	1·9031
Japan	47,236,500·0	0·6396
Germany	19,944,217·0	0·2700
Canada	19,935,657·0	0·2699
Other countries	2,624,250·0	0·0355
Italy	1,653,465·0	0·0223
Peru—Zorritos Field	1,483,768·0	0·0200
	7,385,222,359·0	99·9994
	1907.	
United States	5,690,389,094·0	63·3105
Russia	2,204,832,042·0	24·5306
Galicia	306,813,704·0	3·4135
Rumania	292,850,568·0	3·2582
Eastern Archipelago	258,926,000·0	2·8807
India	140,750,000·0	1·5659
Japan	47,236,500·0	0·5255
Canada	20,119,250·0	0·2238
Germany	19,596,622·0	0.2180
Other countries	3,499,000·0	0·0389
Italy	1,653,465·0	0·0183
Peru	1,399,600·0	0·0155
	8,988,065,845·0	99·9994

The world's production of crude petroleum for 1907 would fill 3,456,948 ten-ton railway tank-waggons, and these waggons would form a train 13,749 miles in length, extending more than half way round the earth, or occupying 50 railway tracks the whole distance from London to Newcastle.

In addressing the members of the Society of Chemical Industry, I am addressing a large number of citizens of the United States, and I may appropriately congratulate them upon the commanding position which their country continues to occupy in the petroleum industry.

It will be noted that with the exceptions of Canada, Burma and Assam, no countries under the British Flag contribute to the world's supplies of petroleum, and that, in respect of her contribution to the total, the British Empire occupies an unenviable position in comparison with that of some other nations. In view of the increasing importance of petroleum as a fuel, especially in the belligerent marine, it would appear to be a national duty to ascertain whether other petroleum fields cannot be developed on British soil, and already some action is being taken with that object in view.

There is good reason to believe that petroleum may be found in commercial quantity in the British West Indies, and especially in Trinidad; whilst, apart from large further developments which may be possible in Canada, the available evidence points to the conclusion that parts of New Brunswick, Newfoundland, and New Zealand may be richly oil-bearing. In Nigeria, also, tests are being made with the drill of districts in which promising indications have been met with.

In his new work on Oil Fuel and the Empire, Mr. J. D. Henry makes a cogent appeal for extended enterprise in the prospecting and development of the liquid fuel resources of the Empire.

In Great Britain petroleum is met with in small quantities in the coal measures in Lancashire, North Staffordshire, Shropshire, and elsewhere, and it will be remembered that the shale oil industry in Scotland was the outcome of the results obtained in 1847 by James Young in the distillation of the oil flowing from a coal working at Alfreton in Derbyshire. For many years there has been an actual commercial output of petroleum in this country which has been recorded in the General Report and Statistics relating to Mines and Quarries in the United Kingdom, issued by the Home Office. The annual output reached its maximum in 1893, when it amounted to 260 tons, valued at £488. It had fallen to 5 tons, valued at £12, in 1899, and was returned as nil in the following year. There was a production of 8 tons in 1901, and 25 tons in 1902, none in the two succeeding years, 46 tons in 1905, and 10 tons in 1906, the locality of production for the latter years being Dumbartonshire.

Apart from the oil thus found, discoveries of petroleum have been made from time to time in this country, some of which were of a very doubtful character, but one, at least, of them, which was investigated at the time (in 1892) by the late Mr. Topley, F.R.S., F.G.S., and myself, was of considerable interest. It took the form of a sudden influx of some hundreds of gallons of a straw-coloured mineral oil into a well which was the source of the water supply of an isolated dwelling-house standing on high ground near Shepton Mallet in Somersetshire, the occurrence taking place immediately after an earthquake shock. Other water wells in the neighbourhood were at the same time found to yield small quantities of petroleum, and shortly afterwards my attention was called to a similar occurrence at Ruabon.

There is, I think, no reason to anticipate that these indications are of more than academic interest, but it is worthy of note that a boring is now being made at Battle in Sussex, in the hope of finding something more than the trace of oil reported to have been met with in the sub-Wealden exploration at Netherfield in 1874. In this connection reference should be made to the natural gas of Heathfield, the out-put of which amounted to 774,800 cubic feet, valued at £155, in 1904.

In the following table, for which I am indebted to my brother, Mr. Robert Redwood, the imports into this country during the last three years of petroleum spirit and burning oil are given, and it will be seen that we have here a measure of the relative extent to which we are dependent upon other countries for our supplies of the commercial products specified. This table shows the changes which have occurred in the petroleum trade of the United Kingdom during recent years, and the rapid growth in the consumption of petroleum spirit brought about by the largely increased use of the automobile.

It will be seen that the quantity of this product imported into the United Kingdom increased from 474,610 barrel units of 41 Imperial gallons for the year 1905 to 809,280 barrel units for 1907. During the period in question there was a considerable falling off in the imports of petroleum spirit from America, owing to the home demand and, fortunately for motorists, a very large increase in the imports of this product from the Dutch East Indies.

Imports of petroleum spirit into the United Kingdom
In barrel units of 41 *Imperial gallons.*

Year.	From America.	From Sumatra and Borneo.	From Roumania.	From Russia.	From various Continental Ports.	Totals.
1905	287,310	167,230	nil.	nil.	20,070	474,610
1906	206,440	379,460	41,410	nil.	22,010	642,320
1907	173,450	576,170	35,230	8,310	16,120	809,280

Imports of petroleum oil (kerosene) into the United Kingdom.
In barrel units of 41 *Imperial gallons.*

Year.	From America.	From Russia.	From Galicie.	From Roumania.	Totals.
1905	2,415,530	1,199,610	130,750	35,090	3,780,980
1906	2,505,110	764,990	242,280	152,120	3,664,500
1907	2,625,590	715,730	38,230	170,590	3,550,140

It is in respect of future supplies of petroleum spirit that, as I have said, there is anxiety in the automobile world. A recent enquiry conducted by motorists led to conclusions which were not reassuring, but these conclusions, I should add, are not accepted by the petroleum trade. It is, unquestionably, most difficult to forecast the future in such a case. No method exists of forming a trustworthy opinion as to the productive capacity of petroliferous lands which have not been brought to the stage of full development, for we cannot measure a natural store of petroleum as we can a deposit of coal, and it has, moreover to be borne in mind that such petroleum spirit as the motorist uses probably does not represent more on the average than 5 per cent. of the crude petroleum raised.

There are, doubtless, many other localities than those already in the condition of developed oilfields, which, with an increased demand, will be added to the producing territories. In Russia alone there are vast areas known to be petroliferous which have not yet been adequately tested with the drill, and in the United States at the present time, owing to the exploitation of the mid-Continent oilfields, the output of petroleum spirit is probably largely in excess of the home demands; but the figures already referred to afforded evidence of scarcity before the development of those fields, and with the further extension of the use of the automobile in America, which would proceed far more rapidly if improvement of the roads was taken in hand, it would not be surprising if that country required all the petroleum spirit which she could produce, though it must be borne in mind that there are in the United States, as in Russia, immense areas of oil-bearing lands, in Wyoming for example, awaiting development. Another country affording highly promising indications over a very large area is Persia.

Supplies are now, as we have seen from the table of imports, coming to this country from Roumania, and a beginning has been made in the importation of Russian spirit from the Grozni district, but it is apparently to the prolific fields of the Dutch East Indies that we must look to supplement the American supplies in the immediate future, though before long we may receive shipments from Peru and other countries which hitherto have not contributed to the world's supplies of this product.

The chief difficulty lies in the fact that the other products, and especially the burning oil, obtained from the crude oil, of which, as already stated, the petroleum spirit represents but a small proportion, must also be marketed if the industry is to be carried on without prohibitive cost. Unfortunately, as will be seen from the figures given, the great increase in the consumption of petroleum spirit has not been accompanied by a corresponding increase in that of kerosene, the imports for the past three years having in fact exhibited a gradually progressive decline, but if success attends the efforts to devise an efficient form of carburettor for the latter product, and other objections attending the substitution of kerosene for petrol can be met, the prospect will be far more hopeful. Kerosene is largely employed in stationary internal-combustion engines, but for automobile use it has many disadvantages. The first of these, viz.: the comparatively high volatilising point, may be overcome by starting the engine with petrol, for there are carburettors which work fairly well on the motor car when the engine has become hot, but under the varying conditions of road-vehicle work it is difficult to secure continuously perfect combustion. On the water, where the work is comparatively uniform, greater success has attended the substitution of kerosene for petrol, although for racing boats, petrol is still preferred. Probably, however, the most serious objection to the use of kerosene in a private carriage lies in the comparatively non-volatile character of the oil and its objectionable habit of spreading on to parts of the vehicle where it becomes a nuisance by reason of its odour.

Whilst, therefore, we cannot, in my opinion, look for any general replacement of petrol by kerosene in the *voitures de luxe* of private owners, unless the objections alluded to can be overcome, much may be done in the direction of encouraging the use of a less volatile description of petroleum spirit, and already considerable progress has been made in this direction, with corresponding increase in available supplies. Concurrently, efforts should be made to bring about an increase in the use of the heavier oils in stationary engines, commercial and public service vehicles, and motor boats.

Among the substitutes for petrol to which attention has recently been directed, is benzol. The quantity of this product hitherto obtainable for use as a source of power has not been large, but Messrs. Sadler and Co., Ltd., consider that if all the patent coke ovens in this country were provided with appliances for the recovery of the benzol from the waste gases, it would not be unreasonable to anticipate that a production of 30,000,000 gallons per annum of benzol suitable for motor-car use could be secured. It is claimed by those who are exploiting the "coalite" patents, that if this fuel were sufficiently largely employed as a substitute for coal, the motor spirit obtained as a by-product would render this country independent of imported supplies.

It will naturally be asked whether Great Britain might not supplement her supplies of imported petrol with the parallel product yielded by the destructive distillation of shale. Apparently this might be done, not only by more fully utilising the most volatile of the liquid hydrocarbons obtained in the Scottish shale-oil refineries, but also by distilling shale for the purpose. At the present time the production of Scotch shale spirit of ·730 specific gravity amounts to about 25,000 barrels per annum.

Another way in which a threatened famine in the more volatile products might be met, would be by the conversion, by dissociation, of the heavier hydrocarbons into others of higher volatility.

Considerable attention has recently been directed to the possibility of replacing petrol by alcohol, for use in internal-combustion engines.

We have seen that the formation of petroleum in the laboratory of nature has occupied a vast period, and that although some creation of this product is in process at the present time, our diminishing stores cannot thus be sensibly replenished.

In alcohol, however, we have an alternative fuel which can be readily and rapidly produced in very large quantities, and considerable interest therefore attached to the consideration of the thermal efficiency of this liquid in comparison with that of petrol.

Professor Lewes, who has devoted special attention to this subject, gives the respective calorific values as:—

	Calories.	British Thermal Units.
Petrol, sp. gr. ·722	11,278	20,301
Methylated spirit	6,288	11,319

In the use of alcohol in an internal-combustion engine, however, far higher compression can be employed than with petrol, more complete combustion can be obtained, and less air is needed, and in practice alcohol gives much better results in comparison with petrol than its thermal value would have led one to anticipate. Thus in experiments made with a pair of 8 h.p. engines, one designed for alcohol and the other for petrol, the consumption was:—

Petrol	340	grms. per Horse-power hour
Methylated spirit	373·5	,, ,, ,, ,,

Taking into account the relative specific gravities, the alcohol was, volume for volume, quite equal to the petrol.

Even better results are obtained with a mixture of alcohol and benzol.

The comparative safety, in respect of fire, of alcohol, is a feature of importance.

At present, alcohol cannot be advantageously used in this country, as a substitute for petrol, owing to its cost, but it could probably, under suitable conditions, be sold at a price which would not compare unfavourably with that of petrol.

In conclusion it may be said that although the vast and highly important industry so inadequately dealt with in this somewhat discursive address, exhibits many features of which its creators may justly be proud, there will be ample scope for the exercise of the abilities of highly-trained specialists for many years to come. Among other problems to which the industrial chemist may be advised to direct his attention are those of the conversion of some of the hydrocarbons into others of higher volatility, by dissociation, the improvement of the existing methods of fractional distillation, the more effective separation of the solid hydrocarbons from the liquid, the substitution of a more rational process for that part of the operation of refining which consists in the somewhat barbaric treatment of the distillate with sulphuric acid, and the devising of some better method of eliminating sulphuretted compounds from petroleum containing these objectionable impurities.

Professor Meldola proposed a vote of thanks to Sir Boverton Redwood for his address. He said the address was characteristic of the man. He had the temerity, not long ago, when he felt it was necessary he should begin to receive instructions in those duties, which by their kindness he had been called upon to discharge, to ask Sir Boverton what subject he had chosen for his address, and his reply was characteristic: "Of course I can only talk about one thing—petroleum." If in that their President had a narrow subject he had at the same time a subject of the widest importance, and one that had become of the most fascinating interest. Apart from its immense value—the value arising from its applications—they had realised perhaps many of them that day that it had opened up the consideration of problems of enormous scientific importance. It had brought them into contact with such chemical questions as the transformation of organic matter, and had raised a problem such as that of the age of the earth, so that the narrow subject which their President thought perhaps would be dull and uninteresting had turned out, under Sir Boverton's treatment, one of a most fascinating character. While they were indebted to the President for the address to which they had listened, it must not be forgotten that during the past year his attention to the affairs of the Society had been unflagging. He had shown great zeal, and had been most tactful in every relationship with those with whom he came in contact. Thus their indebtedness to their President was deep, and it was with very great pleasure indeed that he asked the meeting to pass a hearty vote of thanks to Sir Boverton for his address.

Mr. N. H. Martin, chairman of the Newcastle Section, seconded the motion. He said he did so with the utmost gratification. He was able to testify to the fact that no man had worked harder on behalf of the Society than their President. No man had brought clearer judgment and tact to bear upon the affairs of the Society, and it was due largely to Sir Boverton that they had their Charter of Incorporation and their new by-laws, so that the Society could work on broader lines.

The motion was carried unanimously.

The President, in acknowledging the vote of thanks, said he felt he had not merited the generous expressions which had fallen from Professor Meldola and Mr. Martin, or the very cordial reception the address had received at the hands of those present. He could only say that the terms in which Professor Meldola and Mr. Martin had alluded to him would never be forgotten by him. He would treasure them as amongst his most valued possessions, feeling, nevertheless, that they were not deserved. He again cordially thanked them for the reception they had given him.

On the proposal of Mr. W. T. Gent, seconded by Mr. Alfred Allhusen, Messrs. Norton, Feasey and Slade were appointed auditors to the Society at a fee of twelve guineas.

The next business was the selection of the place of meeting for 1909, and the President called upon Dr. J. Lewkowitsch, Chairman of the London Section.

Dr. Lewkowitsch extended to the Society a hearty invitation to hold the next Annual General Meeting in London. Mention of the name London relieved him of having to resort to anything like an eloquent appeal in support of his motion. The London Section would endeavour to maintain the standard of hospitality set by previous meetings, but whether they succeeded or not, they certainly could not excel their predecessors in cordiality. One great event next year, that would be an additional inducement for them to go to London, was the Seventh Annual International Congress of Applied Chemistry, which was "engineered" by the Society of Chemical Industry, and therefore he appealed to them, as loyal members of the Society, to go to London and support their President. At the same time he appealed to the local members—those of Newcastle and district—especially to attend the meeting, for two of their distinguished townsmen were to take prominent parts in the Congress proceedings—Sir Andrew Noble as Chairman of the Explosives Section and Mr. Martin Chairman of the Pharmacy Section. There would be special arrangements for the fairer sex to see London and its art treasures. If the invitation to hold the meeting in London concurrently with the International Congress was accepted, he could assure the ladies they would come in for a special amount of attention. Dr. Lewkowitsch enumerated several of the receptions and gatherings that were being arranged, indicating a brilliant round of social functions at which the ties of acquaintanceship would be renewed and strengthened. Several of the best hotels had been secured, to be placed at the disposal of the members, and special travelling arrangements would be made with the Railway Companies. Their meeting would commence on Wednesday, May 26th, and the official gatherings would go on until Saturday; but, unofficially, their visit could be extended until the following week, when there would be further attractions.

Mr. Walter F. Reid supported the invitation, and said this was the first time the International Congress of Applied Chemistry had been arranged to be held in Great Britain. He advised everybody who was interested to go. Those who had experienced the hospitality of the London Section, knew that nothing would be left undone to make the stay of the visitors attractive and instructive.

The invitation was accepted unanimously.

Mr. Eustace Carey moved a vote of thanks to the President and Council of the Armstrong College for granting the use of the building, and for the hospitality shown to the members.

Mr. T. Fairley seconded, and the proposal was carried.

Dr. Merz said the College was always glad to welcome the representatives of scientific institutions. The Council was proud to be able to offer the Society the use of a building so suitable as that had been for the purposes of the meeting. In the name of the President and the Council of the College, he thanked them very much for the vote of thanks.

The meeting ended by the company being photographed in the College grounds.

At the invitation of the Reception Committee, luncheon was subsequently provided at the Grand Assembly Rooms, Barras Bridge.

Dr. Russell W. Moore moved a vote of thanks to the Newcastle Section for their hospitality, which was carried unanimously.

Mr. N. H. Martin replied.

River Excursion, and Visit to the Works of Palmers' Shipbuilding and Iron Company, Ltd., Jarrow-on-Tyne.

By the kind invitation of the Lord Mayor of Newcastle-upon-Tyne, a large excursion party embarked at the Tyne Ferry Co.'s landing, Quayside, at 2.15 p.m., on board a steamer, which, calling at Jarrow, landed a portion of the visitors, desirous of inspecting Messrs. Palmers' works, whilst the remainder proceeded by the steamer on a visit to Tynemouth, tea being provided for them on board. Favoured by beautiful weather, the excursion was entirely successful. On the return journey, the steamer called at Jarrow for the members visiting Palmers' works. As a matter of special historic interest it was noted that since the time of the Romans there has been a bridge connecting Newcastle and Gateshead, the present swing bridge standing on the historic site. Immediately above the swing bridge, is Robert Stephenson's High Level bridge carrying both the road and the railway, and standing 83 feet above the river at high water.

Works of Palmers' Shipbuilding and Iron Company Limited.

The party landing for the purpose of inspecting Messrs. Palmers' works, were received by Mr. Malcolm Dillon, and conducted over it in groups by the manager and the general manager of the iron-producing department, assisted by other officials.

This firm was established in 1851, by the late Sir Chas. Mark Palmer, Bart., M.P. The works cover an area of about 100 acres, and comprise a shipyard, graving dock and slipway, engine and boiler factory, steel works and blast furnaces, and include the entire range of shipbuilding operations, from the smelting of the ore to the complete equipment of the vessel. The firm has built over 800 ships of all kinds, and nearly 800 sets of engines. The engine works comprise foundries for producing iron, brass, and steel castings, also plant for manufacturing water-tube boilers, and turbine machinery. The machinery in all the departments is worked by electricity. There are five blast furnaces, and in the steel works, eight melting furnaces. The number of workers employed is from 7,000 to 8,000. The latest battleship built here is the "Lord Nelson," a vessel of 16,500 tons displacement and 16,750 horse-power.

After the inspection of these extensive works, afternoon tea was kindly provided for the visitors by the firm. A vote of thanks to the firm was then moved by Mr. N. H. Martin, Chairman of the Newcastle Section, and seconded by Mr. W. F. Reid, and acknowledged and replied to by the manager and also the general manager of the iron-producing department.

Conversazione.

At the invitation of the Reception Committee a conversazione was held on Wednesday evening, July 22, at the Armstrong College. There were about three hundred ladies and gentlemen present, and the time was enjoyably spent. The visitors were received by the Lady Mayoress (Mrs. Sanderson), Mr. N. H. Martin, and Miss Martin. The Lord Mayor, the Chairman of the Reception Committee, was unable, through other duties, to attend until later in the evening. Amongst the company were Sir Boverton Redwood, Lady Redwood and Miss Redwood, Professor Raphael Meldola, Sir Andrew Noble and Miss Noble, and the Sheriff of Newcastle (Mr. Walter Lee) and Mrs. Lee. Music was rendered by an orchestra in the Great Hall, and in the Physical Lecture Hall there were kinematograph pictures of "The proving of a 12-inch gun and a field gun" by Sir Andrew Noble, and the "Icebreaker 'Ermack' at work," with lantern pictures by Mr. Arthur Gulston. There was also a scientific exhibition in the electrical engineering laboratory by Professor W. M. Thornton, D.Sc., and in the Herschell Laboratory were shown collections of artillery by Sir Andrew Noble, silica ware by the Thermal Syndicate, Wallsend, and art metal work in all its stages. Refreshments were served in the Refectory, under the Great Hall.

Second Day.—Thursday, July 23rd.

Visit for Morning and Afternoon.

Clarence Works of Messrs. Bell Brothers, near Middlesbrough.

Leaders: P. Phillips Bedson and H. Dean.

The party was received by Mr. Walter Johnson, a director, Mr. Greville Jones, the general manager, Dr. J. A. Roelofsen, manager of the coke ovens, Mr. Hanson, the chemist, and Mr. A. H. Cooper, of Messrs. Dorman, Long & Co. Luncheon was served in the board room, after which Professor R. Meldola thanked the firm on behalf of the visitors, and Messrs. Walter Johnson and Greville Jones replied. Telegrams regretting inability to be present, were received from Sir Hugh Bell and Mr. J. E. Stead.

The firm of Bell Brothers was founded by the late Sir Lowthian Bell and his brothers Thomas and John, in 1844, when they became lessors of a small blast furnace at Wylam-on-Tyne. In 1852, having leased the ironstone royalty at Normanby, three furnaces were erected at Clarence and blown in in 1854. The firm's ironstone mines are situated in Cleveland, at Skelton, Skelton Park and Lumpsey, and their collieries (Browney, Tursdale, South Brancepeth and Bowburn) are in the County of Durham. A very good example of a Cleveland ironstone mine is afforded by the Lumpsey Mine, near Brotton, the average output of which is 11,000 to 12,000 tons per week. The ore here contains about 29 per cent. of iron in the raw and 37 per cent. in the calcined state. The Clarence furnaces consist of two groups—the Old Side, comprising eight furnaces, five of which are now in blast, and the "New Side" four furnaces, three being at work, and the fourth in process of rebuilding.

From the blast furnaces the molten metal necessary for steel making is conveyed to two gas-heated mixers—one having a capacity of 200 tons, and the other of 400 tons—and thence to the Siemens-Martin furnaces, of which there are eight, each having a capacity of 45 tons. The steel made at the Steel Works is then rolled in a three-high 32-inch mill, composed of cogging, roughing, and finishing. A recent development of interest is the installation of two batteries, each consisting of 60 "Huessener" coke-ovens, with plant for the recovery of by-products, for the manufacture of coke for the blast furnaces. Each Huessener oven is a rectangular chamber, usually 33 feet long, 6 feet 8 inches high, tapering slightly to one end, the mean width being 1 foot 8 inches; such an oven produces about 26 tons of coke per week. The gas by which the ovens are heated is burnt in horizontal flues in the walls and under the sole, uniform heating being ensured by supplying gas at twelve different points; the ovens are charged through hoppers, and the coke is finally driven out on to the coke-bench by a travelling ram. The ovens yield about 74½ per cent. of coke (calculated on the dry coal) and for each ton of coke there are obtained 1 cwt. of tar, 43 lb. of ammonium sulphate, and 2·15 gallons of 90 per cent. benzol.

The gas evolved by the coke-ovens, and leaving them at a temperature of about 250° C., is drawn by means of exhausters through a series of water-tube condensers, where it is cooled down to from 15° to 20° C., depositing its tar and so-called virgin ammoniacal liquor. The exhausters then push the gas forward under pressure, first through a series of upright ammonia scrubbers, irrigated in the usual manner with water, and finally through a number of vertical benzol scrubbers over which heavy tar oils are pumped. The benzolised oil from these scrubbers is then passed through superheaters, into stills which are fired by surplus coke-oven gas, and which have a rectifying column with reflux coolers, etc., on top, and by means of which benzol of 80 to 83 per cent. is obtained in one operation. The hot absorbing oil remaining behind in the stills is passed through the superheaters, giving up the greater part of its heat to the fresh benzolised oil which thus arrives in the still in a boiling condition. The absorbing oil is then further cooled in irrigating water coolers, and used again on the benzol scrubbers. The crude 80 per cent. benzol is next agitated with sulphuric acid, caustic soda, etc., and finally rectified in steam-heated stills with high rectifying columns, the resulting products being:—90 per cent. benzol, pure benzol, 90 per cent. toluol, pure toluol, solvent naphtha and heavy naphtha.

The ammonia liquor is worked up into ammonium sulphate in the usual apparatus.

The tar is dealt with in the new tar distillation plant, which works under vacuum, and produces creosote oil, anthracene oil, naphthalene (which latter is purified by hydraulic presses), anthracene and pitch.

The production of coke in the Clarence ovens during 1907 was 143,000 tons. The charge of coal used in the ovens is, per oven:—Old ovens (10 tubs), 5 tons 17 cwt.; new ovens (12 tubs), 7 tons 1 cwt. 268,350 tons of beehive coke were used last year, in addition to the quantity made in the by-product ovens, giving a total consumption of 411,350 tons.

The Ashington Colliery.

Leaders: S. H. Collins and A. A. Hall.

The Ashington collieries are about 20 miles to the north of Newcastle-on-Tyne; Blyth being the port of shipment for the coal. They represent an area of about 12,000 acres. Six thousand workmen are employed in these collieries, and over 2,000 houses are provided by the Ashington Coal Company. These houses are supplied with good water from the mine, and the district is furnished with electric light, current being supplied from the Company's power-station. Coal is also supplied to the workmen by tramways and wagons, refuse, &c., being removed. The present output of coal per diem from the mines is about 8,000 tons. Two classes of coal are obtained, the "Bothal West Hartley"—a steam coal, and "Ashington Wallsend"—a house coal. The Coal Company also farms about 1,200 acres of land for the supply of fodder for the horses, the dairy supplying the workmen with milk. In the colliery there are three winding shafts, the Bothal, Carl and Duke pits, the first-named being 36 fathoms deep to the main seam, and the Carl and Duke pits being each 90 fathoms. There are also two ventilating shafts, one to the low main seam and the other to the yard seam; these shafts are each connected with Capell patent exhaust fans. The air-compressor has a capacity of 4,000 cubic feet of free air per minute, the compressed air being used for driving some of the mechanical coal-cutters and conveyors underground. Under the guidance of officials of the Colliery Company, and notably of Mr. R. Warham, the members descended the Bothal pit, and saw the coal-cutting machinery in operation. At the power-station there are two Parsons' three-phase turbo-generators, each capable of generating 750 kilowatts at 500 volts.

A 15-ton travelling crane covers the whole of the floor area of the engine-house. The current generated is used for general power purposes at the surface, and for hauling, pumping, etc., underground. The coals are tipped on to vibrating screens, and after the smalls have been removed are passed on to endless cleaning belts. Thus, the smalls are subdivided into "nuts," "duff," etc., by passage over the corresponding vibrating screens.

Endless-rope haulage is used throughout the pits. The various gears are all electrically-driven, and there are several self-acting incline banks on the same system.

There are several types of machines at work for undercutting the coal, some of which are driven electrically, others by compressed air, and Blackett conveyors are used at the machine faces for filling into the tubs, the breakage being thus reduced to a minimum.

The brickwork plant is capable of turning out 11,000 bricks per day, the bricks being made from fireclay, on the semi-dry process.

The Woodhorn and Linton Collieries, other members of the group, are situated, the former (147½ fathoms deep), 1½ miles to the east, and the latter (50 fathoms deep), 2¼ miles to the north, of Ashington.

THE ELSWICK ORDNANCE AND ENGINEERING WORKS.

Leader: Dr. J. T. DUNN.

Under the general guidance of Mr. R. A. S. W. Waters, the tour of inspection was commenced in the engine works. Here, in 1847, the late Lord Armstrong commenced the manufacture of hydraulic machinery. This part of the factory is consequently the oldest, and forms the nucleus of the existing works.

Passing through the head station of the Elswick Fire Brigade, the chain forge was next entered. Here, all classes of chain are forged, from the largest ships' cables downwards. In this forge, smiths were making various forgings in connection with hydraulic machinery, and further on were shown some small rolling mills for producing bronze bars and plates, and also for drawing, straightening and finishing bronze rod of small diameter.

In the engine works machine shop were noticed quantities of iron and brass castings, component parts of rams, cylinders, bedplates, etc.

Leaving the engine works, the party entered the ordnance works. The first shop visited was that for the manufacture of carriages for field and mountain artillery. Here were seen examples of modern field artillery equipment, and the use and manipulation of the vehicles were explained. Before leaving this section, a detachment of four men took to pieces a new type of Q.F. mountain gun and carriage, ready for placing on mule back, and then reassembled the parts. Both operations were conducted in a wonderfully short time, with great ease and precision. In the mechanical testing room was seen the hydraulic machinery used for tests of all material. The party witnessed tensile test pieces of both soft and hardened steel being broken in the machines.

In the gun shops, large steel tubes were undergoing the various machining operations of boring, turning, etc., in preparation for final building up into guns of 12 in. calibre. In these shops also were 12 pr. guns undergoing the process of rifling. In an adjoining building was pointed out the manufacture of different kinds of gun cradles in various stages. The cradle is that part of the mounting which carries the gun; it also contains the hydraulic buffer or brake for controlling and checking the recoil of the gun on firing, and also the necessary springs (or other device) for returning the gun to its firing position.

In an adjoining shop was seen the construction of naval mountings for 12 pr. guns, torpedo tubes, and electrical ammunition hoists for conveying ammunition from the ship's magazine to the gun deck.

In the Electrical department there was seen electrical machinery of many descriptions, both in course of manufacture and under test prior to delivery.

The shops on the lower level nearest the Tyne were next inspected. In the first, guns, principally of 12 in. calibre, were undergoing their final machine operations of turning, boring and rifling. In another shop were gun-houses of armour plate, and complete mountings and machinery for 12 in. guns on board battleships. Here mountings are erected and thoroughly tested. When ready to be placed on board, part of the roof of the shop is slid back and the mounting is hoisted out by means of a 150 ton hydraulic crane on the jetty outside. When clear of the roof of the shop, the weight (about 120 tons) is slewed round over the ship, brought alongside, and then lowered into place. The giant crane was examined, and the party noticed with great interest that one of the firm's new class of powerful cruisers was then alongside the jetty receiving her gun mountings.

Through the ordnance blacksmiths' shop on a higher level, the party reached the pits for oil hardening and contraction of gun-tubes, passing thence to further shops, in the first of which was mounted a 6 inch gun and carriage of a "disappearing" type used for coast defence. In the same shop were many details of gun-breech mechanisms being machined and fitted.

The Inspection shops were next visited, where all the finished guns are minutely gauged and examined before delivery. On entering, a field gun and carriage was observed, obviously of not very modern construction. This, a 3 pr., was the first breech-loading rifled-gun to be designed and constructed by the late Lord Armstrong, who, after the experience of the Crimean war, had impressed upon him the need for guns of increased power and precision. This interesting old gun is now kept in the works as a memorial of the past and as a standard of contrast with modern methods. Before leaving, a shop was visited where the winding of wire on to the 12-inch guns was witnessed and explained by the guide.

THE REDHEUGH GAS WORKS (THE NEWCASTLE AND GATESHEAD GAS COMPANY).

Leader: H. DOIG GIBB.

The visitors were received by Mr. Alfred Allhusen, a Director, and were conducted through the works by Mr. H. D. Gibb and Mr. T. Hardie, the Manager. These works were opened in 1876, the Company also having works at Elswick and St. Anthony's. The Redheugh Gas Works cover 25½ acres, and can produce over 11,000,000 cubic feet of coal-gas and 1,500,000 cubic feet of oil gas in 24 hours. In 1907 the Company carbonised nearly 311,000 tons of coal, obtaining 2,600,000,000 cubic feet of gas, the average illuminating power of which was 16·2 candles, and its average selling price, one shilling and 8·8 pence per thousand cubic feet. Of the retort houses, three are equipped with West's, and one with De Brouwer's stoking machinery for charging the retorts, a part being worked by compressed air, and a part electrically driven; in these the crushed coal falls on to an endless band travelling at a high speed and is thus thrown the whole length of the retorts.

The ammoniacal liquor is worked up on the premises for ammonium sulphate, and sulphur is also manufactured from the purifier residuals. The sulphuric acid used for ammonium sulphate making, is first subjected to a de-arsenicating process, for which the waste gases from the stills are utilised, before passing to the Claus kiln.

After the inspection of the works, the party was entertained at luncheon by the Directors of the Company. The Chairman of the Company (Sir Wm. Stephenson) presided, and Mr. Allhusen welcomed the guests. Dr. Lessing replied, and proposed a vote of thanks to Mr. Allhuson and the firm.

THE AERATED WATER FACTORY OF THE NEWCASTLE BREWERIES, LIMITED.

Leader: H. DOIO GIBB.

The party was received by Mr. Barras R. Reed, who acted as guide and demonstrator.

The processes of filtration and aeration of bottled beer, for immediate use, were exhibited. The liquid to be aerated, after undergoing a cooling process, is bottled under 70 lb. pressure per sq. in., the liquid being cooled to 55° F.

OTTOVALE COKE-OVEN AND BY-PRODUCT WORKS (THE PRIESTMAN COLLIERIES, LTD.), BLAYDON.

Leader: A. SHORT.

These works consist of 80 coke-ovens in two batteries of 40 each, with complete by-product recovery plant. In these two sets of ovens 450 tons of coal are carbonised each day. The type of oven is that known as the Otto-Hilgenstock, the distinctive feature of which is the mode of heating the ovens by means of Bunsen burners. The flues are arranged vertically in the side walls of the ovens.

The ovens are 33½ feet long, 6 feet 10 inches high and about 21 inches wide, and are each capable of carbonising approximately 7 tons of coal in 29 hours.

The coal, supplied from the neighbouring Priestman Collieries, is first disintegrated and then stored in large hoppers, from which it is fed into the coke-ovens. The gases evolved from the coal are led through a gas main, and after passing through air- and water-coolers, where the tar is extracted, are then forced by means of exhausters through scrubbers for the extraction of ammonia and benzol. The gas, after the removal of these constituents, is used for heating the ovens, and the waste heat, together with some surplus gas, is utilised under five Babcock and Wilcox boilers for raising steam in water-tube boilers. The steam operates a large power station, Parsons' turbo-generators of 2000 kilowatt capacity, being used for this purpose. The electric power is partly used for driving the electrical machinery on the plant, but the bulk of it is supplied to the Newcastle-on-Tyne Electric Supply Company for power and lighting purposes. The coke is discharged from the ovens by means of an electrically-driven ram. The ammoniacal liquor is utilised for the manufacture of sulphate of ammonia and the crude benzol is rectified. The tar is passed on to a neighbouring tar distillery.

The visitors were shown over the works by Mr. Frank Priestman and Mr. Henry Piele, directors, and Mr. S. J. Leybourne, general manager, and afterwards partook of refreshments provided by the firm. A vote of thanks to the firm was moved by Mr. Watson Smith, seconded by Mr. Hy. Baker, and acknowledged by Mr. Fr. Priestman and Mr. Hy. Piele.

COCKLE PARK, THE NORTHUMBERLAND COUNTY COUNCIL EXPERIMENTAL FARM.

Leaders: S. H. COLLINS and F. P. WALKER.

By the courtesy of the County Council of Northumberland, a party of members visited the Farm on the 23rd inst. This experimental farm is under the control of a sub-committee of the Northumberland Education Committee, and the scientific direction of Armstrong College.

After viewing first the quarry in which the nature of the soil and underlying rock are exhibited, the well-known "Tree Field Experiment" was examined, originally designed by Prof. Somerville to illustrate the effect of various phosphatic and other manures on pasture, the benefit being measured in terms of the increase in weight of the sheep grazing thereon. This benefit is also illustrated by the increase of the value of the pasture from 5s. to 25s. per acre. After tea, the Pele Tower was visited.

THE UNITED ALKALI COMPANY'S ALLHUSEN WORKS, GATESHEAD.

The party of visitors was received by Mr. A. Allhuson, and Mr. Burrows, the manager, and conducted round the works.

At these works the staple products manufactured are caustic soda, bleaching powder, and sulphur, the intermediate products utilised as stepping-stones to these staple products, being sulphuric acid, salt cake (sodium sulphate), and "black ash" (crude sodium carbonate and calcium sulphide). The lixiviated black ash furnishes sodium carbonate solution, which, suitably diluted, is causticised with lime, the solutions being evaporated to yield solid caustic soda. The calcium sulphide (alkali waste) is treated by Chance's process, and the sulphur, originally furnished by the pyrites in the manufacture of sulphuric acid, is recovered. The inspection of the Chance plant and process excited great interest in the visitors. Hydrochloric acid, obtained in the salt cake process, is used for the preparation of bleaching powder. The only residual waste product in these works is the calcium carbonate formed in the Chance converters. In the manufacture of sulphuric acid, as far back as 1884, no fewer than 129 Schaffner and Helbig shelf-kilns were employed in the burning of pyrites. The works were commenced in 1834, and the firm became a limited company in 1872, more recently joining the United Alkali Company. It was in a large sulphuric acid chamber in course of being rebuilt, in 1884, that Messrs. Allhusen kindly entertained the President, the late Walter Weldon, F.R.S., and a large company of the Society of Chemical Industry, to lunch, whilst in another chamber the company was photographed.

MESSRS. SPENCER'S NEWBURN STEEL WORKS.

Leader: T. W. HOGG.

The locality in which this steel works is established is of special interest, as having been the home of George Stephenson, Hedley, Hackworth, the brothers Hawthorn, and other pioneers of engineering. It was at a night school in the village of Newburn that the elder Stephenson received his first rudimentary education. The works are intersected by the Newburn and Wylam branch of the North Eastern Railway, alongside of which runs the Wylam wagonway, which is the oldest rail wagonway in the world. In 1812, the line was laid with rack rails and worked by Hedley's locomotive. Some of these old wheels and rails are still to be seen at the Newburn Steel Works, first established in 1810 by John Spencer, who commenced as a maker of files. The works of the firm now cover an area of 60 acres, and give employment to 1500 men. Commencing as a steel tool and file factory, the works extended to the manufacture of volute, spiral and laminated springs, and thence to that of steel castings and forgings. In 1891 extensive rolling mills were added, and this addition has been further extended by a cogging plant, the finest of its kind in the world, and capable of producing plates of the largest size, by which slabs 60 ins. wide and 13 ins. thick are rolled down into plates. (The party witnessed with interest the rolling of a 10 ton ingot into boiler plate.) The firm is now gradually applying electric power to the works. The forge contains a 2000 tons hydraulic forging press, where crank and line-shafting, gun-tubes, and other forgings of the largest size, are made, besides forged steel cylinder liners. In the steel foundry both crucible and Siemens-Martin steel castings up to 35 or 40 tons in weight can be produced. Messrs. Spencer were the first to produce steel castings, to replace the more costly forgings, up to that time used. An economising plant of interest here is one for producing gas from ashes, formerly regarded as waste. The gas thus obtained from one small plant, was furnishing power for one shop during the time of the visit.

Afternoon tea was kindly provided by the firm, after which Dr. J. T. Dunn moved a vote of thanks to the firm.

THE ANNUAL DINNER.

The Annual Dinner was held at the Grand Assembly Rooms, Barras Bridge, on Thursday, July 23, when there was a very large and representative company. The President, Sir Boverton Redwood, was in the Chair, and there were at the head of the table, the Lord Mayor (Mr. W. J. Sanderson), Sir Andrew Noble, Lady Redwood, Miss Redwood, Dr. Lewkowitsch, Chairman of the London Section; Mrs. Russell Moore, New York; the Sheriff of Newcastle (Mr. Walter Lee), Mrs. W. Martin, Mr. Arthur Gulston, Mr. Malcolm Dillon, Miss Martin, Mr. Eustace Carey, the Deputy Lord Mayor (Mr. Alfred Appleby), Mr. Claude B. Palmer, Mr. Walter F. Reid, Mr. Oscar Gutmann, Prof. R. Meldola, F.R.S. (President-Elect), and Mr. George Renwick. There were also present Sir Cecil Spring-Rice, Mr. N. H. Martin, Chairman of the Newcastle Section; Dr. F. C. Garrett, Hon. Secretary of the Section; Prof. G. A. Lebour, Vice-Principal of the College; Mr. C. J. Potter, Mr. Frank Priestman, Dr. Russell W. Moore, (New York), Mr. Max Hasenelever (Germany), Mr. R. Jacques Fletcher (Australia), Mr. John Pattinson, Professor P. Phillips Bedson, Mr. Thomas Tyrer, Hon. Treasurer of the Society, Mr. John Hargreaves, First Hon. Secretary of the Society, and the Secretary, Mr. Charles G. Cresswell.

The usual loyal toasts having been duly honoured:

Professor Meldola proposed "The Industries of Tyneside." Tyneside, he said, had been a seat of industry, one might say, from time immemorial; he might certainly say from the time the Roman Legions crossed the Pons Aellii to the present day. By reason of its geographical situation and its fuel and other resources the Tyne had naturally become a centre of industry. When he searched for local guidance as to what he should say about the Tyneside industries he generally received the depressing answer that they were in a very bad state. He hoped that was not true, and that the inhabitants were taking a pessimistic view of the situation. Tyneside possessed a great and glorious list of names. They need only recall such names as those of Stephenson, Lord Armstrong, the founder of the great Elswick works; and John Glover. Two other Tyneside scientists they had still with them—Sir Andrew Noble and Sir Joseph Wilson Swan—and when they went to the industries themselves they found there was, despite the depression, notable activity in the manufacture of useful products. There had been marked development in the newer processes, particularly in the recovery of by-products from coke ovens, which were making great progress in the district. That afternoon they had had an opportunity of seeing in operation the latest processes at Blaydon, and also on the Tees at Middlesbrough. An old gazetteer said: "The Tyne is a fine, deep, and noble river, and ships up to three or four hundred tons may safely go up and down." That paragraph was written in the year 1813; since then they had launched the "Mauretania." He believed there was a great future before Tyneside. With the natural resources at the people's command, with a supply of energy at their doors, with building material lavishly distributed in their midst, and a wide water-way from which to send their products, there was no reason why some of the lost industries should not be restored to the river. Apart from the smaller manufacturers there were plenty of enterprising men, and he instanced the firm of Allhusen, one of the pioneers of the industry, and which was still holding its own. He submitted the toast with great pleasure, and in the knowledge that it would meet with hearty acceptance.

Mr. Alfred Allhusen replied. He said a wide field existed for the application of scientific energy in obtaining further economy in fuel, and in the utilisation of what was formerly regarded as waste material. These so-called waste materials had become sources of profit to the manufacturer. In 1868 Mr. Lowthian Bell, former President of the Society, called attention to the necessity for recovering sulphur from alkali waste, and they had seen that day how effectually the problem had been solved by the Chance process. Sodium and aluminium were already in course of manufacture on the Tyne, and although they were undoubtedly passing through a period of intense industrial depression, they might safely look to a more favourable future. With North-country perseverance and energy, Tyneside, he believed, could be made a still greater centre of industry.

The Lord Mayor proposed "The Society of Chemical Industry." He said, as Lord Mayor of Newcastle, it was perhaps appropriate that he should testify to the value of this Society in forwarding their various industrial efforts, more especially as it seemed to have had a forerunner in a former local Society known as "The Newcastle Chemical Society." That Society first met in 1868, and prominent among the men who were connected with it were those who built up the great alkali trade on the river. Between thirty and forty years ago there were about sixteen important alkali works on the south bank, and six on the north bank of the Tyne. Bottle-making, paper-making, and other industries were then very prosperous in their midst, and there was almost a world-wide market for the output. It was a pleasure to recollect that of the pioneers of the old Newcastle Society several were still hale and hearty. He referred to Sir Andrew Noble, Sir Joseph Swan, Mr. Allhusen, and the Public Analyst, Mr. John Pattinson. The Newcastle Society continued to exist until the year 1882, when it was amalgamated with the Society of Chemical Industry, which had been founded a year previously. The amalgamation took place on the suggestion of Sir Henry Roscoe and others who were engaged in the Lancashire chemical trade, and who recognised the value of the work which was being accomplished by the Newcastle Society. The success of the Society had been continuous, and last year saw its incorporation under Royal Charter. Local sections had been established in the principal centres of England, and also in Canada, New South Wales, and in the United States. Of the many illustrious men who had filled the position of President of the Society, two at least had come within the category of Tyneside men; the late Sir Lowthian Bell and Sir Joseph Swan. The retiring President (Sir Boverton Redwood) was recognised as the greatest living authority on petroleum and its products. Another of the past Presidents was the late Sir Wm. Perkin, and yet another was Mr. Ivan Levinstein, to be long remembered in connection with the new Patent Act, from which industrial changes of great benefit to the country were expected. In these days of keen competition amongst the nations, it was more than ever necessary that the science of chemistry should be brought to the aid of industry; and that was the object of the Society. The dissemination of the most recent discoveries of science must benefit those engaged in industry, and the work of the Society must be regarded as one of the highest national importance.

The President responded to the toast. He said they all much appreciated the remarks of the Lord Mayor regarding the work which the Society had done in the application of science to industry, and the action which the Newcastle Chemical Society had previously taken in the same direction. The Society of Chemical Industry was no stranger to Newcastle. The third annual general meeting in 1884 was held in the amphitheatre of the Literary and Philosophical Society, under the presidency of Walter Weldon, who was supported by Perkin, Roscoe, Lowthian Bell, Mond, Muspratt, Chance, Allhusen, Eustace Carey, and J. T. Dunn. The Society met again in Newcastle in 1899, under the presidency of Dr. George Beilby, and now for a third time they were assembled in that hospitable city. Newcastle would always be remembered as having taken a leading part in some of the most notable achievements of industrial chemistry, and the Newcastle Chemical Society was in a sense the progenitor of their Society, for it had an active career for many years before the Society of Chemical Industry came into existence. In the report of the Council of the Society of Chemical Industry for 1883 the members were informed in congratulatory terms of the amalgamation of the Newcastle Chemical Society with their Society as a Section, and that was rightly regarded as an important step in the progress of the new organisation. The Chairman of the newly-formed Section, Mr. Barnard S. Proctor, in his inaugural address, gave some interesting particulars of the good work which had been done by the Newcastle Chemical Society, remarking that the inaugural address of that Society was delivered by Lowthian Bell in 1868. He reminded his audience that Lowthian Bell had outlined the history of the alkali industry from the days of Dundonald and Losh, in the infancy of the Le Blanc process, and had alluded to the fact that many other chemical industries had flourished in the district for even longer periods, that of glass manufacture, for instance, having been in existence for 250 years. Amongst the great men mentioned by Mr. Proctor were many who would always be held in high honour by chemists throughout the civilised world, and of whom Newcastle should be proud. The sphere of activity of the Newcastle Chemical Society was a wide one, for the papers dealt not only with the alkali industry, but with such varied subjects as Swan's remarkable discoveries in photographic carbon-printing and the electric incandescence lamp, the Pattinsonisation of lead, the economy of fuel, the germ theory of disease, and the physics of filtration. The members of the Newcastle Section would, therefore, always have reason to congratulate themselves upon the honourable record which they inherited, and that would doubtless continue to be an incentive to them to further effort in the advancement of the objects for which their Society was founded. The visiting members of the Society, as the guests on that occasion of the Newcastle Section, had reason also to be proud of their hosts. As to the Society as a whole there was ample ground for mutual congratulation, for they were year by year adding proof to proof of its value. They were now a duly constituted corporate body, and their new by-laws made in pursuance of their Royal Charter, had within the past few weeks been allowed by his Majesty's Privy Council. The backbone of the Society and the bond of union between the Sections was, of course, the Journal, so ably edited by Mr. Watson Smith; and high as was the repute in which that publication was held throughout the world, the Publication Committee, as they were aware, were not resting satisfied with present conditions, but were considering what improvements could be made. The Committee were specially devoting study, in consultation with the various Sections, to a new scheme for the provision of papers, proposed by Dr. Lewkowitsch, from which good results were confidently anticipated. An event of the past year in the affairs of the Society had been the acceptance by Mr. Thomas Tyrer of the onerous duties of Honorary Treasurer. The efficient discharge of those duties made a heavy demand upon the time of the occupant of the office, and a busy man could not undertake it unless he were possessed of unusual industry and energy. The unselfish devotion of Mr. Tyrer to the welfare of the Society during the whole period of its existence—that was for more than a quarter of a century—had so often demanded mention that they were in danger of losing sight of all that it implied. He was sure that no member had, even for a brief period, devoted as much thought to the interests of the Society as Mr. Tyrer had ungrudgingly given continuously, and certainly to no other member did the Society owe so much gratitude. His present office was a highly important one, and his acceptance of it was a guarantee of their future prosperity. When the Society last met in Newcastle he was afforded the opportunity of invoking its active support for the International Congress of Applied Chemistry, held the following year in Paris under the presidency of Professor Berthelot, the Acting President being Professor Moissan. On the present occasion he wanted to make a still stronger appeal to them all in connection with the meeting of the Congress in London next year. They had been informed of the progress which had been made by the Organising Committee under the able chairmanship of Sir William Ramsay, in consultation with the President, Sir Henry Roscoe. The names of the Chairmen and Vice-chairmen of the Sectional Committees (including those of Sir Andrew Noble and Mr. N. H. Martin) gave assurance that the work of those committees would be well done, and in all respects it might be confidently anticipated that the Congress would be a success. One of the most hopeful features was the arrangement that had been made for enlisting the active co-operation of the various Sections of the Society of Chemical Industry, and judging from the cordial reception which had been given to that arrangement, he was sure that if the Sections would exert themselves the Society would take a part that would entitle it to the thanks of all concerned. In conclusion, he wished to express his thanks to his colleagues one and all, whose loyal and unswerving support had rendered his year of office as President one of the happiest and most interesting of his life. He also wished to record his appreciation of the loyal and able services of the staff of the Society in London. For them the past year had been an unusually laborious one, the questions connected with the grant of the Charter of Incorporation and the improvement of the Journal, having made exceptional demands upon them, but these additional burdens had been most cheerfully borne. What had been done reflected credit upon the General Secretary (Mr. Cresswell), whom he specially mentioned because upon his shoulders had fallen in the past year a large share of the work in connection with the obtaining of the Charter and the drafting of the by-laws. He had no fears for the future of the Society. It was doing a great work of national value, and such difficulties as might be incidental to their progress would, he was satisfied, be successfully overcome. He candidly confessed that he handed over the reins of office with some sadness, for he had derived great satisfaction from the work; but it was a pleasure to him to feel that his successor was a man in whose hands the interests of the Society would be absolutely safe. No more desirable occupant of the Presidential chair could have been chosen, and he handed over the office to Professor Meldola with full confidence that he would safeguard the privileges and advance the interests of the Society, and would at the same time confer distinction upon the Society by reason of his own individual merit.

Mr. Thomas Tyrer gave the toast of "The Armstrong College." He remarked upon the relative merits of that College and the University at Durham, and said he was sure that the Armstrong College would supply the learning that civilisation and industry demanded. They could not get on nowadays in any walk of life without a knowledge of the principles of science. The best chemists were the least wasteful. They had heard of the value of the "liquid mind" and a scientific training, and he believed men who had had a scientific training were willing and anxious to begin at the bottom. There were, of course, the men of rigidity of mind, such as the promoted laboratory boy who lacked science, and the self-satisfied graduate replete with science, but without practical experience. Contrast these with the men who had developed under the broad and mellowing influence of the Literary and Philosophical Society. In an article in a Newcastle newspaper, the Society of Chemical Industry was described as the Society of Chemical Research. Therein the writer had expressed a profound truth, perhaps without knowing it. If the Society was to continue to be successful, there must be research. Research was not confined to the thirty-six syllable substances; there were opportunities for it in the simplest things as they had seen illustrated that day in the valuable recoveries from so-called waste. They had seen the application of common-sense combined with the application of scientific principles, and the results were electricity, steam, gas for combustion—all valuable products. In the old days, the waste material was regarded as obnoxious, to-day it was dealt with in such a way as to make it agreeable. There was in the curriculum of the Armstrong College that which was adopted as a means to a great end, and he did not think the people would allow the College to want for any appliance, great or small, that was essential for attaining progress in science and the higher arts.

Professor Lebour responded. He said the more students there were the more industry would prosper in the end. Although there was a temporary depression at present, perhaps in days to come the people of the North would think still more of the advantages of a scientific training, that was now so necessary for the successful working of any industry. He appreciated very much the good wishes that had been expressed for the future welfare of the College.

Mr. C. J. **Potter**, Chairman-Elect of the Newcastle Section, gave the toast of "Our Guests," whom, he said, they heartily welcomed.

Mr. **Arthur Gulston**, of Messrs. Sir W. G. Armstrong, Whitworth and Company, suitably replied.

Dr. **Russell W. Moore** gave the toast of "The Newcastle Section." Somebody, he said, had touched upon German competition: well, they got Germans across the Atlantic, but they soon Anglicised them into good Americans. So far as the Newcastle Section was concerned, he felt he was voicing the feelings of all the members present, when he said how deeply grateful he was for the hospitality that had been shown, and for the general excellence of the arrangements. He thought they would all carry away happy recollections of their visit to Newcastle.

Mr. N. H. **Martin** modestly acknowledged the kindly and appreciative expressions of Dr. Russell Moore, and assured the visitors that all the Section had done had been conceived and carried out with a single object—to make the Society's visit a success. He believed it had been a great success.

Music was rendered by an orchestral band.

Third Day.—Friday, July 24th.

Full Day Excursion to Alnwick.

The party travelled by special train to Alnwick, and visited the romantic Alnwick Castle, after which lunch was partaken of in the Star Hotel. The visitors were then conveyed in brakes through Alnwick Park to Brislee Tower and Hulne Abbey, by kind permission of His Grace the Duke of Northumberland, K.G. The magnificent approaches through the Park to the Brislee Tower, and the romantic views from its summit, will not soon be forgotten. On arriving at Hulne Abbey, tea was served in the open air, after which the party was again conveyed by brakes to Alnwick, and subsequently by train to Newcastle.

Alnwick, after Newcastle, the most important town in Northumberland, is of Saxon origin, and played, of course, a great part in the days of the Border wars; it is now, however, a quiet little country town, chiefly famous for its magnificent Castle and its history.

A short walk along Bondgate Within leads into Bailiffgate, where the main entrance to the famous Castle stands. The building of the Castle was begun by Ivo de Vescy, who became Baron of Alnwick in 1096, and by 1135, it had become a very important fortress. Traces of Norman work can still be found, but the Castle was rebuilt by the first Percys early in the fourteenth century, and their successors have made frequent additions, the last being the lofty Prudhoe Tower, erected by the fourth Duke between 1854 and 1864. It was one of the most important of the Border fortresses, and is said to have been garrisoned by over three thousand men. Its curtain walls enclose an area of about five acres, and it is the principal residence of the Duke of Northumberland.

Alnwick Parks are among the most beautiful and extensive in the country; they cover an area of 2,800 acres, and the fifty miles of roads and drives give admittance to most lovely and varied scenery. A short distance from the Forest Lodge are traces of the Abbey of Alnwick, founded by Eustace Fitz John in 1147, and a winding drive of nearly an hour leads to the Gothic tower of Brizlee, 90 feet in height, erected in 1781 by the first Duke, on a site 583 feet above sea level. The beautifully situated ruins of the Carmelite Priory of Hulne were founded about 1240 by William de Vescy. Noticeable features are the strength of the curtain wall surrounding the building, and the battlemented tower erected in 1488 by the fourth Earl of Northumberland as a refuge for the brethren.

Fourth Day.—Saturday, July 25th.

Leader: A. A. Hall.

This day was devoted to a visit to Durham Cathedral and Castle, the Dean of Durham and the Master of University College kindly deputing Dr. H. Gee to act as guide and demonstrator for the party.

Obituary.

THOMAS STEVENSON.

Sir Thomas Stevenson, M.D., was born at Rainton, in Yorkshire, on April 14th, 1838. He received his general education privately, and then studied medicine at Guy's Hospital. In 1864 he took the M.D. degree at London University, and became "University Scholar" in forensic medicine and in obstetrics. In 1870, he was appointed Lecturer in chemistry at Guy's Hospital, retaining that post until 1898. He was made a Fellow of the Royal College of Physicians in 1871, and in 1878 he added to his other duties at Guy's, those of Lecturer in forensic medicine. In 1881 he was appointed senior analyst to the Home Office, and in 1904, he received the honour of knighthood. At different times he served as President of the Society of Medical Officers of Health, of the Society of Public Analysts, and of the Institute of Chemistry. He was author of a "Treatise on Alcohol," and in 1883, he edited the third edition of Taylor's "Principles and Practice of Medical Jurisprudence," and in 1892–94, in conjunction with Sir Shirley Murphy, a "Treatise on Hygiene and Public Health," to which he himself contributed a monograph on water. In his official capacity he took part in most of the notorious trials for murder by poisoning which have been held during the last quarter of a century. Sir Thos. Stevenson was an original member of the Society of Chemical Industry. His health had been failing for some time past, but he was taken seriously ill on July 26th, and died on the 27th, at his residence in Streatham.

Journal and Patent Literature.

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I.—PLANT, APPARATUS, AND MACHINERY.

Patents.

Kilns or furnaces with travelling hearths. J. Rappold, Allschwil, Switzerland. Eng. Pat. 13,720, June 13, 1907.

The claim is for a furnace with a travelling hearth, which moves through a tunnel-like furnace chamber. The sides of the hearth are provided with projecting ledges, with or without upturned edges, which engage with corresponding grooves formed in the sides of the furnace chamber. Fuel is charged through hoppers in the roof of the furnace chamber, and falls on to the projecting ledges, which may, if desired, be staggered so as to form a step grate. The fuel burns, and the ashes formed serve as a loose packing to prevent access of air to the hearth.
—W. H. C.

Furnaces. C. Magnée, Charleroi, and E. Demeure, Brussels, Belgium. Eng. Pat. 615, Jan. 10, 1908.

The claim is for the introduction beneath the fire-bars of a furnace of a mixture of air and steam which has been superheated, nearly to the temperature of the furnace by being passed through tubular superheaters arranged at the sides of the combustion chamber and heated by direct radiation from the latter.—W. H. C.

Drying materials; Apparatus for ——. A. Volland, Hamburg, Germany. Eng. Pat. 14,528, June 24, 1907.

The claim is for a drying apparatus with a fixed, horizontal, cylindrical drying chamber, through which the materials to be dried are caused to pass in an opposite direction to the hot air or superheated steam which effects the drying. The chamber is provided with an internal agitator to stir up and move forward the materials, and with a sieve or perforated screen at the air inlet end to prevent the entry of dust with the air or steam. The drying cylinder is built above a tubular heating chamber. —W. H. C.

Drying apparatus. J. L. Sebastian, Baden-Baden, Germany. Eng. Pat. 25,493, Nov. 18, 1907.

The claim is for a device for raising or lowering hurdles in a drying-shaft. Two levers pivoted at one side of the drying-shaft are attached to a table situated outside the shaft at the other side. By means of a chain and pulleys, the table is raised to the top of the shaft, being maintained in a horizontal position by the levers; and at the same time the hurdles within the shaft are lifted the height of one hurdle. The top hurdle is then pushed on to the table and lowered with it, the other hurdles being maintained in position by pawls which project from the inner faces of the walls of the shaft. A freshly-charged hurdle is then pushed into the bottom of the shaft, and the process is repeated at suitable intervals.—W. H. C.

Drying apparatus; Centrifugal ——. A. Neef, Kattowitz, Germany. Eng. Pat. 10,221, May 11, 1908.

The claim is for imparting to the scrapers of a horizontal centrifugal drying drum, a motion which is radial to and longitudinally parallel to the surface of the drum. This is effected by worms and worm-wheels carried by a hollow shaft rotating at a high speed on the main horizontal spindle of the machine. The scrapers are attached to the worm-wheels by crank-pins.—W. H. C.

Filter-press. E. M. Bassler, Chicago, Ill. U.S. Pat. 891,393, June 23, 1908.

The claim is for a filter-press comprising skeleton frames and screens so arranged that each chamber which contains the material to be treated has on one side of it, a chamber connected to a supply of air, and on the other side a chamber provided with a discharge opening and connected to a vacuum vessel.—W. H. C.

Concentrator for solutions. J. U. Lloyd, Norwood, Ohio. U.S. Pat. 891,492, June 23, 1908.

The concentrator consists of a vertical cylinder, the interior of which is devoid of any fittings, but which has a cooling jacket fitted round the lower and a heating jacket round the upper portion. In this way the upper portion of the liquid is heated and the lower cooled. The liquid to be treated enters the cylinder at a point situated between the two jackets, and the cylinder has a vapour escape pipe above and a concentrated liquor discharge pipe below. —W. H. C.

Disaggregating, washing rapidly, and filtering materials containing extractable matter; Continuous process for ——. A. Hellwig. Fr. Pat. 386,859, July 31, 1907.

The material is treated in a chamber having a perforated false bottom, supporting the filtering medium, and is agitated horizontally by vertical knives suspended from a horizontal rotating shaft. A vertical agitation is given to the mass by horizontal blades which project from the vertical knives. The vertical movement is attained by imparting an upward and downward motion to the vertical shaft carrying the horizontal arms to which the knives are attached. The horizontal blades may be so articulated to the knives that the vertical agitation only takes place during the descent of the latter.—W. H. C.

Boilers or vacuum evaporating apparatus; Arrangement for giving a regular motion of circulation to the crystallisable contents of ——. F. Tiemann. Fr. Pat. 386,957, Feb. 6, 1908. Under Int. Conv., Aug. 16, 1907.

A centrifugal drum with vertical sides is rotated in the vessel, below the heating pipes or coils. The liquid in the centre descends through a funnel, fixed within the vessel, into the drum, and is thrown out towards the wall of the vessel and rises to the surface.—W. H. C.

Separation of solid bodies contained in liquids; Continuous ——. E. Eisner and G. Meurens. Fr. Pat. 387,034, Feb. 8, 1908.

The mixture to be separated is fed into the upper end of an inclined trough or shoot provided with a perforated bottom and to which a shaking motion can be given. The liquid passes through the perforations into another inclined trough, fixed below the former, and is conveyed away. The solids pass down the upper trough and are delivered from the lower end into a suitable receptacle. —W. H. C.

Vacuum; Process and apparatus for producing a ——. E. Benkö. Fr. Pat. 387,159, Feb. 12, 1908.

A mixture of air and a combustible vapour or liquid is fired in a cylinder provided with ports. Mechanism is provided by which the ports commence to close at the moment of ignition, and are completely closed when the expansion of the air and the products of combustion, due to the heat given out, is at its maximum. The air and the products of combustion escape through the closing ports, and as the latter are completely closed at the moment of maximum expansion, a rarefaction is produced in the vessel as it cools. By appropriate mechanism the process is made continuous.—W. H. C.

Crystallisation; Process of ——. J. Bock. Fr. Pat. 387,194, Feb. 13, 1908. Under Int. Conv., Jan. 30, 1908.

In order to favour the growth of crystals, the solution in which they are formed is agitated by heating it to ebullition and by shaking the vessel in which the process is carried out. The vapour given off is condensed and measured or weighed, and, it is then either partially or wholly returned to the vessel, either alone, or after using it to dissolve some fresh material. In this way, or by the addition of a fresh portion of solution, the contents of the cystallising vessel are maintained at a concentration favourable to the growth of the crystals. —W. H. C.

Saturated solutions; Apparatus for the crystallisation of ——. M. E. A. Gerhardt. Ger. Pat. 197,378, June 14, 1906.

The claim is for an apparatus in which the solution can be alternately allowed to crystallise, and evaporated *in vacuo*. The crystals are separated from mother-liquor and from wash-water by means of compressed air, and then dried by heating *in vacuo*.—A. S.

Acid-resisting vessels, apparatus, and electrodes; Manufacture of ——. E. de Haën. Ger. Pat. 197,074, July 26, 1906.

Claim is made for the use of tantalum for acid-resisting apparatus ordinarily made of platinum. Tantalum hydride is pressed into the desired form, and converted into the metal by heating it to incandescence *in vacuo* in a porcelain tube. The temperature is raised gradually during about four hours, the tube is then heated strongly for a further two hours, and finally allowed to cool slowly. The large quantity of hydrogen evolved at first is removed by means of a water-pump, and after a temperature of about 800° C. has been attained with a vacuum of about 15 mm. of mercury, the water-pump is replaced by a mercury pump, and the vacuum made as complete as possible.—A. S.

Packing material for reaction chambers, towers, or the like. H. Petersen, Wilmersdorf, Germany. Eng. Pat. 15,406, July 4, 1907. Under Int. Conv., Aug. 4, 1906.

See Fr. Pat. 378,454 of 1907 ; this J., 1907, 1130.—T. F. B.

Compressing, purifying, drying, and cooling air and other gases ; Process for ——. W. O. Felt, New York. Eng. Pat. 21,933, Oct. 4, 1907.

See Fr. Pat. 382,761 of 1907 ; this J., 1908, 273.—T. F. B.

Mineral, vegetable, and animal substances ; Process for separating and simultaneously extracting water from ——. B. Schwerin, Frankfort, Assignor to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on the Maine, Germany. U.S. Pat. 892,188, June 30, 1908.

See Eng. Pat. 10,024 of 1907 ; this J., 1907, 955.—T. F. B.

Composition of a boiling mixture ; Process for determining at any moment the ——. Ges. f. Linde's Eismaschinen A.-G. Fr. Pat. 387,487, Feb. 22, 1908. Under Int. Conv., Feb. 24, 1907.

See Eng. Pat. 19,813 of 1907 ; this J., 1908, 66.—T. F. B.

II.—FUEL, GAS, AND LIGHT.

Miners and detection of gas. [*Coal mines.*] Simeon Snell, President Brit. Med. Assoc., Sheffield, 1908. Times, July 29, 1908, 13.

In his address the president dealt mainly with the question of miners suffering from nystagmus, or oscillation of the eyeballs. Special investigations he had carried out with the assistance of A. H. Stokes, his Majesty's Inspector of Mines, demonstrated that a coal miner suffering from nystagmus was unreliable as a detector of the presence of gas [fire-damp] in the mine. He instanced the case of a deputy who was charged before the magistrates with not having made a proper investigation whereby he omitted to discover the presence of gas in a certain working place. A penalty was inflicted. The president said his investigations led him to suspect that it might have been less negligence than incapacity, owing to the apparent movements of the lamp, which led to his failure to detect a gas cap. He states that a miner with nystagmus when looking at a safety lamp, owing to the oscillations of the eyeballs, gets the impression that the object looked at is in motion ; thus he sees his safety lamp as if it were moving, or "dancing," as he expresses it. The motions, of course, bear a corresponding relation to those of the eyeball. The prime cause of nystagmus was the weariness of the elevators of the eyes induced by the constrained position of the body and eyes which the miner was compelled to assume whilst engaged in certain descriptions of work in the mine. The detection of firedamp was a matter of vital concern to all engaged in a coal mine. The ordinary method adopted for the detection of firedamp was by reducing the size of the oil flame of the safety lamp until the luminosity almost disappeared, and the firedamp then, if present, appeared as a pale-blue flame or "cap" above it, this "cap" being due to the presence of gas in the air. The amount of gas present could be approximately estimated by the appearance and dimensions of the "flame cap." The class of men in a mine who are chiefly responsible for seeing that the pit is free from dangerous quantities of gas are those called "deputies" or "firemen."

The speaker then described experiments he had conducted in the ophthalmoscopic dark-room at the Sheffield Royal Infirmary. Forty-eight miners, from 13 different collieries, were examined, and their incapacity to detect a "gas-cap" unless a dangerous amount of gas was present was very marked in all. One did not see a big "gas-cap," as he said the lamp was "spinning too much" ; another did not see a small cap at all, but when he had steadied his eyes he recognised a 1-inch cap. Another could not see a cap because the lamp appeared to be all jerking about, but when the eyes became steadied and the lamp ceased to spin round he could recognise a gas-cap. Another, in whom the nystagmus was slight, could only see a large cap. Another, in whom the nystagmus was very marked, reeled like a drunken man when rising from the position on the floor he had assumed as for work. The lamp was full before he detected a cap. In another the whole lamp appeared to be "swinging round," and he could see no cap until the lamp was full of blue flame. There were several who saw either only a large cap or a moderate-sized cap when they had steadied themselves. He was not aware of any inquiries, after explosions, having been made as to the vision of those responsible for ascertaining the presence of gas in dangerous quantities, and it was true that when lives were lost the deputy was as likely, or more so, to be a victim as were others. It remained to be seen if later observers would corroborate the investigations he had now set forth, and possibly on a larger scale. At present the information he had given suggested the need for a periodical medical examination of officials, and, in the case of a colliery explosion, an inquiry into the visual condition of those responsible for ascertaining whether gas has been present in dangerous proportions or not.

Peat ; Production of ammonium sulphate and power gas from ——. A. Frank. Chem.-Zeit., 1908, **32**, 580—581.

Preliminary experiments on the utilisation of peat containing 40—50 per cent. of water in the Mond gas producer gave such favourable results that a large-scale experimental plant, capable of dealing with 50—60 tons of wet peat daily, was erected at Sodingen for the purpose of testing the suitability of different North European peats for use in gas generators. The plant was set in operation about the middle of May, the raw material consisting of peat furnished by the Prussian Minister of Agriculture partly in the early part of last year and partly in the spring of this year, and which had been stored in the open. The older peat contained 42—47 per cent., and that freshly-delivered 65—70 per cent. of water, and the contents of nitrogen and of ash were 1·05 and 3 per cent. respectively, referred to dry substance. In a trial run with 45 tons of the older peat (42—47 per cent. of water), there were obtained per 1000 kilos. of peat dry substance, about 2800 cb.m. of gas containing: carbon dioxide, 17·4—18·8 per cent. by volume ; carbon monoxide, 9·4—11 ; hydrogen, 22·4—25·6 ; methane, 2·4—3·6 ; nitrogen, 42·6—46·6 per cent., and traces of oxygen. The heating value of the gas was 1400 calories per cb.m. With the peat containing 65—70 per cent. of water, a larger quantity of gas was obtained, but this contained more carbon dioxide and only 28·6 per cent. of combustible constituents as against 36—39 per cent. in the gas from the drier peat. It is pointed out that blast-furnace gas containing only 20 per cent. of combustible constituents has been successfully used in gas-engines. Tests of the gas containing 36—39 per cent. of combustible constituents in a 50-h.p. gas engine showed that 2·4 cb.m. of gas were consumed per effective horsepower, and no trouble was experienced from tar-mist. Thus 1 ton of dry peat will yield 1160 h.-p.-hours, and as the heat of the waste gas is sufficient to provide for the production of steam for the gas generator, and comparatively little power is required for the air- and water-pumps and scrubber, a yield of 1000 available h.-p.-hours may be counted upon, that is, an amount of energy sufficient for fixing 50 kilos. of atmospheric nitrogen in the form of calcium cyanamide or 16—20 kilos. of nitrogen in the form of nitric acid. With respect to the ammonia, from 77 to 80 per cent. of the nitrogen of the peat was recovered in the form of ammonium sulphate. For instance the peat containing 1·05 per cent. of nitrogen (referred to dry substance) yielded 40 kilos. of ammonium sulphate per ton.—A. S.

Government [*American*] *tests of mine explosives. See* XXII.

Ferrocyanides ; Commercial analysis of ——. H. G. Colman. *See* VII.

Patents.

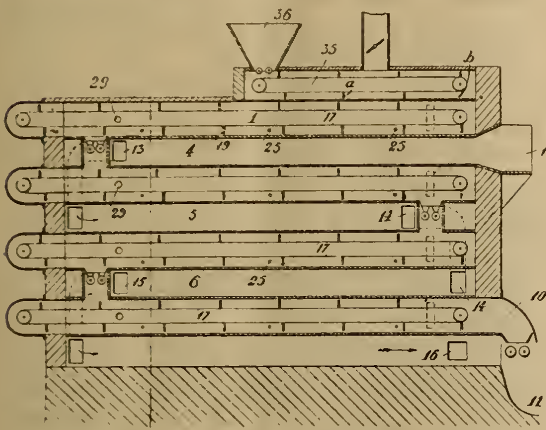
Gases ; Method of electrically detecting dangerous —— *and apparatus therefor.* H. Freise, Bochum, Germany. U.S. Pat. 892,241, June 30, 1908.

The gas is passed across rays of light, which are projected from a source of light to a selenium cell inserted in a primary circuit. The transparent gas is chemically rendered opaque for darkening the selenium cell, and thus reducing the strength of the current circulating in the primary circuit, whereby electromagnetic devices are caused to close a secondary circuit for actuating warning or other devices.—B. N.

Smokeless fuel. S. O. Cowper-Coles, London. Eng. Pat. 14,678, June 25, 1907.

A MIXTURE of about one-third of undried peat and two-thirds of bituminous coal is heated in a retort to a temperature of about 850° F., in order to drive off the smoke-producing hydrocarbons. The coal binds the peat together, and a fuel is obtained which is coherent, easily ignited in an ordinary grate, and burns without producing smoke. The mixture may be treated with a solution of calcium chloride either before or after carbonisation in order to render it slightly deliquescent.—W. H. C.

Drying or carbonising peat, sawdust and similar materials. N. K. H. Ekelund. Fr. Pat. 387,198, Feb. 13, 1908.



THE material is fed from the hopper, 36, into the upper chamber, *a*, then moved forward by the conveyor, 35, dropping through the opening, *b*, into the chamber, 1, next below. Here it is pushed forward by the ⊥-shaped rakes, 19, carried by the endless belt, 17. A heap of material accumulates in front of each rake and is levelled again as the rake passes the fixed cross scrapers, 25, so that only a thin layer is formed on the bottom of the chamber. The material is thus conveyed through the series of chambers to the discharge opening, 10, from which it falls into the trough, 11. A fire, preferably of peat dust, is maintained in the furnace, 12, and the products of combustion pass through the flues, 4, 5, 6, below the chambers. The gases pass downwards from flue to flue by the passages, 13, 14, 15, formed in the side wall, and finally escape to the chimney through the passage, 16. Air enters through the ports, 29, passes over the material, and escapes, along with the steam given off, through the ports, 14, into a chamber, provided with a fan to create the draught, which is built at the side of the drying floors.—W. H. C.

Furnaces ; Gas fired —— [*for vertical retorts*]. J. Bueb, Dessau. Eng. Pat. 26,590, Dec. 2, 1907.

IN gas-fired furnaces, particularly those for heating vertical gas retorts by producer gas, the gas and air enter the combustion chamber in approximately parallel streams. The mixing of these currents and the obtainment of variations in the intimacy of the mixture and in the resulting heat, is effected by means of movable bricks or baffle-plates on the hearth of the combustion chamber in combination with fixed baffle-plates depending from the roof of the chamber.—R. L.

By-product coke ovens ; Arrangement for carrying off the gases which escape while charging and discharging ——. Dr. C. Otto und Co., G.m.b.H. Fr. Pat. 386,941, Feb. 5, 1908.

A GAS conduit is arranged above the ovens, extending the whole length of the battery, and provided with a branch closed by a safety valve vertically above the ascension pipe of each oven. An uptake pipe, with wide-mouthed open lower end, is carried on a wheeled trolley and can be connected to any branch of the gas conduit, its lower end being then over the ascension pipe of one of the ovens. Before charging or discharging an oven, the ascension pipe is shut off from the main by a valve, the uptake pipe is brought into position, and the ascension pipe opened ; the gases which escape are drawn into the gas conduit which is connected to a shaft or to an exhauster. The uptake pipe is at such a distance above the ascension pipe that an excess of air is drawn in, but should an explosion occur, the pressure is relieved by the safety valves on the other branch pipes.—A. T. L.

Coke oven ; Horizontal regenerative —— *with vertical heating flues.* C. Biscanter and A. Hepe. Ger. Pat. 188,650, April 11, 1906.

THE patent relates to horizontal coke ovens having vertical heating flues, two longitudinal waste heat passages, and a device, outside the heating system, for directing the draught into two longitudinal parallel regenerators, below the ovens, between which is a passage for the heated air. The improvement claimed consists in disposing the waste heat passages on either side of the hot air passage, the waste gases and air flowing in opposite directions. —A. S.

Coke oven ; Horizontal ——. O. Eiserhardt and A. Imhäuser. Ger. Pat. 195,285, Dec. 28, 1906.

EACH coking chamber of the oven communicates by numerous openings with a passage located as high as possible, in the cooler portion of the cover of the oven. The gases escape through this passage, and are thus rapidly withdrawn from the hot region of the oven.—A. S.

Gas-generators. G. F. Jaubert, Paris. Eng. Pat. 17,252, July 27, 1907. Under Int. Conv., June 19, 1907.

AN apparatus for generating gas under pressure by the decomposition in a closed vessel of a solid substance, either by self-combustion or by reaction with a liquid, is so constructed that the generating retort and the purifier are placed inside the gas reservoir. By this means the thickness of the walls of the former may be reduced, since the inside and outside pressure will be practically the same. The gas-producing material is placed in a basket which is suspended in the upper part of a central tube, the lower part of which is filled with the purifying material. This central tube may be in direct communication with the gas reservoir through holes in its bottom, or it may be closed, and connected by a pipe.—R. L.

Gas-producer. S. W. Rushmore, Plainfield, N.J. U.S. Pat. 891,292, June 23, 1908.

A GRATE is arranged a short distance below the circular opening of the inverted truncated cone which forms the lower part of a vertical generator chamber. Immediately below the opening and a short distance above the grate, a number of horizontal segmental plates are arranged which can be moved in or out so as to vary the size of the circular opening at the bottom of the generator chamber.

Gas-producer. H. A. du Thil. Fr. Pat. 387,076, Dec. 11, 1907.

IMPROVEMENTS in the process and apparatus described in Belgian Pat. 191,809, are claimed, consisting in the substitution of a Kestner atomiser or turbine for the ejector described therein ; the introduction of an excess of steam into the lower part of the producer to extinguish the coal and to purify and decompose the clinker ; the regulation of the supply of superheated steam and the covering of the pipes with non-conducting composition ; the use of a perforated iron plate to cause the combustion zone to take an inclined position and to limit it to a thickness of from 30 to 40 cm. ; the use of a pyrometer heated by a burning jet of gas taken from the gas main to indicate the quality of the gas ; the use of an automatic governor ; and the frequent charging of the fuel.—W. H. C.

Suction gas-producer. L. Bouht. First Addition, dated Jan. 29, 1908, to Fr. Pat. 372,040, Dec. 1, 1906 (this J., 1907, 400).

The construction of the lower part of the producer is modified to permit of the use of coke or other fuels which form quantities of clinker. The lower part of the furnace chamber comprises an annular cylindrical boiler, the base of which is of inverted conical form. Below the boiler is a free space, separated from the ash-pit by a vaporising and air-heating chamber, of which the upper wall is an inverted truncated conical plate, and which extends inwards so as to support the fuel column. Poking holes are provided below the boiler, so that adhering clinker can be forced down into the ash-pit. A water trough formed around the outside of the conical plate is fed by an overflow pipe from the boiler. Steam from the boiler normally passes to the air-heating chamber, and the mixed air and steam pass to the ash-pit and thence through the fuel column, but when the poking holes and the clinkering doors in the ash-pit are opened, the steam is directed by a three-way cock into the space below the boiler, and the water trough is caused to overflow into the ash-pit.—A. T. L.

Gas-producer without a grate for bituminous coal and schist. F. Heller. Fr. Pat. 386,992, Feb. 7, 1908.

The producer comprises a furnace chamber, decreasing in width towards the base, and a deep narrow rectangular ash-pit extending across the producer from back to front. A vertical steam and air conduit is arranged centrally in the ash-pit and terminates in tuyères at the level of the base of the producer chamber. A groove is provided in each side of the ash-pit and of the central conduit, below the level of the tuyères, to take plates for supporting the fuel column whilst the ashes are being removed.—A. T. L.

Illuminating gas, water-gas, and mixed gas; Furnace for the simultaneous or successive production of ——. H. Croissant. Ger. Pat. 198,052, Jan. 13, 1905.

The retorts in the furnace are heated externally and are each provided with a perforated gas collecting and discharge pipe. At the lower ends of the retorts are devices for the introduction of gases or vapours into the annular space between the gas-discharge pipe and the wall of the retort, or into the gas-discharge pipe, or both. Each retort has, at the top, a mouthpiece, from which one pipe passes to the hydraulic main and another to the heating flues, and which is provided with a device for closing the upper end of the gas collecting and discharge pipe.—A. S.

Illuminating gas from coal; Process for the manufacture of ——. E. Stawitz. Ger. Pat. 191,084, Nov. 2, 1906.

The process consists in keeping the pressure in the retorts below that of the atmosphere during the greater part of the period of carbonisation. A valve is provided in the connection leading to the hydraulic main, in order that, on opening a retort in one furnace, the reduced pressure can be maintained in the whole of the retorts in the other furnaces.—A. S.

Gas; Removing tar and other impurities from producer and like ——. G. H. Bentley and R. A. Hopkinson, Huddersfield. Eng. Pat. 13,550, June 12, 1907.

A combined rotary washer and tar-box is placed at the delivery end of a gas producer plant, at a point where the gas, after passing through the condenser and scrubber, has already been cooled. The tar-box is fitted with a series of vertically suspended, perforated plates, the holes being of different sizes. The plates extend to a point near the bottom of the box and are water-sealed. The relative position of the box to the rotary washer ensures the gases being thrown vertically against the plates, at the same time keeping the perforations clear of tar. An overflow for the water is provided, and steam may be admitted for periodical cleaning.—R. L.

Acetylene; Process for the preparation of a solid, highly porous material for purifying ——. Allgem. Calcium Carbidgenossenschaft and A. Schmid. Ger. Pat. 191,403, Feb. 26, 1907.

Bleaching powder and quicklime are stirred with an aqueous solution of water glass to form a paste, which is then well mixed with calcium carbide dust, and the resulting porous mass dried in a current of air.—A. S.

Gas retort furnaces. H. Ries, Munich, Germany. Eng. Pat. 14,341, June 21, 1907.

See Fr. Pat. 379,113 of 1907; this J., 1907, 1191.—T. F. B.

Retort furnaces for manufacturing gas and coke. H. Koppers, Essen-Ruhr, Germany. Eng. Pat. 17,858, Aug. 6, 1907.

See Fr. Pat. 382,066 of 1907; this J., 1908, 275.—T. F. B.

Gas from heavy liquid hydrocarbons; Process and apparatus for the production of ——. Cie. Anon. Continentale pour la Fabr. des Compteurs à Gaz et autres Appareils. Fr. Pat. 387,217, Feb. 13, 1908. Under Int. Conv., Feb. 14, 1907.

See Eng. Pat. 3689 of 1907; this J., 1908, 274.—T. F. B.

Acetylene; Process of making a solid, porous material for purifying ——. Allgem. Calcium-Carbid-Genossenschaft, and A. Schmid. Fr. Pat. 386,562, Jan. 25, 1908. Under Int. Conv., Feb. 25, 1907.

See Ger. Pat. 191,403 of 1907; preceding.—T. F. B.

Incandescence bodies specially adapted for lighting and heating purposes. Allgem. Elektricitäts-Ges., Berlin. Eng. Pat. 8947, April 17, 1907. Under Int. Conv., April 19, 1906.

See Fr. Pat. 376,870 of 1907; this J., 1907, 1042.—T. F. B.

Illuminating bodies for electric incandescent lamps; Manufacture of ——. Deutsche Gasglühlicht A.-G., Berlin. Eng. Pat. 15,510, July 5, 1907. Under Int. Conv., July 11, 1906.

See Fr. Pat. 379,379 of 1907; this J., 1907, 1232.—T. F. B.

Spirit; Solidified ——. Eng. Pat. 26,915. *See* XVII.

Photometer. Addition to Fr. Pat. 383,228. *See* XXIII.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

Wood distillation and acetone. Times, July 15, 1908.

Attention is directed to the fact that the whole of the acetone consumed in Great Britain (1500 tons per annum) is imported, chiefly from America, Germany, and France. Owing to the precarious nature of some of the supplies and the varying demand, the price, now about £60 per ton, has ranged from £44 10s. to over £100 per ton during the past four years, the latter price being due to the increased demand for the manufacture of explosives during the Russian-Japanese war. It is stated that by a simplified process of wood distillation in operation at a works at Paris, the manufacture of acetone has been put on a more satisfactory basis, and an outline of the process is given (see this J., 1906, 634; 1907, 43, 920, 1002, 1080; 1908, 277, 679). The wood employed (usually elm, poplar, beech, and oak) is similar to that known as "cordwood"; it is packed in iron retorts, 10 ft. high by 5 ft. diam., which are placed in the furnaces by means of hydraulic cranes. The furnace is heated by means of the wood tar produced in the process, the tar being sprayed in with a jet of steam. The distillation products escape through openings in the tops of the retorts, and pass through closed condensing chambers, the first two of which are provided with baffle-plates to accelerate the separation of the tar. The end products are wood charcoal, acetic acid (or acetates of copper, lead, and sodium), wood spirit (methyl alcohol), and acetone. For 1 ton of acetone, about 40 tons of wood are required. The chief features of the process are stated to be:—(1). The utilisation of the vapours arising from the stills containing the wood for the removal of a large proportion of the water distilled therefrom, and consequent concentration of the resulting pyroligneous liquors. (2). The method of saturation of the pyroligneous liquors by means of atomisers working in the condensers. (3). The complete removal of the tar produced in the process. (4). The passing of the acid tars downwards over baffle-plates, where it is met by an ascending current of vapours, to which it gives up the acetic acid contained in it. (5). The direct obtainment of pyroligneous acid or sodium acetate of a higher degree of purity than the corresponding products obtained by older processes. The reduction of cost by the new process of wood distillation is stated to be 25-30 per cent. It is stated that in England, mainly in the southern and midland counties, there are large areas of underwood, for which there is practically no demand, and it is suggested that a new and profitable outlet for this underwood would be opened up by the establishment in this country of a wood distillation plant.—A. S.

Petroleum exports from the United States. Oil, Paint, and Drug Rep., July 20, 1908. [T.R.]

The figures just compiled of the exports of mineral oils for the fiscal year ended June 30, show an increase of 176,651,810 gallons over the same period of a year ago, and an increase in value of $8,644,150. During the twelve months referred to there were shipped from seven principal ports of the United States 1,317,502,801 gallons of mineral oils, valued at $97,723,892, as compared with 1,140,850,991 gallons, valued at $79,079,722 a year ago. These figures comprise about 92 per cent. of the total exports from all the ports of the country.

Of all the classifications crude oil is the only one which shows a falling off in foreign consignments, the difference being 11,577,547 gallons, valued at $734,480. Naphthas showed a gain during the year of 6,189,070 gallons, valued at $928,452. The heaviest proportionate gain was in illuminating oils, the increase being 153,853,416 gallons, valued at $14,740,372. In lubricating oils and paraffin an increase is shown of 24,375,238 gallons and $3,358,014.

Naphthenic acids [from petroleum]. F. Schwarz and J. Marcusson. Chem. Rev. Fett-u. Harz-Ind., 1908, 15, 165—166.

The acids present in a sample of mineral oil sold as "saponaphtha" were separated by saponifying 20 grms., removing the unsaponifiable matter, evaporating the alcohol from the soap solution, taking up the residue with water, and separating the acids by shaking with ether and hydrochloric acid. In washing the ethereal layer, concentrated sodium sulphate solution was used in place of water, which was found to extract part of the acids from the ether. The acids left on distillation of the ether (about 16 per cent.) were viscous and dark brown. They contained sulphur, were completely soluble in petroleum spirit (b. pt. 50° C.), and gave the following results on analysis:—Sp. gr. 0·9216: saponification value, 145·8; and iodine value (Wijs), 42·3. Similar acids were obtained from samples of Russian, Galician, and Roumanian lubricating oils, and showed analytical values varying greatly with their origin (*e.g.*, saponification value, 87·6, Galician oil; 157·4, Roumanian oil; iodine value, 21·8, Russian oil: 51·5, Galician oil). Naturally they had lower neutralisation values than the naphthenic acids separated from the lyes of the kerosine industry, which Lidoff found to have a high neutralisation value (213·9—238·9) and low iodine value (1·4—3·9). Great differences were observed in all cases between the iodine values determined by Waller's and by Wijs' method. Thus the acids from the Russian lubricating oil gave an iodine value of 5·5 by Waller's method, and of 21·8 by Wijs' method.—C. A. M.

Patents.

Combustibles and solvents from mineral oil; Manufacture of liquid ——. R. Hense, Charlottenburg, Germany. Eng. Pat. 14,671, June 25, 1907.

See Fr. Pat. 384,946 of 1907; this J., 1908, 494.—T. F. B.

Crude petroleum or distillate thereof; Method of treating cold —— to obtain an explosive mixture for internal combustion engines. D. Martini, London. U.S. Pat. 892,378, June 30, 1908.

See Eng. Pat. 13,840 of 1906; this J., 1907, 958.—T. F. B.

IV.—COLOURING MATTERS AND DYESTUFFS.

Anthranilic acid; Characteristic reaction of ——. B. Pawlewski. Ber., 1908, 41, 2353—2354.

The author points out that he recently described a very convenient test for anthranilic acid (Chemik. Polski, 1905, 5, 397) which consists in mixing anthranilic acid with *p*-dimethylaminobenzaldehyde and adding a few drops of water or alcohol. A red colour is developed and on grinding the materials together, the mixture becomes cinnabar red. If a mixture of the two components be boiled with water, alcohol, or benzene, the red substance which is an additive compound of formula,

$$CO_2H.C_6H_4.NH_2,CHO.C_6H_4.N(CH_3)_2,$$

crystallises in aggregates of red needles melting at 180°—182° C.—J. C. C.

Azo dyestuffs; Position of entrance of the diazo-group in the formation of ——. W. Scharwin and Kaljanov. Ber., 1908, 41, 2056—2060.

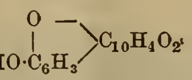
The authors point out certain exceptions to the rule that when a para-substituted amine or phenol is treated with a diazo-compound, the latter enters the ortho-position. Thus *p*-diazobenzenesulphonic acid gives no dyestuff with dimethyl-*p*-toluidine, dimethyl-*p*-bromoaniline, dimethylsulphanilic acid, dimethyl-*p*-aminodiphenylmethane, tetramethylbenzidine or dimethyl-β-naphthylamine. As was to be expected the diazo-salt combines with dimethyl-α-naphthylamine, giving a dyestuff resembling Helianthin and possessing the formula,

$$SO_3H.C_6H_4.N{:}N(4).C_{10}H_6.N(CH_3)_2(1).$$

The sodium salt forms golden yellow leaflets, and the dyestuff gives reddish-brown to orange shades on silk and wool and violet shades on tannin-mordanted cotton, which, however, are not fast to soap. By the action of 2 mols. of *p*-diazobenzenesulphonic acid or of *p*-nitrodiazobenzene on 1 mol. of tetramethyl-*pp*-diaminodiphenylmethane, the methylene group is eliminated as formaldehyde and two mols. of the corresponding dyestuff are produced. Similarly by treating dimethyl-*p*-aminobenzoic acid with *p*-diazobenzenesulphonic acid, the carboxyl group is eliminated with formation of Helianthin. By the action of *p*-diazobenzenesulphonic acid on tetramethyl-*m*-phenylenediamine, tetramethylchrysoidinesulphonic acid is obtained. The free acid is Bordeaux-red and the alkali salts are orange-coloured.—J. C. C.

Brasane from naphthalene. St. v. Kostanecki and V. Lampe. Ber., 1908, 41, 2373—2377.

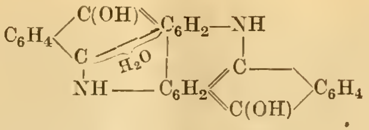
The constitution assigned by Kostanecki and Lloyd (this J., 1903, 902) to brasane has been confirmed by its synthesis in the following way. Liebermann's anhydro-α-naphthoquinoneresorcinol



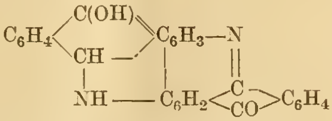
which may be regarded as 3-hydroxybrasanquinone, is methylated and the methoxybrasanquinone is boiled with hydriodic acid, whereby 3-hydroxybrasane is formed. When either 3-hydroxybrasanquinone or 3-hydroxybrasane is distilled over zinc dust the resulting compound is found to be identical with brasane obtained from brazilin.—J. C. C.

Indanthrene and flavanthrene. X. Products of reduction of flavanthrene and the relation between their colour and constitution. R. Scholl. Ber., 1908, 41, 2304—2328. (Compare this J., 1907, 679.)

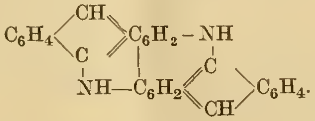
By reducing flavanthrene with alkaline sodium hyposulphite at 60°—70° C., a blue vat is obtained which contains dihydroflavanthrene hydrate. This separates as a bluish-green precipitate on the addition of acetic acid; when heated above 150° C. it loses 1 mol. of water, yielding dihydroflavanthrene. When flavanthrene is reduced with zinc dust and caustic soda in an atmosphere of hydrogen, a brown vat is obtained; this yields α-tetrahydroflavanthrene hydrate which is very readily oxidised to dihydroflavanthrene hydrate, and has the constitution (in alkaline solution):



β-Tetrahydroflavanthrene,



(in alkaline solution), which is only very slowly oxidised, is prepared by heating flavanthrene with hydriodic acid and phosphorus at about 170° C. Its alkaline solution, when treated with zinc dust furnishes a yellow vat which is quickly oxidised to the red β-tetrahydroflavanthrene and which probably contains β-hexahydroflavanthrene. The final product of reduction of flavanthrene, obtained by heating with hydriodic acid and phosphorus at 210° C., is flavanthrine hydrate which loses 1 mol. of water above 200° C., giving flavanthrine, a brown substance,



—J. C. C.

Constitution and colour. F. Kehrmann. Ber., 1908, **41**, 2340—2345.

In criticising the conclusions of Willstätter and Piccard as to the constitution of Wurster's colour salts (this J., 1908, 621) the author shows that change of colour can be classified in two ways, namely: (1), change of colour without change of constitution of the chromophore; that is to say, owing to the introduction of auxochromes such as the hydroxy- or amino-group; and (2), change of colour accompanied by change of constitution of the chromophore; this occurs when faintly coloured bases give strongly coloured salts or *vice versa*. The author considers that the special constitution assigned by Willstätter and Piccard to their *meri*-quinonoid salts is not necessary as these do not really differ from the ordinary quinhydrones which are more strongly coloured than the corresponding quinones, owing to the presence of the auxochromic hydroxyl group.—J. C. C.

Active hydrogen in organic compounds; Determination of ——. T. Zerewitinoff. *See* XXIII.

Patents.

Azo colouring matters; Manufacture of new —— and intermediate compounds for use therein. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 14,248, June 20, 1907.

See U.S. Pats. 877,643 and 877,644 of 1908 (this J., 1908, 218); the 1.8-aminonaphthol-3.6-disulphonic acid may be replaced by 1.8-aminonaphthol or any of its mono- or disulphonic acids; cresidine or *m*-toluidine may be used in place of *a*-naphthylamine or *p*-xylidine; and the final component may be 2.5-aminonaphthol-7-sulphonic acid or -1.7-disulphonic acid, or any of their derivatives, including the dinaphthyl derivatives. The 1.8-aminonaphthol derivatives may first be acidylated, and the acidyl group removed subsequently, this modification avoiding the formation of by-products.—T. F. B.

Anthracene derivatives; Production of ——. Farbenfabr, vorm. F. Bayer und Co. Second and third Additions, dated Jan. 24 and Feb. 7, 1908, to Fr. Pat. 372,676. Dec. 18, 1906 (this J., 1907, 523).

(1) Yellow to red dyestuffs are obtained when 1-acetylaminoanthraquinone or its derivatives are treated with alkaline condensing agents. (2) Anthrapyridones similar to those described in the chief patent but containing an amino-, alkylamino-, or arylamino-substituent in the benzene nucleus, are obtained when negatively substituted anthrapyridones are treated with ammonia or with alkyl- or aryl-amines, with or without the addition of catalytic agents.—J. C. C.

Indigo; Production of halogenated derivatives of ——. Ges. f. Chem. Ind. in Basel. Second and fifth Additions, dated April 25 and June 27, 1907, to Fr. Pat. 375,514, Feb. 25, 1907 (this J., 1907, 920).

(1) Polybromo-derivatives of indigo, similar to those described in the chief patent, are obtained by brominating derivatives of phenylglycine, of isatin or of isatinarylides and converting the products into the corresponding substituted indigos in the usual manner. (2) Tetrachloro- and dichlorodibromo-indigo are obtained when dichloro- and chlorobromoisatin respectively are transformed in the usual way. (Compare this J., 1907, 1274.)—J. C. C.

Anthracene derivatives and dyestuffs and their application in dyeing and printing; Production of a series of new ——. Badische Anilin und Soda Fabrik. Eleventh Addition, dated Jan. 27, 1908, to Fr. Pat. 349,531, Dec. 21, 1904. Under Int. Conv., Dec. 5, 1907 and Jan 16, 1908.

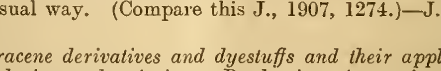
The dyestuffs described in the tenth additional patent (this J., 1907, 1083) are also obtained when instead of copper salts. salts of other metals and also metallic oxides are used.—J. C. C.

Dithiosalicylic acids; Production of ——. Badische Anilin und Soda Fabrik. Fr. Pat. 387,303, Feb. 17, 1908. Under Int. Conv., Dec. 19, 1907.

Dithiosalicylic acids are obtained by treating *o*-diazobenzoic acid or its derivatives with a solution of a thioantimonate, a thioarsenate or a thiostannate. On reduction the products yield the corresponding thiosalicylic acids.—J. C. C.

Sulphide dyestuffs dyeing in Bordeaux shades; Process of preparation of ——. Act.-Ges. f. Anilinfabr. Fr. Pat. 387,120, Feb. 11, 1908.

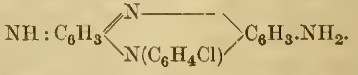
When the safranine of the constitution,



is heated with sulphur and aqueous sodium sulphide in presence of copper sulphate, a sulphide dyestuff is produced which gives very intense and fast Bordeaux shades.
—J. C. C.

Sulphide dyestuff; Preparation of a violet ——. Act.-Ges. f. Anilinfabr. Fr. Pat. 387,238, Feb. 14, 1908.

When the hitherto unknown safranine derived from *p*-phenylenediamine, aniline, and *o*-chloroaniline,



which dyes tannin-mordanted cotton in red shades of a much bluer tint than those given by phenosafranine, is heated with sulphur and aqueous sodium sulphide in presence of copper sulphate, a sulphide dyestuff is obtained which dyes in fast violet shades.—J. C. C.

Disazo-dyestuffs; Preparation of red ——. Act.-Ges. f. Anilinfabr. Fr. Pat. 387,212, Feb. 13, 1908.

The disazo-dyestuff obtained by combining the tetrazo-derivative of *o*-*p*-diaminophenyl ether disulphonic acid with β-naphthol, dyes wool from an acid bath in red shades which are fast to washing. The *o*-*p*-diaminophenyl ether disulphonic acid is prepared: (1), by sulphonating *o*-*p*-diaminophenyl ether; (2), by condensing *o*-nitrochlorobenzenesulphonic acid with sodium *p*-nitrophenolate, reducing the nitro-product to *o*-*p*-diaminodiphenyl ether monosulphonic acid and finally sulphonating this; or (3), by condensing *o*-nitrochlorobenzenesulphonic acid with *p*-nitrophenolsulphonic acid and reducing the product. —J. C. C.

Dyestuffs for wool; Process of preparation of yellow ——. Fabr. Prod. Chim. ci-dev. Sandoz. Fr. Pat. 387,245, Feb. 14, 1908.

When 2:5-dichlorophenylhydrazine-4-sulphonic acid is condensed with ethyl oxalacetate, there is formed ethyl 1-*o*-*m*-dichloro-*p*-sulphophenyl-5-pyrazolone-3-carboxylate, which, after conversion into the carboxylic acid by hydrolysis, combines with diazoarylsulphonic acids to give yellow dyestuffs producing greenish-yellow to yellowish-orange shades on wool which are fast to light and fulling. The same dyestuffs can be obtained by combining the above compound with diazo-salts in the first place and hydrolysing the product. In the two examples given in the patent, metanilic and 2-chloroaniline-5-sulphonic acids respectively are mentioned as being used for the preparation of the diazo-compound.—J. C. C.

Dyestuffs soluble in fats, oils, and resins; Preparation of ——. Chem. Fabr. Flörsheim Dr. H. Noerdlinger. Ger. Pat. 198,278, Jan. 6, 1907.

Dyestuff compounds soluble in oils, fats, and resins may be obtained from dyestuffs which form salts with alkalis or ammonia, by mixing the alkaline-earth, earth, or heavy metal salts of the dyestuffs with the alkaline-earth, earth, or heavy metal salts of fatty or resin acids. The compounds may be precipitated from solutions of the mixed alkali or ammonium salts by addition of the alkaline-earth, earth, or heavy metal salt in solution, or the salts may be precipitated separately and subsequently melted together. The compounds can be dissolved in fatty or resin acids.—T. F. B.

Thioindigo Red series; Process for preparing dyestuffs of the —— and their leuco-compounds. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 198,509, March 21, 1907.

o-Acetylthiophenol is treated in alkaline solution with air or other oxidising agent, or is heated with sulphur in alkali sulphide solution. The dyestuff obtained is identical with Thioindigo Red.—T. F. B.

Triphenylmethane series; Preparation of chrome, blue-violet, acid dyestuffs of the ——. Anilinfarben- und Extrakt-Fabr. vorm. J. R. Geigy. Ger. Pat. 198,729, July 9, 1907. Addition to Ger. Pat. 189,938 (see U.S. Pat. 877,053; this J., 1908, 156).

o-Chloro-*p*-dialkylaminobenzaldehydes are condensed with *o*-cresotinic acid in presence of sulphuric acid, and the leuco compounds oxidised to the triphenylmethane dyestuffs. Acid solutions of the ammonium salts of the dyestuffs dye wool dull violet shades, converted by chroming into intense blue-violet shades, fast to washing and alkalis.—T. F. B.

Triphenylmethane series; Preparation of chrome, blue, acid dyestuffs of the ——. Anilinfarben- und Extrakt-Fabr. vorm. J. R. Geigy. Ger Pat. 198,909, May 28, 1907. Addition to Ger. Pat. 189,938.

The *o*-chlorobenzaldehyde in the original patent (U.S. Pat. 877,053; this J., 1908, 156) is replaced by a *m*- or *p*-substitution product of *o*-sulpho- or *o*-chlorobenzaldehyde (*e.g.*, the 2.4- or 2.5-disulpho, 2-sulpho-4-nitro- or -chloro benzaldehyde). The resulting dyestuffs produce blue shades on wool, after chroming.—T. F. B.

Vat dyestuffs containing bromine; Preparation of ——. Basler Chem. Fabrik. Ger. Pat. 198,510, Oct. 29, 1907. Addition to Ger. Pat. 196,349 (this J., 1908, 557).

By brominating the condensation product of acenaphthenequinone and indoxyl, in nitrobenzene solution, products are obtained which form "vats" with hydrosulphite, from which cotton is dyed green shades, converted by exposure to air into violet shades, more reddish in tint than those produced by the original dyestuff.—T. F. B.

Anthracene series; Manufacture of compounds of the ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 16,246, July 15, 1907.

See Fr. Pat. 383,286 of 1907; this J., 1908, 329.—T. F. B.

Vat colouring matters of the anthracene series; Manufacture of ——. Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 16,505, July 18, 1907. Under Int. Conv., Oct. 15, 1906.

See Fr. Pat. 379,414 of 1907; this J., 1907, 1235.—T. F. B.

Dyestuffs of the anthracene series; Manufacture of new ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 16,962, July 24, 1907.

See Fr. Pat. 380,176 of 1907; this J., 1907, 1274.—T. F. B.

Azo dyestuffs; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 18,698, Aug. 19, 1907.

See U.S. Pats. 874,967 and 874,968 of 1907; this J., 1908, 116, 117.—T. F. B.

Sulphur [sulphide] dyestuff; Manufacture of a new ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 19,548, Aug. 31, 1907.

See U.S. Pat. 866,939 of 1907; this J., 1907, 1082.—T. F. B.

Dyestuff of the gallocyanine series; Manufacture of a new ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 23,410, Oct. 23, 1907.

See Fr. Pat. 383,190 of 1907; this J., 1908, 329.—T. F. B.

Diphenylnaphthylmethane dyestuffs. M. Weiler, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pats. 891,888 and 891,889, June 30, 1908.

See Fr. Pat. 386,814 of 1908; this J., 1908, 744.—T. F. B.

Azo dyestuff; Blue ——. C. Heidenreich, Vohwinkel, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 891,931, June 30, 1908.

See Fr. Pat. 383,169 of 1907; this J., 1908, 329.—T. F. B.

Sulphur [sulphide] dyestuff; Yellow —— and process of making same. W. Schmidt, Frankfort, Germany, Assignor to Cassella Color Co., New York. U.S. Pat. 892,455, July 7, 1908.

See Eng. Pat. 4097 of 1906; this J., 1906, 1143.—T. F. B.

Indigo; Production of halogen derivatives of ——. Ges. f. Chem. Ind. in Basel. Third Addition, dated April 25, 1907, to Fr. Pat. 375,514, Feb. 25, 1907.

See U.S. Pat. 872,115 of 1907; this J., 1907, 1274.—T. F. B.

Indigo; Production of halogen derivatives of ——. Ges. f. Chem. Ind. in Basel. Fourth Addition, dated June 5, 1907, to Fr. Pat. 375,514, Feb. 25, 1907.

See U.S. Pat. 872,280 of 1907; this J., 1907, 1274.—T. F. B.

Sulphide dyestuffs for printing; Process of making ——. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 387,327, May 4, 1907.

See Eng. Pat. 10,527 of 1907; this J., 1908, 497.—T. F. B.

Sulphur [thioindigo] dyestuffs and their leuco-compounds; Process of making ——. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 387,178, Feb. 12, 1908. Under Int. Conv., March 20, 1907.

See Ger. Pat. 198,509 of 1907; following.—T. F. B.

Dyes [*lakes from azo dyestuffs*]. Eng. Pat. 17,676. *See* XIII*A*.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

Cotton; Treatment of —— to resist direct colours. C. F. Cross and J. F. Briggs. J. Soc. Dyers and Colourists, 1908, **24**, 189—190.

Cellulose nitrates resist perfectly substantive dyestuffs, but their inflammable nature precludes their use. This defect is not present in the cellulose acetates, and products which entirely resist direct colours, can be obtained from cotton without tendering the fibre or appreciably changing its structure and appearance. It is not necessary to prepare an acetate of the maximum limit of esterification. The cotton, previously dried, is digested with a mixture containing acetic anhydride, glacial acetic acid, and zinc chloride; the different degrees of acetylation are controlled by keeping the proportions of liquid and cotton approximately constant and varying the acetic anhydride concentration. Suitable mixtures for a hard yarn are:—

	Mixture A. For gain in weight of 26 per cent.	Mixture B. For gain of 34 per cent.
	parts.	parts.
Acetic anhydride	42	42
Acetyl chloride	11½	11½
Glacial acetic acid ...	50	25
Ignited zinc oxide ...	6½	6½

Of A, twice, and of B 2·3 times the weight of the dry cotton are used. The reaction is complete after 36 to 48 hours at 35° C., and the yarn can be washed and dried. The cost of the treatment is little more than the cost of the reagents, and this depends chiefly on the price of acetic anhydride. On the basis of 2 marks per kilo. for this product, the reagents required to treat 1 lb. of cotton with mixture A, would cost 1s. 2d., and with mixture B, 1s. 6d. The treated yarn in addition to the resistance to substantive dyestuffs, shows an increased affinity for basic colours. It resists the action of cold mercerising sodium carbonate for a sufficient length of time to permit of the differential mercerisation of mixed fabrics. The acetylating process can be applied to cotton fabrics in the piece, and imparts a finish and firmness resistant to careful washing. The normal hygroscopic moisture of the acetylated cotton is about one-half of that of the original cotton.—R. B. B.

Magnesium salts; Tendering of cotton during singeing, due to the use of —— in the warp size. J. Donninelli. Rev. Gen. Mat. Col., 1908, **12**, 203—204.

Commission dyers are often made responsible for pieces which are sent to them to dye, and which become tender during dyeing. Especially is this the case with goods dyed Aniline Black (Oxidation) and "schreinered," the warp threads being much more affected than the weft. The cause of the tendering may, however, be quite independent of the dyeing, and may be present in the grey piece. The operations of dyeing and finishing include drying, singeing, malting (to remove size), washing, drying, dyeing, filling, and schreinering at 70 atmospheres pressure and 120° C. The strengths of the warp and weft in a satteen in the grey were found to be 25 and 35 respectively, but in the finished piece they were only 12 and 25, representing a loss of 53 per cent. in the warp and 28 per cent. in the weft. A comparison was made of a piece dyed in the usual way, and one which had been freed from size before singeing. The mean result of 10 trials on the dynamometer, after the various operations, was as follows:—

	Warp.	Loss per cent.	Weft.	Loss per cent.
Strength in the grey ...	26	—	36	—
After singeing..........	23·3	10	35	2·8
,, malting and singeing	25·5	1·9	34·8	3·1
,, singeing and dyeing	18·1	30	28	22
,, malting, singeing, and dyeing.....	21	19	29	19
,, singeing, dyeing, and schreinering	12·7	51	25	30
,, malting, singeing, dyeing and schreinering	17·3	33	25·6	28

As is well known, the loss in strength in the case of pure cotton during dyeing is about 20 per cent., so the increased loss here shown must be due to some outside cause. The filling in a grey cloth was analysed, and in it were found alumina and chloride and sulphate of magnesium. The greater loss of strength in the material which was singed before malting, is due to the effect of the dry heat upon the magnesium salts, the cotton suffering in this operation, and being tendered still more (proportionally) in the subsequent processes, than that from which the size had been removed. Merchants are recommended to insist that the size, used for the warps, shall be free from magnesium salts.—F. M.

By-product formed in Aniline Black dyeing; The red-violet ——. E. Böttiger. J. Soc. Dyers and Col., 1908, **24**, 169—170.

On evaporating to dryness the violet-red solution which was obtained by extracting cotton, dyed with Aniline Black, with very dilute hydrochloric acid, a greenish-black solid remained which proved to be Pseudomauveïne, $(C_{24}H_{20}N_4)$, a dyestuff which is formed by the action of various oxidising agents, especially chromic acid, on aniline. The Pseudomauveïne, therefore, which is formed as a by-product in Aniline Black dyeing, is probably chiefly produced by the action of the bichromate used in the chroming process upon the aniline salt remaining in the greened cotton after ageing. Since this by-product dulls the black obtained, and also stains the whites in printing, it is necessary to reduce its production to a minimum. This may be effected in two ways. (1). The amount of sodium chlorate in the padding liquor must be raised almost to the theoretical quantity required for the oxidation of the whole of the aniline, so as to lessen the amount of free aniline salt left on the material after ageing. (2). A much weaker solution of bichromate must be used in the chroming process than is usually employed, the reduction being as much as 50 per cent. in the case of a short treatment.—P. F. C.

Hydrosulphite-formaldehyde; Analysis of ——. W. F. Greaves. J. Soc. Dyers and Colourists, 1908, **24**, 195—196.

The formaldehyde is estimated by a gasometric method. Cross's method of chromic acid combustion is employed, the evolved carbon dioxide being collected in a Lunge's nitrometer. The inner tube of a Lunge bottle contains 5 c.c. of a cold saturated solution of chromic acid. The portion of the bottle surrounding this receives 10 c.c. of a solution of the hydrosulphite-formaldehyde of a strength of 1 grm. in 100 c.c. The bottle is then connected as usual to the side tube of the nitrometer; the graduated limb is completely filled with mercury, and connection is opened to the bottle, a Torricellian vacuum of a few c.c. being produced. The bottle is then tilted and the resulting mixture of chromic acid and hydrosulphite warmed gently till slight ebullition takes place. The apparatus is cooled by immersing the bottle in cold water, and after one hour the mercury is levelled off and the usual corrections made. An analysis of hydrosulphite NF conc., gave 16·48 per cent. of formaldehyde. The sodium sulphoxylate in this compound was then estimated by Knecht's method for the estimation of sodium hydrosulphite with Methylene Blue and titanium chloride (this J., 1907, 1165). The analysis showed 48·38 per cent. of sodium sulphoxylate ($NaHSO_2$).—R. B. B.

Adsorption of Methylene Blue and Crystal Ponceau by various wools. L. Pelet-Jolivet and N. Andersen. Rev. Gen. Mat. Col., 1908, **12**, 201—202.

The adsorptive power of wools from various countries, was tested, after thorough scouring and rinsing, by immersing for 5 days at a temperature of 18° C., in solutions of Methylene Blue and Crystal Ponceau, of known strength. The amount of dyestuff adsorbed, per grm. of material, varied within wide limits but was always much greater in the case of the basic than in that of the acid dyestuff. —F. M.

Decolorisation of coloured liquids by different forms of charcoal; Cause of the ——. *II.* F. Glassner and W. Suida. Annalen, 1908, **361**, 353—362. (Compare this J., 1907, 1195.)

The authors have extended their researches to the examination of the action of three different samples of charcoal on coloured liquids. The analysis of the samples gave :—

	C.	H.	O.
Lampblack I.	91·70	0·71	7·59
,, II.	93·67	0·51	5·82
Acetylene carbon	98·98	0·11	0·91

All were free from nitrogen and ash. It was found that benzene extracted a substance of camphor-like odour from the lampblack which, when freed from benzene, decolorised solutions of basic dyestuffs. Lampblacks I. and II. absorbed roughly about one and a half times the amount of basic and acid dyestuffs as did the acetylene carbon, and the conclusion is drawn that this may be due to the presence of oxygen in the form of a phenolic compound. In confirmation of this, it is found that a large number of phenols give precipitates with Magenta, Crystal Violet, Methylene Blue and Chrysoidine, whilst a few do not. The authors have also examined the action of carboxylic acids, sulphonic acids, amines, diamines, and aminophenols, towards these dyestuffs and classify them accordingly. It seems probable that the union of phenolic substances with basic dyestuffs may be due to the formation of oxonium or carbonium compounds. —J. C. C.

Petroleum benzine [*and other solvents*]*; Germicidal power of* ——. F. J. Farrell and F. Howles. *See* XVIII*C.*

Patents.

Vapours of ether, alcohol, etc.; Method for the recovery of —— *from the atmosphere of certain factories* [*artificial silk works*]. Soc. Anon. pour la Fabrication de la Soie de Chardonnet. Fr. Pat. 387,054, Feb. 8, 1908.

In consequence of the relatively large mass of air with which these vapours are mixed, and other difficulties, methods depending on absorption by sulphuric acid, etc., or by simple refrigeration have not worked well. It is therefore proposed to use a machine analogous to those of the Linde, Lourmiet, or Pictet types, whereby by combined refrigeration and compression, the volatile vapours may be condensed and subsequently separated by centrifugal or other means from the atmosphere of a workshop.—J. W. G.

Mordanting wool and other animal fibres with chromates and lactates. A. Elhardt Söhne. Ger. Pat. 191,507, April 5, 1906.

The claim is for the use of acid calcium lactate in place of the acid alkali lactates ordinarily employed in mordanting wool.—A. S.

Hair; Dyeing ——. R. Wolffenstein and J. Colman. Ger. Pat. 196,674, April 12, 1907.

Instead of producing the dyestuff on the hair itself, it is prepared beforehand, converted into its leuco base, and the latter used for the dyeing operation. For example, 6 grms. of *p*-phenylenediamine are dissolved in 300 grms. of warm water, and 2·5 c.c. of a 10 per cent. practically neutral solution of gold chloride added, whereupon the dyestuff separates. Bisulphite is now added, and the resulting clear solution is employed for the dyeing operation.—A. S.

Discharging indigo by means of chlorates; Process for ——. Lembach und Schleicher, G.m.b.H. Ger. Pat. 198,043, June 27, 1907.

Glycollic acid or its ammonium salt is added to the indigo discharge paste containing chlorate. This has the advantage over citric and tartaric acids that it does not crystallise out, even in 50 per cent. solutions.—T. F. B.

Viscous liquids produced by heating glycerin; Application of the highly ——. [*Finishing materials and plastic substances.*] C. Claessen. Ger. Pat. 198,711, April 9, 1907.

The use of the viscous mixtures of diglycerin and polyglycerins produced by heating glycerin, is claimed for the preparation of finishing materials and plastic substances. A finish for cotton and linen for example consists of a mixture of 30 parts of Cologne size, 45 parts of water, 35 parts of starch syrup, and 5 parts of polyglycerin. A waterproof gelatin-paper is prepared by coating a sheet of white writing paper on both sides with a solution of 1 part of gelatin and 0·25 part of polyglycerin in 4 parts of water, and then drying it.—A. S.

Dry cleaning; Process and apparatus for —— *with recovery of the solvents.* R. Sparmberg. First Addition, dated Jan. 21, 1908, to Fr. Pat. 377,949, May 17, 1907 (this J., 1907, 1089).

The end walls of the different compartments of the washing drum are provided with openings disposed symmetrically around the central axis, in order that air or liquid may be drawn into the central part of the drum. A portion of the drum is surrounded by a jacket, through which cold water can be circulated, so that the air leaving the drum can be immediately cooled and the entrained vapours condensed. Protecting plates are disposed around the drum, in order that aspiration can be maintained throughout the length of the drum.—A. S.

Wool-combers' effluents; Process for the treatment of ——. E. Dowie, Montreal, Canada. Eng. Pat. 28,057, Dec. 19, 1907.

See Fr. Pat. 385,194 of 1907; this J., 1908, 558.—T. F. B.

Wool-combers' effluents; Process for the treatment of ——. E. Dowie, Montreal. U.S. Pat. 892,370, June 30, 1908.

See Fr. Pat. 385,194 of 1907; this J., 1908, 558.—T. F. B.

Dyeing and bleaching apparatus. J. Schmitt, Belfort, France, and E. Handschin, Masmünster, Germany. U.S. Pat. 892,898, July 7, 1908.

See Fr. Pat. 368,485 of 1906; this J., 1906, 1218.—T.F.B.

Dyeing [*with sulphide dyestuffs*]*; Process of* ——. H. Toepfer, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Reissue No. 12,826, dated July 7, 1908, of U.S. Pat. 873,636, Dec. 10, 1907.

See Fr. Pat. 367,921 of 1906; this J., 1906, 1218.—T. F. B.

Volatile or fluid solvents; Apparatus for recovering —— [*in drying proofed fabrics, etc.*]. J. Spenle. Fr. Pat. 387,594, Feb. 26, 1908. Under Int. Conv., Aug. 3, 1907.

See Eng. Pat. 17,780 of 1907; this J., 1908, 746.—T. F. B.

Electrolytic apparatus for bleaching, scouring, etc. Fr. Pat. 387,104. *See* XI*A.*

Polyglycerins from glycerin. Ger. Pat. 198,768. *See* XX.

VII.—ACIDS, ALKALIS, AND SALTS, AND NON-METALLIC ELEMENTS.

Alkali &c., works; Forty-fourth annual report on —— by the Chief Inspector. Proceedings during the year 1907, *etc.* February 29, 1908. Price 1s. 1d.

The total number of works registered on Dec. 31, 1907, in the United Kingdom was 1389, of which 158 were in Scotland. Of these, 72 only were alkali works, decomposing salt with the evolution of hydrochloric acid. The numbers show an increase of 168 scheduled and registered works, as compared with 1906, this increase being due to the new Act of 1906 (this J., 1906, 315). The processes newly included, have been already noticed (this J., 1907, 683). The total number of separate processes of manufacture under inspection is now 1821, as compared with 1470 for 1906 and 1452 for 1905. The great increase in the number of registrable works takes place in District No. 6 (South-west of England and South Wales), and, of the new works added, 60 are tinplate flux works.

There have been no prosecutions during the year. In four cases, however, the question of proceedings was under consideration at the close. As the result of an examination of the returns, made by local authorities to the Board, of new works coming under the operative clauses of the Act of 1906, it was found that several works, that were registrable under the Acts of 1881 and 1892, had not been registered. Back fees have been accepted in lieu of penalties incurred.

The demand for the products of the alkali and wet copper works has been maintained at a fairly high level throughout the year. 400,055 tons of burnt cupreous pyrites were treated in 1906 at the metal extraction works in England and Scotland by the wet copper process, the estimated produce of valuable metals being 14,401 tons of copper, 1837 oz. of gold, and 320,041 oz. of silver; the corresponding figures in 1905 being 402,863 tons of burnt ore, 14,502 tons of copper, 1850 oz. of gold, and 322,291 oz. of silver. Although the average escape of hydrochloric acid from the chimneys of alkali works varies little from year to year, several serious complaints have been received during 1907 from farmers near Widnes. In one case, however, of damage to clover, investigation showed that some of the damage was certainly produced by insects, and was not due to acid fumes.

The new statutory limitations of escape for the acid gases of sulphur and nitrogen, from the lead chamber processes in sulphuric acid works, has produced no sensible effect, since manufacturers have never applied tests for the control of the process to the chimney gases, but solely to the gases escaping from the process. The new Act has, therefore, merely rendered former procedure strictly legal. Fans are much used now at the exit of the process, or between the Gay-Lussac towers, where two of these are worked in tandem; and bottom inlets and centre outlets, at the ends of the chambers, are employed at most works in the North-Eastern District. The usual position for steam jets, owing to the advent of the bottom inlet, is just above the inlet and just below the outlet. The position of the steam jet undoubtedly plays an important part in the production of acid in the second chamber, and in the third chamber in a set of four or five, and in the regular and steady working of the process. The demand for sulphuric acid is increasing rapidly in the North-Eastern District, with the increase in the number of by-product coke-ovens recovering ammonium sulphate. The amount of pyrites, cupreous and non-cupreous, imported, was 759,324 tons in 1906, chiefly from Spain, as compared with 698,746 tons in 1905, the home output being 7342 tons of coal "brasses" from the Midlands, and 3724 tons of pyrites from Ireland. In the London district the use of spent oxide, as a source of sulphur, has increased, and the whole of the acid produced by the three largest metropolitan gas companies has been entirely yielded by the sulphur impurities removed from coal gas. The use of brimstone is still on the decrease. In two works zinc blende is used as the source of sulphur. Plant arranged on Petersen's plan (this J., 1907, 870) is now being tried in this country at a works using the intensive system of conducting sulphuric acid manufacture, with a minimum of chamber space. A *résumé* of Raschig's researches on the mechanism of the chamber reactions is given (see this J., 1907, 965 and 1276), which confirms the view that the "nitre content" of acid containing 79 per cent. of monohydrate, *i.e.*, Gay-Lussac acid strength, consists mainly of nitrosulphonic acid, $NO_2.SO_3H$ (the nitrosylsulphuric acid of Lunge and the nitrososulphuric acid of Divers, or "chamber crystals"). This decomposes on dilution, so that at 73 per cent. monohydrate strength, only nitrous acid exists, and this can then react with sulphur dioxide to form nitrosisulphonic acid. Raschig looks upon nitrous acid as the catalyst in the lead chamber (*loc. cit.*, and this J., 1906, 882). In works for the concentration or distillation of sulphuric acid, the acidity of the gases discharged into the atmosphere may not exceed 1½ grains of sulphuric anhydride per cb.ft., except in the case of gases from the "overheat pan" process, in which the acidity allowed, is 2 grains for a period of three years from the commencement of the Act — Jan. 1, 1907. Already, however, such plant, on the average, complies with the lower limit, which will finally apply to all processes registered under this heading. A new process for rectifying acid has been introduced from the Continent during 1907, known as the "Barcelona" or "Gaillard" process (this J., 1906, 1146), of which three examples are working. In one of the older continuous processes, in which porcelain basins in stepped series have been employed, the substitution of similar basins of fused quartz has given satisfaction in lessened breakages, with their accompanying evils.

At tinplate flux works, the acidity of the fumes arising from the calcination of the "scruff," or skimmings from the tinplate baths, is chiefly due to hydrochloric acid, from the zinc chloride, which is the main constituent of the flux, through which the metal plates pass on their way to the tinning bath. These fumes are mixed with the products of the partial combustion of palm oil, which is used as the final flux, to impart a lustre to the tinned surface. An improvement has been effected by arranging that the skimmings of the first section of the tin bath, where solution of zinc chloride covers the melted metal, should not be thrown into the portion covered with palm oil and re-skimmed from that, but should be kept entirely separate, and be treated, not by calcination, but by solution, then diluting and separating the tin and tin oxide by settling. At one works, the amount of hydrochloric acid in the chimney gases of the calcining operation has been thus reduced by one-half. Moreover, the chloride may be still further reduced in the scruff, obtained in this way, by steaming it with hot water before calcination. In the operations, as frequently conducted, much loss of tin occurs by volatilisation with the more volatile zinc chloride. It is recommended that depositing and cooling flues of considerable length should form part of the equipment to every scruff furnace, to be followed by a condenser, in which the first compartment is filled with chequer brickwork, and the second with coke, both being fed with water by tumbling boxes, giving periodical flushes of water. No condensing appliances at present exist at such works.

The firing of salt pans by Mond producer-gas as fuel is found to give even heating, with far less buckling, and wear and tear of the pans. The production of salt, including that used in the ammonia-soda process, was 1,734,593 tons in 1906, as compared with 1,658,364 tons in 1905.

The amounts, in tons, of manure materials imported in 1905, 1906, and 1907 were:—

	1907.	1906.	1905.
Guano	31,278	24,906	29,223
Mineral phosphates	504,528	442,970	421,026
Nitrate of soda	113,894	108,486	104,436

The exports of ammonium sulphate in 1907 amounted to 230,000 tons, as compared with a home consumption of 87,500 tons. It is noted that Japan took 64,000 tons, as compared with less than 4000 tons 5 years ago. The application of calcium nitrate as a manure has been somewhat retarded, owing to the fact that it is a deliquescent salt. The addition of 40 per cent. of ammonium sulphate has been found to remove this disadvantage. Reference is made to the favourable results obtained by Bottomley with cultures of nitrifying bacteria in the treatment of tomatoes and other plants. There is a large trade in the manufacture of chemical manure carried on in Ireland.

With reference to attempts, which are sometimes made, to recover oxides of nitrogen in the form of alkali nitrites, attention is drawn to Raschig's researches on the oxides of nitrogen and their behaviour towards reagents (this J., 1907, 966).

The number of sulphate of ammonia works continues to increase. At another such works, connected with a large coke-oven plant, the Claus process of sulphur recovery has been adopted, and the process is likely to receive more attention in future. There is great discrepancy as to the quality and quantity of sulphur produced, the quality varying from 99·8 per cent. purity down to green mixtures practically unsaleable. The following figures are given, relating to the use of burnt oxide in gas purifiers:—First saturation gave 9·92 per cent. of free sulphur; second saturation, 7·33 per cent.; third saturation, 3·32 per cent.; fourth saturation, 4·55 per cent., making 25·12 per cent. in all of additional sulphur. When the burnt oxide was thoroughly washed before use, it only absorbed a trace of sulphuretted hydrogen, even on the addition of ammonia. Experimental work is proceeding in various directions with the object of reducing the amount of volatile cyanogen compounds in the liquors before distillation. A poisoning fatality has occurred at one works in connection with the repairing of a faulty saturator.

Amount of sulphate of ammonia (in tons) produced in the United Kingdom.

	1907.	1906.	1905.
Gas works	165,474	157,160	155,957
Iron works	21,024	21,284	20,376
Shale works	51,338	48,534	46,314
Coke oven works	53,572	43,677	30,732
Producer-gas and carbonising works (bone and coal) ...	21,873	18,736	15,705
	313,281	289,391	269,114

It will be seen from the above table, that a steady increase in the amount of coal coked in recovery ovens continues. The number of producer gas plants, with recovery of ammonia, is also increasing, though experts appear to hold the view that recovery will not pay for less than 50 tons of coal a day carbonised. Ammonia, acetic acid, and paraffin tars are being recovered from the products of distillation of peat at one works in Ireland, the minimum yield obtained, being 5 tons of sulphate for every 100 tons of dry peat. In dealing with the question of the disposal of spent ammoniacal liquors, reference is made to a paper read before this Society by Frankland and Silvester (this J., 1907, 231), in which it is shown, that it is possible to subject sewage, containing such liquors, to bacterial treatment with satisfactory results. Attention is called to the importance of phenols in such spent liquors, as absorbers of oxygen. In a paper by Skirrow (this J., 1908, 58) it appears that about half the pure phenol, which is produced in the retorts, is lost in the ammoniacal liquor. G. Fowler has found it possible to cultivate bacteria specially capable of oxidising the impurities in spent liquor.

The presence of ammonium chloride has given rise to difficulties in some ironworks and coke-oven works, the brickwork of the coke-ovens being seriously attacked in a short time. It is noted that the ammonium chloride, on reaching the hydraulic main, becomes deposited in the thick tars, rather than in the ammonia liquor. Feld's washer (this J., 1906, 467) is reported to be applicable, not only to the recovery of tar, ammonia, etc., but even to the removal of dust from blast-furnace gases. Its use in this country is suggested for the removal of tar and dust from producer gas, for large power gas engines, its use on the Continent for a great variety of purposes being apparently attended with great success.

The introduction of vertical, instead of horizontal retorts, in gas works, is found to have a very marked effect in increasing the yield of ammonia and on the constitution of the tars. Experience shows, moreover, that with the Dessau retort, a considerable reduction of cyanogen may be looked for in the crude gas. Marked reductions in naphthalene and sulphur compounds have also been noted. In the Dessau retort, the gas apparently ascends in the centre of the charge, and so is less subject to secondary changes induced in the valuable illuminants, when radiant heat has the opportunity of action, as in the upper portion of the ordinary horizontal gas retort. At the Guildford Gas Works eight retorts set at an angle of 45° have been in use for three years; they give a harder and denser coke than the ordinary retort. In the vertical continuous (Woodall-Duckham) retort, it is claimed that, though the heating by producer gas takes place at the top, the heated products of combustion being drawn downwards, the heat is supplying energy needed for the work of destructive distillation, and is being absorbed, and so does not appear as sensible heat, until the charge has descended lower in the retort and is getting spent. The coal is, therefore, subjected to a process of fractional decomposition, each portion of gas and vapour coming off at its own critical temperature, and never having to pass through any zone at a temperature above that at which it is evolved. This would explain the extra yield of ammonia (about one-third), as this does not become decomposed on its way out of the retort. The production of cyanogen compounds is probably connected with the decomposition of ammonia.

Experiments on the sensitiveness of lead acetate paper to sulphuretted hydrogen, show this to be subject to wide variation, according to the manner of applying the test, both as regards moisture and alkalinity of the paper, and also, in even greater degree, as regards the angle at which the paper is held. The presence of even a small amount of sulphur dioxide (less than 1 grain per cb. ft.) is found to render the paper less sensitive. The only practicable method of applying the test to samples drawn from the chimneys and flues of chemical works, is to aspirate the gas through a glass tube holding the test paper, with a filter of cotton wool or asbestos, if necessary. With gas containing 1 volume or more of sulphuretted hydrogen in 100,000, the condition of the paper is immaterial, but with gas, containing from 1 volume per million to 1 per 100,000, moist ammoniacal paper is most sensitive; 1 in 10 million is the limit of sensitiveness. The test is most delicate when the gas is made to impinge directly on the surface of the paper, and it may be made quantitative, if the conditions as to quality of paper, rate of flow, etc., remain constant.

Next to muriatic acid works and tin-plate flux works, bisulphite works contribute most in new registrations. The sulphur dioxide required in these works is obtained chiefly by heating sulphuric acid with carbon or sulphur, or by burning sulphur.

In the cement industry the demand has fallen considerably, and the selling price is also lower. Satisfactory results are being obtained with rotary kilns, the number of which is increasing. These are now made larger and longer, and special dust-arresting appliances are provided. The workable kiln plant existing in the South-Eastern District at the close of 1907 is as follows:—82 open kilns, 1059 chamber kilns, 32 Schneider kilns, and 61 rotary cylinder kilns; many kilns of the first two classes have remained idle during the year.

Two fatalities are reported at a tar works, during the washing of products with sulphuric acid, by a process analogous to ordinary naphtha-washing. Sulphuretted hydrogen was, by accident, evolved in quantity.

Previous mention has been made of "Dolly Cream" dye as a selective indicator of hydrochloric acid vapour, in the presence of chlorine and sulphur dioxide (this J., 1907, 684). It is now found that metanil yellow and tropaeolin 00 are more sensitive, and their use is to be preferred (see this J., 1908, 485).

In Scotland the number of works registered and of processes under inspection has increased, as compared with the preceding year, and this apart from those works newly inspected as a consequence of the new Act. Numerically the largest new group is that of bisulphite works in and about Glasgow, the principal uses, to which the product is put, being as a disinfectant of casks in breweries and as a preservative and restorer of meat. Such works are also often attached to paper mills. The most important addition to the schedule is paraffin oil. Progress is already being made in providing plant for the utilisation of sulphuretted hydrogen and other noxious gases from the oil stills. In one works it is stated that the crude gases from the stills yield 60,000 cb. ft. of good rich illuminating gas daily, and 150 gallons of light naphtha. Sulphuric acid works have been very active during the year. In several of these works water sprays have been used with success in the chambers, in place of steam jets. A fatality is reported, which occurred to a plumber, after repairing the lead work of a chamber, and attention is drawn to the insidious nature of the oxides of nitrogen, which can be breathed with apparent impunity for a prolonged period, without causing such distress as to necessitate a man's leaving his work; the dangerous symptoms usually show themselves many hours later, often with fatal results.

The total shale mined in the United Kingdom for 1907 was 2,675,989 tons, and the yield in lb. of sulphate of ammonia per ton of shale mined, 43·0, the corresponding numbers for the preceding year being 2,546,522, and 42·7.

The Report consists of 220 pages, of which 22 pages are devoted to Scotland.—F. Sodn.

Chlorite and hypochlorite in potassium chlorate; Detection and determination of ——.

B. Carlson and J. Gelhaar. Chem.-Zeit., 1908, **32**, 604—605, 633—634.

Gartenmeister's method of testing for hypochlorite and chlorite in potassium chlorate (this J., 1907, 223) is not reliable, because the addition of indefinite quantities of acid affects the results very seriously. In order to detect the impurities named, 5 grms. of the chlorate should be dissolved in 100 c.c. of cold water, and a drop of potassium iodide and starch solution added. If a blue colour does not at once appear, hypochlorite is absent, and if a blue colour is not immediately produced on the addition of 2 c.c. of $N/_{10}$ sulphuric acid, chlorite is also absent. 0·00004 per cent. of either may be thus detected. For the quantitative estimation of chlorite, the hypochlorite present is first determined volumetrically with arsenious acid and iodine solution. The quantity of arsenious acid necessary to destroy the hypochlorite is then added to a new sample of the liquid, and this is diluted to 250 c.c. The solution is heated to 95° C., made faintly acid with sulphuric acid, though not to such an extent as to liberate chlorine, and titrated, as rapidly as possible, with standard indigo solution, until a green tint becomes permanent. The indigo solution is made to contain about 6 grms. of sodium indigosulphonate per litre, and is standardised with a chlorite solution, the strength of which has been determined iodometrically. It is noted that chlorate which is odourless, contains neither chlorite nor hypochlorite, and, further, that the authors have not detected either impurity in samples of commercial chlorate, though chlorite, as well as hypochlorite, occurs in electrolytic liquors.—F. Sodn.

Potassium chlorate; A new impurity in commercial ——.

R. Gartenmeister. Chem.-Zeit., 1908, **32**, 677.

Potassium chlorate, prepared in the old way, and not electrochemically, in solution gives no immediate blue colour with potassium iodide and starch and sulphuric acid, even at 40° C. or with a considerable quantity of acid. Chloric acid is not decomposed under these conditions. (Compare preceding abstract.) It is now evident, however, that the blue colour obtained with a former sample (this J., 1907, 223) was due, not to the presence of hypochlorite or chlorite, but to another oxyacid of chlorine, which decomposes very slowly in the cold and in presence of little acid, but more rapidly at a higher temperature and with a larger quantity of free acid. This impurity is present in all electrolytically prepared chlorate, even when so-called "pure." The test for the suitability of a chlorate, to be used in making explosives, formerly proposed by the author (*loc. cit.*), requires modifying. It should be performed as follows:—A small crystal of potassium iodide is dissolved in about 25 c.c. of the cold saturated chlorate solution, and the mixture shaken, after adding a few drops of starch solution and about 10 drops of sulphuric acid (25 per cent. by volume). No appreciable blue colour should develop within two minutes.—F. Sodn.

Ferrocyanides; Commercial analysis of ——.

H. G. Colman. Analyst, 1908, **33**, 261—272.

For the analysis of crude materials containing ferrocyanide, such as spent oxide from gasworks, the sample is ground and thoroughly mixed, and a quantity of 30 to 40 grms. placed in a mortar with an excess of sodium hydroxide and about 100 c.c. of water, and allowed to stand for several hours, during which time it is frequently well triturated with the pestle. A few crystals of ferrous sulphate may be added to convert any cyanide into ferrocyanide and to reduce any ferricyanide present. If ammonia is present no heat should be employed, to avoid the formation of thiocyanate. The mixture when decomposition is complete, is either filtered and made up to 1000 c.c., or it may be at once placed in a litre flask and made up to 1000 c.c. plus a quantity of water equal to the volume of insoluble matter present. The three classes of methods employed depend upon:—1. The titration of the ferrocyanide with copper or zinc sulphate. 2. The estimation of iron present in solution as ferrocyanide. 3. The estimation of the hydrocyanic acid present. 1. Titration with metallic salt solutions. The titration with copper sulphate solution, as originally suggested by Bohlig (Polytechn. Notizblatt, 1861, **16**, 81), and modified by Knublauch (this J., 1889, 732) consists in titrating the ferrocyanide solution with a copper sulphate solution, an insoluble copper salt being precipitated, until the solution gives no blue coloration with a ferric salt. Any sulphide may be previously removed by adding lead carbonate and filtering. Instead of the copper salt, zinc sulphate is sometimes employed. This method gives fairly accurate results, but only when all conditions are rigidly adhered to. The reaction does not proceed quantitatively according to the equation:—$K_4Fe(CN)_6+2CuSO_4=Cu_2Fe(CN)_6+2K_2SO_4$, but a much smaller amount of copper is required for complete precipitation, the precipitate consisting of an insoluble colloidal double ferrocyanide of copper and the metal originally present as ferrocyanide. The extent to which the proportion of copper to the other metal varied was found by comparing equivalent solutions of different ferrocyanides. 50 c.c. of these would require according to the equation 23·6 c.c. of either the copper or zinc solution. The results actually obtained were:—

	$CuSO_4$.	$ZnSO_4$.
		c.c.
50 c.c. $K_4Fe(CN)_6$ solution	=16·4	17·0
50 c.c. $Na_4Fe(CN)_6$ solution	=18·0	17·30
50 c.c. $Ca_2Fe(CN)_6$ solution	=18·4	17·45

The amount of copper or zinc salt required is not only materially affected by the nature of the sulphate present, but also by its quantity. By adding varying quantities of potassium, sodium, or calcium sulphate to the respective ferrocyanide solutions, similar differences were obtained; in the case of the potassium salt, 15·85 c.c. of copper sulphate solution were required after addition of 0·2 grm. and 14·0 c.c. after addition of 10 grms. of potassium sulphate.

A practical method by which the tedious conversion of the ferrocyanides into the potassium salts is avoided, and the influence of the sulphates present is excluded, consists in adding an excess of a saturated solution of potassium sulphate to the ferrocyanide solution, a similar quantity being added to the solution of pure potassium ferrocyanide for the standardisation of the copper or zinc sulphate. Variations of the dilution and the amount of free acid present do not materially affect the results. 2. Determination of the iron. The method of decomposing the ferrocyanide and estimating the iron obtained, was first proposed by Rose (Z. anal. Ch., 1862, 1, 194) and further developed by Leybold and Moldenhauer (J. Gasbel., 1899, **33**, 153), the substance being evaporated with sulphuric acid. Dittrich and Hassel (this J., 1903, 883) substituted treatment with ammonium persulphate. The solution is slightly acidulated with sulphuric acid, and after addition of 2 to 3 grms. of ammonium persulphate, heated to the boiling point for twenty to thirty minutes, whereby the whole of the iron is converted into ferric sulphate. The iron is precipitated with ammonia and estimated by the usual gravimetric or volumetric methods. Good results are obtained with fairly pure ferrocyanides; in crude material however, where iron sulphides are present, these go in solution with alkali, and the results are then too high. 3. Determination of the hydrocyanic acid. This method, originally proposed by Rose and Finkener (Z. anal. Ch., 1862, **1**, 299), was worked out by Drehschmidt (J. Gasbel., 1892, **36**, 221), and especially by Feld (this J., 1903, 1068). It depends on the conversion of ferrocyanides into mercuric cyanide by boiling with mercuric oxide. A solution containing the equivalent of 0·3 to 0·5 grm. of potassium ferrocyanide is diluted with water, mixed with 10 c.c. of $N/_1$ sodium hydroxide, and boiled; 15 c.c. of boiling $3N$-magnesium chloride are added, and the boiling continued for five minutes, after which 100 c.c. of boiling $N/_{10}$-mercuric chloride are added. After boiling for a further ten minutes, the flask is connected to a condenser, 30 c.c. of $4N$-sulphuric acid added through a dropping funnel, and the hydrocyanic acid formed is distilled into 25 c.c. of $N/_1$-sodium hydroxide. This after dilution and addition of a crystal of potassium iodide, is titrated with $N/_{10}$-silver solution, one c.c. being equal to 0·0054 grm. of hydrogen cyanide.

The presence of carbonyl ferrocyanide, of which gas-works products contain usually 2 to 5 per cent. of the total cyanogen present, but in exceptional cases up to 20 per cent., interferes with the analysis in all the methods described. Being a comparatively valueless material, it should not be included in the analysis as ferrocyanide. A simple method for the separation of this compound is to add to the aqueous solution of the mixture, four to five times its volume of methylated spirit, when the whole of the ferrocyanide is precipitated, together with any sulphate, carbonate, or chloride present, whilst the carbonyl ferrocyanide, thiocyanate, sulphide, and excess of caustic alkali remain in solution. The precipitate may be filtered off after some time, washed with methylated spirit, and dried at 100° C.; it can be analysed in the manner described. Results obtained from the analysis of different materials by all the methods described, with and without separation of the carbonyl ferrocyanide, are given and show the comparative value of the methods. The Knublauch method is readily carried out and is of sufficient accuracy for use in the control of the working of a ferrocyanide plant. The most accurate results are obtained by Feld's process of determination of the hydrocyanic acid and it should be employed for the valuation of trade samples. The iron method invariably gives higher results with crude products and should only be used in the case of comparatively pure crystals.

In the discussion it was pointed out by Lessing that the irregularities in the copper method were due to the colloidal nature of the precipitate. By adding the maximum amount of electrolyte required, the complete precipitation of the copper hydrogel was attained very rapidly. A qualitative test for the discrimination of ferrocyanide, carbonyl ferrocyanide, and thiocyanate in mother liquors was a spot reaction on filter paper with ferric chloride.—R. L.

Calcium phosphates; Action of ammonium citrate on ——. A. Barillé. Ann. Chim. Analyt., 1908, 13, 264—266.

It is considered by many that ammonium citrate solution can be employed to separate the di- and tri-calcium phosphates. Grupe and Tollens in 1881 (Ber., **13** and **14**) stated that both salts were soluble in this liquid. The author finds that 100 c.c. of neutral ammonium citrate solution dissolves 4·1 grms. of hydrated dicalcium phosphate or 1·4 grms. of dry tricalcium phosphate. The solubilities of the salts are affected by the degree of hydration, the calcined salts being insoluble. He concludes, therefore, that ammonium citrate solution cannot be used to distinguish between these salts. The author shows too that the solution of dicalcium phosphate in ammonium citrate yields definite crystals of two ammonio-calcium citrophosphates on evaporation on the water-bath and at room temperature respectively. —R. L. S.

Fluorspar; Occurrence and commercial uses of ——. W. M. Egglestone. Trans. N. Engl. Inst. Mining and Mech. Eng., 1908, 58, 204—236.

Government returns show that the output of fluorspar in England during the year 1873 was nil, and that during the following twenty-seven years 1000 tons per annum was only twice exceeded. The figures for the succeeding years are as follows:—

Year.	Weardale.	United Kingdom.		United States.
		Quantity.	Value.	
	Tons.	Tons.	£.	Tons.
1901	3,309	4,214	2,226	19,586
1902	4,990	6,287	3,486	48,018
1903	5,591	11,911	8,538	42,523
1904	4,435	18,160	15,464	36,452
1905	4,989	39,446	19,557	57,385
1906	14,165	41,849	20,023	40,796

Fluorspar is usually found in metalliferous veins producing galena. The paper goes on to give some account of the uses of fluorspar as a flux in metallurgy, of its characteristics, and of its occurrence in Weardale and elsewhere.—W. S.

Lithium chloride; Method of separating —— *from alkali chlorides and from barium chloride.* L. Kahlenberg and F. C. Krauskopf. J. Amer. Chem. Soc., 1908, **30**, 1104—1115.

The method proposed is based on the fact that sodium, potassium, rubidium, cæsium, and barium chlorides are practically insoluble in pyridine containing less than 5 per cent. of water, whilst lithium chloride is quite soluble even in pure pyridine. Consequently, lithium may be separated directly and completely from the other alkalis or from barium by treating the chlorides with pyridine. The procedure is as follows:—An aqueous solution, containing not more than 2 grms. of the mixed chlorides, is evaporated to dryness, and the residue is treated with about 25 c.c. of pyridine at a boiling temperature for a few minutes, any large pieces being broken up by means of a stirring rod. After settling, the clear solution is decanted on to a small filter, and the residue is washed twice with small quantities of hot pyridine. The residue is then dissolved in water, again evaporated to dryness, and the extraction with pyridine repeated. The united filtrates are evaporated, and the lithium chloride thus obtained is converted into lithium sulphate, and weighed. The filter may then be washed with water, the washings being received in the beaker containing the residue of chlorides insoluble in pyridine, and, after evaporating the solution to dryness, these chlorides may be weighed. In cases where the amount of lithium chloride is small as compared with the quantity of other chlorides present, it is advisable to make a third extraction with pyridine. —W. P. S.

Strontium salts ; Preparation of —— free from barium. H. Caron and D. Raquet. Répert. Pharm., 1908, 20, 241—245.

Barium is almost invariably present in the so-called pure commercial salts of strontium. Of 50 samples recently examined only 5 were pure ; 6 contained more than 1 per cent. of barium, and 6 more than 2 per cent. The official method of the Codex Supplement is not satisfactory for the preparation of strontium salts free from this impurity ; the following process gives better results. Commercial strontium nitrate is dissolved in 10 times its weight of distilled water and the solution is treated with one-tenth of its volume of 3 per cent. normal potassium chromate solution. After standing for 24 hours, the barium chromate is filtered off, and the filtrate, which should have a distinct yellow tint, is gradually added, with constant agitation, to an excess of a 10 per cent. solution of sodium carbonate. The precipitated strontium carbonate is washed by decantation, collected, and dried. From it salts may be prepared by solution in the requisite acids.

The following method for testing strontium carbonate for the presence of barium is more delicate than that prescribed in the Codex. A slight excess of the dry carbonate is added to 10 c.c. of 10 per cent. solution of hydrochloric acid ; after filtration, the volume is made up to 20 c.c. with distilled water ; 2 c.c. of 3 per cent. normal potassium chromate solution are then added. No precipitate should be formed, even after the lapse of several hours.—J. O. B.

Silver chloride ; Solubility of —— in mercuric nitrate solution. B. H. Buttle and J. T. Hewitt. Chem. Soc. Proc., 1908, 24, 173.

The authors have studied the solubility of silver chloride in solutions of mercuric nitrate at 25° C., using variable concentrations of mercuric nitrate, nitric acid, silver nitrate, and hydrochloric acid. Alteration in the concentration of the nitric acid, the other components remaining constant, has the effect of slightly increasing the precipitation of silver chloride. From the results obtained when only the silver nitrate or hydrochloric acid is varied, the concentration of the other three components remaining unchanged, the authors arrive at the same conclusion as Morse, that when mercuric nitrate is present in large excess, chlorine only occurs as $HgCl^{\cdot}$ ions.

Antimony sulphide ; Rapid method for obtaining Schlippe's salt for the preparation of golden ——. A. Sartorius. Apoth.-Zeit., 1908, 23, 342.

One hundred and four grms. of quicklime are suspended in 320 c.c. of water, and the mixture is poured into a boiling solution of 280 grms. of sodium carbonate in 1000 c.c. of water. Meanwhile, an intimate mixture of 144 grms. of black sulphide of antimony, 28 grms. of sulphur, and 50 c.c. of water is prepared by rubbing the ingredients together in a mortar. This is added, in small portions at a time, to the boiling solution of sodium hydroxide. The reaction is completed in about 15 mins. ; the insoluble precipitate is filtered off, and the filtrate evaporated to crystallisation. The Schlippe's salt thus obtained is purer than that produced by the ordinary method, and the time occupied is much shorter. From it, golden sulphide of antimony is obtained in the usual manner.—J. O. B.

Titanous iodide, TiI_2 ; A new iodide of titanium. E. Defacqz and H. Copaux. Compt. rend., 1908, **147**, 65—67.

Titanium tetra-iodide was prepared by Hautefeuille by the action of gaseous hydrogen iodide on titanium tetrachloride. When its vapour is heated with mercury vapour in a current of hydrogen, the di-iodide and mercury iodide are formed. The titanium tetra-iodide and mercury are placed in separate boats in a porcelain tube, so that the mercury is nearest the entrance, and a current of hydrogen passed over them. When the air has been replaced, the tube is heated to a dull red heat. After cooling, the titanous iodide is found as a crystalline deposit not far from the boat which had contained the tetra-iodide. It is infusible and non-volatile, has the sp. gr. 4·3, and does not dissolve in organic solvents. It is reduced by hydrogen at a white heat but not at a dull red heat : in the former case it leaves a residue of amorphous titanium which is easily oxidised. Chlorine transforms it into chloride ; oxygen, at a temperature much below a dull red heat, converts it into iodine and titanic acid. Water and alkalis decompose it ; it forms an addition compound with ammonia. Nitric and sulphuric acids in the cold liberate iodine. To analyse it the titanium iodide is heated in a current of air, and the iodine liberated absorbed in sulphuric acid and estimated as silver iodide. The residue of titanium oxide is also weighed.—E. F. A.

Titanium nitride and a new class of titanium compounds, titanium halogen-nitrides. O. Ruff and F. Eisner. Ber., 1908, **41**, 2250—2264.

The authors find that the so-called titanium nitride of formula, Ti_3N_4, described by Wöhler (Annalen, 1850, **73**, 43), Friedel and Guérin (Ann. Chim. Phys., 1876, **8**, 24) and others, and the "nitride A" of Schneider (Z. anorg. Chem., 1895, **8**, 88), consist mainly of the nitride, TiN, of trivalent titanium, contaminated by titanium dioxide and *titanium chloronitride*, TiClN. If these products be heated more strongly in a current of ammonia, they are converted into pure titanium nitride, TiN. On treating the tetrachloride or tetrabromide of titanium with liquefied ammonia, and washing the reaction products with the latter, no titanium amide or imide is obtained, but compounds which contain at least 1 atom of halogen (or the corresponding quantity of oxygen) for each atom of titanium, and which are converted, on heating, into the corresponding titanium halogen-nitrides. The latter are extremely sensitive to moisture, and, when heated strongly, decompose into titanium nitride, titanium tetrachloride or tetrabromide, and nitrogen.—A. S.

Patents.

Filtering material ; Process and apparatus for [continuously] renewing the —— in filters [for sulphurous gases] from roasting furnaces. F. Benker and E. Hartmann. Fr. Pat. 387,456, Feb. 22, 1908.

Sulphurous gases from roasting furnaces (pyrites kilns, etc.) are deprived of the dust they carry, before they reach the Glover tower, by passing them horizontally through vertical filters composed of pieces of firebrick or stone contained between vertical perforated walls. The bottom of the filtering column rests on a rotating roller, which continuously carries away a small quantity of the filtering material to a rotating drum, in which it is deprived of the dust with which it is laden. It then falls into a receptacle, from which a conveyor elevates it to a pipe which returns it to the top of the filtering column.—A. G. L.

Sodium carbonate ; Manufacture of ——. J. F. Griffeuille. Fr. Pat. 387,246, Feb. 17, 1908.

Sodium sulphide is treated with carbon dioxide, in the presence of a little water. Sulphuretted hydrogen is evolved, and a mixture of sodium carbonate and bicarbonate obtained.—F. Sodn.

Caustic potash and soda from volcanic minerals ; Manufacture of ——. F. Schäcke. Ger. Pat. 198,481, Nov. 17, 1905.

Eruptive minerals such as liparite, quartz-porphyry, syenite, trachyte, pantellerite, andesite, phonolite, nepheline-syenite, nepheline-basalt, leucite-basalt, porphyrite, etc., are finely-ground and mixed with a quantity of finely powdered quicklime in slight excess over that corresponding to their content of potash and soda. The mixture is heated with water for a long time under atmospheric or increased pressure. The mass is then allowed to stand and the solution of caustic soda and potash removed by pressing. Except in the case of well weathered minerals, it is preferable to work under increased pressure.—A. S.

Salt ; Melting and purifying of ——. New Salt Syndicate, Ltd., London, and E. R. Royston, Liverpool. Eng. Pat. 12,110, May 25, 1907.

Rock salt is melted in a horizontal furnace upon a number of trays or carriers, preferably in echelon arrangement with considerable spaces between the shelves. The heating gases are introduced into the chamber above the furnace bed and act directly upon the surface of the salt to be fused, the molten salt being collected either on the imperforate bed of the furnace, or in a well directly connected with it. The raw material is supplied to the furnace at a number of points along the surface of the trays. The salt thus forms a number of heaps, uniformly heated by the furnace gases, and as the material melts and flows down to the collecting bed, fresh salt is supplied as required through conduits in the roof. The trays or carriers are made of firebrick and provided with raised edges, with openings at suitable points, so arranged that the fluid salt flows out, but solid impurities are retained. The impurities are subsequently removed by scraping. In a modified form of the apparatus, there is only one continuous platform, slightly inclined to cause drainage of the molten salt to the furnace bed. The floor of the latter inclines away from the tap-hole, so that the heavier impurities gravitate to the lower part of the bed, away from the tap-hole, and only the pure molten salt above is tapped.—O. R.

Basic ferric sulphate ; Method of manufacturing ——, *and apparatus therefor.* W. Crowther, Upper Birstall, Yorks. Eng. Pat. 13,946, June 17, 1907.

Copperas (ferrous sulphate) is charged into a cylindrical iron drum provided with a man-hole, an outlet for steam and air, and a hollow perforated central shaft. The drum is revolved slowly, and air, heated in a coil above a furnace placed close to the drum, is passed in through the hollow shaft at such a rate that the ferrous salt oxidises and loses its water of crystallisation without liquefying. The volume of air passed in is then increased, the drum is rotated more rapidly and heated by the hot products of combustion from the furnace, a loose roller being also introduced through the man-hole to powder the salt. The process is stopped when the product has acquired a red colour. Two drums are preferably worked alternately with one furnace.—A. G. L.

Ammonia and chlorine or hydrochloric acid ; Process for the production of ——. N. L. G. Whitehouse, London. Eng. Pat. 15,140, July 1, 1907.

Ammonium chloride, preferably though not necessarily in the dry state, is heated to about 300° C. with one or more of the oxides, or oxychlorides, of cerium, thorium, didymium, lanthanum, or yttrium, whereby ammonia is given off and chlorides of the earth or earths used are formed. The latter are then heated to 450°—500° C. in air or steam, to cause evolution of chlorine or hydrochloric acid, and regeneration of the rare earth or earths employed.—O. R.

Cyanides ; Process of purifying ——. Soc. pour l'Utilisation de l'air et ses dérivés. Fr. Pat. 387,144, April 29, 1907.

Crude products containing cyanides are treated with gases containing carbon dioxide, whereby hydrogen cyanide is liberated. The gases are then passed in succession through a number of vessels containing the crude cyanide, until the carbon dioxide is completely absorbed, and the effluent gas contains only hydrogen cyanide and inert gases. If it be desired to prepare alkali cyanides, hydrogen cyanide thus obtained is absorbed in a solution of alkali in an alcohol, preferably amyl alcohol.—A. S.

Cyanides and cyanamides ; Production of ——. Badische Anilin und Soda Fabrik. Fr. Pat. 387,001, Feb. 7, 1908. Under Int. Conv., Mar. 30, 1907.

The compounds of nitrogen and titanium, such as the nitride and cyanonitride, when heated with the oxides or salts of the alkali or alkaline-earth metals, in the presence of carbon, with or without the addition of a flux, give cyanides or cyanamides of these metals. Some form of carbon itself may be used in the process, or some compound containing it, such as a gas from which carbon is readily deposited. For example, by melting 100 kilos. of titanium cyanonitride, for half an hour at a red heat, with 160 kilos. of calcined sodium carbonate and 10 kilos. of lampblack, the nitrogen is converted into sodium cyanide, or, by heating a mixture of 120 kilos. of quicklime, 240 kilos. of anhydrous calcium chloride, 40 kilos. of titanium cyanonitride, and 10 kilos. of lampblack, to a yellow heat for 15 minutes, calcium cyanamide and a little cyanide are obtained. One advantage of the process is that the titanium may afterwards be readily converted into the nitride or cyanonitride again.—F. Sodn.

Nitrogen compounds and compounds of nitrogen with titanium ; Production of ——. [*Utilisation of atmospheric nitrogen.*] Badische Anilin und Soda Fabrik. Fr. Pat. 387,002, Feb. 7, 1908. Under Int. Conv., Mar. 9 and Aug. 30, 1907, and May 13 and May 18, 1907.

The nitrogen present in such titanium compounds as the nitride and cyanonitride, is quantitatively converted into ammonia by most of the ordinary oxidising agents, or by heating with acids, in the presence of water or steam, under suitable conditions. For example, when titanium cyanonitride is boiled with ten times its weight of strong sulphuric acid, oxidation is complete in 15—30 minutes, the nitrogen being converted into ammonium sulphate. The proportions and conditions may vary within very wide limits, and other examples are given in the specification, but the temperature employed must not be high enough to oxidise the ammonia to nitrogen. A special case is that of titanium cyanonitride impregnated with 2—3 per cent. of platinum, which, when heated to 300°—400° C., in a current of air and steam, is rapidly oxidised, some of the ammonia formed being converted into oxides of nitrogen by the catalytic action of the platinum, in the presence of an excess of oxygen. In these processes of oxidation, titanic acid is formed and, when heated with carbon and the salt of an alkali metal, absorbs nitrogen at a comparatively low temperature. For instance, a mixture of 80 kilos. of titanic acid, 20 kilos. of wood charcoal, and 2 kilos. of sodium sulphate, requires heating in a current of nitrogen for 2 hours at about 1240° C.—F. Sodn.

Sodium hydrosulphite ; Manufacture of hydrated crystallised ——. Badische Anilin und Soda Fabrik. Fr. Pat. 387,541, May 8, 1907.

A slightly alkaline solution of sodium hydrosulphite is evaporated *in vacuo* at a temperature not exceeding 48° C. The temperature at first should be about 38° C., and be increased finally to about 45° C. The evaporation is stopped while there is still a considerable quantity of liquor left.—A. G. L.

Kieserite ; Conversion of —— *into a product readily soluble in water.* W. Hüttner. Ger. Pat. 198,496, April 9, 1907.

Kieserite, $MgSO_4,H_2O$, contaminated with potassium salts, obtained as a by-product in the production of crude potassium salts, is further hydrated and thus rendered soluble, by grinding it to a fine powder in presence of water.—A. S.

Hydrogen ; Method and apparatus for the commercial production of ——. H. Lane and G. Monteux. Fr. Pat. 386,991, Feb. 7, 1908.

Pure or nearly pure hydrogen, suitable for aeronautical purposes, is produced by the action of steam on red hot iron, the process, in this patent, being made a continuous one. Finely divided iron is contained in a series of vertical retorts, heated externally by gas, in combination with a regenerative system. The retorts are so connected, that a current of steam passes through some, while the iron oxide, already formed, is being reduced in others, by a stream of reducing gas sent in the opposite direction. Oxidation and reduction thus take place alternately, oxidation being found to occupy only half the time of reduction. The hydrogen produced is cooled and then purified, to remove traces of carbon dioxide, etc. The reducing gas is made in a generator and, by introducing an excess of steam, it becomes rich in hydrogen. The carbon dioxide, formed during reduction, is recovered from the gases leaving the retorts, after cooling, and the excess of reducing gas is utilised, with the gas from a producer, for heating the retorts. After repeated use the iron becomes inactive, owing to an accumulation of impurities, but these are burnt away by the occasional admission of air, which rapidly restores the efficiency of the iron.—F. Sodn.

Sulphur; Process for the recovery of —— by the oxidation of sulphuretted hydrogen. W. Feld. Fr. Pat. 387,438, Feb. 21, 1908. Under Int. Conv., Mar. 6, 1907.

Almost complete interaction between sulphur dioxide and sulphuretted hydrogen may be obtained by bringing them together in the presence of a liquid capable of dissolving the liberated sulphur. Oils resulting from the destructive distillation of organic matter are suitable for this purpose and especially the heavy oils obtained from coal tar. The bases, which they contain, assist the process by forming intermediate compounds which dissociate, and as these bases become fixed by the accumulation of small quantities of sulphuric acid, it becomes necessary to add suitable inorganic bases or salts, such as sodium carbonate, in order to liberate them. After the addition of coal tar bases and sodium carbonate, the heavy oil is warmed to 40° C. and the mixed gases are passed through, some excess of sulphur dioxide being maintained. The oil becomes heated by the reaction and, when the amount of sulphur reaches 50—60 per cent., the bath is allowed to cool, and the crystallised sulphur separated centrifugally. Adhering oil is removed by washing with steam, and the precipitated sodium sulphate is dissolved out by the condensation water. Pure sulphur is thus obtained. If ammonia be present in the gases, the bath is kept slightly acid.—F. Sodn.

Oxides of nitrogen diluted with air; Process for the recovery of ——, and apparatus therefor. A. A. Naville, P. A. and C. E. Guye, Geneva. Eng. Pat. 6155, March 19, 1908. Under Int. Conv., March 20, 1907.

See Fr. Pat. 385,569 of 1907; this J., 1908, 627.—T. F. B.

Nitric acid; Process of producing concentrated ——. B. F. Halvorsen, Christiania. U.S. Pat. 892,516, July 7, 1908.

See Fr. Pat. 363,157 of 1906; this J., 1906, 847.—T. F. B.

Calcium and ammonium nitrates and other substances; Process of utilising peat in the production of ——. A. Müntz and A. C. Girard, Paris. Eng. Pat. 16,162, July 13, 1907. Under Int. Conv., July 18, 1906.

See Fr. Pat. 377,711 of 1906; this J., 1907, 1100.—T. F. B.

Ammonium chloride; Process of producing ——. E. Naumann, Cologne, Germany. U.S. Pat. 892,178, June 30, 1908.

See Fr. Pat. 378,445 of 1907; this J., 1907, 1138.—T. F. B.

Sodium hydrosulphite; Process of dehydrating ——. A. Schmidt, Assignor to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on the Maine, Germany. U.S. Pat. 892,186, June 30, 1908.

See Eng. Pat. 11,565 of 1906; this J., 1907, 527.—T. F. B.

Peroxide of potassium; Manufacture of ——. G. F. Jaubert, Paris. U.S. Pat. 892,842, July 7, 1908.

See Eng. Pat. 7641 of 1907; this J., 1907, 1008.—T. F. B.

Cyanide briquettes; Process for making resistant, stone-hard ——. Chem. Fabr. Schlempe Ges. m. b. H. Fr. Pat. 386,997, Feb. 7, 1908. Under Int. Conv., April 27, 1907.

See Eng. Pat. 18,096 of 1907; this J., 1908, 628.—T. F. B.

Hydrogen; Process and apparatus for the manufacture and purification of ——. G. F. Jaubert, Paris. Eng. Pat. 25,215, Nov. 13, 1907. Under Int. Conv., Nov. 14, 1906.

See Fr. Pat. 381,605 of 1906; this J., 1908, 152.—T. F. B.

VIII.—GLASS, POTTERY, AND ENAMELS.

Patents.

Glass-furnace. R. H. Miller, Assignor to Christy Fire Clay Co., St. Louis, Mo. U.S. Pat. 892,379, June 30, 1908.

The glass furnace is provided with an outlet discharging into a settling basin. To this basin are connected both ends of a continuous covered duct or channel; the outer wall of this duct is expanded into a number of pockets, for each of which openings are provided in the cover of the duct.—A. G. L.

Amalgam for use in coating glass to form mirrors. J. Laval, Allegheny, Pa. U.S. Pat. 892,435, July 7, 1908.

The amalgam consists of 5 parts of antimony, 20 of lead, 20 of tin, and 15 of mercury.—A. G. L.

Enamel; Manufacture of ——. H. W. Lake, London. From Chem. Fabrik Güstrow, Güstrow, Germany. Eng. Pat. 12,583, May 30, 1907.

White clouded enamels are obtained by melting and grinding ordinary enamels as usual, and then adding 5 or 10 per cent. of artifically produced titanates or zirconates of metals of the alkaline-earth or earth groups, or of zirconium oxide alone. Any yellowish colour may be neutralised by adding copper oxide or cobalt oxide to the enamel before fusing.—A. G. L.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Patents.

Plaster casts; Utilisation of old —— and of hydrated sulphate of lime. E. Latham, Ruabon. Eng. Pat. 14,452, June 22, 1907.

Old plaster casts are heated to about 100° C. in a slow current of air until all the free and combined water has been driven off, after which the material is finely ground and mixed with about 5 per cent. of its weight of fresh plaster. (Reference is directed to Eng. Pats. 9528 of 1885, and 8475 and 13,198 of 1894; this J., 1894, 888; 1895, 483.)—O. R.

Plaster; Method of retarding the setting of ——. H. Mendheim. Ger. Pat. 198,100, May 5, 1907.

From 0·1 to 1 per cent. of an alkali phosphate, alone or mixed with other salts, is added to the plaster.—A. S.

Marble and stone blocks and slabs; Artificially produced —— for building and other purposes. T. M. Thom, Cheshunt, Herts. Eng. Pat. 15,667, July 8, 1907.

Composite blocks are obtained by lining the sides of moulds with fine concrete, as used in the manufacture of ordinary artificial marble, and then filling up the interior with waste stone chippings or slag mixed with lime. A hollow removable core may also be used. The whole block is finally moistened with water and carbonated by means of carbon dioxide gas under pressure.—A. G. L

Wood; Vulcanising and colouring ——. W. A. Hall, New York. Assignor to American Mahogany Co., Maine. U.S. Pat. 891,987, June 30, 1908.

Wood is coloured and "vulcanised," by first drying it thoroughly, then subjecting it to a vacuum, and forcing an alkaline solution, containing "ammonium hydroxide" and sodium hydroxide, into it under high pressure, the wood being finally boiled in this solution.—A. G. L.

Coloured wood; Process for rendering the colour of —— fast. G. von Rigler. Ger. Pat. 195,746, Feb. 8, 1906.

The wood is coloured with a solution of the dyestuff in a liquid which dissolves resinous bodies, and after drying, is impregnated with a solution of vegetable, animal, or mineral fats in benzine or similar liquid, the solvent being subsequently removed by a current of air or other inert gas.—A. S.

Combustible materials, especially wood and analogous substances; Process for fireproofing ——. S. Gousseff. Fr. Pat. 387,135, Feb. 11, 1908.

See Eng. Pat. 3368 of 1908; this J., 1908, 751.—T. F. B.

Wood, especially railway sleepers; Process for preserving —— by impregnation. W. Brase. Fr. Pat. 387,535, Feb. 25, 1908.

The wood is first impregnated in the usual manner with an aqueous solution of an antiseptic agent, *e.g.*, a zinc salt or a fluoride, the liquid being heated if necessary. The wood is then further impregnated with tar heated to a temperature not exceeding 100° C., a pressure of 6—8 atmospheres being applied for 2 or 3 hours.—A. G. L.

Refractory and insulating material; New ——. P. Marcellot. Fr. Pat. 387,511, Feb. 24, 1908.

Black or red flint is washed, calcined, quenched in water, fused in an electric furnace, and cast into the required shape in moulds of argillaceous sand. Sand, gelatinous silica, or kieselguhr may be substituted for the flint. —A. G. L.

Solid bodies [abrasive materials]; Preparation of ——. Gebr. Siemens und Co. Ger. Pat. 197,278, May 19, 1907. Addition to Ger. Pat. 182,445.

According to the main patent, electric conductors were prepared by mixing metallic powders with charcoal, moulding the mixture, and then heating the articles in an indifferent or reducing atmosphere. It is now found that by replacing the whole or part of the charcoal by carborundum, emery, or the like, abrasive materials are obtained.—A. S.

Clay ware; Manufacture of dense, strong ——. H. Putz. Ger. Pat. 198,840, Sept. 29, 1907.

In the preparation of refractory clay goods, materials such as fireclay, quartz, graphite, etc., are added to the clay, the products having a structure corresponding to that of the substance added. It has been found that products having a structure similar to that produced by the addition of graphite can be obtained by the use of fireclay, if the latter be added in the form of thin flakes. Such "laminated fireclay" is produced by drying the clay, powdering and sifting it, and then passing it in a moistened condition between rollers, so as to obtain a band or ribbon of the thickness of paper. This band is cut into flakes of a suitable size, which are burnt, and then added to the clay mass from which the desired articles are to be prepared. Goods prepared in this manner are stated to be very resistant to cracking.—A. S.

Sand suitable for the preparation of mortar; Process for obtaining —— from the residue produced in working up kaolin. E. Lemcke. Ger. Pat. 197,170, Dec. 5, 1906.

The residue obtained in the working up of kaolin is dried, and then freed from dust by suitable mechanical means.—A. S.

[Collos] Cement; Manufacture of hydraulic and like ——. Collos Portland Co., Ltd., London. From H. Colloseus, Berlin. Eng. Pat. 25,795, Nov. 21, 1907.

Finely ground natural gypsum is added to Collos cement (see Fr. Pat. 356,276 of 1905; this J., 1905, 1307), which is poor in lime, for the purpose of lowering the setting time. Slaked lime, on the other hand, is added to increase the setting time. An addition of about 1 per cent. is made in either case.—A. G. L.

X.—METALS AND METALLURGY.

Brass; Regulations, dated June 20, 1908, *made by the Secretary of State for the casting of* ——. Statutory Rules and Orders, 1908. No. 484.

The regulations are identical with the draft regulations printed in the July 31st, 1908, issue of the Journal (p. 753). The dates (for which blanks were left) are, in the fourth line of the preamble, January 1st, 1910; and in Part I., 1 (*a*), January 1st, 1908.

Steel; Determination of nickel and chromium in ——. E. D. Campbell and W. Arthur. J. Amer. Chem. Soc., 1908, **30**, 1116—1120.

The method described is a modification of the cyanide-iodide process, sodium pyrophosphate being used to keep the iron in solution, and the following details as to procedure are given as yielding the most satisfactory results. One grm. of the steel is dissolved in from 10 to 15 c.c. of nitric acid (sp. gr. 1·2), and the solution is then heated with sulphuric acid until fumes of the latter are given off. From 30 to 40 c.c. of water are added, the mixture is heated to dissolve the ferric sulphate, and then filtered to remove silica or carbon. To the sulphuric acid solution, which should measure about 70 c.c., are added 13 grms. of sodium pyrophosphate previously dissolved in 70 c.c. of warm water. The mixture is cooled to the ordinary temperature, and dilute ammonia (1 : 1) is added drop by drop, with vigorous stirring, until the greater portion of the ferric pyrophosphate has dissolved and the solution has assumed a greenish coloration. At this point, the solution should have an alkaline reaction towards litmus, but not smell of free ammonia. The solution is again cooled, 5 c.c. of a 0·05 per cent. solution of silver nitrate are added, followed by 5 c.c. of a 2 per cent. solution of potassium iodide. A standard solution of potassium cyanide is now run in until the clearing up of the solution shows that the nickel and silver have been converted into the corresponding double cyanides. A correction is made for the amount of potassium cyanide required for the 5 c.c. of indicator (silver iodide) used. The solution of potassium cyanide is standardised by titration with *N*/10 solution of silver nitrate. Each c.c. of *N*/10 potassium cyanide is equivalent to 0·002935 grm. of nickel. Samples of nickel steel containing copper must be dissolved directly in 25 c.c. of water to which are added 5 c.c. of sulphuric acid (sp. gr. 1·84). The copper remains undissolved and is filtered off. The ferrous sulphate in the filtrate is then oxidised by the addition of hydrogen peroxide, the excess of the latter is expelled by boiling, and the nickel in the solution is then determined as described above. In the case of chrome-nickel steels, the sample is dissolved and converted into sulphate; after diluting with water, the solution is boiled, and a 2 per cent. solution of potassium permanganate is added drop by drop until a slight permanent precipitate of manganese dioxide is obtained. The solution is then cooled, filtered, the filtrate evaporated to a volume of about 60 c.c., sodium pyrophosphate added, and the determination carried out as described. The chromium may also be determined in the same portion of the sample as that used for the nickel. After the oxidation with permanganate, the clear filtrate is treated with a weighed amount (0·7 grm.) of ferrous-ammonium sulphate, and the excess of the latter is titrated with a standard solution of potassium permanganate, using drops of potassium ferricyanide as an external indicator. The chromium is then again oxidised by the addition of permanganate, and the determination of the nickel is proceeded with.—W. P. S.

Nickel in nickel-steel and nickel-chrome-steel ; Determination of —— with dimethylglyoxime. H. Wdowiszewski. Stahl u. Eisen, 1908, **28**, 960—961. (Compare this J., 1907, 643, 1217 ; 1908, 284).

The drying of the nickel-oxime precipitate in a Neubauer crucible is unnecessary. The filter containing the washed precipitate is folded, without drying, so that the point of the filter is surrounded by the clean outer part, and the whole is folded in a second wet filter paper. The filters are then incinerated slowly in a platinum or porcelain crucible. In the analysis of a steel, the iron and manganese are separated before the nickel is precipitated. —A. T. L.

Tungsten ; Determination of —— in steel in presence of chromium. G. von Knorre. Stahl u. Eisen, 1908, **28**, 984—988.

The author agrees essentially with Hinrichsen's objections to his benzidine method for tungsten if chromium is present (this J., 1905, 292 ; 1908, 229). He has now modified it as follows : From 1·5 to 6 grms. of the steel are boiled with hydrochloric acid until no more metal is dissolved. The liquid is nearly neutralised with a strong solution of sodium carbonate, cooled to 15° C., and 8—10 c.c. of $N/10$ sulphuric acid and 30—60 c.c. of a solution of benzidine chloride (containing 20 grms. of benzidine dissolved in 25 c.c. of fuming hydrochloric acid per 1 litre of water) are added. The sulphuric acid is added merely to give an easily filtered precipitate of benzidine sulphate ; the benzidine precipitates the traces of tungsten which may have been dissolved. After standing for 20 minutes in the cold, the insoluble residue and precipitate are filtered off, washed with a dilute solution of benzidine, and ignited. The oxides obtained are fused with sodium carbonate, the melt is extracted with water, and the insoluble ferric oxide filtered off and washed with a very dilute solution of sodium carbonate. Methyl orange is added to the filtrate, which may then be treated in one of two ways : (A) The liquid is acidulated with hydrochloric acid and boiled for 1 or 2 minutes to precipitate the greater part of the tungsten as metatungstic acid. After cooling, the chromic acid is reduced by means of sulphur dioxide, an excess of the benzidine solution is added, and the precipitate is filtered off after standing a short time, washed with dilute benzidine solution, and ignited to oxide. (B) The liquid is exactly neutralised with hydrochloric acid, 8—10 c.c. of $N/10$ sulphuric acid and about 0·4 grm. of hydroxylamine hydrochloride are added, followed immediately by an excess of the benzidine solution. The hydroxylamine prevents the oxidising action of the chromic acid on benzidine, but the latter must be added before the chromic acid is reduced. The precipitate is treated as above. The results obtained by either modification are excellent. —A. G. L.

"*Battery chips*" ; *Assay of* ——. L. J. Wilmoth. J. Chem., Met., and Min. Soc., S. Africa, 1908, **8**, 343—345.

In the discussion on Wilmoth's paper (this J., 1908, 407), H. R. Jolly described a method for assaying battery chips which was used at the Robinson Deep Mine. Instead of producing a matte the material is fluxed direct with a mixture containing sodium bisulphate, sodium carbonate, borax, silica, litharge, and nitre, a high temperature being employed. When fusion is complete, a wash of 40—60 grms. of litharge is added, and the pots left for twenty minutes, after which they are poured. The presence of bisulphate is stated to result in complete and ready removal of the iron, all of which is retained by the slag, the lead button breaking away from it without difficulty and being soft and malleable. A higher assay result is claimed for this method.—F. R.

Steel plates ; Pickling of thin ——. B. Clement. Stahl u. Eisen, 1908, **28**, 937—944.

The author employs a pickling tank made of cast lead, 25 mm. thick, or of sheet lead, 8 mm. thick, encased in a shell of 10 mm. sheet iron well coated with tar. The shell is formed by plates screwed to angle irons at the corners of the tank, and any plate can be removed for repairing the lead where damaged. The tank is covered by a light iron hood, coated with tar, and the acid fumes and sulphuretted hydrogen are drawn off to a flue, into which water is sprayed. The hood is provided with a hinged lid for introducing and withdrawing the plates. The author's experiments show that in pickling plates for tinning or for galvanising, blistering is reduced to a minimum when the strength of the acid is 13° B. and the temperature about 80° C. The pickling is then finished in one minute. This process is only suitable where machines are used for raising and lowering the plates and moving them about in the bath.—A. T. L.

[Cyaniding] The Adair-Usher process. A. Adair. J. Chem., Met., and Min. Soc., S. Africa, 1908, **8**, 331—340.

The author describes at length, the original experiments which led to the introduction of the Adair-Usher process. The process consists mainly in the addition of umber to slimes before cyaniding, and in the use of a special decantation plant, in which the cyanide solution is delivered at the bottom of the tank and overflows at the top, where it is caught and returned continuously. A series of experiments was tried both on the slimes as they were produced, and on accumulated slimes, a duplicate being run in each case, under exactly the same conditions but without the addition of umber. Eight sets of curves are given showing the percentage extraction and cyanide consumption throughout the tests. In each case the charge to which umber had been added showed a more rapid and better extraction, with a smaller cyanide consumption. A slight excess of lime was added in each experiment, to neutralise the acidity in the slimes. On account of the high extraction obtained, the author proposes that the whole of the ore should be slimed in the first instance, and treated directly by the process. He describes a modification of the plant suitable for treating slimes containing a certain proportion of coarser material. In the discussion following, G. Melvill stated that large scale experiments had been carried out on the Crown Reef Mine, but that equally good results had been obtained on that ore without the addition of umber. —F. R.

Silver ore treatment in Mexico ; Some features of ——. W. A. Caldecott. J. Chem., Met., and Min. Soc., S. Africa, 1908, **8**, 266—270.

The primary reaction in the dissolving of silver sulphide from its ores may be taken as :

$$Ag_2S+4NaCN=2NaAg(CN)_2+Na_2S.$$

After, however, a certain amount of silver has been dissolved, depending upon the proportions of cyanide and soluble sulphide, an equilibrium is established and solution ceases. The quantity of silver sulphide dissolved as the soluble double cyanide is approximately proportional to the amount of cyanide present, but even with 0·5 per cent. solutions the quantity of dissolved silver is less than 0·5 oz. per ton of 2000 lb. The introduction of soluble sulphide into an argentiferous cyanide solution, by the addition of a free alkali or otherwise, results in the precipitation of silver. The fact that dissolved silver and other than very small amounts of sodium sulphide cannot exist simultaneously in the same solution explains why working solutions do not show more than traces of the latter when sulphide ores are being treated. With solutions low in silver it is difficult to filter off the very finely divided suspension or colloidal precipitate of silver. The following secondary reactions are found to take place :—

$$(a)\ \begin{cases} 2Na_2S+2O_2=Na_2S_2O_3+Na_2O \\ Na_2S_2O_3+Na_2O+2O_2=2Na_2SO_4 \end{cases}$$

$$(b)\quad Na_2S+NaCN+O=NaCNS+Na_2O$$

$$(c)\left\{\begin{array}{l}Na_2S+PbO=PbS+Na_2O\\ PbS+NaCN+O=NaCNS+PbO.\end{array}\right.$$

These reactions all involve the absorption of oxygen, which in practice is brought about by lengthy agitation in the vats. The first reaction, resulting in the production of sodium thiosulphate, which is a silver solvent, represents the most desirable result of aeration. The silver requires nearly its own weight of sodium cyanide to dissolve it, so that the consumption from this cause alone with 500 grm.-silver ore would be nearly a pound of sodium cyanide per ton. This, as one of the sources of high cyanide consumption experienced with silver ore, renders the cyanide regeneration processes more promising in Mexico than with South African banket gold ores. When silver sulphide is agitated in a cyanide solution with barium dioxide or with air under 100 lb. pressure, considerably more silver is dissolved than in absence of these oxidising agents. A solution of lead plumbite containing 1·95 per cent. of lead oxide, prepared by dissolving precipitated lead hydroxide in caustic soda solution, when added to the cyanide solution prevents the precipitation of silver, and so facilitates the solution of silver sulphide in spite of the concurrent formation of soluble sulphide. Mercury salts probably act in a similar way when present in the mercurous state.—W. S.

Silver alloys: Some ——. E. Pannain. Gaz. chim. ital., 1908, 38, I., 349—351.

Experiments were made with a view to finding metals or alloys capable of replacing copper in silver coins. Silver can be alloyed with cobalt, nickel, and manganese only with difficulty, but more readily on addition of a third metal. If silver and copper be melted with nickel, cobalt, and manganese respectively, alloys are obtained containing the three constituent metals in different proportions. The alloys rich in silver are white, malleable, capable of being readily polished, and harder than those containing silver and copper only. The alloys containing nickel or cobalt are magnetic. They are prepared by first melting or strongly heating the nickel or cobalt, then adding the copper or other base metal, and finally the silver; or better by melting a suitable alloy of nickel or cobalt, and adding the molten silver or silver alloy. Care must be taken to employ a sufficiently high temperature; otherwise the mixture separates into two parts, one very rich in silver, and the other containing only about 30 per cent. of that metal. These alloys are specially suitable for coinage owing to the care needed in their preparation, this rendering the making of counterfeits difficult. Moreover they are harder and thus more durable than ordinary silver coins, and their magnetic properties allow of their ready identification.—A. S.

Water and ferrous-iron content of minerals and rocks; Influence of fine grinding on the ——. W. F. Hillebrand. J. Amer. Chem. Soc., 1908, 30, 1120—1131.

The manner in which a mineral is ground in preparation for analysis has a considerable influence on some of the constituents; for instance, long continued grinding causes oxidation of the ferrous iron and the percentage of water is increased. In order to remove this source of error it is recommended that the mineral or rock under examination be ground so that it will pass a sieve of 80 meshes to the linear inch; if the powder thus obtained is completely decomposed by dilute hydrochloric acid within 30 minutes, a powder of this degree of fineness can be used for all the determinations. Where finer grinding, either in air or under alcohol, is necessary, determinations of the water must be made on both the coarse and fine portions. For the determination of the ferrous iron it is preferable to treat the coarse powder with hydrofluoric and sulphuric acids and to titrate with permanganate until the solution is just pink in colour. The residue is allowed to settle, washed once by decantation with water, and then rinsed into an agate mortar. After grinding the residue for a short time under water, it is transferred to a crucible, again treated with hydrofluoric and sulphuric acids, and the solution further titrated with permanganate.—W. P. S.

Lead ethoxide; Formation of ——. F. M. Perkin. *See* XXIV.

Patents.

Tin ores or tin slag; Process of treating ——. P. Jensen, London. From H. Mühlinghaus, Wiesbaden, Germany. Eng. Pat. 15,039, June 29, 1907.

Powdered or granulated ores poor in tin (*e.g.*, containing 3 or 4 per cent. of tin) are made into briquettes with coal or coke, limestone, and tar. The briquettes are placed in a furnace together with coal or coke, and air or oxygen blown in from below. The materials melt and sink in the furnace until they reach a zone where the reduced tin is oxidised and vaporised, the fumes of tin oxide being condensed and collected as usual. (Reference is directed to Eng. Pats. 1527 of 1870 and 3138 of 1886; this J., 1887, 43.)—A. G. L.

Tin-scrap; Apparatus for treating ——. M. Leitch, Springfield, Mass., Assignor to Metal Process Co., New York. U.S. Pat. 891,486, June 23, 1908.

The apparatus consists of a "reclining" cylinder with a feed-opening at one end and an exit-opening at the other end. Apparatus for creating a heated de-oxidising atmosphere is placed within the cylinder. At one end of this apparatus there is a restraining wall to delay the passage of the tin-scrap through the cylinder; at the other end is placed a wall transverse to the cylinder and provided with an opening discharging into the cylinder. Adjacent to this wall is a screening cylinder and a scoop operating through the opening; a second screening cylinder may be placed at the other end of the heating apparatus.—A. G. L.

Tin from tin plate scrap and other products containing tin; Process and apparatus for extracting ——. H. Brandenburg. Fr. Pat. 386,781, Jan. 31, 1908.

The tin is dissolved by the action of hot caustic soda in the presence of air. Means are provided for passing the scrap, contained in perforated receptacles, alternately through the solution and through a space filled with air; and for the aeration and circulation of the hot caustic soda solution.—O. F. H.

Wrought iron and steel; Process of and apparatus for directly reducing iron ore and subsequently treating same for the manufacture of ——. M. Moore, Melbourne, and T. J. Heskett, Brunswick, Victoria. Eng. Pat. 26,131, Nov. 26, 1907.

The patent constitutes an improvement on the patentees' previous inventions (this J., 1904, 827, 868; 1905, 241; 1907, 52, 258). The reducing gas is supplied to the bottom of the reducing chamber in such volume that a part only passes first upwards through the ore, reducing it to metal, and then to a second chamber, in which it is fully burnt after mixing with air, thus supplying the heat necessary to reduce a fresh quantity of ore: the other part of the gas passes downwards with the reduced ore, protecting it from oxidation, into a chamber into which the ore passes beneath a bath of molten slag, and where it is "balled" and hammered into wrought iron, or where it is mixed with steel-scrap, which has been melted in a cupola furnace with solid fuel, so as to take up a high percentage of carbon, if steel is to be manufactured. —A. G. L.

Carburising a molten metal [*steel*]; *Method of* ——. C. A. Keller. Fr. Pat. 387,461, May 6, 1907.

Small pieces of carbon, preferably waste carbons of arc lamps, are placed in a foundry mould and molten cast iron or steel poured in. The blocks thus obtained, which may be made to contain known proportions of carbon, are used for the carburisation of molten steel. —A. S.

Iron ; Process and apparatus for the manufacture of ——. N. Wikström. Fr. Pat. 387,080, Jan. 10, 1908. Under Int. Conv., Jan. 25, 1907.

A mixture of iron ore, lime or other flux, and carbon, all finely-divided, falls from a hopper down a vertical channel, at the bottom of which it is met by a horizontal blast of gas and air at a temperature of about 1000° C. The blast blows the ore mixture into the first chamber of the furnace, on the sloping hearth of which the iron is reduced, and whence it flows into a second refining chamber, which is of a U- or annular shape. Both chambers may be further heated electrically by external induction coils. The opening between the two chambers is so small that the gases from the second chamber, to which additional gas can be furnished from another source so as to give a reducing atmosphere, cannot return to the first chamber, but pass away through flues which serve to pre-heat the incoming air ; unburnt gases can also be drawn off by another flue. In the second chamber are placed refining agents, and separate tap-holes are provided for the iron and slag.—A. G. L.

Steel ; Process for the manufacture and refining of ——. Bismarckhütte. Fr. Pats. 386,785, and 386,786, Jan. 31, 1908.

(1). The impurities are eliminated in a basic-lined electric furnace, and the operation completed in an acid-lined electric furnace, where recarburisation is effected, and additions of other metals, such as chromium, nickel, tungsten, silicon, etc., are made. It is stated that, owing to the ease with which oxidation is prevented in the acid furnace, steel very low in manganese can be made. (2.) The steel is made in an electric furnace and then transferred to a crucible where it remains as long as necessary, the chief object being to allow of the separation of intermingled slag. The necessary additions are also made in the crucible.—O. F. H.

Wolfram [*tungsten*] *; Concentration of ores containing* ——. M. Ruthenburg, London. Eng. Pat. 26,810, Dec. 4, 1907.

The crushed ore is screened, mixed with water to form a pulp of suitable consistency, and separated in the usual manner by gravity on a concentrating table or the like. The concentrates are then dried and fed raw to a magnetic separator, which removes the wolfram, the only mineral present which is magnetic at this stage. The residue of this magnetic separation is now roasted to remove arsenic and render the mundic iron magnetic, and, after cooling, again passed through a magnetic separator. The roasted mundic is thereby removed, and the final residue consists mainly of pure cassiterite.
—O. R.

Copper from its ores ; Method of recovering ——. H. M. Wilcox, Chicago, Ill., Assignor to Esmeralda Copper Precipitating Co., Chicago, Ill. Re-issue No. 12,815, June 16, 1908, of U.S. Pat. 790,238, May 16, 1905.

The ore is leached with a suitable reagent in order to yield a neutral solution of copper sulphate which is then treated with sulphur dioxide. The solution is now heated under pressure to a temperature above its boiling point in order to precipitate the copper in metallic form. The excess of sulphuric acid in the spent solution may be neutralised, or may be used in dissolving the copper from a fresh lot of ore.—O. F. H.

Gold, silver, copper, and platinum from lead alloys ; Process of removing ——. W. Morrison, Des Moines, Iowa. U.S. Pat. 890,160, June 9, 1908.

The lead alloy is melted with zinc and a material, such as potassium cyanide, which will melt and form a flux at a temperature below the volatilisation point of zinc. The molten mixture is agitated and allowed to cool.
—O. F. H.

[*Auriferous*] *Ore products ; Process of treating crushed* ——. W. A. Caldecott, Johannesburg, Transvaal. U.S. Pat. 891,459, June 23, 1908.

The ore-pulp, freed from the bulk of liquid, is treated in a closed vessel with a super-aerated solvent solutions, the pressure in the vessel being kept greater than that of the atmosphere. By admitting compressed oxygen or air, the solution and pulp are agitated and transferred from one vessel to another. The gold-bearing solution is then separated from the extracted pulp, which is washed with precipitated solution or water.—A. G. L.

Precious metals ; Extraction of —— *from their ores.* J. Baxeres de Alzugaray, New York. U.S. Pat. 892,110, June 30, 1908.

The ores containing gold, silver, platinum, or metals of the platinum group, are subjected to a stream of gaseous hydrogen fluoride or heated with some mixture capable of evolving that gas. The metals thus liberated from combination with refractory elements may be recovered by any of the usual methods. The hydrofluosilicic acid, produced by passing the evolved silicon fluoride through water, may be treated with sulphuric acid for the recovery of the hydrogen fluoride.—C. A. W.

Gold and precious metals ; Apparatus for the extraction of ——. A. Stuer. Fr. Pat. 386,777, Jan. 31, 1908.

The precious metals are extracted by amalgamation, by forcing the crushed ores with water under pressure into mercury contained in a series of iron drums.—O. F. H.

(1). *Ore-reducing furnace.* (2). *Ores ; Method of dephosphorising* ——. (3). *Ore ; Method of treating* ——. (4). *Ore-smelting furnace.* (5). *Iron ore ; Method of dephosphorising and reducing* ——. (6). *Iron ores ; Method of treating* ——. (7). *Ingots ; Method of forming* ——. (8). *Copper ores ; Method of treating* ——. J. T. Jones, Iron Mountain, Mich., Assignor to G. A. St. Clair, Duluth, Minn. U.S. Pats. 890,229—890,235 and 890,563, June 9, 1908.

(1). The furnace consists of an ore stack and a producer furnace, the two being connected by a horizontal flue. A water-jacketed tuyère projects through the wall of the producer opposite the connecting flue, which together with a section of the wall of the producer is composed of carbonaceous material. (2). A column of the ore, which is slowly descending in the shaft of a furnace, is subjected to the action of a reducing gas introduced into the lower part of the column, the temperature of the gas being insufficient to cause the phosphorus to combine with the metal. Fresh hydrocarbon fuel is forced into the descending column at a point near which the reduction reaches completion. (3). Ores containing sulphur, zinc, and iron are treated in two furnaces of the type described under (1). In one of the furnaces the ore is heated by gases from the producer to a temperature sufficient to drive off the sulphur but insufficient to volatilise the zinc, air being introduced to assist oxidation. In the second furnace, at a lower level, the ore is more strongly heated, the zinc volatilised, and the zinc fume condensed. The unfused residue may be treated subsequently for the recovery of the iron. (4). The furnace is a modification of that described under (1), the ore stack being widened out just below the horizontal flue to form a smelting chamber. (5) Finely-divided iron ore is briquetted with a mixture of lime and clay, and the briquettes subjected to the action of a reducing gas at a temperature sufficient to reduce and agglomerate the iron particles, but insufficient to flux the lime or cause the phosphorus to combine with the iron. (6). The oxides of iron in the ore are first reduced to the metallic state at a temperature insufficient to cause fusion of the slag-forming constituents. The reduced ore, with a small percentage of iron oxide, is more strongly heated to cause fusion of the slag, which is separated by gravity from the still unfused metallic iron. (7). A large quantity of ore mixed with a binding material is moulded into a block having a gas passage through it. The block is then subjected to the action of hot reducing gases, the reduced metal becoming agglomerated within the block. (8). The iron and copper in the ore are first reduced, without fusion, to the metallic state. The temperature is then raised to melt the copper and slag, which are separated from the still unfused iron.—O. F. H.

Ore-reducing furnace, and method of treating [*iron*] *ore.* J. T. Jones, Iron Mountain, Mich., Assignor to G. A. St. Clair, Duluth, Minn. U.S. Pats. 891,549, 891,704, and 891,705, June 23, 1908.

(1). The furnace is provided with an ore-stack communicating with a closed chamber, placed below the stack, by an opening serving as the gas-outlet for the chamber and the discharge-opening for the stack. The reduced ore falls through the discharge-opening into a crusher, thence into a separator, and finally into a smelting-furnace, all of which are placed within the closed chamber. (2). The ore is subjected, under deoxidising conditions, to a temperature at which the iron oxide is reduced to metal, but the slag-making constituents do not become fluid. The temperature is then raised sufficiently to melt the slag-making constituents, but not the metallic iron, and the mass is subjected to a rolling and squeezing process to remove the slag. (3). Iron ore is subjected to a deoxidising atmosphere at a temperature at which iron oxide is reduced to metal without the metal or the slag-forming constituent of the ore being melted. The mass is cooled, crushed, and screened. The finer particles of iron are separated magnetically from the screenings. The particles of iron are then mixed with a binder and formed into briquettes.
—A. G. L.

Smelting-furnace. W. J. Holzapfel, Scottdale, Pa. U.S. Pat. 891,256, June 23, 1908.

The furnace consists of a base through which air is supplied, an upright casing which can be tilted, supported on the base, and locking means for retaining the casing in an upright position, these means consisting of a coupling ring which can be moved vertically, and a seating in the base for the ring.—A. G. L.

Smelting-furnace. J. S. Loder, Assignor to The Loder Smelter and Refiner Co., Reno, Nev. U.S. Pat. 891,349, June 23, 1908.

Air pipes, which are adjustable longitudinally, extend through openings opposite the combustion chamber of the furnace. Fuel pipes extend into the air-pipes, and flexible connections are arranged to supply the pipes with air and fuel.—A. G. L.

Furnace; Ore-roasting ——. W. H. Smith, Berkeley, Cal. U.S. Pat. 891,300, June 23, 1908.

A furnace of brick, etc., is constructed with its hearth divided into two parallel portions, the adjacent edges of which are not divided structurally. A slot is formed in each of the portions between their sides, the two slots being joined by a curved slot continuation at one or both ends. Rabbling devices and tracks for the same are provided within the furnace, the rabbling devices being moved by means passing through the slot. A metallic skeleton or frame is arranged to support the rabble-track and slots independently of the brick structure, and to keep them in alignment.—A. G. L.

Furnace; Crucible ——. E. H. Schwartz, Assignor to Kroeschell Bros. Co., Chicago, Ill. U.S. Pat. 892,012, June 30, 1908.

By means of a spirally grooved combustion chamber in connection with a receptacle for air, a gyratory motion is imparted to the flame and products of combustion. The chamber communicates, by means of a tangential passage, with a vaporiser, the air supply of the latter being connected with the air-receptacle by a supplemental tube.—C. A. W.

Uranium and vanadium from ores; Process of extracting ——. H. Fleck and W. G. Haldane, Golden, and E. L. White, Denver, Colo. U.S. Pat. 890,584, June 9, 1908.

The ores are subjected to the action of a solution of sulphurous acid under pressure in order to extract the uranium and vanadium. The resulting solution is then heated to expel sulphur dioxide and precipitate uranium as basic sulphite, and the vanadium precipitated from the residual solution by caustic lime.—O. F. H.

Sintering apparatus [*for ores, etc.*]. E. B. Clark, Chicago, Ill., and C. H. Fettel, Hubbard, Ohio, Assignors to American Sintering Co., Chicago. U.S. Pat. 891,327, June 23, 1908.

The apparatus consists of a rotatory cylindrical kiln, having a lining composed of segments of cast-iron plates fitted together to form a continuous cylinder, the plates being provided with supports connected to the inner wall of the kiln. Means are provided to scrape off material adhering to the lining.—A. G. L.

Agglomeration of finely-divided materials [*ores*]*; Process for the* ——. A. P. Foniakoff. Fr. Pat. 387,427, Feb. 21, 1908.

Finely-divided materials, *e.g.*, iron ores, are mixed with a solution of a suitable chloride such as sodium chloride, or sea-salt, and then with a solution of a soluble silicate, *e.g.*, water-glass, water being added if necessary, so as to form a thick mud, which is cut up into briquettes and allowed to dry to some extent before being charged into the furnace.—A. G. L.

Fine ores and the like; Briquetting of ——. A. Nath. Ger. Pat. 198,486, May 31, 1906.

An oxidisable substance is mixed with the ore, and the mass is treated with oxygen gas or an oxygen-yielding compound, whereby oxidation takes place with the development of sufficient heat to cause a sintering of the particles of ore and of the product resulting from the oxidation of the added substance. In the case of fine iron ores, iron powder is used as the oxidisable substance.
—A. S.

Fine ores or other metallurgical products containing silica and lime; Process for hardening lumps formed from ——. A. Jerusalem. Ger. Pat. 197,497, June 9, 1907.

The lumps are hardened by means of steam under pressure in an inclined rotating drum, through which they travel by the action of gravity.—A. S.

Metallic oxides; Process of reducing ——. E. F. Price and F. M. Becket, Niagara Falls, N.Y., Assignors to Central Trust Co., New York. U.S. Pat. 891,565, June 23, 1908.

Ores containing metallic oxides are reduced by smelting with a mixture of carbides of acid and basic elements (silicon carbide and calcium carbide) in such proportions as to form a suitable slag with the ore constituents.
—A. G. L.

Ores; Process of smelting ——. F. L. McGahan, St. Louis, Mo. U.S. Pat. 891,630, June 23, 1908.

The ore is subjected to the action of a combustible body so as to liberate gases and other volatile products. The gases and vapours are removed, passed over a second charge of ore, carburetted, mixed with steam, raised to such a temperature that a part of the steam dissociates, and returned to the smelting zone of the furnace.—A. G. L.

Metals and their alloys; Process for improving the physical properties of ——. D. Lamon, Denver, Colo. U.S. Pat. 892,269, June 30, 1908.

The metal, or alloy, is subjected while hot to the action of boric acid and a sulphate of aluminium. It is then kept for some time at a suitable temperature, and is finally passed through an aqueous solution of the same substances.—C. A. W.

Ores containing volatile compounds; Process for treating ——. A. M. G. Sébillot and L. Mauclaire. Fr. Pat. 387,011, Feb. 7, 1908.

The fumes coming from a furnace in which ores containing volatile compounds are roasted, are caused to pass slowly through a condensing chamber which is water-jacketed and is also provided with hollow partitions through which water is circulated. The fumes leaving the condensing chamber may be passed through a series of perforated metal plates, or through a scrubber, in order to remove any uncondensed fumes. In the treatment of mixed lead and zinc ores in shaft furnaces, the lower part of the furnace is water-jacketed, and the zinc fumes are led off through a pipe passing through the water-jacket, the zinc oxide being condensed in a scrubber. In the case of poor ores, or those with a refractory gangue, two sets of tuyères are used, one above and one below the outlet pipe for the zinc fumes.—A. S.

Slag: Process and apparatus for granulating ——. "Pyrotrass," Soc. Anon. pour la Fabrication du Trass Artif. (Breveté) et ses Applications Ind. Fr. Pat. 387,218, Feb. 13, 1908.

The molten slag flows down an inclined channel, the end of which is widened and inclined more steeply, so as to give a thin sheet of rapidly flowing slag. Below the end of the channel, and in a direction at right angles to the line of flow, are placed pipes provided with orifices, from which jets of water, steam, or air under pressure are blown against the slag, dividing and granulating it. If the height available is not sufficient to cool the slag before it reaches the ground, the falling granules of slag are caught on perforated arms fastened to a revolving shaft, which fling the slag through the air on to inclined planes, whence it falls on to an endless metallic band which conveys it to trucks. Each inclined plane is provided with a rose, from which a shower of water is delivered to the next plane. The conveyor is kept cool by having its lower end placed in a trough of water.
—A. G. L.

Non-metallic bodies: Process for applying a metallic coating of tin, zinc, and mercury to ——. F. Langer, Ger. Pat. 192,560, Oct. 28, 1906.

A uniform thin coating of pure copal, free from oil, is first applied to the article, and the copal is then covered with tin powder. After about three days, when the coating has hardened, any non-adherent tin is removed, the tin surface is suitably polished, and amalgamated by brushing with powdered mercuric chloride and water. A mixture of tartar and zinc powder is next rubbed on the surface of the article, and then, gradually, a concentrated solution of stannous chloride containing some tartar. The amalgamation and succeeding operations may be repeated if desired.—A. S.

Aluminium and articles made therefrom; Process for treating the surface of ——. A. Lang, Karlsruhe, Germany. Eng. Pat. 14,194, June 19, 1907.

See Addition of Dec. 18, 1907, to Fr. Pat. 354,713 of 1905; this J., 1908, 690.—T. F. B.

Ores; Method of and apparatus for concentration of metallic ——. D. H. Norris, New York. Eng. Pat. 14,806, June 27, 1907.

See U.S. Pats. 864,856 and 873,586 of 1907; this J., 1907, 1095, and 1908, 26.—T. F. B.

Metallic dark coatings upon metals; Electrolytic process for the production of ——. A. Classen, Aachen, Germany. U.S. Pat. 891,982, June 30, 1908.

See Third Addition, of Aug. 8, 1907, to Fr. Pat. 350,964; this J., 1908, 28.—T. F. B.

Iron, steel, or iron ores in fusion; Process of treating ——. K. A. F. Hiorth. Fr. Pat. 387,207, Feb. 13, 1908. Under Int. Conv., Feb. 16, 1907.

See Eng. Pat. 3173 of 1908; this J., 1908, 755.—T. F. B.

Gilt or silvered surfaces; Process for obtaining ——. G. A. Bauer. Fr. Pat. 387,546, Feb. 25, 1908. Under Int. Conv., March 7, 1907.

See Eng. Pat. 4385 of 1908; this J., 1908, 755.—T. F. B.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(*A.*)—ELECTRO-CHEMISTRY.

Patents.

Furnaces; Electric ——. The Gröndal Kjellin Co., Ltd., and J. Härdén, London. Eng. Pat. 8445, April 11, 1907.

The furnace is of the type in which the material in an annular fusion chamber forms the secondary winding. The fusion chamber consists of a hearth or lining formed in a metallic casing, and is made detachable from the remainder of the furnace, in order that it may be easily removed when repairs are necessary, and a new lining placed in position without interrupting the working of the furnace.—B. N.

Electric currents of high periodicity; Production and employment of —— *and apparatus therefor.* J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 12,220, May 27, 1907.

Electrical oscillations, or vibrations, of high periodicity are obtained by means of a circuit containing an electric arc, with a current of air, or other gas, directed between the electrodes, so that the arc is not permanently interrupted. Regular mechanical vibration of the arc is prevented, and the frequency of the electrical oscillations does not depend upon the mechanical vibration. The air, or gas, may be supplied with a rotary or tangential motion, and the electrodes are preferably of such a form that the air is supplied in a thin layer of large area. For this purpose, conical or disc-like electrodes are described. Such electrical oscillations or vibrations may be employed in wireless telegraphy.—B. N.

Insulating material; Electric ——. The British Thomson-Houston Co., Ltd., London. From the General Electric Co., Schenectady, N.Y. Eng. Pat. 18,111, Aug. 9, 1907.

Fragments of flake-mica are cemented together by a silicious binding material in the following proportions:—glass, 2 parts; mica, 2 parts; kaolin, 24 parts; slate, 12 parts; sodium silicate, 37 parts; water, 23 parts. The material is pressed, machined into the desired form, and heated to expel air. It is then plunged whilst hot into the above silicious insulating composition, and the resulting material is indurated by the application of heat and pressure.—B. N.

Insulating, impregnating, and protective materials. E. S. Ali-Cohen, Singapore, Strait Settlements. Eng. Pat. 5279, March 9, 1908.

A thoroughly dried, purified, and oxidised vegetable oil (castor oil, linseed oil, etc.) is incorporated by the aid of heat with the product described in Eng. Pat. 8071 of 1902 (see Fr. Pat. 320,198 of 1902; this J., 1903, 34), the mixture being afterwards vulcanised. By diluting the resulting product with a suitable solvent, such as benzene, it may be used for impregnating porous material, or for waterproofing or insulating purposes.—B. N.

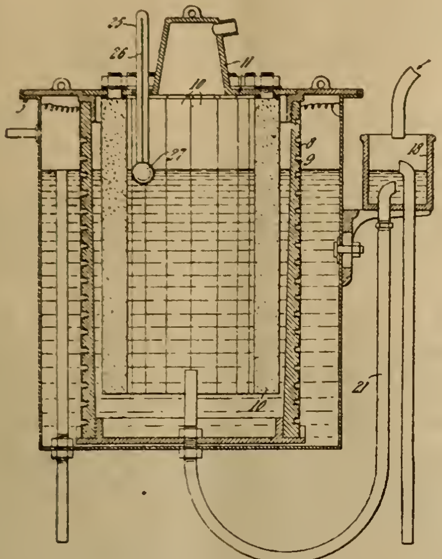
Plastic material; Process of manufacture of a —— *opaque or transparent, non-inflammable, insulator of heat and electricity.* H. M. Proveux. Fr. Pat. 387,429, Feb. 21, 1908.

The material is obtained from a solution of casein, sodium or potassium hydroxide or other alkali, boric acid dissolved in alcohol with heat, with addition of sulphoricinate of sodium and animal oils. Filling materials are added to give the necessary consistency.—B. N.

Electrolytic cell. R. B. Ingram, Wilkinsburg, Pa., Assignor to Westinghouse Electric and Manufacturing Co., Pennsylvania. U.S. Pat. 891,995, June 30, 1908.

The cell comprises a number of similar, circular, tray-shaped plates, each having a central "upwardly-extending frustro-conical indentation." These are supported by a vertical rod, with insulating spacing pieces between the adjacent plates, whereby each plate is supported above the maximum level of the liquid in the plate below, and at a predetermined distance from each of the adjacent plates. The assembled plates are disposed in a containing tank.—B. N.

Electrolytic vessels. C. E. Assi. Fr. Pat. 385,135, Dec. 17, 1907.



The hollow permeable diaphragm, 8, diminishes in thickness towards the top, and is closely surrounded by a metallic envelope, 9, acting as the cathode, the latter being provided with projecting points, which are let into the diaphragm. The anodes, 10, consist of a series of carbon rods, disposed in the interior of the diaphragm chamber, and are carried by an independent insulated support, 11, which is provided with a dome, and forms a cover for the anode chamber. A separate receptacle, 18, the height of which may be regulated, is provided for the admission of electrolyte into the main vessel through the rubber tube, 21. A float, 27, is connected to a rod, 26, which projects vertically into a tube, 25, closed at the top, the position of the rod, 26, indicating the height of the liquid in the anode chamber.—B. N.

Electrolytic apparatus with carrying apron, applicable to the bleaching and scouring of vegetable and animal fibres, textile fabrics, paper pulp, and to the treatment of all liquids. A. Dassonville. Fr. Pat. 387,104, Feb. 10, 1908.

The apron, carrying the material, consists of two endless sheets, with rods of wood and plates of carbon alternately fixed between them, the apron moving between extreme electrodes, various types of which are described, fixed at the ends of the bath. The plates of carbon act as movable electrodes, which successively change their polarity. Alternative forms are described, in which the plates of carbon are suitably supported in a fixed position at the interior of the movable apron. By means of a reversing commutator, the extreme electrodes, and therefore the fixed electrodes at the interior of the apron, may be made to successively change their polarity. This prevents fouling of the carbon, or, if metallic electrodes are used, suppresses the formation of metallic salts in the electrolyte, by alternate oxidation and reduction of the electrodes.—B. N.

Galvanic cells of the Bunsen type; Method of operating ——. K. Heintz. Ger. Pat. 198,019, Feb. 24, 1906.

In order to effect the complete utilisation of the depolarising agent, the concentration of the sulphuric acid is not allowed to fall below 28° B. The renewal of the sulphuric acid thus becomes necessary only when the acid is no longer capable of dissolving further quantities of the reduction products (chromium sulphate, manganese sulphate, etc.) formed in the depolarisation. —A. S.

Ozone; Apparatus for the preparation of ——. W. Elworthy and W. Kölle. Fr. Pat. 386,869, Feb. 3, 1908.

The apparatus consists of a series of ozonising elements, each composed of a dielectric tube and an interior and exterior conducting helix, not in contact with the tube. These elements fit one within another concentrically, in such a way, that the exterior conductor of one element becomes the interior conductor of the surrounding element, and so on. The central conductor is a metal rod, and alternate conductors are connected with the two terminals of an electric circuit. Air is made to circulate through each element of the ozoniser in turn, between the dielectric tubes and the conductors: it thus becomes much enriched in ozone, without a corresponding expenditure of current.—F. Sodn.

Nitrogen; Process and apparatus for oxidising atmospheric —— *by electricity.* D. Helbig, Brescia, Italy. Eng. Pat. 27,790, Dec. 17, 1907.

See Fr. Pat. 385,193 of 1907; this J., 1908, 576.—T. F. B.

Refractory or insulating material. Fr. Pat. 387,511. *See* IX.

(*B.*)—ELECTRO-METALLURGY.

Steel; Desulphurising of ——, *in the electric induction furnace.* B. Osann. Stahl u. Eisen, 1908, **29**, 1017—1022.

An account of experiments made in a small Röchling-Rodenhauser induction furnace in Völklingen (see also this J., 1908, 757). The furnace was fed with molten steel from the converter, usually containing 0·07 to 0·08 per cent. of carbon; if the carbon is much above this it must be burnt out to about this content, before the removal of phosphorus can begin. The dephosphorising is carried out by addition of lime and mill cinder, and the phosphoric slag is removed. Then ferrosilicon and carbon are added, followed by lime and fluorspar; the first ferrosilicon is added in pieces as large as a hen's egg, and subsequent additions are gradually made of fragments the size of coarse gravel, till the slag is white, and is thus seen to contain no iron. The metal can then be poured, and the sulphur content is usually found to be not more than 0·008—0·016 per cent. The essentials for success are an iron-free slag and complete protection from the air. Ferromanganese, used instead of ferrosilicon, was found to be ineffectual. The ferrosilicon, reducing iron oxide according to $2FeO+Si=2Fe+SiO_2$, raises the temperature of the bath, and the silica formed tends to make the slag more fluid, and thus both to exclude air more efficiently and to secure better contact between the metal and the lime in the slag for the desulphurising reaction.—J. T. D.

[*Copper*] *Electroplating baths; Rapid analysis of* ——. E. Pannain. Gaz. chim. ital., 1908, **38**, I., 352—355.

A rapid method for the determination of copper sulphate and free sulphuric acid in copper-plating baths is given. A known quantity of the solution is diluted to ten times its volume, and 25 c.c. of the diluted solution poured into a flask containing a large excess of finely powdered potassium iodide. The iodine liberated by the copper sulphate is titrated with $N/_{10}$ thiosulphate.

$$2CuSO_4+4KI=Cu_2I_2+2I+2K_2SO_4.$$

Potassium iodate is now added to the solution, when the free sulphuric acid present causes the liberation of a further quantity of iodine from the iodate and iodide; the free iodine is titrated as before. For control purposes the copper sulphate and sulphuric acid are determined together in another 25 c.c. of the solution, by adding potassium iodide and iodate, and titrating the liberated iodine.—A. S.

PATENTS.

Anode slimes; Treating —— from electrolytic refining of lead. A. G. Betts, Troy, N.Y. U.S. Pats. 891,395 and 891,396, June 23, 1908.

(1). The slime is oxidised and melted, with the addition of "unoxidised or comparatively little oxidised slime" as reducing agent, in order to convert antimony peroxides into trioxide, thus producing a slag which contains most of the lead and antimony, and an alloy containing the silver and gold. The slag is then treated with an acid, such as hydrofluoric acid, or a mixture of acids, in order to remove the antimony. (2). The slime is oxidised and fused, with the addition of material containing sulphur, such as antimony sulphide, thus producing a fusible slag containing most of the lead and antimony, and a matte containing most of the copper and precious metals.—B. N.

Low-carbon metals or alloys; Process of making ——. F. M. Becket, Niagara Falls, N.Y., Assignor to Electrometallurgical Co., West Virginia. U.S. Pats. 891,898 and 892,211, June 30, 1908.

(1). A LOW-CARBON ferro-chrome is produced by smelting an oxide ore of chromium and silicon with carbon in the electric furnace. In this way a metal, rich in chromium and silicon, is obtained, and is treated with a further quantity of the ore to the end that the latter element may be wholly or partially oxidised. The process may be varied, but the preliminary production of a high-silicon alloy is an essential feature. (2). A charge, containing an ore of a refractory metal and a reducing agent, is smelted in the electric furnace between metallic electrodes, these last being capable of alloying with the reduced product and being so cooled at the working ends as to permit their consumption, and consequently the composition of the final product, to be regulated. In this way, using electrodes of iron, low-carbon ferro-alloys can be obtained.—C. A. W.

Electric furnace method. F. M. Becket, Niagara Falls, Assignor to Electrometallurgical Co., West Virginia. U.S. Pat. 892,212, June 30, 1908.

THE heat is retained within the molten bath by means of a superficial crust of the solidified constituents of the latter. Apertures are provided around the electrodes, in this crust, for renewing the charge and allowing the escape of volatile by-products.—C. A. W.

Metals and metalloids; Process for extracting —— from ores, etc., containing them. H. Herrenschmidt. Sixth addition, dated April 20, 1907, to Fr. Pat. 369,878, Sept. 18, 1906 (this J., 1907, 208, 419; 1908, 506).

THE process described in the main patent is applied to the preparation of metallic borides, the ore being reduced by means of carbon in an electric furnace, in presence of an excess of boric acid or other boron compound. By excess is meant a quantity of boric acid over and above that necessary for effecting the fusion of the charge.—A. S.

Ores, especially iron ores; Process for the reduction of ——. K. A. F. Hiorth. Fr. Pat. 387,284, Feb. 17, 1908. Under Int. Conv., Feb. 21, 1907.

GRAPHITE rich in silica, of too poor a quality to be used for making pencils, crucibles, etc., is used as reducing agent in electric furnaces, especially for iron ores.—A. G. L.

Nickel-plating, copper-plating or brassing, avoiding the oxidation of the iron or steel so treated; Process for ——. J. Lafond. Fr. Pat. 386,787, Jan. 31, 1908.

THE articles are first covered with a layer of zinc deposited electrolytically, then polished and burnished, and finally electroplated with nickel, copper, or brass in the usual way. In the case of nickel plating, however, the articles after being polished and burnished are lightly silvered, amalgamated, or coppered.—O. F. H.

Metals; Process for the electro-deposition of —— by wet processes, dispensing with the preliminary scouring of the objects. A. Levy. Fr. Pat. 385,058, Feb. 25, 1907.

THE anodes are formed of the metal or alloy to be deposited, and the electrolyte consists of a concentrated solution of an alkali hydroxide, to which has been added a small proportion of an alkali cyanide, phosphate, or pyrophosphate, with or without the addition of an alkali sulphite, bisulphite, or hyposulphite. The cyanide may be replaced by chloride, iodide, etc., but in this case the alkali sulphite, bisulphite, or hyposulphite must be added; or in place of the alkali cyanide, etc., a cyanide, chloride, iodide, phosphate, or pyrophosphate of the metal to be deposited may be added to the concentrated alkali.—B. N.

Tin deposits; Obtaining pure, dense —— by electrolysis of an alkali sulphostannate solution. B. Neumann. Ger. Pat. 198,289, Dec. 24, 1905.

THE electrolyte consists of an alkali stannate solution to which alkali sulphide has been added. The electrolysis is performed at a temperature of at least 70° C., and the tin is obtained as a dense silver-white deposit.—A. S.

Removing from metallic or other surfaces the layers of plating metal, etc., covering them; Process of —— [electrolytically]. Kings Norton Metal Co., Ltd., and T. R. Bayliss, W. R. Hodgkinson, J. H. Hardcastle, A. H. Coote, and R. A. E. Payne. Fr. Pat. 387,117, Feb. 11, 1908.

THE article to be treated is made the anode in an electrolytic bath, in which the electrolyte is an ammoniacal liquid, and the cathode one or more plates, bars, rods, tubes, or other electrical conductors in metal. The cathode may be given a movement of rotation, preferably rapid. The electrolyte may contain an acid amide, or an ammonium salt, preferably of an organic acid, in solution with ammonia.—B. N.

Anodes in electrolytic vessels. A. Levy. Fr. Pat. 385,059, Feb. 25, 1907.

THE anode is enclosed in a porous, permeable diaphragm, which offers little resistance to the passage of the current. Short-circuits, between the anode and the suspended objects forming the cathode, are thus avoided, and the insoluble products forming at the anode are prevented from mixing with the electrolyte. The diaphragm may consist of an envelope, perforated or not, of cloth, wood, or pasteboard, or of perforated insoluble material, such as celluloid or ebonite. In order to prevent the anode from being raised from the bath, or otherwise manipulated by hand, the anode and diaphragm may be enclosed in a framework of wood or other suitable insoluble material, provided with an appropriate fastening.—B. N.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

Cocoanut oil; Unsaponifiable constituents of ——, and detection of that fat in butter. H. Matthes and E. Ackermann. Ber., 1908, **41**, 2000—2001.

THE unsaponifiable matter of cocoanut oil was found to contain, in addition to ordinary phytosterol, another phytosterol giving similar reactions, but forming an addition compound containing 2 mols. of bromine. One kilo. of the fat yielded 1·25 grm. of crude phytosterol (m. pt. 135°—140° C.) and 0·25 grm. of a fluid unsaponifiable constituent. The acetylated crude phytosterol (m. pt. 126°—128° C.) when brominated in ether and acetic acid, yielded a tetrabromide (m. pt. 180°—183° C.), whilst the filtrate on evaporation yielded minute crystals of phytosteryl acetate dibromide, which melted, after recrystallisation from alcohol, at 132°—135° C. Since butter contains only cholesterol, which, according to Windaus, does not give an acetate-tetrabromide, it is suggested that a sensitive method of detecting cocoanut oil in butter may be based on an examination of the unsaponifiable matter.—C. A. M.

Mafura tallow and mafura oil. W. R. Daniel and J. McCrae. Analyst, 1908, **33**, 276—277.

Specimens of the oil and fat prepared by natives in Portuguese East Africa from the seeds of *Trichilia emetica* have been examined. The fruit of this tree, which is known amongst the native tribes as Umkuhlu, Mkhuklu, Marba, Marwa-Maawa, Gnanda, Mafoureira, Mafura, or Mafurrera, is about 18 mm. long, and contains three loculi, each enclosing one to three bright red seeds with a large black spot. On drying the seeds, they appear as small brown nuts covered with a thin shell easily detached by rubbing, but the change of colour proceeds only slowly, under ordinary circumstances. The oil is obtained by the natives by boiling the seeds and skimming; it is used for cooking purposes. The tallow is made by crushing the seeds; it is used for greasing the skin. The slightly yellowish oil congeals when cooled for some hours at 5° C. It has the following characters:—Sp. gr., 0·931 at 15°/15° C., 0·920 at 30°/15° C., 0·913 at 40°/15° C.; Zeiss butyro-refractometer reading, 65·6° at 20° C., 60·1° at 30° C., 54·6° at 40° C.; acidity (as oleic acid), 8·9 per cent.; saponification value, 202·5; iodine value, 66; saponification value of acetylated oil, about 235; acetyl value (corr. for volatile acidity), 36·5; Reichert-Wollny value, 2·0; unsaponifiable matter, 0·8 per cent. The oil is optically inactive, and gives no reaction by Halphen's test.

The mixed insoluble fatty acids yielded the following constants:—Sp. gr., 0·854 at 92°/15° C.; solidifying point, 44·2° C.; Zeiss butyro-refractometer reading at 50° C., 37·2°; neutralisation value, 201; saponification value, 206; iodine value, 68.

The yellowish tallow showed the following constants:—Sp. gr., 0·909 at 30°/15° C., 0·902 at 40°/15° C.; m. pt., 29·5—38° C.; Zeiss butyro-refractometer reading at 40° C., 47·3°; acidity (as oleic acid), 14·7 per cent.; saponification value, 201; iodine value, 43·5; saponification value of acetylated oil, 218; acetyl value, 16; Reichert-Wollny value, 1·3; unsaponifiable matter, 1·2 per cent.

The mixed fatty acids from the tallow gave the following constants:—Sp. gr., 0·843 at 92°/15° C.; solidifying point, 52·1° C.; Zeiss butyro-refractometer reading at 57° C., 26·3; neutralisation value, 204; saponification value, 205; iodine value, 46.

The supposed toxic properties of the tallow have not been verified.—R. L.

Fats; Rancidity of ——. A. Scala. Gaz. chim. ital., 1908, **38**, I., 307—327.

The rancidity of fats is stated to be due to the formation of substances of unpleasant odour and taste, partly of an aldehydic, partly of an acid character. The aldehydic substances are volatile. A specimen of them was freed from the acid substances by treatment with barium hydroxide solution, and then distilled, two fractions distilling between 133° and 170° C. and between 170° and 240° C. being collected. These fractions and also the residue were oxidised with permanganate, and the different acids produced, were separated by means of their barium salts. From the two distillates there were thus formed œnanthylic, pelargonic, and butyric acids, and probably caproic acid; and from the residue, caprylic and capric acids. The rancid odour and taste of fats and oils is probably mainly due to œnanthylic and pelargonic aldehydes, and in lesser degree to caproic and butyric aldehydes.—A. S.

Potassium soaps of different fats; Solubility of —— *in alcohol.* J. Freundlich. Chem. Rev. Fett- u. Harz-Ind., 1908, **15**, 133—136; 160—161.

A study of the differences in solubility in alcohol of the potassium soaps of different fats, has been made, and the construction of a method of distinguishing between them, has been attempted. A concentrated (5 per cent.) solution is obtained by saponifying 1 to 1·1 grm. of the fat with 20 c.c. of $N/2$ alcoholic potassium hydroxide solution, and this is diluted with absolute alcohol to obtain the weaker solutions. The potassium soaps of the fats examined could be classified into the following groups:—(I). Those giving a 5 per cent. solution which remained clear at 10° C.: castor oil, sesamé oil, cocoanut oil, cotton "stearin"; edible linseed oil; poppy oil. (II). Those giving a 1·25 per cent. solution clear at 10° C.: lard, butter, palm oil, rape oil, technical sunflower oil. (III). Those giving a 0·31 per cent. solution clear at 10° C.: ox tallow, arachis oil, mutton tallow. (IV). Those giving a 0·16 per cent. solution clear at 10° C.: fat from *Mimusops Djave*, stearin. The fatty acids recovered from the soaps separated into two fractions by filtering off the portion insoluble in alcohol, showed pronounced differences. Thus in the case of lard, the fatty acids from the insoluble soaps were hard and friable, whilst those from the dissolved soaps were soft and yellow. In making use of the behaviour of the soaps in analysis, the determinations should be made at varying concentrations, temperatures, and durations of treatment. After cooling, and filtration, it is best to wash the residue with absolute alcohol. Subsequently it may be dissolved in hot alcohol, and examined further by the usual methods.—C. A. M.

Soap; Chemical control of the manufacture of ——. V. Boulez. Bull. Soc. Chim. Belg., 1908, **22**, 208—218.

Soaps; Disinfectant constituents of ——. H. Reichenbach. *See* XVIII*C*.

Patents.

Colouring fats, oils, resins, and analogous compounds; Process for ——. Chem. Fabr. Flörsheim, Dr. H. Noerdlinger. Ger. Pat. 198,470, Feb. 1, 1907.

Fats, oils, or resins are mixed with an organic metal salt (*e.g.*, a salt of a fatty or resin acid), alone, or in presence of a solvent, and then treated with a mordant dyestuff: the fat, etc., may be first mixed with the dyestuff, and the latter fixed by the organic salt, or the salt and dyestuff may be added to the fat together, either in the dry state or dissolved in a solvent of (or substance soluble in) the fat, etc. One claim covers the production of the organic metal salt by precipitation in the solvent or in the fat, oil, or resin.—T. F. B.

Liquids [oils, etc.]; Process for the improvement or refinement of ——. T. Macherski and E. Koperski, Brest-Litowsk, Poland. Eng. Pat. 17,607, Aug. 1, 1907.

See Addition of June 22, 1907, to Fr. Pat. 377,700; this J., 1907, 1244.—T. F. B.

Viscous liquids produced by heating glycerin. Ger. Pat. 198,711. *See* V.

Polyglycerins from glycerin. Ger. Pat. 198,768. *See* XX.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(*A.*)—PIGMENTS, PAINTS.

Patents.

Dyes [lakes from azo dyestuffs]; Manufacture of ——. E. Ulrichs, Charlottenburg, Germany. Eng. Pat. 17,676, Aug. 2, 1907. Under Int. Conv., Nov. 2, 1906.

Alkaline-earth or heavy metal salts of azo dyestuffs containing a sulphonic acid group, are ground dry with calcium or barium sulphate, alumina, or other substratum.—T. F. B.

Celluloid, ivory, etc. ; Applying paint to ——. Fr. Pat. 386,846. *See* XIX.

(*B*.)—RESINS, VARNISHES.

Patent.

Colouring fats, oils, resins, etc. Ger. Pat. 198,470. *See* XII.

(*C*.)—INDIA-RUBBER, &c.

Patents.

Benzene or other volatile solvents ; Process and apparatus for the recovery of —— *especially in the manufacture of rubber-coated goods.* E. Bataille. Fr. Pat. 387,325, May 4, 1907.

A cover, provided with passages for the entry and exit of hot air, is placed on the drying table over which the fabric is passed, and the current of air (entering at the centre and leaving near the openings through which the fabric passes, or *vice versa*) is so regulated that the pressure at the openings for the passage of the fabric, is the same as that of the atmosphere outside, thereby avoiding any loss of the volatile solvent. The hot air charged with the vapour of the solvent is passed through a condenser, etc., to recover the same, then through a reheater, and back over the drying table.—A. S.

Caoutchouc and gums ; Apparatus for the extraction of ——. Nicolas et Cie. Fr. Pat. 387,243, Feb. 14, 1908.

The apparatus consists essentially of a long drum in which several independent conveyor screws are mounted on a single shaft, these screws acting in conjunction with fixed and rotating sets of knives, in order to effect the disintegration of the raw material and the separation of the rubber.—A. S.

Elastic compositions. L. Roland, Paris. Eng. Pat. 26,432, Nov. 29, 1907. Under Int. Conv., Dec. 5, 1906.

See Addition of Dec. 5, 1906, to Fr. Pat. 364,075 of 1906 ; this J., 1907, 539.—T. F. B.

Indiarubber ; Process of preparing —— *for vulcanisation.* H. Scholz, Assignor to B. Gratz, Berlin. U.S. Pat. 891,866, June 30, 1908.

See Fr. Pat. 363,341 of 1906 ; this J., 1906, 895.—T. F. B.

XIV.—TANNING, LEATHER, GLUE, SIZE.

Hide-powder ; Preservative effect of "boro-phenol" upon chromed ——. J. G. Parker and A. T. Hough. Collegium, 1908, 252—255.

The powder is chromed and washed as prescribed in the official regulations of the International Assoc. of Leather Trade Chemists, and is then covered with a solution containing 1 part of anhydrous phenol, and 2 parts of boric acid per 1000, in a bottle closed with a rubber bung. When required for use, the powder is squeezed and washed, and the necessary quantity weighed out as for the official method, the portion not required being put back in the bottle and again covered with the preservative solution. Analyses carried out with hide powder which had been preserved in this manner for 14 days, gave results for non-tannins varying by only 3 mgrms. from those obtained with freshly prepared powder.—H. Br.

Leather ; Deterioration of —— *under the influence of gas fumes.* M. C. Lamb. J. Soc. Dyers and Col., 1908, **24**, 160—166.

A series of experiments on the influence of the tannage, dyeing, and finishing, on the decay of modern bookbinding leathers. The conclusions of the Committee of the Society of Arts (see this J., 1901, 819 ; 1902, 128) are further confirmed. Algarobilla, chesnut extract, and myrobalans are stated to be the most suitable tanning materials for such leathers, next to sumach. Chrome tannages are also suggested for the production of non-decaying leathers. The influence of various "finishes" on the permanence of these leathers was also investigated, shellac, albumin, formaldehyde-gelatin, and linseed finishes being used. The results show that the most resistant to deleterious influences is the shellac finish, and the next best, egg-albumin. Japanned leathers also withstand well the action of heat and gas fumes.—H. G. B.

Patents.

Tanning process. E. Perrot. Fr. Pat. 386,840, April 19, 1907.

It is claimed that a strong, very supple leather is obtained by treating the skins first in a solution of magnesium sulphate and alum and then in a bath prepared with gambier extract.—A. S.

Leather ; Process of recolouring ——. E. M. Robbins, Buffalo, N.Y. U.S. Pat. 891,864, June 30, 1908.

The leather is treated first with a solution capable of penetrating it and separating the fibres, and then with a solution containing colouring matter, which adheres to the fibres and unites with the portion of the first solution remaining in the leather. For example, the leather is first treated with a solution composed of an animal oil, a vegetable oil, ammonia, and a volatile alcoholic solvent, and then with a solution composed of a vegetable oil, a suitable thinning material, and a colouring matter. Gum copal may be added to the second solution.—A. S.

Plastic material from casein ; Process for the preparation of a —— *insoluble in neutral, acid, or alkaline liquids.* Eborit-Ges.m.b.H. Ger. Pat. 191,125, Dec. 16, 1902.

Casein free from lactose is treated with a suitable acid, *e.g.*, hydrochloric acid, only such a small quantity of the latter being used that the product on cooling sets to a perfectly homogeneous jelly, which is hardened in the usual manner with formaldehyde, and then dried. —A. S.

Leather. P. M. Justice, London. From S. H. Knight, Hastings, and C. D. Lightband, Wellington, New Zealand. Eng. Pat. 27,882, Dec. 18, 1907.

See Fr. Pat. 383,361 of 1907 ; this J., 1908, 291.—T. F. B.

Waste leather, raw hides or skins, hoofs, horns, or bones of animals ; Treatment of ——. A. G. Inrig, Tottenham, Assignor to H. E. McKrell, London. U.S. Pat. 892,840, July 7, 1908.

See Eng. Pat. 17,129 of 1906 ; this J., 1907, 703.—T. F. B.

Celluloid, ivory, etc. ; Applying paint to ——. Fr. Pat. 386,846. *See* XIX.

XV.—MANURES, &c.

Calcium cyanamide ; Influence of the moisture of the soil on the manurial value of ——. Sante de Grazia. Staz. sperim. agrar. ital., 1908, **41**, 115—126. Chem. Zentr., 1908, **1**, 2198.

The manurial effect of calcium cyanamide is greatest if the substance be exposed to the action of moisture for some time after application. It should therefore be applied to the well-watered soil or at a time when rain is expected. Comparative experiments showed that "Kalkstickstoff" ("nitrolim," crude calcium cyanamide) is always more effective than pure calcium cyanamide, but its action also is improved by moisture. On the other hand, the moisture of the soil has scarcely any influence on the manurial effect of dicyandiamide.—A. S.

Dicyandiamide ; Physiological action of ——. O. Loew. Chem.-Zeit., 1908, **32**, 676—677.

Experiments have been made on the physiological action of dicyandiamide ($C_2N_4H_4$), which is liable to be formed, when calcium cyanamide is used as a manure on alkaline soils. The growth of the lower organisms (algæ, etc.) and of bacteria is scarcely affected by it, and experiments on mice show that it is non-poisonous. It had no marked harmful effect on young barley plants, and a 0·2 per cent. solution was found to act as a source of nitrogen to *Elodea canadensis*. Its physiological indifference is striking, when compared with the poisonous nature of cyanamide (CN_2H_2).—F. Sodn.

Organic nitrogenous fertilisers ; Action of —— *compared with that of sodium nitrate.* M. Popp. Landw. Vers.-Stat., 1908, **68**, 253—300. Chem. Zentr., 1908, **1**, 2199—3000.

A quantity of the fertiliser containing 0·2—0·4 grm. of nitrogen was mixed with 250 grms. of a loamy soil, and the ammonia- and nitrate-nitrogen were determined after periods of 2, 6, and 12 weeks respectively. In all of the organic fertilisers examined, the original very small quantities of ammonia-nitrogen had increased considerably after two weeks, but after six weeks had almost entirely disappeared. The nitrate-nitrogen increased rapidly during the first six weeks, but only slightly during the following six weeks. In no case was the whole of the nitrogenous matter nitrified. An addition of 2 per cent. of calcium carbonate had no effect on the conversion of the nitrogenous matter. Pot experiments extending over several years, with different plants, showed that taking the value of the nitrogen of sodium nitrate as 100, the corresponding values of the nitrogen of different organic manures were as given in the following table:—

Blood meal	70	Bone meal	55
Horn meal	70	Wool dust	25
Fish meal	60	Conc. cattle manure	20
Castor meal	60	Leather meal	10

—A.S.

Phosphates of lime ; Action of ammonium citrate on ——. A. Barillé. *See* VII.

Artificial fertilisers in Italy. Board of Trade J., July 23, 1908. [T.R.]

The chemical fertilisers prepared in Italy consist chiefly of superphosphates, the great majority being mineral phosphates, and the remainder bone phosphates. Another artificial manure produced to a certain extent is ammonium sulphate. The production of superphosphates has rapidly increased during recent years. In 1904 it amounted to 400,000 met. tons, in 1906 to 600,000, and in 1907 to 800,000 tons of mineral and 50,000 tons of bone superphosphates. It is stated that the output is now almost equal to the demand, a small quantity only being imported. Ammonium sulphate is produced by the large gas-works, the output amounting to some 10,000 metric tons annually.

Patents.

Superphosphate ; Method of and apparatus for removing —— *from the decomposition chamber.* K. J. Beskow, Helsingborg, Sweden. Eng. Pat. 20,466, Sept. 13, 1907. Under Int. Conv., Feb. 25, 1907.

The mass of superphosphate is supported on a platform within the decomposition chamber, so that, at the end of the decomposition, the platform can be moved out of the chamber, laterally or vertically, after removing one of the sides or the top of the chamber. The platform may be mounted on wheels for this purpose. Outside the chamber, the mass of superphosphate is exposed to the action of mechanically driven cutting devices, such as scoops or blades, rotated by a shaft, or carried on an endless belt, by which means it is removed from the platform.

—A. G. L.

Fertiliser ; New ——. F. Schäcke. Fr. Pat. 386,512, Jan. 24, 1908. Under Int. Conv., Jan 25, 1907.

Eruptive minerals containing potassium are finely powdered, and mixed with a quantity of calcareous matter capable of yielding sufficient lime to neutralise the acid constituents of the minerals.—A. S.

XVI.—SUGAR, STARCH, GUM, &c.

Beet in the first year's growth ; Assimilation of nutriment by the —— *and its relation to the sugar-content of the root.* K. Andrlík and J. Urban. Z. Zuckerind. Böhm., 1908, 32, 559—575.

The authors have already examined the assimilation of nitrogenous substances by the beet (Z. Zuckerind. Böhm., 1906-7, 149; this J., 1907, 214), and now give an account of similar experiments with potassium salts. The experiments were carried out during the years 1902—1905; several kinds of seed-roots were used, and crops were cultivated in different localities. The chief conclusions drawn from the experiments were as follows:—The amount of potash assimilated during the first year's growth may vary greatly, being dependent on the nature of the soil, manure, weather, and kind of seed. The minimum amount of potash (K_2O) assimilated by the plant under the most favourable conditions for growth was found to be 156·9 kilos. per 400 quintals of roots; generally, the amount assimilated is much greater; it is increased by treating the soil with potash salts or stable manure. In dry weather, the amount of potash absorbed is small, even if the soil is abundantly manured with potash salts, and the crop is also small. A large assimilation of potash tends to cause vigorous leaf growth, but the size of the root and the yield of sugar depend only to a certain extent on the quantity of potash absorbed; the authors found, that for the formation of 100 parts of sugar, the amounts of potash required by the plant ranged between a minimum of 2·1 and a maximum of 5·8 parts. More potash is accumulated in the shoot than in the root, and the proportion accumulated in the latter decreases (though the absolute quantity generally increases) as the total amount assimilated, increases; the authors found, that of the total quantity of potash absorbed, 32·1—41·5 per cent. was accumulated in the roots. The amount of potash accumulated in the root is dependent also on the kind of seed-root.—L. E.

Molasses ; Formation of ——. S. Lebedeff. Z. Ver. deut. Zuckerind., 1908, 599—621.

Betaine and salts of glutamic acid occur to a considerable extent in beetroot molasses and after products; the author has examined the influence of varying quantities of these substances on the solubility of sucrose at 30°, 50° and 70° C. Sugar syrups (saturated at the ordinary temperature) were treated with increasing quantities of the non-sugar and excess of pure granulated sugar. The mixtures were heated in a water-bath at the experimental temperature for 45 minutes, transferred to a stirring apparatus and kept stirred for several hours at the same temperature. The mixtures were then placed in a water-bath (maintained at the experimental temperature), the syrups were drawn off by suction through funnel tubes into flasks (egress of crystals being prevented by wads of cotton wool in the funnels), and their contents of sucrose and non-sugar determined. The results of the experiments are given in tables and are also represented by curves; the chief conclusions drawn from them are as follows:—*Betaine.* The total content of dry substance in solution increases with increasing amounts of betaine; the amount of sucrose dissolved (per 100 parts of water) decreases at 30°, and increases at 50° and 70° C. with increasing quantities of betaine, *i.e.*, betaine exerts a salting-out action at 30°, and a melassagenic action at 50° and 70° C. At 30° C., the salting-out effect of 1 grm. of betaine increases with increasing quantities of this substance, whilst at 50° and 70° C. the melassagenic effect of 1 grm. decreases. *Potassium glutamate.* The total content of dry substance in solution increases with the content of this salt; the salt exerts a melassagenic action at 30°—70° C (greatest at 50°). The melassagenic action of 1 grm. of the salt (which is very marked when the salt is present in small quantity) decreases with increasing quantities of the salt. *Sodium glutamate.* The total content of dry substance in solution increases with the content of this salt. The salt exerts a salting-out action at 30° C. and a melassagenic action at 70° C.; at 50° C., it has a salting-out action when present in small quantity, but becomes melassagenic as the amount present increases. The salting-out action of 1 grm. of the salt first decreases with increase of temperature and amount of salt present, and is then converted into a melassagenic action. The author has also compared the salting-out and melassagenic actions of sodium and potassium acetates and of the substances examined by Schukow (potassium, sodium, and calcium chlorides and potassium nitrate), and has shown, that in regard to the formation of molasses, these substances may be classified as follows:—1. Substances which exert chiefly a salting-out action which slowly decreases with increasing temperature and accumulation of substance (calcium chloride and sodium acetate). 2. Substances which, at low temperatures and in small quantities, exert a slight salting-out action, this action giving place to a melassagenic one as the temperature and amount of substance present increase (potassium and sodium chlorides, potassium acetate and nitrate). 3. Substances which exert a strong melassagenic action even at low temperatures and when present in small amount (potassium glutamate, and to a certain extent, betaine). The effect of non-sugar on the solubility of sucrose may be: (1), mechanical, due to alteration of viscosity; (2), physical, due to alteration of the nature of the solvent; (3), chemical, due to the formation of new compounds from the sucrose and non-sugar. The action of sodium chloride and betaine on the solubility of sucrose appears to be chiefly of a physical nature, that of potassium and sodium glutamate and calcium chloride, chiefly of a chemical nature.—L. E.

Cane sugar [*sucrose*]; *Inversion of* —— *by invertase.* C. S. Hudson. J. Amer. Chem. Soc., 1908, **30**, 1160—1166.

The experiments and data recorded show that the polarimetric measurement of the inversion of sucrose by invertase involves a considerable error which can be avoided by adding alkali to the inverting solution before each reading is taken. If the source of error is thus eliminated, as was done by O'Sullivan and Tompson (this J., 1890, 1049) in their experiments, the inversion by invertase becomes a true unimolecular reaction, like the inversion of sucrose by acids.—W. P. S.

Patents.

Crystallising apparatus ("*malaxeur*") *for instantaneous production of sugar and molasses.* Soc. des Raffinerie et Sucrerie Say. First Addition, dated Jan. 23, 1908, to Fr. Pat. 369,319, Aug. 28, 1906 (this J., 1907, 108).

The hollow, transverse cooling frames (*loc. cit.*) are provided with a number of interior partitions, which cause the cooling water to take a sinuous course, and the frame supports are simplified in construction. Instead of having an opening through its centre, the frame is hollowed at the bottom to permit the passage of the conveyor shaft.—L. E.

Beet juice; Obtaining —— *by diffusion.* C. Renner. Ger. Pat. 198,168, Dec. 14, 1906.

The juice is not withdrawn from the freshly-charged diffusion vessel, but from a preceding one, and then from the same vessel a second lot of juice is drawn off. This is heated to 85°—90° C., and introduced from above into the next succeeding diffusion vessel, displacing the juice therein. The displaced juice is introduced into the diffusion vessel charged with fresh beet slices. In working a battery of diffusion vessels, the second lot of juice withdrawn as mentioned above, is held in reserve in a suitable receptacle, and then used as required for displacing the juice from a diffusion vessel, the displaced juice serving for the digestion of fresh beet slices. In this way the drawing-off of the juice and the digestion proceed simultaneously.—A. S.

Starch out of potato mash, maize mash, and the like; Process for washing ——. F. Bing, Stavanger, Norway. Eng. Pat. 21,381, Sep. 26, 1907.

The material from which the starch is to be washed is fed into a horizontal cylinder, the bottom portion of which is constructed of wire-gauze or perforated tin. A shaft passing through the centre of the cylinder carries a number of spokes to which are fixed brushes; other spokes carry scoops arranged immediately in front of the brushes. These scoops carry the material up from the bottom of the cylinder, as the central shaft is rotated, and under a stream of water introduced at the top of the cylinder. Screw blades fixed between the brushes move the material from the inlet to the outlet end of the cylinder, whilst the starch, passing through the gauze, is collected in a trough situated below the bottom of the cylinder. The central shaft may be fixed excentrically to the sides of the cylinder so as to leave a space at the top.—W. P. S.

Soluble starch; Process for the preparation of ——. Stolle und Kopke. First Addition, dated Jan. 23, 1908, to Fr. Pat. 384,704, Dec. 5, 1907. (See also this J., 1908, 503.)

According to the main patent, perborates were employed for the preparation of soluble starch. In the present addition the process is extended to other substances than starch, such as insoluble gums, algæ, lichens, etc. The gum or other substance is soaked in a solution containing, *e.g.*, 1 part of perborate per 100 of gum, and the swollen material is then heated, with addition of water, until it is dissolved.—A. S.

Gum; Process for the production of soluble ——. F. Fritsche, Rumburg, Austria. Eng. Pat. 1353, Jan. 20, 1908.

Gums which are ordinarily insoluble in water, *e.g.*, natural gums and those derived from algæ and lichens, such as bassorin, tragacanth, agar-agar, Carrigeen moss, Iceland moss, etc., are converted into soluble gums by steeping them in a solution of a perborate and then heating them with a sufficient quantity of water to give a solution of the desired consistency. The quantity of perborate required is usually about 1 per cent. of the weight of the gum.—J. F. B.

XVII.—BREWING, WINES, SPIRITS, &c.

Starch; Metamorphosis of —— *in the plant, and the detection of amyloclastic enzymes.* W. Butkewitsch. Biochem. Zeits., 1908, **10**. 314—344.

When submitted to the action of toluene- or chloroform vapour, the starch stored up in the bark and in the wood of branches of trees (*Sophora japonica*, *Populus nigra*, *Robinia pseudacacia*, *Caragana arborescens*, and *Morus alba*) is rendered soluble. The experiments were made with branches gathered in February or March, placed in water and kept some days at room temperature until sufficient starch had accumulated. This rendering soluble of the starch cannot be ascribed to increased respiratory activity as it is accompanied by an accumulation of sugar. The actions of toluene and chloroform have a certain analogy to the action of low temperatures and in both instances the conversion of starch into sugar is due to a weakening of the synthetic starch-forming function of the plastids. A similar instance of starch degradation and sugar accumulation is afforded by an increase in temperature. At 60°—70° C. the formation of reducing sugars and disappearance of starch from the bark take place with great rapidity. The starch disappears rapidly also at 80° C., but in this case the products are dextrin-like in character and give a violet-red coloration with iodine. These experiments indicate the presence of a diastatic enzyme in bark which is able to saccharify starch. In confirmation it is demonstrated that dried and pulverised bark and also the aqueous extract rapidly liquefy starch paste at 50° C. and finally produce reducing sugars. An active preparation of the diastatic enzyme is obtained by precipitation of the aqueous extract with alcohol. This is without action on maltose, but the original aqueous extract as also the bark itself hydrolyses this sugar to dextrose. The observation of the solution of the starch contained in the plant tissues at 50°—60° C. affords a convenient method of detecting the diastatic enzyme in bark, and similar results were obtained with leaves, in which instance the whole of the starch disappeared within a few hours. The conversion of the starch under these conditions is so complete that it may be used to estimate the starch. The method indicates also the presence of the amyloclastic enzyme in fresh and dried wood; here the conversion of the starch is not complete, and the enzyme becomes inactive after a time. The amount of sugar formed amounted to 10 per cent. in the case of Sophora wood. The barks of some *Papilionaceæ* are only slightly inferior to malt in diastatic power and these may find a technical application. Branches gathered in the spring and rich in diastase are able to produce starch in quantity when placed in sugar solutions. The part played by the diastatic enzymes and by the plastids in the formation of starch is discussed in detail: it is at present impossible to pronounce definite opinions on this subject.—E. F. A.

Malt; "Chit" ——. [*"Spitzmalz"*]. C. Bleisch. Z. ges. Brauw., 1908, **31**, 309—313.

The author has investigated and compared the yields of extract obtainable from ordinary pale malt, and from mixtures of about 75 per cent. of ordinary pale malt and 25 per cent. of "chit" malt. He concludes, that if the "chit" malt is ground fairly fine, and submitted to a preliminary mashing with a portion of the ordinary malt, and boiled before adding the remainder of the latter, the loss of extract due to non-disintegrated starch should not be serious. The loss of dry substance in the preparation of "chit" malt is very much less than that which occurs in the ordinary malting process; hence, considerable saving should be effected by adding, say, 25 per cent. of "chit" malt to ordinary malt. The flavour of beer prepared with "chit" malt appears to be satisfactory, but information concerning its keeping properties, etc., is required.—L. E.

Oxydases; Investigation of ——. O. Dony. Bull. Acad. roy. Belg., Classe des Sciences, 1908, 105—163. Chem. Zentr., 1908, **1**, 2184—2185.

The object of the present paper is to show that the existence of Bertrand's laccase (this J., 1894, 1071; 1895, 374, 1074; 1896, 561; 1897, 626, 692) has not been conclusively established. In the laccase prepared by precipitation with alcohol, the manganese present (according to Bertrand, laccase may be represented by the formula, MnR) is not combined with a definite radical, but is simply adsorbed by the colloidal precipitate. If a manganese salt be added to a 10 per cent. aqueous solution of gum arabic, then on adding to the liquid twice its volume of alcohol, the precipitate produced contains a considerable proportion of the added salt. This precipitate and similar ones prepared from solutions of blood serum and dextrin containing manganese salts, exhibit the characteristic properties of laccase, although not so strongly as Bertrand's preparation. The action of these manganese preparations is greatly increased by the presence of alkali. An artificial laccase, having a similar action to that of Bertrand's preparation, is obtained if a solution of gum or dextrin containing alkali and a manganese salt be precipitated with alcohol. The precipitate gives a blue colour with guaiacum tincture, but does not oxidise guaiacol. The performance of this latter reaction by Bertrand's preparation is considered to be due to the presence of another element, probably iron.—A. S.

Peroxydase; Purification of ——. A. Bach and J. Tscherniack. Ber., 1908, **41**, 2345—2349.

The purest peroxydase preparations hitherto made contain considerable quantities of sugar and gum-like substances, and activate, in the most favourable circumstances, only about twice their weight of hydrogen peroxide. This result is the maximum achieved on fractionation with alcohol, where a point is soon reached where enzyme and impurities are precipitated together in constant proportions. Better results are obtained on precipitating the impurities with basic lead acetate, removal of the excess of lead by means of sodium carbonate, and dialysis of the filtrate. The large quantity of material necessary was obtained from the white beet, extracts of which are even more active than those from horse-radish. 30 kilos. of beets were used in one operation. After purification, the crude peroxydase solution, about 600 c.c., was dialysed against distilled water for 12 days, and 670 c.c. of an opalescent liquid obtained which had lost in activity. The opalescent liquid was precipitated by alcohol and a light grey powder obtained which contained 7·9 per cent. of water, 81·7 per cent. of organic substances, and 1·47 per cent. of ash, and showed an activity of 22·7 units, that is, eleven times as much as before. The peroxydase shows the biuret and xanthoprotein reactions and is remarkably stable towards heat.—E. F. A.

Enzyme action. XI. Raffinose; Hydrolysis of —— by acids and enzymes. H. E. Armstrong and W. H. Glover. Proc. Roy. Soc., **80B**, 312—321.

Accurate measurements of the rate of hydrolysis of raffinose, as compared with that of sucrose, when effected by dilute mineral acids at the ordinary temperature, whereby raffinose is resolved into lævulose and a biose sugar (melibiose) isomeric with sucrose, indicate that it is hydrolysed in accordance with the simple logarithmic law of mass action. Raffinose is hydrolysed at a rate nearly one-fifth less rapidly than sucrose. Nitric, hydrochloric, and sulphuric acids differ in their activity towards both sugars; whereas the ratios of the rates of hydrolysis of the two sugars are nearly the same for nitric and hydrochloric acids, sulphuric acid is relatively less active towards raffinose. Invertase is five times as active towards sucrose as it is towards the sucrose section of raffinose. This difference is ascribed by the authors either to the weighting having the effect of twisting the oxygen centre from which the hydrolytic attack proceeds somewhat further away from the junction at which hydrolysis takes place, or to the galactose interposing to block the way of the hydrolytic agent.—E. F. A.

Enzyme action. XII. Enzymes of emulsin. H. E. Armstrong, E. F. Armstrong, and E. Horton. Proc. Roy. Soc., 1908, **80B**, 321—331. (Compare this J., 1904, 388; 1905, 1242, 1246, 1247; 1906, 1106; 1907, 885.)

Experimental evidence is adduced to show that emulsin obtained from sweet or bitter almonds is in reality a mixture of at least three enzymes, which are closely related, *viz.*, emulsin proper which is capable of effecting the hydrolysis of β-glucosides, a glucolactase which hydrolyses lactose, and amygdalase (compare Caldwell and Courtauld this J., 1907, 885) which hydrolyses amygdalin into amygdonitrile glucoside (Fischer's glucoside) and dextrose. The behaviour of the glucolactase has been studied in detail: it differs from the galactolactase obtained from kephir in being controlled by dextrose, whereas kephir lactase is controlled by galactose. Probably therefore hydrolysis is effected in consequence of the attachment of the one enzyme to the dextrose section and of the other to the galactose section of the complex disaccharide lactose. The amount of glucolactase present in the preparations used was small, but the method devised allowed it to be obtained in a very highly active state. The course of change of amygdalin under the influence of emulsin has been followed analytically. The final products are two molecules of dextrose and one each of benzaldehyde and hydrogen cyanide, but apparently during the earlier part of the change, the production of dextrose was in advance of the production of hydrogen cyanide, indicating that Fischer's glucoside was the main initial product of change and that the action of emulsin is comparable with that of acids. By stopping the action when about half complete, Fischer's glucoside could be isolated and identified.—E. F. A.

Yeasts ; Function of —— in the formation of aldehyde from alcohol. Trillat and Sauton. Compt. rend., 1908, **17**, 77—80.

The authors have previously shown (this J., 1908, 463, 636) that yeasts in the course of normal fermentation are able to form notable quantities of acetic aldehyde from alcohol in a few hours, and that this slowly disappears again. Further experiments show that the formation of aldehyde attains a maximum when the cell is living, and that the amount formed diminishes very considerably when the yeast is killed by heat or by the addition of antiseptics. The oxidation is not brought about by the juice apart from the yeast cell. It is specific for ethyl alcohol, neither methyl, propyl, nor amyl alcohols giving rise to any aldehyde. The presence of yeast increases the rapidity of ester formation ; the maximum of ester corresponds to a minimum of aldehyde, possibly since the acetic acid necessary for ester formation is provided by the oxidation of the aldehyde. The disappearance of aldehyde is also a function of the living cell and does not take place in presence of dead yeast.—E. F. A.

Formaldehyde ; Formation of —— in fermentation without cells. A. Lebedew. Biochem. Zeits., 1908, **10**, 454—457.

The carbon dioxide formed from sugar during fermentation with pressed yeast extract disappears again when left in contact with the yeast extract, which remains neutral or slightly acid. Pressed yeast extract contains formaldehyde, which, in the opinion of the author, is formed by the reduction of carbon dioxide. The amount of formaldehyde is largest when the yeast contains least reducing sugar. It is shown that, as measured by direct estimation, sugar is fermented more quickly by pressed yeast than appears when the quantity fermented is calculated from the carbon dioxide formed. Apparently the disappearance of the sugar and the fermentation are two independent processes which go on side by side.
—E. F. A.

Yeast-juice ; Alcoholic ferment of ——. III. Function of phosphates in the fermentation of dextrose by yeast juice. A. Harden and W. J. Young. Proc. Roy. Soc., 1908, **80**B., 299—311. (Compare this J., 1906, 490, 1111 ; 1907, 62).

The addition of a phosphate to a fermenting mixture of dextrose and yeast-juice produces a temporary acceleration in the rate of fermentation, the extra amount of carbon dioxide evolved being equivalent to the phosphate added. Besides this, a greater total fermentation is produced, due to the fact that the hexosephosphate, $C_6H_{10}O_4(PO_4R_2)_2$, formed during the period of temporary acceleration is continually hydrolysed by an enzyme, with the production of free phosphate. This again enters into reaction and brings about an increased fermentation in the same manner as when it was originally added. Since free phosphate and a hexosephosphate are invariably present in the yeast juice prepared by grinding yeast, some portion of the fermentation must always be due to their presence. It appears probable that phosphate is essential for the alcoholic fermentation of dextrose by yeast juice, and that the following cycle of changes occur :—

$$(1).\quad 2C_6H_{12}O_6 + 2R_2HPO_4 = 2CO_2 + 2C_2H_6O + C_6H_{10}O_4(PO_4R_2)_2 + 2H_2O\ ;$$

$$(2).\quad C_6H_{10}O_4(PO_4R_2)_2 + 2H_2O = C_6H_{12}O_6 + 2R_2HPO_4.$$

Phosphates alone in the absence of co-ferment (this J., 1906, 1111) are unable to bring about fermentation in a mixture of ferment and dextrose, the presence of both ferment and co-ferment being necessary to realise reaction (1), which must also include the fermenting complex with which the dextrose and the phosphate form an intermediate association. The rate at which reaction (2) occurs determines the rate of fermentation observed when dextrose is fermented by yeast juice. An optimum concentration of phosphate exists which produces a maximum initial rate of fermentation. The rate of fermentation is diminished by an increase in concentration beyond this optimum.—E. F. A.

Enzyme action ; Reversion of ——, and influence of external factors on enzymes. F. G. Kohl. Woch. für Brau., 1908, **25**, 402—403.

Invertase preparations were kept with solutions of sucrose of known concentration in the dark at a constant temperature in presence of antiseptics. Titrations by Bertrand's method (this J., 1907, 60) showed a progressive increase in the amount of invert sugar present up to a certain point, until an equilibrium was attained. The author disputes Tammann's hypothesis that this is due to the enzyme having become inactive, and takes the position that reversion is going on at the same time as and in opposition to inversion, so that the invert sugar present is the resultant of the action of the two opposing forces. Diffused daylight acts adversely on the hydrolysis of sucrose, inversion taking place much more quickly in the dark and also giving place at an earlier stage to reversion.
—E. F. A.

Polypeptides ; Hydrolysis of —— by ferments. E. Abderhalden and A. H. Kœlker. Z. physiol. Chem., 1908, **55**, 416—426. Chem. Zentr., 1908, **1**, 2191.

The authors' experiments on the hydrolysis of optically-active polypeptides (see this J., 1907, 833) have been extended to *d*-alanylglycin, *d*-alanylglycylglycine, and *d*-alanylglycylglycylglycine ($[\alpha]_D^{20} = +\ 22°{\cdot}4$), the last-named having been prepared for the first time. The hydrolysis was effected by means of expressed yeast juice, and was followed by means of determinations of the optical rotation. Parallel series of tests were made, in one the amount of ferment being kept constant and the proportion of polypeptide varied, whilst in the other the converse was the case. In all instances the first stage consisted in the splitting-off of *d*-alanine (decrease of rotatory power). With a given quantity of yeast juice acting on molecular proportions of the different polypeptides, the reaction proceeded more rapidly with the tetrapeptide than with the tripeptide, and more rapidly with the latter than with the dipeptide.—A. S.

Potato spirit ; Use of malt extract with yeast and sulphuric acid in the manufacture of ——. J. Wilke. Z. Spiritusind., 1908, **31**, 298.

In manufacturing spirit from potatoes it is sometimes customary to add sulphuric acid to the yeast used. The author states that his experience of this method during the last four seasons has not been entirely satisfactory. In dry seasons the potato mash contains a considerable proportion of maltose and accordingly the yeast, although its diastatic power has been weakened by the addition of the sulphuric acid, is able to carry out the fermentation to a satisfactory end. In moist seasons the maltose is largely replaced by dextrins, and the yeast with its weakened diastase is unable properly to complete the fermentation. To overcome this the author advises the addition of malt extract to the yeast, subsequent to the addition of the sulphuric acid, whereby the diastase of the malt remains unimpaired.—E. F. A.

Fusel oil formation ; Suppression of ——, and the co-operation of bacteria in the formation of higher alcohols during fermentation. H. Pringsheim. Biochem. Zeits., 1908, **10**, 490—497.

Leucine, which is converted into amyl alcohol by yeasts during alcoholic fermentation, may be in part shielded by the presence of other sources of nitrogen, *e.g.*, ammonium sulphate, from the attack of the yeast. This conclusion has been confirmed by experiments made on a large scale. 500 grms. of ammonium sulphate for 2000 litres of

mash suffice to reduce the formation of fusel oil to a minimum. Double this quantity of ammonium sulphate produces no further reduction in the amount of fusel oil, showing that the amino-acids cannot be entirely protected. In some instances, particularly in the case of materials lacking sufficient protein, the addition of ammonium sulphate causes an increase in the amount of alcohol. Investigation of the nature of the fusel oils obtained in these experiments showed that they all contained *n*-butyl alcohol in quantity. That formed without ammonium sulphate contained also *iso*-propyl alcohol, which was almost absent from the product prepared in presence of this salt. These two products, which do not occur in properly conducted fermentations, are the fermentation products of the ordinary butyric acid bacillus. The fusel oils investigated were formed on the one hand by the action of the yeast on protein degradation products, giving rise to *n*-propyl, *iso*-butyl, and amyl alcohols, and secondly by the action of the butyric acid bacteria. The alcohols were identified by fractional distillation and conversion into the corresponding iodides.
—E. F. A.

Brewer's pitch and pitch compositions; Viscosity of —— and melting point reduction of same. A. Wagner. Allgr Zeits. f. Bierbrau. u. Malzfal, 1908, **36**, 316—317, 330—333, 342—344.

Brewer's pitch should give a smooth, uniform surface, resistant to heat and cold and to the action of beer and cleansing agents; it must be free from mineral admixture and must contain no substance liable to decompose with the production of an unpleasant odour or taste, at the temperature at which it is applied to the surface to be coated. Apart from these qualities, the viscosity of the pitch at the temperature of application is very important, since the lower the viscosity, the more economically and efficiently can the pitch be applied. The viscosity should be determined, in the first place, at the highest permissible temperature of application, *e.g.*, 210° C., and also at lower temperatures (every 10 or 20 degrees). From such a series of determinations, the most suitable temperature for applying the pitch may be found; for to use a temperature of, say, 210° C., if the pitch is sufficiently mobile at 160°—180° C., is not only useless, but may injure the quality of the pitch owing to decomposition. The viscosity of pitch and pitch compositions may be reduced by addition of paraffin wax, which is the best, though most costly, material for this purpose; the wax must be free from odour or taste and must not show any coloration when heated on the water-bath with concentrated sulphuric acid and then allowed to solidify. Wax of relatively high melting point (58°—62° C.) is preferable, since it is less liable to decompose when applied at a high temperature; the viscosities of waxes of different melting points do not differ much. Many commercial pitch compositions consist merely of a mixture of pitch and paraffin wax, and may often be made more cheaply in the brewery. Pitch which is too viscous, but satisfactory in other respects, may be made sufficiently mobile by addition of paraffin wax; since the wax is costly, it is important to determine the amount required, by viscosity experiments. The author gives a table and curves showing the reduction of viscosity, at various temperatures, caused by addition of increasing proportions of paraffin wax to pitch. The viscosity of a pitch increases with protracted heating, and with the temperature of heating, and increases more if the pitch is heated in an open boiler than in a closed one. Hence, the temperature, not only in the pitching apparatus, but in the boiler as well, should be kept under observation. The viscosity of a pitch, not only at the temperature of application, but at lower ones also, is important, since the temperature of the pitch decreases very considerably as it is sprayed into the vat. Of two pitches possessing the same viscosity, say, at 200° C., that which has the lower viscosity at 150°—160° C. is the most economical. No certain conclusions concerning the viscosity of a pitch composition can be deduced from its melting point, since with increasing content of paraffin wax, the melting point may rise, whilst the viscosity falls.—L. E.

Cane sugar [sucrose]; Inversion of —— by invertase. C. S. Hudson. *See* XVI.

Abrastol [asaprol, calcium β-naphthol-a-sulphonate]; Reactions of —— [and its detection in wine]. D. Vitali. *See* XX.

Royal Commission on Whisky and other Potable Spirits; Report of the ——. [Cd. 4180.] Price 1d.

The Commissioners appointed to inquire and report:

I. Whether, in the general interest of the consumer, or in the interest of the public health, or otherwise, it is desirable—

(*a*) To place restrictions upon the materials or the processes which may be used in the manufacture or preparation in the United Kingdom of Scotch Whisky, Irish Whisky, or any spirit to which the term whisky may be applied as a trade description;

(*b*) To require declarations to be made as to the materials, processes of manufacture or preparation, or age of any such spirit;

(*c*) To require a *minimum* period during which any such spirit should be matured in bond; and

(*d*) To extend any requirements of the kind mentioned in the two sub-divisions immediately preceding to any such spirit imported into the United Kingdom,

submit the following preliminary Report:—

"We have held 22 sittings and examined 74 witnesses. Certain of the Commissioners have visited distilleries in Scotland and Ireland, and have thereby obtained much valuable information.

"Whilst the labours of the Commissioners are by no means terminated, we have arrived at certain conclusions, which we now humbly submit to Your Majesty as follows:

"1. That no restrictions should be placed upon the processes of, or apparatus used in, the distillation of any spirit to which the term "whisky" may be applied as a trade description.

"2. That the term 'whisky' having been recognised in the past as applicable to a potable spirit manufactured from (1) malt, or (2) malt and unmalted barley or other cereals, the application of the term 'whisky' should not be denied to the product manufactured from such materials.

"We reserve for further consideration the question of the advisability or otherwise of attaching special significance to particular designations such as 'Scotch Whisky,' 'Irish Whisky,' 'Grain Whisky,' and 'Malt Whisky'; of placing restrictions upon the use of such designations as trade descriptions; or of requiring such designations to be used in connection with the sale of whisky.

"We ask Your Majesty's permission to postpone stating in full the grounds upon which we have arrived at the above conclusions until we submit our final Report upon all the matters referred to us.

"We also submit to Your Majesty the Minutes of Evidence given before us.

"We think that the immediate publication of this Report is desirable.

"All of which we most humbly submit to Your Majesty's most gracious consideration."

James of Hereford, *Chairman.*
L. N. Guillemard.
W. E. Adeney.
J. R. Bradford.
Horace T. Brown.
G. S. Buchanan.
J. Y. Buchanan.
Arthur R. Cushny.
Aubrey V. Symonds, *Secretary.*
24th June, 1908.

Report of the Principal Chemist of the Government Laboratory for the year ended March 31, 1908. *See* XXIII.

Patents.

Malt grain for brewing; Treatment of ——. A. G. Bristow, Bury St. Edmunds. Eng. Pat. 23,787, Oct. 28, 1907.

The grain is crushed between a pair of rollers, and then falls on to a shaking or beating device which separates the grits from the husks, which are both next passed through a second pair of rollers, set closer together than the first pair, so as to crush the ends of the grains. The product obtained is as free from flour as it would be with a single crushing only, but the whole of the grain in the husk is efficiently bruised.—W. P. S.

Malting; Rapid method of ——. A. A. Poulverel. Fr. Pat. 387,384, Feb. 20, 1908.

The malting process is accelerated and the diastatic power of the malt increased by husking the barley, or other grain, and using a 3—4 per cent. solution of hydrochloric acid for steeping and sprinkling.—R. L. S.

Malt product rich in amylase; Process of manufacturing a ——. A. A. Poulverel. Fr. Pat. 387,601, Feb. 27, 1908.

Malt is treated with one and a half times its weight of water, and the mixture is heated in a closed vessel under reduced pressure to a temperature of 40° C. for 1 hour. The mixture is then filtered under reduced pressure, and out of contact with air, and the filtrate is evaporated at a temperature of 55° C., and also under reduced pressure, until a syrup or powder is obtained. Another portion of the wort, prepared as described above, is treated with alcohol, the precipitated diastase (amylase) is collected, dried, and added in desired quantities to the evaporated malt extract previously obtained.—W. P. S.

Fermented beverages; Manufacture of ——. E. W. Kuhn, London. Eng. Pat. 4622, Feb. 29, 1908.

This invention has the object of preventing the formation of carbon dioxide in the gaseous form during alcoholic fermentation and ensuring its retention in the liquid in a state of more or less stable combination. For this purpose, fermentation is carried out in a closed, vertical cylinder of enamelled steel, capable of resisting very high pressures. The cylinder is provided with a conical bottom for the purpose of withdrawing the deposited yeast by means of a cock at the apex. A jacket is fitted around the cylinder for the circulation of a cooling liquid. This is necessary after fermentation is complete, in order to cool the contents of the cylinder sufficiently to allow the pressure to be reduced for racking. The cylinder has a special valve situated within the liquid and hermetically closed by a spring so adjusted that the valve is tight up to a pressure of 20 atmospheres, but so soon as this pressure is exceeded, it lifts a little to allow so much liquid to escape, that the pressure is again restored to 20 atmospheres. The cylinder is charged with wort so that there is no free space above the liquid; it is next connected with a compressing pump, by which liquid of the same nature as that undergoing fermentation is forced in until the pressure of 20 atmospheres is reached, this pressure being automatically maintained constant. The pump and valves, and other fittings which come in contact with the liquid are constructed of solid silver or glass. When fermentation sets in, there is no evolution of carbon dioxide, and the retention of this product in solution checks the fermentation in such a way that carbon dioxide is produced very slowly and remains in combination with the colloids of the wort. This latter action is assisted by the passage of an electric current, between a cathode at the top and an anode at the bottom of the liquid. The fermented liquid is finally chilled and forced through sterilised asbestos filters into the racking apparatus.—J. F. B.

Saccharine juices; Process for sulphitating and desulphitating —— and its applications to various fermentation industries. E. A. Barbet. Fourth Addition, dated May 6, 1907, to Fr. Pat. 361,869, Oct. 27, 1905 (this J., 1906, 1229; 1907, 109, 708, 1250).

The desulphitated and cooled juice passes to the top of a column of a construction similar to that of the desulphitating column (*loc. cit.* 1229). The descending juice is aërated by an ascending current of air which, if the juice is to be fermented, is sterilised by filtration through cotton wool before entering the column. The air which leaves the top of the aëration column is used in the desulphitation process.—L. E.

Wine; New process for the carbonation of white ——. L. Pagès and J. Trespaillé. Fr. Pat. 387,147, Jan. 17, 1908.

The wine, contained in a very strongly made wooden cask reinforced with iron plates over the heads, is treated during 4 to 5 days with carbon dioxide under increasing pressure. The cask is fitted with suitable valves for the introduction of wine and gas, and with a pressure gauge and safety valve, and can be rotated about its longitudinal axis, the thorough mixing of wine and gas being facilitated by the presence of five feathers which project into the cask throughout its length.—R. L. S.

Fruit juice, wine, and cider; Process and apparatus for the concentration of —— *by freezing.* E. A. Barbet. Fr. Pat. 387,460, May 6, 1908.

The liquid to be concentrated is partially frozen while in motion in a jacketed vessel. The ice crystals and mother liquor are discharged into separate vessels through which the next charge is passed in turn, thereby becoming cooled; in this way a great saving is effected in the amount of power subsequently required to freeze the liquid.
—R. L. S.

Spirit; Process for manufacturing solidified ——. V. Perelzveich and G. Rosenbusch, Oerlikon-Zürich, Switzerland. Eng. Pat. 26,915, Dec. 5, 1907.

Solidified spirit is prepared by mixing denatured alcohol with about 3 per cent. of tristearin and 5 per cent. of "sodium sebate," heating the mixture for a short time until dissolved and finally adding to the solution about 1 per cent. of cellulose tetranitrate in the form of an alcoholic-ethereal solution. It is claimed that this product gives a flame of great heat, melts very slowly, and leaves very little residue; it is also non-explosive.—J. F. B.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, AND DISINFECTANTS.

(*A.*)—FOODS.

Report of the Principal Chemist of the Government Laboratory upon the work of the Laboratory for the year ended March 31, 1908. *See* XXIII.

Cocoanut oil; Unsaponifiable constituents of ——, *and detection of that fat in butter.* H. Matthes and E. Ackermann. *See* XII.

Patents.

Food for cattle; Manufacture of ——. A. Zimmermann, London. Eng. Pat. 14,442, June 22, 1907.

The food is prepared by mixing molasses or like saccharine substances with the cellulose product obtained by treating wood, moss litter, etc., as described in Eng. Pats. 258 of 1900 and 12,588 of 1901 (this J., 1900, 1028; 1901, 1008).
—W. P. S.

Proteose preparation from fish; Process for the manufacture of a ——. K. Schwickerath, Bonn, Germany. Eng. Pat. 1343, Jan. 20, 1908. Addition to Eng. Pat. 4436 of 1907.

Any sufficiently soluble oxide, hydroxide, or weak acid salt of the alkaline-earths, including magnesia, may be used in place of the calcium hydroxide (milk of lime) employed in the process described in the main patent (this J., 1908, 350).—W. P. S.

Meat extracts ; New process for the preparation of ——. A. Corthay. Fr. Pat. 387,364, Feb. 19, 1908.

The meat, previously freed from fat and bone, is sliced and heated for 40 minutes at 150° C. in an "Auto Vacuum" apparatus. The residue is ground and packed for the market in the usual way. The bones after removal of the gelatin and fat by digestion at 150° C. are reduced to a paste and used as cattle food or manure. The fat is washed in cold water, drained, and, after being flavoured, heated *in vacuo* to 150° C. whereby all ill-smelling substances are removed. The fat so treated is fit for human food.—R. L. S.

Dynamo-electric machine especially intended for bleaching flour. F. H. Loring. Fr. Pat. 387,266, Feb. 15, 1908. Under Int. Conv., Feb. 15. 1907.

See Eng. Pat. 3724 of 1907 ; this J., 1908, 130.—T. F. B.

Fruit juice, wine, and cider ; Concentration of —— *by freezing.* Fr. Pat. 387,460. *See* XVII.

(*B.*)—SANITATION ; WATER PURIFICATION.

Absorption of oxygen by polluted waters and other fermenting liquids ; Apparatus for observing the rate of ——. W. E. Adeney. *See* XXIII.

Patents.

Sewage sludge ; Destructive distillation of —— *for the recovery of by-products such as ammonia and oil therefrom, and the utilisation of the residue.* G. Watson, Leeds. Eng. Pat. 14,414, June 22, 1907.

The sludge, after being dried by suitable means until it contains from 10 to 15 per cent. of water, is fed into a retort where it is subjected to distillation. The retort is pear-shaped in section and flattened in cross-section, and is heated by causing burning gases to circulate through spiral flues surrounding it ; a combustion chamber is provided at one side of the retort where non-condensable gases, withdrawn from the top of the retort, are burnt. Means are provided for admitting superheated steam into the retort and for drawing off the distillation products from different levels in the retort, and condensing them. A long chain passing through the centre of the retort affords a means for stirring or breaking up the contents. The retort-residue is useful as a manure, either alone or when mixed with other fertilisers.—W. P. S.

Water or effluents ; Method and apparatus for clarifying and purifying ——. L. Linden, Brussels. Eng. Pat. 16,239, July 15, 1907.

The water is treated with milk of lime or lime-water, other reagents being added if desired, and is then conducted through a pipe to the bottom of a tank. A bell-shaped vessel is suspended over the mouth of the inlet pipe, and baffle-plates are arranged at different heights in the tank. The water rises in this tank, partial sedimentation having taken place, flows from the top edge over a long, slightly inclined channel, whence it is delivered on to a pulverising or centrifugal apparatus rotating at high speed. The water thus aerated is collected in a small tank below the aerating apparatus, then conducted to the bottom of a second settling tank similar to the first, and thence to a third ; the three tanks are situated one slightly below the preceding one, and means are provided for removing the sludge from the tanks as required. The bell-shaped vessels are provided with central pipes extending above the tank, so that air, collecting under the bell, may escape ; solid particles, which rise up these pipes, are removed through side pipes.—W. P. S.

Sewage, trade effluents, and other impure liquids ; Filtration or purification of ——. R. Malabar, Seacombe, Cheshire. Eng. Pat. 17,389, July 30, 1907.

The sewage is conducted into a tank, one end of which is covered by a filter. The latter consists of two layers of carbon, separated by a layer of wood in the form of fine fibre, granules, or powder, the layers being held in position by perforated plates. The pieces of carbon used in the filter are of such size that they will pass through a ¼-inch mesh, but not through a ⅛-inch mesh. After passing upwards through this filter, the liquid flows into a channel whence it is led away. A similar filter through which the sewage passes downwards, may be provided at the bottom of the tank ; a space is arranged below this filter and the discharge outlet from this space is provided with a valve, so that the flow of liquid can be stopped when required.—W. P. S.

Water and sewage ; Process for purifying ——. A. E. Woolf, New York. U.S. Pat. 892,486, July 7, 1908.

The sewage, or water, is freed from suspended organic matter and is then treated with a quantity of a saline solution which has been submitted to electrolytic action. The sewage is next filtered, and an excess of the saline solution is added to the effluent, so as to completely sterilise it.—W. P. S.

Water, etc. ; ; Process of sterilising ——. R. Cambier, A. Tixier, and C. E. Adnet, Paris, Assignors to Special Products Co., of New Jersey. U.S. Pat., 892,580, July 7, 1908.

See Fr. Pat. 337,630 of 1903 ; this J., 1904, 500.—T. F. B.

(*C.*)—DISINFECTANTS.

Petroleum benzine [and other solvents] ; Germicidal power of ——. F. J. Farrell and F. Howles, J. Soc. Dyers and Col., 1908, **24**, 166—169.

A series of experiments was made to determine the effect of various organic substances upon cultures of the *Bacillus typhosus.* It was found that the solutions of a "benzine soap" in petroleum benzine, which are largely used for dry cleaning, possess no germicidal properties. The organism, however, is killed in half an hour by immersion in pure carbon tetrachloride, though mixtures of carbon tetrachloride and petroleum benzine containing 50 and 75 per cent. by volume of the tetrachloride, were found to have no action upon the bacilli even after a contact of 24 hours' duration. The organism is not affected by immersion for 24 hours in pure chloroform, whilst an aqueous solution containing 0·622 per cent. of chloroform kills the bacilli in half an hour. A somewhat similar behaviour was observed with phenol, for a 1·25 per cent. aqueous solution was found to have the same germicidal value as an 8 per cent. solution of phenol in benzene.
—P. F. C.

Soaps ; Disinfectant constituents of ——. H. Reichenbach. Z. Hyg. u. Infekt.-Krankh., 1908, **59**, 296—316. Chem. Zentr., 1908, **1**, 2194—2195.

Of the alkali salts of fatty acids, the palmitate has the strongest bactericidal action, followed by the stearate and myristate. With the exception of the stearate, the disinfectant action of the salts decreases with the molecular weight of the acid. gradually down to the caprate, and then very rapidly. The potassium salts of saturated fatty acids present in noteworthy quantities in ordinary soaps possess considerable disinfecting power, but the salts of the unsaturated acids are without appreciable action, with the exception of those of elaidic acid, which are almost as effective as the salts of saturated acids. The main cause of the disinfecting power of soaps is due to the free alkali present therein and formed by hydrolysis. The effect of free alkali and a salt of a fatty acid when present together is greater than the sum of the effects of the two acting singly.—A. S.

Patent.

Antiseptic compounds ; Process of making ——. E. Lutz et Cie. Fr. Pat. 387,603, Feb. 27, 1908.

The compounds are prepared by mixing borofluorides, or mixtures of boric acid and fluorides, with alkali bisulphates.
—W. P. S.

XIX.—PAPER, PASTEBOARD, &c.

Patents.

Celluloid, ivory, shells, and the like; Method of applying paint to ——. H. Ligny. Fr. Pat. 386,846, April 20, 1907.

The colouring matters are mixed with liquids which will attack the material to which the paint is to be applied, *e.g.*, with alcohol and acetone for celluloid, and with acetic acid and alcohol for shells, ivory, or horn.—A. S.

Celluloid; Process for the manufacture of products resembling ——. Soc. anon. nouvelle "L'Oyonnithe." Fr. Pat. 387,179, Feb. 12, 1908.

It is proposed to partly or wholly replace the camphor used in the preparation of celluloid by the methylic, ethylic, etc., esters of fatty acids such as palmitic, stearic, and oleic acids. Such esters may be obtained by ordinary methods, or better by acting on the oil or fat, in the presence of mineral acids, with the required alcohol, at the boiling point of the alcohol.—J. W. G.

Celluloid-like substance. C. Schraube and E. Laudien, Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. U.S. Pat. 892,899, July 7, 1908.

See Fr. Pat. 366,106 of 1906; this J., 1906, 1001.—T. F. B.

Electrolytic apparatus for bleaching, scouring, etc. Fr. Pat., 387,104. *See* XIA.

Viscous liquids produced by heating glycerin. Ger. Pat. 198,711. *See* V.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

Morphine; Colorimetric determination of small amounts of ——. Mai and Rath. Arch. Pharm., 1908, **244**, 300.

One c.c. of a 1:1000 aqueous solution of morphine hydrochloride, or even a more dilute solution, is evaporated on the water-bath, and the residue treated with 1 c.c. of Marquis's reagent (2 drops of 40 per cent. formaldehyde solution with 3 c.c. of sulphuric acid). The deep violet liquid is transferred to a small test glass and diluted with 4 c.c. of sulphuric acid. The colour may then be matched with that produced by a known weight of morphine hydrochloride. One mgrm. of morphine gives a deep violet-blue colour; and with 0·03 mgrm. the colour is distinct, and colorimetrically measurable.—J. O. B.

Quinine tannates; Solubility of true and false ——. F. Muraro. Gaz. chim. ital., 1908, **38**, I., 427—430.

The author has determined the solubility in water and hydrochloric acid of two true tannates and one pseudo-tannate of quinine (compare this J., 1908, 138). The true tannates, $C_{20}H_{24}N_2O_2,C_{14}H_{10}O_9,4H_2O$ and $(C_{20}H_{24}N_2O_2)_2(C_{14}H_{10}O_9)_3,8H_2O$, were prepared by pouring into a solution of 1 part of tannin in 95 per cent. alcohol a solution of 1 or 2 parts of quinine respectively in the same solvent. They are light, dirty white powders. The pseudo-tannate

$$(C_{20}H_{24}N_2O_2,H_2SO_4)_2(C_{14}H_{10}O_9)_5\,14H_2O,$$

was prepared by pouring an aqueous solution of 2 parts of tannin into an aqueous solution of 1 part of quinine sulphate, removing the precipitate, washing it, melting it in twice its volume of water at about 70° C., and drying at 30° C. in the air. It is a powder of straw-yellow colour. The true tannates are practically insoluble in water. In hydrochloric acid (1 : 1000 and 3 : 1000), the dihydrochloride of quinine is formed, so much of the quinine tannate dissolving as corresponds to the hydrochloric acid present. The pseudo-tannate is somewhat more soluble in water, but less soluble in hydrochloric acid than the true tannates. On washing, the true tannates tend to become richer in quinine, and the pseudo-tannate richer in tannin. For example, the pseudo-tannate mentioned, on prolonged washing, yielded a product of the composition,

$$(C_{20}H_{24}N_2O_2,H_2SO_4)_2(C_{14}H_{10}O_9)22H_2O.$$

—A. S.

Ipomœa purpurea; Chemical examination of ——. F. B. Power and H. Rogerson. Amer. J. Pharm., 1908, **80**, 251—286.

The stems and roots of *Ipomœa purpurea* are employed, under the name of "i-Jalapa" as an aperient by the natives of South Africa. The dried stems of the plant, obtained from Durban, have been found to contain 4·8 per cent. of a complex purgative resin. Systematic examination of this resin, removed by alcohol, gave the following results:—*Light petroleum spirit extract.* This represented 8 per cent. of the total resin. After treatment with alcoholic potassium hydroxide, it yielded pentatriacontane, $C_{35}H_{72}$, m. pt. 74—75° C.; a phytosterol, $C_{27}H_{46}O$, H_2O, m.pt. 132—133° C.; formic, butyric, and higher volatile acids; stearic, and apparently some palmitic acid; and a trace of an unsaturated oily acid. *Ether extract.* This represented 7·3 per cent. of the total resin. When fused with potassium hydroxide it gave formic and butyric acids, a mixture of higher volatile acids, and a small amount of a crystalline acid, m. pt. 103—104° C. apparently azelaic acid, $C_{19}H_{16}O_4$; and a trace of substance giving the catechol reaction. When the extract was heated with 5 per cent. alcoholic sulphuric acid, it gave, besides a quantity of resin, a small amount of a fragrant, neutral oil; formic and butyric acids, with higher volatile acids; a soluble non-volatile acid; and dextrose. *Chloroform extract.* This represented 9·8 per cent. of the total resin. When fused with potassium hydroxide, it gave decomposition products similar to the ether extract, but no crystalline acid. The products of hydrolysis with 5 per cent. alcoholic sulphuric acid were also similar to those obtained from the ether extract. *Ethyl acetate extract.* This represented 23·8 per cent. of the total resin. It yielded a very small amount of a new crystalline alcohol, *ipuranol*, $C_{23}H_{38}O_2(OH)_2$ m.pt. 285—290° C. (m. pt. of acetyl derivative, 160°C.). When fused with potassium hydroxide and when heated with 5 per cent. alcoholic sulphuric acid, the extract yielded products similar to those obtained from the ether and chloroform extracts. *Alcohol extract.* This represented about 50 per cent. of the total resin. When decolorised by animal charcoal, and dried at 110° C., it melted between 150—160° C.; $[a]_D = -51{\cdot}64°$. When hydrolysed with 5 per cent. alcoholic sulphuric acid, in addition to the products previously obtained from the other extracts, a new crystalline acid, *ipurolic acid*, $C_{13}H_{25}(OH)_2.COOH$, was isolated in fine, colourless, silky needles, m. pt. 100—101° C. Several salts and derivatives of this acid have been prepared. In addition to this a number of other acids have been isolated and identified among the products of alkaline hydrolysis of the alcohol extract. Physiological experiments show that the ether, ethyl acetate, and alcoholic extracts were all actively purgative; the light petroleum spirit extract was without definite action; the chloroform extract was less actively purgative, but was slightly emetic. After hydrolysis with barium hydroxide the alcoholic extract was physiologically inert.—J. O. B.

Eupatorium rebaudianum; Sweet principle of ——, *and method of preparing glycyrrhizin from licorice root.* P. Rasenack. Arbb. Kaiserl. Gesundheitsamte, 1908, 2, 240; Apoth.-Zeit., 1908, **23**, 446—447.

The composite plant, *Eupatorium rebaudianum*, indigenous to Paraguay, contains a sweet principle, $C_{42}H_{72}O_{21}$, crystallising in long white needles. The whole plant has a markedly sweet taste, which is most pronounced in the young shoots and leaves. These were extracted with alcohol, and the alcoholic filtrate was precipitated with ether: the precipitate thus obtained, when further purified, afforded the sweet substance in a crystalline form. It was readily soluble in water, alcohol, and amyl alcohol; sparingly so in methyl alcohol and acetone; only traces were dissolved by ether, benzene, and hydrocarbons. It had no sharp melting point. When hydrolysed by boiling with water, or with very dilute sulphuric acid, it was split up into dextrose and a tasteless, crystalline body, $C_{30}H_{10}O_5$, m.pt. 226—227° C., readily soluble in ether. Besides this sweet principle, the plant contained a tannin, giving a green precipitate with iron-alum reagent, and a black precipitate with a trace of alkali. The sweet principle of *Eupatorium* differs from glycyrrhizin, not only in its chemical formula, but in its behaviour towards reagents, since it is not precipitated by those salts which remove glycyrrhizin from solution.

Method of isolating glycyrrhizin (glycyrrhizinic acid).—One part of finely disintegrated Russian licorice is macerated with 5 parts of water, for 2 days, at 15—20° C. The expressed liquid, after standing and filtering, is further clarified by boiling with a little egg albumin. The clear filtrate is then treated with an equal volume of dilute (1 : 3) sulphuric acid; after 12 hours the crude glycyrrhizin is collected and washed, first with dilute sulphuric acid, then with a very little water, until the latter begins to be coloured. The brown, viscous, crude glycyrrhizin is then treated with excess of ammonia solution, and the orange-yellow solution diluted to 1 litre for each kilo. of root originally used. The amount of sulphuric acid present in an aliquot part of this is determined, and a slight excess of the necessary quantity of barium hydroxide is added to the bulk. After removing the barium sulphate, the excess of barium hydroxide is precipitated by means of ammonium carbonate: the filtrate from this is evaporated to dryness, and dissolved in 1 to 1·5 parts of hot acetic acid. On cooling, the acid ammonium salt crystallises out, and is washed or recrystallised with acetic acid until it gives a colourless solution in strong sulphuric acid. One part of this salt is then dissolved in about 200 parts of cold, 50 per cent. alcohol, and precipitated with a solution of neutral lead acetate in the same solvent; the precipitate is collected and washed, first with 50 per cent. alcohol, to remove ammonium acetate, then with absolute alcohol to remove water. It is then suspended in absolute alcohol and treated with hydrogen sulphide, filtered, and the filtrate evaporated at the ordinary temperature under reduced pressure. The residue is recrystallised from alcohol or acetic acid. The presence of sucrose in licorice root has been established.—J. O. B.

Apocynin. Constituents of Canadian hemp. H. Finnemore. Chem. Soc. Proc., 1908, **24**, 171.

The important constituent (0·2 per cent.) of the root of *Apocynum cannabinum* is identical with the crystalline apocynin of commerce, and with the product previously isolated by Wood (*J. Amer. Med. Assoc.*, 1904, **43**, 1953) for pharmacological purposes. Apocynin, $C_9H_{10}O_3$, which has a faint odour of vanillin, forms slender, colourless prisms, m. p. 115° C. It is convertible into a crystalline potassium derivative, and into acetyl, benzoyl, and methyl derivatives, m. p. 57°, 106°, and 51° C. respectively; it yields an oxime and a well-defined hydrazone and semicarbazone, m. p. 126° and 167° C. respectively; its molecule contains a single methoxyl group. As it has no aldehydic properties, it follows that apocynin is a hydroxymethoxyacetophenone. It is in fact identical with the acetovanillone (4-hydroxy-3-methoxyacetophenone) obtained by Tiemann (*Ber.*, 1891, **24**, 2855) from *iso*-eugenol, and by Goldschmiedt and Hemmelmayr (this J., 1895, 63, from scoparin.

The pharmacological properties of apocynin are under investigation. A synthesis of acetovanillone from vanillic acid by Neitzel (*Ber.*, 1891, **24**, 2863) could not be confirmed, and another by T. Otto (*ibid.*) gave a yield too small for practical use: the product, however, was identical with apocynin.

Apocynin; New synthesis of ——. H. Finnemore. Chem. Soc. Proc., 1908, **24**, 171—172.

The previously known syntheses of apocynin (acetovanillone) being unsatisfactory (see preceding abstract), the author has synthesised this substance from vanillin by an application of the Grignard process. Benzoylvanillin, $C_6H_3(O.CO.C_6H_5)(OCH_3).CHO$, is converted by magnesium methiodide, with subsequent hydrolysis, into *benzoylapocynol*, $CH_3O.C_6H_3(O.CO.C_6H_5).CH(OH).CH_3$, m. p. 128° C., the phenolic benzoyl derivative of the secondary alcohol corresponding with apocynin. This benzoyl compound is oxidised by chromic acid mixture to *benzoylapocynin*, $CH_3O.C_6H_3(O.CO.C_6H_5).CO.CH_3$, m. p. 106° C., which gives on hydrolysis, 4-*hydroxy*-3-*methoxyacetophenone*, $CH_3O.C_6H_3(OH).CO.CH_3$, m. p. 115°; this is identical with natural apocynin, and with acetovanillone prepared from guaiacol (preceding abstract). The yields throughout are good. *Apocynol* or 4-*hydroxy*-3-*methoxyphenylmethylcarbinol*, $CH_3O.C_6H_3(OH).CH(OH).CH_3$, m. p. 101° C., obtained by hydrolysing the above synthetic benzoyl derivative, may also be formed, although with poor yield, directly from apocynin by the action of sodium amalgam. This alcohol and the corresponding *dihydroxycarbinol*, $C_6H_3(OH)_2.CH(OH).CH_3$, that is formed from it by the action of suitable hydrolytic agents, promise to be of interest pharmacologically by reason of their very close relation to adrenaline.

d-Pinene; Hydration of ——. W. Smirnow. J. Russ. Phys.-Chem. Ges., 1908, **40**, 150—153. Chem. Zentr., 1908, **1**, 2152—2153.

The union of *d*-pinene with water in presence of sulphuric acid is a catalytic reaction. Even with only 2 per cent. of the acid, more than half of the hydrocarbon is converted into the corresponding alcohol. On increasing the quantity and concentration of the acid, the reaction proceeds more rapidly. The secondary alcohol produced, $C_{10}H_{18}O$, boils at 93°—95° C. at 10 mm., and has the sp.gr. 0·9185 at 18·8°/4°C. When oxidised with chromic acid mixture, it yields a ketone, b.pt. 200°—205° C., very similar to that obtained by Aschan (this J., 1907, 776), whilst when oxidised with permanganate, it yields trihydroxyhexahydrocymene. In the author's opinion the *d*-pinene from birchwood tar is a mixture of pinolene with pinene or another new hydrocarbon.—A. S.

Cholesterol and cholic acid and camphor and oil of turpentine; Relation between ——. H. Schrötter and R. Weitzenböck. Monats. Chem., 1908, **29**, 395—398.

It has been shown previously that by the action of concentrated sulphuric acid and mercury on cholesterol or cholic acid, followed by treatment of the reaction-product with nitric acid, a crystalline acid (m.pt. 228°—230° C.), which the authors have named *rhizocholic acid*, and which is probably a hydroxycyclopentadiënetricarboxylic acid, is produced. It is now found that when treated in a similar manner, camphor and oil of turpentine yield the same acid, and thus for the first time, proof is afforded of a genetic relationship between cholesterol and cholic acid and the terpenes.—A. S.

Reductions with platinum and hydrogen. II. Formation of dihydrocholesterol. R. Willstätter and E. W. Mayer. Ber., 1908, **41**, 2199—2203.

In a previous communication (this J., 1908, 642) it was shown that the ethylene bond may be reduced at the ordinary temperature by hydrogen in the presence of platinum. This treatment also effects the reduction of cholesterol, whereas Windaus (this J., 1907, 782) found that that substance was not attacked by the most energetic reducing agents. If the cholesterol is dissolved in ether and a current of hydrogen passed through the solution in the presence of platinum, the reduction is quantitative. The resulting compound, dihydrocholesterol, $C_{27}H_{48}O$, is identical with the β-cholestanol obtained by the action of sodium and amyl alcohol upon cholestenone. These facts support the view of Diels and Linn (this J., 1908, 358) as to the relationship between cholesterol and cholestenone. Dihydrocholesterol crystallises from alcohol in hexagonal plates, melting at 141·5°—142° C. (corr.), and having an optical rotation of $[\alpha]_D^{22} = +23{\cdot}8°$. On treating its solution in chloroform with 2 drops of strong sulphuric acid and 2 drops of acetic anhydride, it does not give Liebermann's cholesterol reaction. When oxidised by chromic acid in acetic acid solution, it yields an oxidation product (m.pt. 128°—129° C.), which still combines with bromine. Acetylation of dihydrocholesterol yields a compound which crystallises in brilliant prisms (m.pt. 110·5°—111° C. corr.), and does not give the colour reactions of cholesteryl acetate.—C. A. M.

Amygdalin; Hydrolysis of —— by emulsin. Part II. S. J. M. Auld. Chem. Soc. Proc., 1908, **24**, 181—182.

By observation of the change of rotation of the dextrose produced during the hydrolysis of mandelonitrile glucoside by emulsin and the approximate constancy of the rotation after hydrolysing amygdalin by emulsin, it is possible to show that amygdalin is derived from an $\alpha\beta$-disaccharide, the β-dextrose residue being attached to the benzaldehydecyanohydrin nucleus. Exact measurement of the quantities of hydrocyanic acid, benzaldehyde, and dextrose formed from amygdalin shows that mandelonitrile glucoside is formed as an intermediate product during the hydrolysis by emulsin, the biose ether-linking breaking preferentially. By stopping the hydrolysis at a suitable point, it is possible actually to isolate Fischer's glucoside. (See also this J., 1907, 437.)

Ergosterol and fongisterol. C. Tanret. Compt. rend., 1908, **147**, 75—77.

Rye ergot contains, in addition to ergosterol, another closely related crystalline substance which has been met with in other fungi and which the author terms fongisterol. The two substances may be separated by means of ether in which ergosterol is the less soluble. Pure ergosterol, $C_{27}H_{42}O,H_2O$, obtained by fractional crystallisation from ether, has the rotatory power, $[\alpha]_D = -126°$. It crystallises from ether in needles and from alcohol in large plates. It is dehydrated only with difficulty. It melts at 165° C. when heated on the Maquenne block. The rotatory power of the pure acetate is $[\alpha]_D = -91{\cdot}8°$ and of the formate, $[\alpha]_D = -97{\cdot}9°$. The lower values obtained previously are due to the presence of fongisterol. Fongisterol obtained from the ethereal mother liquors, is a lower homologue, $C_{25}H_{40}O,H_2O$, of ergosterol and crystallises in the same system. It melts at 144° C., has $[\alpha]_D = -22{\cdot}4$ in chloroform and $[\alpha]_D = -12{\cdot}9$ in ether. The acetyl derivative melts at 158·5° C., and has $[\alpha]_D = -15{\cdot}9$. Fongisterol is coloured ruby-red with 90 per cent. sulphuric acid, the coloration finally changing to a violet-red. Ergosterol under similar conditions gives no coloration. A very large number of lower plants contain cholesterols (mixtures in different proportions of ergosterol and fongisterol) quite distinct from animal cholesterol or the phytosterol of higher plants.—E. F. A.

Arsinic acids; Secondary aromatic ——. L. Benda. Ber. 1908, **41**, 2367—2373.

When aniline and arsenic acid are heated together to 180—200° C., in addition to arsanilic acid there is formed *pp*-diaminodiphenylarsinic acid $(NH_2.C_6H_4)_2AsO(OH)$. The crude product is dissolved in hot sodium hydroxide solution and filtered into twice the volume of alcohol. The sodium arsanilate crystallises out at once, and after 12 hours is filtered off. The filtrate is evaporated, and much alcohol added, whereby the last traces of sodium arsanilate are precipitated. The filtrate is evaporated till free from alcohol, the residue neutralised with hydrochloric acid, and the precipitate again dissolved in alkali and precipitated with acid, being finally crystallised from 50 per cent. acetic acid. The diaminodiphenylarsinic acid crystallises in needles melting at 232° C. It is distinguished from arsanilic acid in giving no precipitate with magnesia mixture in ammoniacal solution on heating. The diacetyl derivative melts at 263° C. By treating the diamino-acid with sodium nitrite and a mineral acid, and passing steam through the resulting tetrazo-compound, *pp*-dihydroxydiphenylarsinic acid is obtained. This crystallises from 50 per cent. acetic acid in thin plates, melting at 239° C. *pp*-Diaminodi-*o*-tolylarsinic acid is prepared from *o*-toluidine and arsenic acid as in the case of the diphenyl derivative. It crystallises from 35 per cent. acetic acid in short prisms melting at 243° C. The diacetyl derivative melts at 255° C. after softening at 237° C. *pp*-Dihydroxydi-*o*-tolylarsinic acid, prepared by diazotising the corresponding diamino-acid and boiling the solution, melts at 247° C.—J. C. C.

Abrastol [asaprol, calcium β-naphthol α-sulphonate]; Reactions of ——, [and its detection in wine]. D. Vitali. Boll. Chim. farm., [9], 291. Apoth.-Zeit., 1908, **23**, 507.

In addition to its use in medicine as an antiseptic, abrastol is employed as a clarifying agent and as a preservative for wines. Under these conditions, it precipitates calcium tartrate and forms 1 mol. of free β-naphthol-α-sulphonic acid and 1 mol. of its potassium salt. 0·2 grm. of abrastol are stated to be sufficient for 1 litre of wine; and the addition of this quantity is said to be quite unobjectionable. The best extraction media for abrastol are amyl alcohol, ethyl acetate, and chloroform. It may be identified by the following reactions:—(1). Ferric chloride gives a blue colour with a 1 : 1000 solution of abrastol. In the case of dark coloured wine, the test is applied to the ether extract; the blue colour obtained is changed, on evaporating, to dull yellow, and a bright brownish-blue dry residue is left. (2). With mercuric nitrate, abrastol gives a red colour, evident with 0·0001 grm. (3). It gives a yellow colour with strong sulphuric acid. (4). If 1 c.c. of a 1 : 10,000 solution of abrastol be evaporated to dryness, and the residue be moistened with sulphuric acid and formaldehyde solution, a fine green fluorescence is developed. (5). On evaporating to dryness 1 c.c. of a 1 : 10,000 solution of abrastol with mercurous nitrate, a residue with a fine violet-red colour is obtained. (6). A very dilute solution of abrastol gives a fine blue fluorescence with potassium or sodium hydroxide solution. (7). On adding chlorine solution and then a little ammonia to a 1 : 1000 solution of abrastol, a green colour with a blue fluorescence is developed. (8). On evaporating 1 c.c. of a 1 : 1000 abrastol solution to dryness, moistening the residue with potassium nitrate solution, and adding excess of sulphuric acid, an intense red colour appears, changing to violet. (9). Potassium nitrite solution gives a yellow colour with abrastol, changing to green on evaporation, and turned blood-red on adding sulphuric acid. (10). On evaporating 1 c.c. of a 1 : 10,000 abrastol solution and warming gently with a few drops of Froehde's reagent, a blue colour appears: and a green tint when vanadium-sulphuric acid reagent is similarly applied.—J. O. B.

Naphthols; Simple test to differentiate α- and β- ——. Voley-Boucher. Rep. Pharm., 1908, **18**, 289.

Half a grm. of the naphthol is dissolved in just sufficient 95 per cent. alcohol, the solution is treated with 2 c.c. of 10 per cent. copper sulphate solution and 4 c.c. of freshly prepared 10 per cent. potassium cyanide solution, with brisk agitation. α-Naphthol gives an abundant violet-red precipitate; with β-naphthol, the precipitate is yellow. On adding just sufficient 95 per cent. alcohol to redissolve the precipitate, the α-naphthol solution is rose-coloured by transmitted, and violet by reflected light. β-Naphthol solution is yellow. The reaction serves to detect the presence of α- in β-naphthol in the proportion of 1 : 2000, and is equally applicable to the camphorated naphthols used in medicine. Benzonaphthol gives no colour with the test, so that the presence of either α- or β-naphthol may be detected in that substance by its means.—J. O. B.

Anisal chloride. H. Schmidt. Ber., 1908, **41**, 2331—2332.

Anisal chloride, $C_8H_8OCl_2$, can be prepared by the addition of phosphorus pentachloride to anisaldehyde dissolved in ether. After digesting the mixture on the water-bath, the product is obtained by fractionating *in vacuo*. A more satisfactory method is to heat equivalent proportions of anisaldehyde and thionyl chloride in benzene solution in a reflux apparatus for several hours, and then to fractionate the liquid *in vacuo*. Anisal chloride is a colourless oil, which solidifies to a white crystalline mass in a freezing mixture and then melts at about 20° C. It boils at 130°—132° C. at 13 mm., and at 134° C.

at 14 mm. It is moderately stable. It is readily hydrolysed by cold water, and is vigorously hydrolysed by alcoholic potassium hydroxide, the product in both cases being anisaldehyde.—F. Shdn.

Primary alcohols ; Action of metallic oxides on ——. P. Sabatier and A. Mailhe. Compt. rend., 1908, **147**, 16—18.

A number of metallic oxides, acting below 400° C. on primary alcohols, oxidise these and are themselves reduced either to metal or to a lower oxide. The most simple case is that in which the oxidation is limited to the formation of water and aldehyde, without further oxidation of the latter to acid or carbon dioxide. Examples are afforded by the oxides of antimony (Sb_2O_5 and Sb_2O_3) and bismuth oxide. In cases where the oxide is more easily reduced, the oxidation goes further, and the aldehyde is attacked, forming an acid or even carbon dioxide and water. This takes place in the case of oxides of mercury and manganese. In both cases the action ceases when all the oxide has been reduced, and the metal formed is without catalytic properties. More often the metal or lower oxide formed acts catalytically to decompose the primary alcohol at the temperature of the experiment and as change proceeds the intensity of this second reaction increases. Oxides which act in this manner are those of lead, nickel, cobalt, copper, uranium, and vanadium. The products formed in such instances include aldehyde, hydrogen, carbon dioxide, ethylene, and water. Lastly in addition to oxides reduced by alcohols there are some which are powerful catalysts and at the same time only very slowly reduced. In such cases the products of change consist chiefly of hydrogen and carbon dioxide with a small quantity of ethylene, which diminishes as change proceeds. The oxides of iron, cadmium, and tin behave in this manner.—E. F. A.

Acetic acid from chloroform residue. D. B. Dott. Pharm. J., 1908, **81**, 54.

The author finds that, besides the products indicated in the equation :

$$2CO(CH_3)_2 + 6CaOCl_2 = 2CHCl_3 + 2Ca(OH)_2 + (CH_3COO)_2Ca + 3CaCl_2$$

there are considerable amounts of carbonate and chlorate in the residual liquor obtained in preparing chloroform from acetone. To ascertain the amount of acetate produced, 0·5 kilo. of bleaching powder was made into a thin paste with water at 30° C., and 45 grms. of acetone added. A brisk reaction took place ; the heat was increased to drive off the chloroform. The residue was filtered and washed, and the filtrate evaporated. Sulphuric acid was added in excess, the solution filtered from sulphate, and distilled. The yield of acetic acid as found by titration was practically half the theoretical.—W. S.

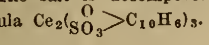
Monomethylamine ; Precipitation of —— as monomethylamine-magnesium phosphate. M. François. J. Pharm. Chim., 1908, **28**, 86.

When 1 mol. of sodium phosphate, 1 mol. of magnesium sulphate, and 2 mols. of free monomethylamine interact in dilute aqueous solution, a precipitate of monomethylamine-magnesium phosphate, analogous to ammonium-magnesium phosphate, is slowly formed. Under similar conditions, di- and tri-methylamine give no precipitate. Consequently the method suggested by Quantin of separating ammonia from the methylamines as the insoluble ammonium-magnesium phosphate, is not applicable in the presence of monomethylamine, but it serves to separate ammonia from the other two methylamines.—J. O. B.

Naphthalenesulphonates of cerium. H. Erdmann and T. Nieszytka. Annalen, 1908, **361**, 166—189.

The authors have prepared a number of cerous salts of naphthalenesulphonic acids by treating the acids with cerous carbonate or by double decomposition of the alkali salts and cerous nitrate. The solubilities of the various salts in water and methyl and ethyl alcohols is given in the following table :—

Cerium salt of :	Grms. of salt dissolved in 100 grms. of water at :		Grms. of salt dissolved at 15° C. in 100 grms. of :	
	15° C.	100° C.	Methyl alcohol.	Ethyl alcohol.
Naphthalene-β-sulphonate + 1 aq. ..	0·97	19·60	0·48	0·17
,, α-sulphonate	1·36	27·58	0·71	0·23
,, -1 : 5-disulphonate...	0·51	3·88	0·04	0·01
,, -2 : 7-disulphonate...	4·00	22·50	0·20	0·18
,, -2 : 6-disulphonate...	7·41	24·88	1·86	0·90
,, -1 : 6-disulphonate...	31·48	126·60	19·44	9·84
,, 1 : 3 : 5-trisulphonate...	16·41	42·58	0·17	0·03
,, 1 : 3 : 6-trisulphonate...	19·69	58·94	0·22	0·05
,, 1 : 3 : 7-trisulphonate...	26·76	165·42	0·22	0·10
,, -β-sulphonate + 2 aq. ..	24·60	411·50	1·36	0·51
1-Naphthol-8-sulphonate	0·09	*	0·01	0·02
Chromotropate	54·11	531·10	3·34	0·62
Anthraquinonesulphonate	0·17	40·68	0·10	0·02

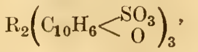
* The salt is decomposed by heat forming a blue salt of formula  $Ce_2\left(\begin{smallmatrix}O\\SO_3\end{smallmatrix}\!>C_{10}H_6\right)_3$.

—J. C. C.

Rare earths ; The ——. H. Erdmann and F. Wirth. Annalen, 1908, **361**, 190—217.

The authors have prepared the salts of several of the rare earths with α-naphthol-8-sulphonic acid and also with malonic acid. The salts of the latter with the rare metals of the cerium group are isomorphous and micro-crystalline, whilst those of the yttrium group form spear-like crystals. By means of this difference the two kinds of salts can be readily identified. By systematic fractional crystallisation of the double magnesium nitrates, praseodymium and lanthanum can be separated from neodymium, samarium, and the metals of the yttrium group ; the middle fraction contains the nearly pure neodymium double salt ; this is purified by recrystallisation and separated from traces of praseodymium and samarium by means of the oxalates and sulphates. The separation of lanthanum, cerium, and praseodymium is effected by means of the double ammonium nitrate, the lanthanum salt being less soluble in nitric acid than the others. The lanthanum is freed from traces of praseodymium and neodymium by recrystallisation of the oxalates from nitric acid solution. The cerium is removed by the potassium permanganate method. The separation of samarium and gadolinium depends on the fact that when a neutral solution of samarium nitrate is mixed with a warm saturated solution of potassium sulphate and solid potassium sulphate added, a crystalline salt, $2Sm_2(SO_4)_3,9K_2SO_4,3H_2O$, separates which is insoluble in a concentrated solution of potassium sulphate, whilst the corresponding salt of gadolinium is readily soluble. From the middle fractions obtained by carrying out this separation, the europium is removed by adding bismuth nitrate and magnesium nitrate, whereby the salt, $3Mg(NO_3)_2 2Bi(NO_3)_3,24H_2O$, is formed, which with respect to its solubility lies between the corresponding double magnesium salts of samarium and europium. By fractionation in strong nitric acid solution a material containing samarium free from gadolinium, neodymium, and europium is obtained. The material containing the gadolinium is fractionally precipitated with dilute ammonia whereby terbium is first precipitated, then samarium, whilst gadolinium remains in solution.

The malonates of the rare earths are prepared by neutralising the hydroxides with an aqueous solution of the acid and heating, whereby the malonates are precipitated in the crystalline form. The salts of lanthanum, cerium, praseodymium, neodymium, samarium, gadolinium, yttrium, and erbium were thus obtained and their solubilities in water determined. The salts of these metals with α-naphthol-8-sulphonic acid have the general formula



$$R_2\left(C_{10}H_6<\begin{matrix}SO_3\\O\end{matrix}\right)_3,$$

and are prepared by neutralising the acid with the metallic carbonates. The amount in grams dissolved by 100 grms. of water at 14° C. are: lanthanum, 0·0926—0·0987; cerium, 0·0901; praseodymium, 0·0709—0·0818; neodymium, 0·0171—0·0211; samarium, 0·0496—0·0573; gadolinium, 0·117; yttrium, 0·0951; and erbium, 0·0339.

The authors also prepared the sulphides of samarium and gadolinium, Sa_2S_3 and Gd_2S_3, by heating the sulphates in a stream of hydrogen sulphide.—J. C. C.

Cerium, lanthanum, and yttrium; Separation and quantitative spectra of ——. J. H. Pollok and A. G. G. Leonard. Scient. Proc. Roy. Dublin Soc., 1908, **11**, 257—269.

Pure ceria, lanthana, and yttria have been obtained from cerite by a process which, in outline, is as follows:—The mineral was fused in a wind furnace with its own weight of sodium hydroxide, and the melt treated with hydrochloric acid, to separate the silica. From the solution lead and copper were removed by sulphuretted hydrogen, and the rare earth metals then precipitated as oxalates, by oxalic acid. These were ignited to oxides, which were dissolved in hydrochloric acid and treated with excess of sodium hydroxide and chlorine to saturation: the cerium was thus precipitated as the dioxide. The rare earths remaining in solution were again precipitated as oxalates and converted into nitrates, which were then partially decomposed by fusion, below a red heat. Insoluble basic nitrates, containing all the yttrium, were thus obtained, and an undecomposed portion, containing lanthanum. This was treated with water and the extract precipitated by ammonia. The precipitated oxides were dissolved in hydrochloric acid and fractionally precipitated with sulphuric acid and alcohol, and this precipitate was dissolved and the solution precipitated with ammonia again, which furnished pure lanthana. The basic nitrates were dissolved, and the solution was precipitated with potassium sulphate, pure yttria being obtained from the filtrate by precipitating with ammonia, dissolving the precipitate, and again precipitating as oxalate and igniting. For the quantitative examination of their spectra, the oxides were dissolved in hydrochloric acid and the solutions "sparked," using gold electrodes. Tables of wave-lengths are given, and reproductions of photographs of the spectra.
—F. Sodn.

Molybdenum, tungsten, thorium, and zirconium; Quantitative spectra of ——. A. G. G. Leonard. Scient. Proc. Roy. Dublin Soc., 1908, **11**, 270—279.

The spark spectra, obtained with solutions of molybdenum, tungsten, thorium, and zirconium, have been quantitatively examined, and tables of wave-lengths and reproductions of the spectra are given. Gold electrodes were used, and are recommended.—F. Sodn.

Anthranilic acid; Characteristic reaction of ——. B. Pawlewski. *See* IV.

Enzyme action. XII. Enzymes of emulsin. H. E. Armstrong and others. *See* XVII.

Cerium; Determination of —— by potassium ferricyanide, in the presence of the other rare earth metals. P. E. Browning and H. E. Palmer. *See* XXIII.

Java cinchona industry. Indische Mercuur. Chem. and Drug., July 25, 1908. [T.R.]

The output of cinchona bark from the Government plantations in the Preanger, Java, during 1907 was 897,715 kilos., of which 737,981 kilos. was hybrid Ledgeriana, with an average content of 7·02 per cent. of quinine sulphate, as compared with 656,238 kilos. of similar bark, yielding 6·6 per cent. of quinine sulphate, in the previous year. The Ledgeriana plantation at Malabar yielded 1112 kilos. of bark per "bouw" [1 bouw = 1·75 acres] equivalent to 71 kilos. of quinine, while the Tjibeureum plantation gave 1253 kilos. per "bouw," yielding 90·7 kilos. of quinine sulphate. In neither of these last two plantations was the full amount gathered, with a view to avoiding depression of the market by over-production. From the Tirtasari plantation of Ledger "grafts" on succirubra "stocks," 12,500 kilos. of stem bark were obtained from 1½ bouw. A considerable number of these trees, originally planted 4 feet by 4 feet, and now 25 years old, were uprooted, and 591 of them gave on the average 21 kilos. each of stem bark, equivalent to 1·4 kilo. of quinine sulphate per tree.

After paying all expenses, the net gain on the plantations showed an increase over that of 1906 of 306,905 florins, making an increase of 1,604,150 florins for the two years 1906 and 1907. With reference to scientific work, it is pointed out that recent investigations show that until Ledger trees are five years old the root-bark contains much quinidine, the average being 1·4 per cent. and the highest 3·15 per cent., but the stem bark up to this stage contains none.

Patents.

Camphene; Manufacture of ——. Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 5674, March 13, 1908. Under Int. Conv., April 3, 1907. Addition to Eng. Pat. 16,429, July 20, 1906.

Pinene hydrochloride can be converted into camphene by heating with an alkaline-earth salt of a phenol or naphthol, instead of with an alkali salt, as in the original patent (this J., 1906, 909).—T. F. B.

Camphene; Preparation of solid —— free from halogens (chlorine). Chem. Fabr. auf Aktien, vorm. E. Schering. Ger. Pats. 197,346 and 197,805, Jan. 16, 1907.

(1). Camphene free from chlorine is obtained by the action of alkali or alkaline-earth salts of organic sulphamides (benzene sulphamide, naphthylsulphamide, etc.) on pinene hydrochloride. (2). The use of phenolsulphonic acids and their substitution products for the conversion of pinene hydrohalides into camphene is claimed.—A. S.

Camphor from borneol, isoborneol, or their esters; Process for preparing ——. Dr. Schmitz und Co., G.m.b.H. Fr. Pat. 387,053, Feb. 8, 1908. Under Int. Conv., March 12, 1907.

It is found that borneol and isoborneol can be heated in presence of basic substances, to a high temperature, without being converted into camphene. This property is utilised, according to the present patent, in the preparation of camphor, the borneol or isoborneol being heated in presence of a base, with a metal peroxide, or with a salt of a metal acid, or with an oxide which can act as an oxidising agent (*e.g.*, oxides of copper, nickel, or mercury). For example, five kilos. of isoborneol are heated with 100 kilos. of sodium carbonate and 200 kilos. of manganese dioxide, for 10 hours at 250° C. The camphor formed is isolated by distillation with steam. The esters of borneol and isoborneol are saponified by heating with aqueous alkali solutions, the oxidising agent being added during or after saponification.—T. F. B.

Digitalis leaves; Pharmaceutical preparations from ——. J. Wetter, London. From Knoll und Co., Ludwigshafen, Germany. Eng. Pat. 6019, Mar. 18, 1908.

Ten kilos. of finely powdered digitalis leaves are extracted a few times with 5 "parts" of absolute alcohol, the extracts are neutralised by the addition of sodium hydroxide, and then treated with ether as long as a precipitate forms. The extract is separated from the precipitate, and concentrated under reduced pressure, after the addition of 2 "parts" of lactose, or other suitable vehicle. The powdered product obtained contains the therapeutically important constituents of the drug in their original proportions.—W. P. S.

Carbon tetrachloride; Process of making ——. C. E. Acker. Niagara Falls, Assignor to M. Stine, New York. U.S. Pat. 891,896, June 30, 1908.

A solution of sulphur in sulphur chloride is subjected, in a finely divided condition, to the action of a gas containing chlorine; the resulting liquid is treated with carbon bisulphide, and the carbon tetrachloride is distilled off. The residual sulphur is dissolved in sulphur chloride and again used for the process.—T. F. B.

Pyrogallol; Process for preparing ——. Act.-Ges. f. Anilinfabr. Fr. Pat. 387,170, Feb. 12, 1908.

2.6-Dihalogenated-phenol-4-sulphonic acids are readily converted into pyrogallol-4-sulphonic acid by heating with alkalis; the sulphonic acid can then be converted into pyrogallol by heating under pressure with mineral acids.—T. F. B.

o-Nitrobenzaldehyde and o-nitrobenzaldoxime; Preparation of ——. Kalle und Co. Ger. Pat. 199,147, March 20, 1907. Addition to Ger. Pat. 186,881.

The dimercury compound of *o*-nitrotoluene (see Fr. Pat. 370,522; this J., 1907, 278) is converted, by treatment with nitrous acid at low temperatures, into a dinitrite, $NO_2.C_6H_4.CH(HgNO_2)_2$. This is treated with hydrochloric acid, in ice-cooled solution, the concentration of the acid not exceeding about 25 per cent. A mixture of *o*-nitrobenzaldehyde and *o*-nitrobenzaldoxime is obtained. —T. F. B.

Kava-kava resin; Process for the preparation of a solid product from ——. J. D. Riedel, A.-G. Ger. Pat. 197,806, June 12, 1907.

The resin is dissolved in concentrated sulphuric acid, and the solution diluted with water. The product possesses the therapeutic properties of the resin, but, unlike the latter, has a pleasant, aromatic odour and a faint aromatic taste (see also this J., 1908, 708).—A. S.

Polyglycerins from glycerin; Process for the preparation of ——. C. Claessen. Ger. Pat. 198,768, June 25, 1907.

Glycerin is heated with a quantity (*e.g.*, 0·5 per cent.) of an alkali or an alkaline substance insufficient to cause the decomposition of the glycerol molecule. The resulting mixtures of diglycerin and polyglycerins are suitable for the preparation of finishes for textiles, and for the manufacture of plastic substances and explosives resistant to freezing.—A. S.

Mercury-albumin solutions; Process for the preparation of stable aqueous ——. A. Busch. Ger. Pat. 196,060, Aug. 28, 1907. Addition to Ger. Pat. 187,697, Nov. 27, 1906.

The complex mercury compounds (double salts of mercury and hexamethylenetetramine) described in the main patent are mixed with water-soluble protein substances, such as albumoses, the sodium derivative of casein, or alkali albuminates, in such proportions that the mercury in the product can no longer be precipitated by the usual reagents (hydrogen sulphide, etc.). The solutions are specially suitable for subcutaneous injections.—A. S.

Ferro-albumen and ferro-casein compounds. P. Hoering, Berlin. Eng. Pat. 16,152, July 13, 1907.

See Fr. Pat. 379,693 of 1907; this J., 1907, 1254.—T. F. B.

Phthalic acid salts of cotarnine; Process for preparation of —— *and product resulting therefrom.* M. Freund, Frankfort, Germany. U.S. Pat. 892,414, July 7, 1908.

See Ger. Pat. 180,395 of 1905; this J., 1907, 1066.—T. F. B.

Polychloramidine and process of making same. C. Schraube and E. Laudien, Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 892,900, July 7, 1908.

See Eng. Pat. 8077 of 1906; this J., 1906, 608.—T. F. B.

Phenols and formaldehyde; Process for preparing condensation products of ——. K. A. Lingner. Fr. Pat. 387,082, Jan. 15, 1908.

See Eng. Pat. 1330 of 1908; this J., 1908, 643.—T. F. B.

Errata.

Page 640, col. 2; l. 31 from bottom, *for* "F. P. Power" *read* "F. B. Power."
Ibid, col. 2; l. 12 from bottom, *before* "which," *insert* "the two latter of."
Page 641, col. 1; l. 10 from end of first abstract, *for* "$C_{29}H_{67}CO_2H$" *read* "$C_{29}H_{57}CO_2H$."
Ibid, col. 1; l. 5 from end of first abstract, *delete* "the ethyl ester of."

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Toning the bleached silver image and for toning P.O.P. prints; Compound thio-salts for ——. H. E. Smith. Phot. J., 1908, **48**, 267—271.

Many compound thio-salts are unsuitable for toning bleached bromide prints, owing to their instability or to the fact that they produce unsuitable tones. Such are the following:—Sulphantimoniates, thioarsenates, thiovanadates, thiotellurates, thiotellurites, thiothallates, thioplatinates. Sodium and ammonium salts of thio-acids of the chromium group, especially the thiotungstates and thiomolybdates, are, however, well suited for the purpose, and also for toning silver prints. The tones obtainable are similar to those produced by gold and platinum, and double toning appears to be absent. A further advantage is that the prints can be fixed by means of ammonia solution.—T. F. B.

Light; Electrochemistry of ——. W. D. Bancroft. J. of Phys. Chem., 1908, **12**, 209—278, 318—376.

The author attempts to show, by quoting passages from the works of Vogel, Herschel, Eder, and others, that all known facts relating to the chemical action of light, are in accord with the laws enunciated by Grotthuss in 1818, as follows:—(1). Only those rays of light which are absorbed can produce chemical action. (2). The action of a ray of light is analogous to that of a voltaic cell. He further concludes that the presence of a depolariser makes possible, or increases, the action of light: in many cases of oxidation by gaseous oxygen, the oxygen acts as depolariser. When chlorine reacts with silver, it is the chlorine that is made active by light. All sensitisers are depolarisers, and are light-sensitive; they are either reducing agents, or are converted into reducing agents by light, as in the case of cyanine and eosines, when halogens are set free by light. There is no connection between sensitising power and fluorescence.—T. F. B.

Hydrogen peroxide; The photographic capacity of ——, *and its so-called radioactivity.* P. and A. Dony-Henault. Bull. Soc. Chim. Belg., 1908, **22**, 224—244.

The partial vapour tension of hydrogen peroxide in aqueous solutions increases with the concentration of the solutions, as does the photographic activity of hydrogen peroxide. Sulphuric acid raises or lowers the vapour tension and photographic activity of hydrogen peroxide solutions, according to their concentration, owing to the reaction between the acid and hydrogen peroxide. The presence of water vapour with gaseous hydrogen peroxide increases the activity of the latter. It is concluded that the "vapour" theory of the photographic action of hydrogen peroxide is far more in accord with facts than is the theory of radioactivity. It was found that an impression was produced on a photographic plate by the action of $1\times10^{\ 7}$ grm. of hydrogen peroxide per sq. cm. The vapour tension of hydrogen peroxide was measured by passing the vapour into a sulphuric acid solution of titanic acid, and titrating with permanganate. It is suggested that the photographic activity of a solution may be used to determine the molecular state of combination of double compounds of hydrogen peroxide with oxides of titanium, molybdenum, etc.—T. F. B.

Patents.

Printing out papers and photographic sensitive surfaces for use in the production of positive pictures. W. F. C. Kelly, London. Eng. Pat. 13,835, June 14, 1907.

Photographic papers are coated, on the unsensitised surface, with a developing mixture, containing boric acid or a soluble borate as preservative, and a colloid. An insoluble, impervious layer may be interposed between the developer and the paper; this may serve as a dry mountant. The developer may be coated with a protective covering of gum arabic, etc. One claim covers the use of a developing mixture consisting of metol, quinol, potassium metasulphite or a soluble acid sulphite, potassium bichromate, boric acid or a borate, and gum or other colloid.—T. F. B.

Film; Non-inflammable —— for cinematographs, &c. G. Chandon de Brialles. Fr. Pat. 386,845, April 20, 1907.

With the object of forming a non-inflammable, solid, flexible, and transparent ribbon, gelatin—preferably chondrin—is bleached with dry chlorine, the residual hydrochloric acid being removed by means of ammonia. The gelatin is then liquefied, filtered under pressure, formed into ribbons, and rendered impervious to moisture by placing it between two helical electrodes in a bath of alcohol, water, and tannic acid or analogous substances, at a low temperature. It is then dried *in vacuo* to prevent deposition of dust and moisture, and steeped in a solution of collodion in acetone oil and vaseline oil, after which it is again dried *in vacuo*, the acetone being recovered. The steeping operation may be repeated as often as thought desirable. The bands of gelatin may be joined end to end by a solution of gelatin in hydrochloric acid, but this should be done before the deposition of the collodion layers.—J. W. G.

Oxidising baths for photographic purposes; Preparation of acid ——. R. Krügener. Ger. Pat. 198,061, Aug. 9, 1907.

A solution containing potassium permanganate and an acid sulphate (*e.g.*, sodium bisulphate) may be used for oxidation processes in photography (*e.g.*, for the reversal of negatives).—T. F. B.

Photographic emulsion for pigment printing. J. T. Gateau, Aix-en-Provence, France. Eng. Pat. 20,740, Sept. 18, 1907.

See Fr. Pat. 380,188 of 1907; this J., 1908, 38.—T. F. B.

XXII.—EXPLOSIVES, MATCHES, &c.

Explosives; Regulations for transportation of —— in the United States. Oil, Paint, and Drug. Rep., July 18, 1908. [T.R.]

The following regulations, which take effect on October 15th, 1908, have been made by the Interstate Commerce Commission (see this J., 1908, 714):—

General Rules.

A. Explosives, when offered for shipment by rail, must be in proper condition for transportation and must be packed, marked, loaded, stayed and handled while in transit in accordance with these regulations. All packages of less than carload shipments must also be plainly marked on the outer covering or boxing (outside package) with the name and address of consignee. Empty boxes previously used for high explosives are dangerous and must not be again used for shipments of any character. Empty boxes which have been used for the shipment of other explosives than high explosives must have the old marks thoroughly removed before being accepted for the shipment of other articles. Empty metal kegs which have been used for the shipment of black powder not contained in an interior package must not be used after January 1, 1909, for shipment of any explosive.

B. Explosives, except such as are forbidden, must be received for transportation by railroads engaged in interstate commerce on and after October 15, 1908, provided the following regulations are complied with, and provided their method of manufacture and packing, so far as it affects safe transportation, is open to inspection by a duly authorized representative of the initial carrier or of the Bureau for the Safe Transportation of Explosives and Other Dangerous Articles, of the American Railway Association. Shipments of explosives that do not comply with these regulations will not be received. Shipments offered by the United States Government may be packed, including limitations of weight, as required by its regulations.

C. Before any shipment of explosives destined to points beyond the lines of the initial carrier is accepted from the shipper, the initial carrier must ascertain that the shipment can go forward viâ the route designated, and that delivery can be made at destination. To avoid unnecessary delays, arrangements must be made to furnish the information promptly to initial carrier. Shipments of explosives destined to points beyond the lines of the originating carrier must only be accepted subject to these and any additional reasonable regulations of the roads over which the shipments are to be moved. Shipments offered by connecting lines must be received subject to these regulations.

Tests for Strength of Package.

D. Packages receive their greatest stresses in a direction parallel to the length of the car and must, therefore, be loaded so as to offer their greatest resistance in this direction. Cleats or handles, when prescribed for packages, must be so placed as not to interfere with close packing lengthwise in the car.

E. When inexplosive material of equal weight is substituted (sand for a granular explosive, dummy cartridges for high explosive cartridges), and the outside package is dropped on its end on to a foundation of solid brick or concrete from a height of four feet, the outside package must not open, nor rupture, nor must any portion of the contents escape therefrom.

F. In addition to standing the test in paragraph E, the design and construction of packages must be such as to prevent the occurrence in individual packages of defects that permit leakage of their contents under the ordinary conditions incident to transportation. The results of experience, gained by an examination of packages on arrival at destination, must be recorded by the Bureau of Explosives, to the end that further use of any particular kind of package, shown by experience to be inefficient, may be prohibited by the commission, even if it should stand the drop test prescribed by paragraph E.

G. Violations of these regulations discovered in cars containing explosives, or in the loading or staying of packages, must be corrected before forwarding the car. A report in duplicate of all serious violations, with a statement of apparent cause (such as defective packing, improper staying, rough treatment of car, etc.), must be made by the carrier to the chief inspector of the Bureau of Explosives.

Grouping.

H. For transportation purposes, all explosives are divided into the following groups:—1, Forbidden explosives; 2, Black powder; 3, High explosives; 4, Smokeless powders; 5, Fulminates; 6, Ammunition; 7, Fireworks.

Forbidden Explosives.—The following are forbidden explosives:—Liquid nitroglycerin; dynamite containing over 60 per cent. of nitroglycerin (except gelatin dynamite); dynamite having an unsatisfactory absorbent, or one that permits leakage of nitroglycerin under any conditions liable to exist during transportation or storage; nitrocellulose in a dry condition, in quantity greater than ten (10) pounds in one exterior package; fulminate of mercury in bulk in a dry condition, and fulminates of all other metals in any condition; fireworks that combine an explosive and a detonator or blasting cap.

Black (or brown) powder embraces all explosives having a composition similar to that of ordinary gunpowder, such as carbonaceous material, sulphur, and a nitrate of sodium or potassium. This group includes rifle, sporting, blasting, cannon and the prismatic powders.

High explosives are all explosives more powerful than ordinary black powder, except smokeless powders and fulminates. Their distinguishing characteristic is their susceptibility to detonation by a commercial detonator, or blasting cap. Examples of high explosives are the dynamites, picric acid, picrates, chlorate powders, and nitrate of ammonia powders.

Smokeless powders are those explosives from which there is little or no smoke when fired. The group consists of smokeless powder for cannon and smokeless powder for small arms. Smokeless powder for cannon used in the United States at the present time consists of a nitrocellulose colloid, and is safe to handle and transport. Smokeless powders for small arms may consist of nitrocellulose, nitrocellulose combined with nitroglycerin, picrate mixtures, or chlorate mixtures.

Fulminate includes fulminate of mercury in bulk form—that is, not made up into percussion caps, detonators, blasting caps, or exploders.

Ammunition includes small arms and cannon ammunition, explosive projectiles, detonators, detonating fuses, blasting caps, primers, and percussion and time fuses.

Fireworks include everything that is designed and manufactured, primarily, for the production of pyrotechnic effects.

[*United States*] *Government tests of mine explosives.* Scient. American, 1908, July 11, 27—30. [T.R.]

Plans for a Government experimental station, to be devoted to the testing of explosives used in coal mining, have been perfected by the Technologic Branch of the United States Geological Survey. The station is to be erected at a point in one of the large coal districts the exact site not having yet been selected.

This line of investigation is one of several recently entered upon by the Government in pursuance of its determination to reduce the waste of the fuel resources of the United States. The use of improper explosives in coal mining, as well as the improper use of suitable explosives, results annually in the waste or destruction of great amounts of coal. The use of too high charges in blasting or the use of unnecessarily violent explosives shatters much good fuel, converting some even into dust, which is itself explosive, and may thus be productive of further damage. Such explosions often loosen the roof of a coal mine, which may fall later, to be thus wasted, or productive of fatal accidents.

In addition to conducting experiments on explosives in a testing laboratory, the Geological Survey will carry on actual experiments in mines, with a view of determining methods of reducing waste of fuels in mining operations. Several of the best explosives, as determined by experiments at the testing station, will be purchased in open market and used in different mines in blasting different types of coal, and the lump and slack coal produced will be carefully screened, weighed, and compared. The classification of these explosives will be made with reference to cost per ton of fuel produced, and various methods of using explosives in mines will be investigated with special reference to increasing safety and efficiency in coal-mining operations.

Investigations will also be conducted with a view to reducing the enormous loss of life in the mines of the United States, as compared with the low death rate from mine accidents in those European countries in which testing stations have been maintained for several years. The number of men killed and injured in the coal mines of the United States in 1906, according to Mr. E. W. Parker, chief statistician of the Survey, reached the total of 6,881, the number killed being 2,061 and the number injured 4,800. In 1900 the number killed was 1,493; 1901, 1,594; 1902, 1,825; 1903, 1,794; 1904, 1,959; 1905, 2,097.

The total number of fatal accidents in the coal mines of the United States since 1890 is 22,842, the number practically doubling since 1895.

While the coal mine death rate in the United States has been increasing at an alarming pace, all European coal-producing countries show a decided decrease, due, it is believed, to the establishment of Government testing stations for the study of the use of explosives and other factors relating to safety in mining. Belgium in 1860, before it commenced its experimental work, had a death rate in its coal mines of 3·28 per 1,000 men employed. In 1904, several years after the testing station had been in operation, the rate had been reduced to 1·07 per 1,000 men employed, which is about one-third of the number killed in the mines of the United States to-day.

In the last period of five years the number of men killed for each 1,000 men employed in Great Britain, was 1·53; in Germany, 2·49; in the United States, 3·64.

Belgium, which has the lowest rate, maintains the most thoroughly equipped testing station in the world. In all European coal-producing countries the use of excessive charges of explosives is prohibited by law, and definite limits are set as to the amount of any explosives which may be used. The United States has no such precaution.

An analysis of the figures for the United States shows that 50 per cent. of all the fatal accidents and 39 per cent. of all non-fatal accidents are the result of falls of roof and coal. In the European countries the number of accidents from this cause is much less. In 1906, gas- and dust-explosions cost 228 lives in the States; powder, 80; falls of roof and coal, 1,008; and other causes, 732. It is believed that although the actual fall of the rock or coal may not occur at the time of firing the charge, the heavy shots weaken the walls and roof, so that months after, without warning, they fall.

The experiment station.—The station which is to be erected in the expectation of reducing the number of mine explosions in America will consist of an explosives gallery, rescue room, observation house, lamp-testing rooms, and explosives laboratory. The explosives gallery is to be made of boiler plate, and will be in the form of a cylinder, 100 feet long and 6 feet in diameter. A series of safety valves on hinges will be arranged along the top to allow the escape of gas following an explosion. Port holes along the sides, covered with half-inch plate glass, will allow those in the observation house to see whether an explosion has taken place in the gallery during the tests. The cylinder will be filled with natural gas or coal dust and air, and the explosives will be hurled into the gallery by means of a cannon fired by electricity from the observation house, 60 feet away. The cannon will be imbedded in a mass of masonry at one end of the explosives gallery, being backed by a rubber disc on heavy timber to absorb the recoil. Ten cubic metres of an explosive gas mixture are to be used with each shot, the portion of the gallery next to the cannon being utilised as an explosion chamber by placing a paper diaphragm five metres from one end.

Natural gas is to be used in all the tests because it corresponds most closely to fire-damp. It will be purified before using, special care being taken to remove the carbon dioxide, if any be present. The necessary amount of natural gas for each experiment will be measured by a gas meter, and led into the gallery by a 2-inch iron pipe for a distance of 10 feet along the bottom of the gallery. The pipe is perforated with holes in a manner to insure from the start a more equal distribution of the gas. A fan on the outside of the gallery connected by 6-inch iron pipes to the explosion chamber insures the thorough mixing of the gas and air. When the tests are to be made, the fan will be cut out of the circuit by closing the valves situated between the fan and gallery.

The experiments in the gallery will be carried out at a temperature of 25° to 30° C., to be regulated by the radiation from steam pipes.

An 8 per cent. mixture of methane is considered the most dangerous mixture with air. The necessary amount of methane displaces a like amount of air in the explosion chamber, and by experiments and calculation the exact number of cubic metres of gas to supply to the explosion chamber to produce an 8 per cent. mixture can be determined.

Before each shot is fired, a sample of the explosive gas mixture is taken from the explosion chamber and tested in the laboratory. It is diluted with a known quantity of air and then ignited. This experiment determines whether the mixture is properly made before the shot is fired.

The cannon in which the explosives are to be fired is made of cast steel with a tool-steel liner. The bore is 46 centimetres in length and its calibre 5·5 centimetres. The axis is at an angle, so that its prolongation intersects the top of the gallery 25 feet from the farther end.

Testing of lamps.—The apparatus for testing lamps will consist of a small gallery, through which the natural gas or fire-damp will be drawn by an electric fan. Different velocities can be obtained, and the safety lamps can be subjected to an ascending, descending, or horizontal current of an inflammable atmosphere. At the farther end of the gallery the intimate mixture of the air and fire-damp is produced by a mixing box, which consists of 36 tubes, each of them perforated in the circumference with narrow apertures disposed in spirals. The air passes inside these tubes, and the fire-damp penetrates through the 432 small apertures, the eddies which are produced causing thorough admixture of the air and fire-damp.

Apparatus which is capable of sustaining life will be used, and miners will be instructed to enter a miniature mine which has previously been filled with fire-damp, and search as they would for their fellow men. The apparatus consists of canvas jackets equipped with cylinders of compressed oxygen, connected with the operator's mouth by a flexible, rubber-lined metallic tube. The exhalation of the operator is passed through small lumps of potassium hydroxide, the carbon dioxide being absorbed, and the remaining products together with more oxygen being again made available for the operator.

Tests will be made in the explosives gallery with various explosives, and the maximum quantity of each explosive that can be used safely in mines, will be published under the head of "Permissible Explosives." Explosives known as "Safety Powders," in which the temperature at the point of detonation is low and the flame of short duration, will have a higher "limit charge" than the less safe explosives.

Methods of testing explosives.—Tests of explosives will also be made to determine their relative strength, for the efficiency of the explosive must also be considered as well as its safety. No. 1 dynamite, which contains 75 per cent. of nitroglycerin and 25 per cent. of kieselguhr, is taken as the standard. No two contrivances for measuring the disruptive force produced by explosives yield concordant results. Explosives which detonate at the same rate of velocity permit of accurate comparison, but when the rate of detonation varies considerably, the comparative results are very misleading.

From investigations made by the Technologic Branch of the Survey, the only apparatus which permits of accurate results is Bichel's pressure gauge. This apparatus consists of a steel cylinder 31½ inches long and 19¾ inches in diameter. It is strongly made, and the escape of the generated gases produced by the explosion is rendered impossible. The apparatus is constructed to stand the firing of a 3½-ounce charge of high explosives. The pressure exerted in the 15-litre firing chamber is measurable.

Flame of explosives.—Experiments conducted at foreign testing stations have proved an incentive to inventors, and a large class of explosives known as safety powders have been produced, and the old powders have been altered and improved upon so that they will conform to the official tests.

The explosive temperature for methane, which is the principal constituent of fire-damp, is 658° C., and is therefore below the detonating point of many explosives. The characteristic of the safety powders is the production of a small flame, of short duration, so that the products of combustion after the explosion in the drill hole, are cooled down before reaching the surface. The heat being partially absorbed by the surrounding walls, and the flame being small and of short duration, the chance of a gas or dust explosion is reduced to a minimum. An explosive in which the rate of detonation is too rapid may blow out the coal too quickly, and project its flame immediately into the inflammable gas mixture. Gelatin-dynamite and other high-grade dynamites may be classed in this list. On the other hand, black blasting powder, whilst it does not detonate in practice and perform its work quickly, causes explosions on account of the large flame produced and its duration.

The use of dynamite and black blasting powder in foreign coal mines known to generate gas, or troubled with coal dust, has been prohibited, and they have almost universally been replaced by the so-called safety powders.

The apparatus used at the German station to determine the length of flame, consists of a steel cannon, which is loaded with the explosive to be tested and fired. The flame is photographed at night upon a rotary drum. The entire photographic instrument consists of a wooden box provided with a quartz camera lens for focussing the ultra-violet rays. Inside the camera a rotary drum covered with a sensitised film is fixed between two pointed screws in a guide bracket. The drum is motor driven, and the number of revolutions recorded on a vibration tachometer. A cartridge of the explosive to be tested is inserted in the borehole of the cannon, and as soon as the tachometer indicates the desired drum speed, the shot is fired electrically.

Rate of detonation.—The rate of detonation is to be determined upon a recording device which operates electrically. The apparatus comprises a soot-covered drum, with pointed platinum terminals, tooth gear and measuring adjustment, an electric motor, vibration tachometer, and sparking coils. The rotary drum is made of bronze, the lower edge being fitted with teeth of which there are the same number as there are millimeters to the circumference, about 500. The drum is operated by the motor, and its peripheral rotation speed and the device for reading it are such that the distance between two points of the drum may be measured to within the 100th part of a millimetre. An iron pipe is filled with the cartridges to be exploded. This pipe is 30 millimetres inner diameter, and the density of the charges plays a very important part in regard to correctness of results. In operating the recorder, the electrical current is shunted through resistances, and connected in parallel with primary and secondary coils in such a manner that when those circuits are broken by the explosion, a succession of corresponding sparks is emitted by induction from the terminals of the secondary connections, thereby marking the blackened drum.

Potassium chlorate; A new impurity in commercial ——. R. Gartenmeister. *See* VII.

Wood distillation and acetone. See III.

PATENTS.

Blasting powder. H. D. Farris and A. C. Jex, Wetaskiwin, Alberta, Canada. U.S. Pat. 891,334, June 23, 1908.

GRANULES made of a mixture of potassium chlorate, wheat flour, and picric acid are "coated" with nitric acid, hydrochloric acid, and coal oil.—J. W. G.

Explosive. W. S. Pierce, Assignor to Union Powder Co., Seattle, Washington. U.S. Pat. 892,302, June 30, 1908.

THE proposed explosive consists of an alkali chlorate, a carbohydrate, caramel, shellac, and the constituents of alkanet soluble in alcohol, but insoluble in water. —J. W. G.

Explosive; Stable ——. F. B. Holmes, Woodbury, N.J., Assignor to The E. I. du Pont de Nemours Powder Co., Wilmington, Del. U.S. Pat. 891,420, June 23, 1908.

NITRATED starch is mixed with from 2 to 20 per cent of ammonium oxalate.—J. W. G.

Military explosives of enhanced stability; Preparation of ——. J. Luciani. Fr. Pat. 386,966, April 25, 1907.

It is proposed to mix powder—whether of the ordinary kind or that having a nitroglycerin base—with 2—7 per cent. of blanched beeswax, 4—8 per cent. of barium nitrate, and 2 per cent. of magnesium bicarbonate if for use in cannon, or with 0·5 per cent. of nitroguanidine, 0·5 per cent. of synthetic camphor, 0·5 per cent. of beeswax, and 0·5 per cent. of magnesium bicarbonate if for use in small arms. These proportions may be varied, but the above are recommended. Castor oil, resin, or vaseline may be used instead of beeswax. Intimate and uniform mixture is brought about by using mixing machinery and suitable solvents (alcohol, ether, or acetone). While still pasty the substance is passed between rollers or through dies of appropriate section, whence it issues as striated plates, cords, or tubes. The depth and character of the striations can be varied and thus it is claimed that the ballistic properties can be controlled during manufacture. These explosives are stable and can be safely stored and are nearly flameless; the density of the charge and the barrel pressure are reduced, the sound of explosion is not so loud, and the muzzle velocity remains unaltered.
—J. W. G.

Nitrocellulose: Preparation of ——. Patronenfabr. Saxonia. Ger. Pat. 198,284, Dec. 29, 1903.

Amorphous nitro-products of oxy- and hydro-celluloses are prepared by treating cellulose with a mixture of sulphuric acid and a small quantity of nitric acid, with cooling, until the mass begins to become pasty, then adding the required quantity of concentrated nitric acid to effect the nitration, and de-acidifying and washing the product in the usual manner. For example, 100 grms. of paper-cellulose are introduced into a mixture of 500 grms. of 85·5 per cent. sulphuric acid with 3·5—4 per cent. of concentrated nitric acid, to which 2—2·5 per cent. of water has been added. The cellulose is kneaded with the acid mixture, the temperature being kept at 2—3° C., and 100—120 grms. of nitric acid of 48° B. are then added. The nitration is complete in about 15 minutes.—A. S.

Phosphorus compounds; Preparation of —— and other easily inflammable substances [for safety matches]. R. Gartenmeister. Fr. Pat. 386,988, Feb. 7, 1908.

Red phosphorus, sulphur, and the sulphides of metals, of which the specific gravities are above 5, are heated together in such proportions that they combine at about 170° C. A mixture of 25 per cent. of antimony sulphide, 25 per cent. of sulphur, and 50 per cent. of red phosphorus, for instance, is heated in a crucible, until the reaction begins, and is then cooled. Other proportions may be used, that of the phosphorus varying between 25 and 60 per cent. The products are inflammable at about 120° C. and, when mixed with potassium chlorate, readily ignite by friction, but such mixtures are not explosive. As an example of their application to the manufacture of safety matches, a mixture containing 20 per cent. of the antimony compound, 45 per cent. of potassium chlorate, 10 per cent. of powdered glass, 17 per cent. of glue, and 8 per cent. of zinc oxide may be used for the match heads, and the box may be coated with a mixture of "45 per cent. of the antimony compound, 20 per cent. of clay or powdered glass, and 25 per cent. of dextrin." An advantage claimed for the new products is that they are not sensitive to moisture.—F. Sodn.

Dipping mixtures for matches; Preparation of ——. J. D. Riedel A.-G. Ger. Pat. 197,865, Aug. 19, 1905.

It is stated that the danger of explosion of match compositions containing potassium chlorate and phosphorus or a phosphorus sulphide is destroyed by addition of a polythionate or a sulphopolythionate. In preparing the match composition, the phosphorus or phosphorus sulphide is first added to the melted glue, and the polythionate or sulphopolythionate is then introduced, the mixture being stirred and warmed for about 2 hours at 40°—70° C. After cooling to about 30°—35° C., the moistened powdered chlorate is added, and the mixture kept at the temperature mentioned for some time. It is stated that match-heads prepared with such mixtures will not ignite by rubbing one against the other.—A. S.

Primers for explosives. L. Wöhler, Karlsruhe, Germany. Eng. Pat. 4468, Feb. 27, 1908. Under Int. Conv., March 1, 1907.

See Ger. Pat. 196,824 of 1907; this J., 1908, 593.—T. F. B.

Detonating caps; Charges for ——. L. Wöhler. Fr. Pat. 387,640, Feb. 28, 1908. Under Int. Conv., March 1, 1907.

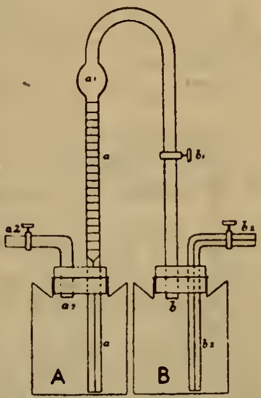
See Ger. Pat. 196,824 of 1907; this J., 1908, 593.—T. F. B.

Polyglycerins from glycerin. Ger. Pat. 198,768. *See* XX.

XXIII.—ANALYTICAL CHEMISTRY.

APPARATUS.

Absorption of oxygen by polluted waters and other fermenting liquids; Apparatus for observing the rate of ——. W. E. Adeney. Scient. Proc. Roy. Dublin Soc., 1908, **11**, 280—287.



The form of the apparatus is shown in the accompanying diagram. The two bottles, A and B, are of similar capacity and each is closed by a cork previously soaked in melted paraffin. Through the cork of A is passed a capillary glass tube, *a*, reaching to the bottom of the bottle; above the cork this tube is continued by a graduated one of larger bore, the upper end of which is enlarged into a small bulb, a_1 and then bent downwards through the cork of the bottle, B. A piece of tubing, a_2, provided with a tap is fitted in the cork of A and a similar piece, b_2, but of capillary bore and reaching to the bottom of the bottle, is fitted through the cork of B. A tap, b_1, is provided on the tube, *a*. The bottle, B, is partially filled with a known volume of the polluted water, previously mixed with a little magnesium hydroxide to fix the free carbon dioxide, and a similar volume of distilled water is placed in the bottle, A. The plug of the tap, b_1, is taken out, the tap a_2, is closed, and the tap b_2, is opened. The two corks are then inserted in the bottles, and the whole is placed aside for a short time so that the contents of the bottles may come to the same temperature; this is noted, as is also the height of the barometer. The tap, a_2, is now opened cautiously to allow the water which has risen in the graduated tube to sink to the zero point; it is then closed. The tap, b_2, is also closed, and the plug of b_1 is replaced. As the oxygen is absorbed from the air in the bottle, B, the reduction in the pressure can be measured by the water in the bottle, A, rising in the graduated tube, when the tap, b_1, is opened, and the quantity of oxygen absorbed may be calculated, due regard being taken to the temperature, pressure, height of the water in the capillary, *a*, above the level of the water in the bottle, etc. The two bottles may conveniently have a capacity of from 1000 to 1500 c.c. for use with waters, when it is desired to use the water subsequently for further chemical examination. In the case of sewage, the bottles need only have a capacity of about 150 c.c. The bottles should be about two-thirds filled, leaving one-third as air space. If the sewage under examination absorbs more oxygen than corresponds with the capacity of the graduated tube, a fresh supply of pure oxygen may be introduced through the tube, b_2, the volume already absorbed having been noted previously.—W. P. S.

PATENTS.

Photometer. G. H. Delmas-Azema. First Addition, dated Feb. 3, 1908, to Fr. Pat. 382,228, Oct. 23, 1907 (this J., 1908, 356).

THE apparatus described in the main patent has been improved by placing in the box, before the objective, an oscillating prism with translucent faces that are traversed alternately or simultaneously by light from the standard and test sources. With the object of rendering more perfect the mixing of the colours, two mirrors are so placed that each one receives a beam of light directly from each source and throws this through the light received from the same source upon the corresponding face of the prism.—J. W. G.

Colours and tints; Apparatus for comparing and determining —— and ascertaining the components thereof. F. V. Kallab, Offenbach on Maine, Germany. Eng. Pat. 15,263, July 2, 1907.

SEE Fr. Pat. 379,463 of 1907; this J., 1907, 1256.—T. F. B.

Gas analysis; Apparatus for ——. C. A. Hartung, Berlin. U.S. Pat. 892,955, July 7, 1908.

SEE Eng. Pat. 17,708 of 1905; this J., 1906, 561.—T. F. B.

INORGANIC—QUALITATIVE.

Arsenic; Detection of —— in sodium fluoride. W. Van Rijn. Pharm. Weekblad, 1908, 45, 98—101. Chem. Zent., 1908, 1, 1087.

IT is stated when fluorine compounds are present, no indication of arsenic is given in the Marsh apparatus, although positive results are obtained by the Gutzeit and Flückiger methods with silver nitrate paper. Investigation showed that arsenic fluoride instead of arseniuretted hydrogen was probably formed in the Marsh apparatus and that it decomposed in the heated glass tube according to the equation: $4AsF_3 + 3SiO_2 = 3SiF_4 + 2As_2O_3$. Beyond the heated portion of the tube the hydrogen reduced the arsenic trioxide back to arseniuretted hydrogen. —W. S.

Calcium phosphates; Action of ammonium citrate on ——. A. Barillé. *See* VII.

INORGANIC—QUANTITATIVE.

Iron and vanadium; Determination of —— in presence of each other. G. Edgar. Amer. J. Sci., 1908, **26**, 79—82.

SULPHUR dioxide is passed through the solution, containing iron and vanadium, until the colour becomes clear blue. A little dilute sulphuric acid is then added, the solution heated to boiling, and the sulphur dioxide displaced by a current of carbon dioxide, free from air. After cooling in the presence of carbon dioxide, the solution is titrated with permanganate, until the colour changes to yellowish-green, after which the titration is completed at 70°—80° C. The solution is next passed through a reductor, containing amalgamated zinc, being preceded by 150 c.c. of a hot 2·5 per cent. solution of sulphuric acid and followed by 100 c.c. of the dilute acid and finally by 200 c.c. of water. The receiving flask, which contains an excess of ferric sulphate, is kept cool, and, after addition of syrupy phosphoric acid, to remove the colour due to iron, the liquid is titrated with permanganate, until the bluish-green colour has changed to yellow, and the titration is then finished at 70°—80° C. The oxide, V_2O_5, is reduced by sulphur dioxide to the oxide, V_2O_4, whereas, by means of amalgamated zinc, reduction to the lower oxide, V_2O_2, is effected. Hence, the difference in the number of c.c. of $N/10$ permanganate used in the first and second titrations, multiplied by the factor 0·00456, gives the amount of vanadic acid present, and, this being known, the amount of iron is readily calculated from the result of either titration.—F. SODN.

Chromium; Determination of —— as silver chromate. F. A. Gooch and L. H. Weed. Amer. J. Sci., 1908, **26**, 85—86.

CHROMIUM, present in solution as a bichromate, may be accurately determined by precipitation with a large excess of silver nitrate, the solution being made first ammoniacal, and then faintly acid with acetic acid. Precipitation is effected at the boiling temperature, and the precipitated silver chromate (Ag_2CrO_4) is collected in a Gooch crucible and washed with a dilute solution of silver nitrate, which is then removed by the minimum quantity of water. The precipitate may be dried by gentle heating over a flame.—F. SODN.

Cerium; Determination of —— by potassium ferricyanide, in the presence of the other rare earth metals. P. E. Browning and H. E. Palmer. Amer. J. Sci., 1908, **26**, 83—84.

CERIUM may be rapidly and easily determined in rare earth mixtures by the following process:—A measured volume of a standard solution of potassium ferricyanide is added to the solution, and then potassium hydroxide, to complete the precipitation. The hydroxide is filtered off and washed, the filtrate made distinctly acid with sulphuric acid, and titrated with standard permanganate. This gives the amount of potassium ferrocyanide formed by reduction, and, hence, the weight of potassium ferricyanide used to oxidise the cerous compound to the ceric condition. The accuracy of the method has been tested in the presence of thorium, yttrium, lanthanum, didymium, and zirconium. It is noted that ferricyanide solutions, kept in clear glass bottles, remain practically unchanged for a week or more.—F. SODN.

Chlorite and hypochlorite in potassium chlorate; Detection and determination of ——. B. Carlson and J. Gelhaar. *See* VII.

Ferrocyanides; Commercial analysis of ——. H. G. Colman. *See* VII.

Lithium chloride; Method of separating —— from alkali chlorides and from barium chloride. L. Kahlenberg and F. C. Krauskopf. *See* VII.

Steel; Determination of nickel and chromium in —— E. D. Campbell and W. Arthur. *See* X.

Nickel in nickel-steel and nickel-chrome-steel; Determination of ——. H. Wdowiszewski. *See* X.

Tungsten; Determination of —— in steel in presence of chromium. G. von Knorre. *See* X.

"Battery chips"; Assay of ——. L. J. Wilmoth. *See* X.

Water and ferrous-iron content of minerals and rocks; Influence of fine grinding on ——. W. F. Hillebrand. *See* X.

Electroplating baths; Rapid analysis of ——. E. Pannain. *See* XI.*B*.

ORGANIC—QUALITATIVE.

Anthranilic acid; Characteristic reaction of ——. B. Pawlewski. *See* IV.

Cocoanut oil; Unsaponifiable constituents of —— and detection of that fat in butter. H. Matthes and E. Ackermann. *See* XII.

Potassium soaps of different fats; Solubility of —— in alcohol. J. Freundlich. *See* XII.

Abrastol [asaprol, calcium β-naphthol α-sulphonate]; Reactions of —— [and its detection in wine]. D. Vitali. *See* XX.

Naphthols; Simple test to differentiate α- and β- ——. Volcy-Boucher. *See* XX.

ORGANIC—QUANTITATIVE.

Active hydrogen in organic compounds; Quantitative determination of ——. T. Zerewitinoff. Ber., 1908. **41**, 2233—2243.

The author has continued his work on the determination of hydroxyl groups in organic compounds by measuring the methane produced by the action of magnesium-methyl iodide (this J., 1907, 646) and finds that, in addition, the method can be extended to the determination of the "active" hydrogen in compounds containing the sulphhydryl, the imino- or the amino-group as well as to the determination of the mobile hydrogen atom of certain tautomeric compounds. Whilst in many natural dyestuffs a hydroxyl group in the ortho-position to a carbonyl cannot be alkylated and thus presents a difficulty in the usual method of determining such groups, this difficulty is not met with in employing the author's process. The correct number of hydroxyl groups was found in experiments on 2′-hydroxy-4′:3:4-trimethoxy-chalkone, Euxanthone, Chrysin, Fisetin, Morin, Hæmatoxylin (= 5OH), Hæmatin (= 4OH) and Brasilin (= 4OH). Mercaptans react according to the equation: $R.SH + CH_3.MgI = CH_4 + R.SMgI$, the methane being quantitatively evolved. Amines, imines and acid imides react as follows:

$$CH_3.MgI + R.NH_2 = CH_4 + MgI.NHR$$
$$CH_3.MgI + RR'NH = CH_4 + MgI.NRR'$$

In the former case if the reaction is carried out at a higher temperature than the ordinary, the second hydrogen atom of the amine is displaced and two molecules of methane are produced. An exception to the rule is exhibited by carbamide, thiocarbamide, and their derivatives. Whereas carbamide and thiocarbamide should lose two atoms of hydrogen in the cold and four atoms at a higher temperature, only three atoms of hydrogen are displaced in the latter case. Similarly, phenyl-carbamide and -thiocarbamide lose only two atoms of hydrogen in each case. Tautomeric substances exhibiting keto-enolic tautomerism thus lose one atom of hydrogen, and malonic acid, in addition to the two carboxylic hydrogen atoms, loses one of those attached to the CH_2 group.—J. C. C.

Report of the Principal Chemist of the [British] Government Laboratory upon the work of the Laboratory for the year ended March 31, 1908. [Cd. 4157.] Wyman and Sons, Ltd., 34–40, Bacon Street, London, E. Price 3d.

In the Customs Branch of the Laboratory, 25,731 samples were examined for liability to spirit duty. These included beer, 2264, tested for original gravity; cider, 41, for genuineness; spirits, 2783, including 193 samples of methyl alcohol, wood spirit, and petrol; wines, including vinegar and acetic acid for denaturing unsound wines, 13,640; the remainder were "spirit preparations," including flavouring essences, fruit juices, perfumes, fusel oil, soaps, varnishes, yeast, ethers, and ethyl halides. The number of samples of dry goods tested was 9382, including 1883 samples of tobacco, 1097 of nicotine from tobacco, and 36 tobacco extracts. 6553 samples of saccharine products were examined, including 20 of imported sugar (for polarisation), 3509 of composite goods containing sugar, 1298 of molasses and preparations containing molasses, 37 of glucose, 9 of caramel, and 817 of substances suspected to contain saccharin or similar material; of these last, all but 9 were found to be free. 5167 samples of saccharine products (exports) were tested for drawback. 3303 "miscellaneous" samples of sugar, spirits, etc., were also examined. The number of hydrometers, thermometers, and measuring instruments tested was 2639. At other London stations and at the Outports the number of samples tested was as follows:—Beer, 4053; cider and perry, 214; spirits, 24,417; wines, 80,119; sugar, 23,422; molasses, 3121; miscellaneous, spirit preparations, &c., 2808. In connection with the Excise, 138,259 analyses and examinations were made, an increase of over 17,000 on the previous year. 8215 samples of wort were examined for original gravity, and 1218 of these were found to be under-declared. 458 samples of malt, sugar, maize, rice, etc., were examined, 36 samples of wort to determine whether sugar had been used without entry, and 210 samples of yeast foods, beer preservatives, etc., for suitability. Of the samples of beer examined for drawback, 0·8 per cent. did not agree with the declaration of the exporter. 741 out of 6112 samples of beer from public houses were found to have been diluted. 1106 samples of temperance drinks were tested for alcohol, and of these 89 contained from 3 to 4 per cent. of proof spirit; 32 from 4 to 6 per cent., and 6 contained more than 6 per cent. Of the 1011 samples of beer, wort, and brewing materials tested for arsenic, 48 were found to contain it in excess of the requirements of the Royal Commission on Arsenical Poisoning. Nine out of 121 samples of malt were found to exceed the arsenic limit, whilst of the 617 samples of glucose, invert sugar, caramel, etc., none exceeded the limit.

Spirits.—16,808 samples of medicinal tinctures, presented for drawback, were examined. 152,268 proof gallons of spirit were exported under the Tincture Regulations. 3973 samples of compounded spirits, liqueurs, and wines were tested for spirit value and character, and 1898 of these for sugar content. 214 samples of brandy and rum were tested to see how far their alcoholic strength was obscured.

782 samples of wood naphtha, representing 291,895 gallons, were examined; 11 samples, representing 2864 gallons, were not approved. This shows a decrease of 46,938 gallons from the previous year. Of methylated spirit for manufacturing purposes, 2,589,500 bulk gallons was made during 1907–1908 (an increase of 143,900 gallons over 1906–1907), and 1,583,900 gallons of mineralised methylated spirit, mainly for domestic use (a decrease of 6100 gallons over the previous year). During the year ended March 31, 1908, 715 applications connected with the use of methylated spirit have been referred to the department for report. 189 samples of mineral naphtha, representing 6047 gallons, were examined and approved for methylating purposes. 85 samples of petroleum ether, representing 2631 gallons, were also examined, and all but one (representing 35 gallons) were approved.

Duty free spirit under the Finance Act, 1902.

The total quantity of duty-free spirit expressed in proof gallons used for all purposes, domestic and manufacturing, during the years ended 31st March, 1907 and 1908, was as follows:—

——	1908.	1907.
	Proof Gallons.	Proof Gallons.
In mineralised methylated spirit for domestic use	2,339,782	2,338,000
In industrial methylated spirit for manufacturing	4,115,593	3,717,000
In spirit otherwise denatured—manufacturing	473,509	432,000
Used in universities, colleges, &c.	4,323	4,000
Total	6,933,207	6,491,000

The total quantity of foreign spirit used for manufacturing purposes, etc., during the year ended 31st March, 1908, including pure absolute alcohol and methyl alcohol, was equivalent to 13,500 proof gallons, or about 6,500 bulk gallons.

Two cases of illegal traffic in industrial methylated spirit by manufacturers authorised to use it, were discovered.

46 samples of spirit and "finish" were examined, and in 15 instances of unlicensed sale the samples were found to be either methylated spirit or to contain less than the legal proportion of gum resin.

Agricultural produce.—There was a considerable reduction in the number of samples of imported butter found to contain excess of water. No case of adulteration with foreign fat was found. A further diminution has also been noted in the number of samples which have been artificially coloured. Of the 178 samples of margarine examined, four exceeded the legal amount of water. Twelve samples of "condensed milk" were milk powder, and two samples of "milk powder" consisted of milk proteins only. Eight samples of condensed milk and four of milk powder were found to have been prepared from skimmed milk, though this was not indicated on the label. Of the 65 samples of cream, 45 contained boron preservative, 36 of these also containing salicylic acid. "Hydroxyl" [hydrogen peroxide] has been used as preservative in some recent samples. 230 samples were examined for the Home Office, including 44 in connection with an investigation on matches. 97 samples consisted of pottery glazes and glazed pottery, which were tested for lead. Of 30 samples of the class supposed to contain less than 5 per cent. of soluble lead compounds, eight glazes contained more than 5 per cent. of soluble lead oxide; in six of these the amounts varied from 8 to 67 per cent.

The following table shows some of the uses of industrial methylated spirit:—

Nature of manufacturing operation or other purpose for which the spirit is used.	Quantity used during the year ended 31st March, 1908.
	Gallons.
Finish for sale	363,074
Varnishes, polishes, and lacquers for sale	886,485
Stains, paints, enamels, &c., for sale	49,203
Varnishes, finish, stains, lacquers, &c., and spirit used for polishing purposes in manufacturers' own workshops	257,100
Felt hats	116,590
Celluloid, xylonite, and similar substances	19,561
Oil-cloths, leather-cloths, pegamoid, and similar substances	200,944
Linoleum and similar substances	536
Smokeless powders, fulminates, and other explosives	18,596
Soap	136,399
Electric lamp filaments	15,291
Electric cables	4,937
Incandescent gas mantles	16,888
Ether	166,460
Chloroform	19,941
Ethyl chloride and bromide	835
Solid medicinal extracts	21,261
Alkaloids and fine chemicals	21,146
Plant washes, insecticides, and sheep dips	8,431
Aniline and other dyes	4,270
Fireworks and matches	4,460
Photographic plates and papers, and other photographic purposes	37,423
Steel pens	2,324
Silk, crape, and embroidery	6,595
Artificial flowers, &c.	2,630
Rubber	3,327
Artificial silk	*not stated*
Inks	2,094
Dyeing and cleaning operations in laundries and dye works	42,889
Calico printing	5,479
Preservation of specimens in museums and hospitals	8,442
Educational and scientific purposes in colleges and schools	4,968
Analytical and scientific purposes in the laboratories of analysts, works chemists, &c.	4,421
Hospitals, asylums, and infirmaries	10,593
Electrotyping and printing	1,381
Various miscellaneous manufactures, including cements, disinfectants, &c.	10,740

Hydrosulphite-formaldehyde; Analysis of ——. W. F. Greaves. *See* V.

Hide powder; Preservative effect of borophenol upon chromed ——. J. G. Parker and A. T. Hough. *See* XIV.

Morphine; Colorimetric determination of small amounts of ——. Mai and Rath. *See* XX.

Monomethylamine; Precipitation of —— *as monomethylamine-magnesium phosphate.* M. Francois. *See* XX.

XXIV.—SCIENTIFIC & TECHNICAL NOTES.

Helium; Liquefaction of ——. Times, July 20, 1908.

PROF. ONNES has communicated to Sir James Dewar the fact that, on July 10, he had obtained 60 c.c. of liquid helium, which did not solidify at a vapour pressure of 1 cm. Its boiling point was 4·3° Absolute.

Lead ethoxide; Formation of ——. F. M. Perkin. Chem. Soc. Proc., 1908, **24**, 179.

WHEN thin sheets of lead are boiled in alcohol or suspended in the vapour of boiling alcohol, no action takes place, but if they are suspended over absolute alcohol and ozone is bubbled through it, in a short time the surface of the lead becomes tarnished and then assumes a brownish-yellow colour. At the end of some days, the whole of the lead is converted into a light yellow powder. On carefully washing this powder with alcohol and drying *in vacuo* over sulphuric acid for some hours, a light yellow, friable powder is obtained. This, on analysis, proves to be *lead ethoxide*, $Pb(OC_2H_5)_2$. It appears to be soluble in water, although a clear solution is never obtained, probably owing to hydrolysis. It has not been found possible to obtain the ethoxide by passing oxygen alone through the alcohol, but, after the ozone has been passed for some time, the reaction can be completed by the continued passage of dry oxygen. When mercury is placed in alcohol and ozone bubbled through it, a white powder is formed which has not yet been analysed. The method is being tried with other metals.

New Books.

Exports and Imports (United Kingdom). Wyman and Sons, Fetter Lane, E.C. Price 1½d.

THIS is a return showing for the years 1906 and 1907 the value of our exports to and consignments from France, the United States, Belgium, and Germany respectively, distinguishing between food, drink and tobacco, raw materials and manufactures.

LA CANFORA ITALIANA. Ricerche analitiche comparative sulla produttività in canfora, ed in olio di canfora, del fogliame dei *Laurus camphora* o *Cinnamomum camphora*, vegetanti in varie parti d'Italia. Notizie sulla storia, sulla industrie e sul commercio della canfora: sulla cultura, distribuzione geografica e sulla acclimazione del Lauro della canfora: per dimostrare la utilità della cultura industriale di questro albero in Italia.—Con appendice bibliografica. Ristampa, con aggiunte, dagli Atti del VI. Congresso internazionale di Chimica Applicata tenuto in Roma nel maggio 1906. Di ITALO GIGLIOLI, Professore nella R. Università di Pisa. Tipografia Nazionale di Giovanni Bertero e C., Roma. 1908.

THIS is a reprint, with additions, of a report presented to the Sixth International Congress of Applied Chemistry, Rome, 1906, and now issued by the Italian Minister of Agriculture, Industry and Commerce. It occupies 292 pages, divided into 19 chapters, including a bibliography, together with a table of contents. The report deals with a comparative analytical study of the yields of camphor and camphor oil from the leaves of *Laurus camphora* and *Cinnamomum camphora* grown in Italy. Also an account of the history of the camphor industry, and of the geographical distribution of the camphor tree and its acclimatisation in different countries, with a view to demonstrate the advantages of the culture of this tree in Italy.

Patent List.

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

Applications.

15,000. Ridley. Methods of obtaining gases from solids. July 15.

15,019. Wilson. Cleansing filtering media. July 15.

15,267. Guillaume. *See under* III.

15,306. Kerfoot. Production of sterilised crystals. July 20.

15,683. Feld. Apparatus for subjecting gases or vapours to the action of liquids. July 23.

Complete Specifications Accepted.

13,529 (1907). Place. Apparatus for liquefying air. July 22.

16,978 (1907). Griffin and Tucker. Drying apparatus for peat, etc. July 29.

24,295 (1907). Black and Lennox. Drying apparatus. July 29.

25,907 (1907). Watson. Apparatus for removing solid matter from liquids. July 22.

26,620 (1907). Schalenberg. Precipitating dust or soot contained in gases by injection of water. July 29.

27,496 (1907). Kubierschky. Towers for distilling, absorbing, etc. July 29.

II.—FUEL, GAS, AND LIGHT.

Applications.

14,851 and 14,853. Trenzen and Pope. Manufacture of metallic filaments for incandescent electric lamps. July 13.

14,852. Trenzen and Pope. Manufacture of bodies of titanium, particularly for incandescent lamp filaments. July 13.

14,867. British Thomson-Houston Co. (General Electric Co.). Manufacture of electric incandescent lamp filaments. July 13.

14,942. Westinghouse Metal Filament Lamp Co. (Westinghouse Metallfaden Gluhlampenfabr.). Production of tungsten incandescent filaments. July 14.

14,961 and 14,962. Majert. Manufacture of metallic filaments for electric incandescent lamps. July 14.

14,971. Sabatier. Manufacture of methane or mixtures of hydrogen and methane.* July 14.

15,042. Lake (Trump). Gas producers.* July 15.

15,079. Aron and Geiger. Decarbonising filaments for electric lamps.* July 16.

15,080. Aron and Geiger. Manufacture of metallic incandescent filaments.* July 16.

15,086. Nelson. Manufacture of briquettes for fuel.* July 16.

15,178. Hanappe. Gas generators.* July 17.

15,756. Symour and Smith. Fuel for producing light, heat, and motive power. July 24.

Complete Specifications Accepted.

16,768 (1907). Woolley. Gas producers. July 29.

16,937 (1907). Boult (A.-G. Görlitzer Maschinenbau Anstalt u. Eisengiesserei). Gas generators. July 29.

18,196 (1907). Armstrong. Manufacture of coke and gas. July 29.

19,873 (1907). Rider. Manufacture of fuel gas from a mixture of mineral carbonates and organic substances. July 22.

314 (1908). Driscoll, Peckover, and Scriven. Compound for treating coal and other fuel. July 22.

2572 (1908). Weickert. Manufacture of mantles for incandescent gas lighting. July 29.

7229 (1908). Wolters. Coking ovens. July 29.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

Application.

15,267. Guillaume. Rectification and fractional separation of crude petroleum and other liquids.* July 18.

Complete Specification Accepted.

16,432 (1907). Martini. Refining crude petroleum by distillation. July 29.

IV.—COLOURING MATTERS AND DYESTUFFS

Applications.

15,008. Vidal. Colouring matters for animal fibres. [Fr. Appl., Aug. 29, 1907.]* July 15.

15,351. Johnson (Kalle und Co.). Manufacture of disazo colouring matters. July 20.

15,352. Imray (Soc. Chem. Ind. in Basle). Manufacture of permanent printing colours and their application in printing fabrics.* July 20.

15,355. Imray (Meister, Lucius, und Brüning). Manufacture of dyestuffs of the anthracene series. July 20.

15,417. Haas. Dyestuffs capable of dyeing vegetable fibres without mordants. [Fr. Appl., Aug. 5, 1907.]* July 21.

15,463. Soc. Chem. Ind. in Basle. Manufacture of amidoarylazimidonaphtholsulphonic acids and dyestuffs therefrom. [Fr. Appl., July 22, 1907].* July 21.

15,729. Levinstein, and Levinstein, Ltd. Dyestuffs and the manufacture and application thereof. July 24.

Complete Specifications Accepted.

16,775 (1907). Johnson (Badische Anilin und Soda Fabrik). Manufacture of anthracene dyestuffs. July 29.

17,677 (1907). Ulrichs. Manufacture of dyes. July 22.

20,367 (1907). Bloxam (Act.-Ges. f. Anilinfabr.). Manufacture of *o*-nitrated amino derivatives of the benzene and naphthalene series. July 29.

22,818 (1907). Newton (Bayer und Co.). Manufacture of dyestuffs of the phthalein series dyeing on a mordant. July 22.

23,182 (1907). Newton (Bayer und Co.). Manufacture of a tetrazo dyestuff. July 22.

25,080 (1907). Soc. Anon. Mat. Col. et Prod. Chim. de St. Denis. Manufacture of a black sulphurised dyestuff. July 22.

28,514 (1907). Badische Anilin und Soda Fabrik. Manufacture of anthracene dyestuffs. July 29.

3628 (1908). Wiegand and Rieder. *See under* XIV.

5840 (1908). Imray (Basle Chem. Works). Manufacture of indoxyl, its homologues or derivatives. July 29.

6153 (1908). Ges. f. Chem. Ind. in Basle. Manufacture of a tribromo derivative of indigo. July 29.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

Applications.

14,936. Imray (Meister, Lucius, und Brüning). *See under* XX.

15,009. Vidal. *See under* XIV.

15,015. Boullier and Lafois. Manufacture of artificial silk. [Belg. Appl., July 15, 1907.]* July 15.

15,284. Weiss. Boiling, washing, bleaching, and otherwise treating textile materials.* July 18.

15,339. Levy. Fireproof and waterproof coating. July 20.

15,352. Imray (Soc. Chem. Ind. in Basle). *See under* IV.

15,448 and 15,449. Bemberg A.-G. Apparatus for spinning viscous liquids. [Ger. Appl., April 21, 1908. Addition to No. 8711 of 1908.]* July 21.

15,506. Levinstein, and Levinstein, Ltd. Printing with sulphur colours. July 22.

15,536. Hill. *See under* XVIII*B*.

15,564. Hertel. Bleaching and washing vegetable textile goods. July 22.

Complete Specifications Accepted.

20,049 (1907). Karsam Soap Co., and Samuel. Treatment of vegetable fibres and fibrous material. July 29.

23,793 (1907). Johnson (Badische Anilin und Soda Fabrik). Printing on textile fibre. July 22.

7700 (1908). Burmann. Printing wall papers, etc July 22.

VII.—ACIDS, ALKALIS, AND SALTS.

Applications.

14,824. Soc. Commerciale du Carbure de Calcium. Fixation of phosphoretted hydrogen. [Fr. Appl., March 6, 1908.]* July 13.

14,850. Gossens, Pope, and Co. Manufacture of plastic masses of tungsten oxide. [Ger. Appl., July 12, 1907.]* July 13.

14,863. Menter and Sedlitzky. Compositions for generating carbonic acid.* July 13.

15,239. Pochin and Richardson. Manufacture of ferric sulphate and cakes or slabs containing the same. July 18.

15,391. Dyes (Lehmann). Manufacture of nitrates. July 21.

15,490. Haber and Koenig. Manufacture of compounds of oxygen and nitrogen. [Ger. Appl., July 24, 1907.]* July 21.

15,505. Schumacher. Section of ammonia still. July 22.

15,554. Brünler. Producing an air mixture of a high ratio of oxygen.* July 22.

15,667. Rawson. Burning magnesite. July 23.

15,696. Mays. Manufacture of salt. July 24.

Complete Specifications Accepted.

21,786 (1907). Frank and Voigt. Manufacture of nitrogen compounds from carbides. July 29.

25,227 (1907). Pochin and Richardson. Treatment of the residue from the manufacture of aluminium sulphate. July 29.

1461 (1908). Brandenburg. Manufacture of tin chloride. July 29.

2974 (1908). Elworthy. Apparatus for generating ozone. July 29.

6366 (1908). Naville, Guye, and Guye. Recovery of oxides of nitrogen diluted with inert gases. July 29.

6453 (1908). Jirotka. Production of ozone. July 22.

7909 (1908). Ostwald. Catalytic apparatus for converting ammonia into oxides of nitrogen. July 29.

VIII.—GLASS, POTTERY, AND ENAMELS.

Application.

15,669 and 15,670. Imray (Window Glass Machine Co.). Apparatus for drawing glass.* July 23.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Applications.

15,110. Kathe. Making mortar and artificial stone watertight.* July 16.

15,556. Polifka and Hacker. Impregnation of wood.* July 22.

15,625. Snyder. Manufacture of cement.* July 23.

15,797. Hövermann. Cements.* July 24.

15,863. Cordes. Manufacture of artificial stone, etc. July 25.

Complete Specification Accepted.

467 (1908). Bougleux. Treatment of puzzolane or other volcanic earths to facilitate admixture with lime and cement. July 29.

X.—METALS AND METALLURGY.

Applications.

14,911. Fear. Soldering aluminium. July 14.

14,926. Bismarckhütte. Refining steel in electric furnaces. [Addition to No. 6029 of 1908.]* July 14.

14,933. Reynolds. Manufacture of steel and similar metallurgical operations. July 14.

14,969. Lake (Magnalium-Ind. Ges.). Manufacture of aluminium alloys. July 14.

15,038. Johnson (Chem. Fabr. Griesheim-Elektron). Melting and casting magnesium and its alloys. July 15.

15,056. Dick. Treatment of oxidised ores of copper. July 15.

15,175. Howarth. Associating nickel and iron. July 17.

15,176. Loiseau. Manufacture of zinc.* July 17.

15,192. Von Zelewski. Mechanical roasting furnace. [Addition to No. 21,961 of 1907].* July 17.

15,628. Coslett Anti-Rusting Synd., and Coslett. Treating iron or steel to prevent oxidation or rusting. July 23.

15,645. Kilburn (Oesterle). Furnaces for treating ores, etc. July 23.

15,678. Mordey. Deposition and cleaning of metals. July 23.

15,688. Fennell and Sackett. Furnaces for treating metals and ores.* July 23.

Complete Specifications Accepted.

11,297 (1907). Cowper-Coles. Recovery of gold from cyanide solutions. July 22.

15,941 (1907). Petersen. Furnace for roasting sulphide ores. July 22.

15,962 and 15,963 (1907). Lloyd. Process and apparatus for converting metals. July 22.

17,343 (1907). Dwight and Lloyd. Roasting and sintering ores. July 29.

17,687 (1907). Koch. Smelting furnace heated with oil. July 29.

25,460 (1907). Muhlinghaus. Extraction of tin from ores, slag, or refuse. July 29.

6051 (1908). Siemens und Halske A.-G. Process for hardening tantalum. July 22.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

Applications.

15,031. Bianco. Electrolytic galvanising process.* July 15.

15,264. Mordey. Deposition of metals. July 18.

15,350. Dolphin. Obtaining copper and other metals by the electrolytic process, and septa for separating solutions. July 20.

15,362. Edison. Preparation of metallic films. [U.S. Appl., Feb. 6, 1908.]* July 20.

15,698. Cook. Electric furnaces. July 24.

15,792. British Thomson-Houston Co. (General Electric Co.). Electrolytes for electrolytic cells. July 24.

Complete Specifications Accepted.

16,735 (1907). Harrison. Electrochemical deposition of metals. July 29.

8017 (1908). Branco and Gumpert. Manufacture of electric insulating material from peat. July 29.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

Applications.

15,466. Common. and Hull Oil Manufacturing Co. Rendering castor-oil miscible with mineral oils. July 21.

15,697. Hollingworth. Soap or soap compound. July 24.

Complete Specification Accepted.

21,658 (1907). Wood. Process of distilling glycerin. July 29.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc.

(*B.*)—Resins, Varnishes.

Application.

15,325. Joly. Resins, resin compounds, etc. July 20.

(*C.*)—India-Rubber.

Applications.

14,830. Roux. Treatment of waste rubber. [Fr. Appl., July 13, 1907. Addition to No. 7795 of 1904.]* July 13.

14,859. Rütgerswerke A.-G. Manufacture of filling compositions for addition to rubber. [Ger. Appl., Oct. 11, 1907.]* July 13.

15,775. Hyatt. Reclamation of waste rubber and vulcanite. July 24.

XIV.—TANNING, LEATHER, GLUE, SIZE, Etc.

Applications.

15,009. Vidal. Treatment of hides, leather, furs, hair, feathers, woven and spun goods. [Fr. Appl., Aug. 29, 1907.]* July 15.

15,368. Howorth (Steinkern Industrie). Manufacture of substitutes for horn.* July 20.

Complete Specifications Accepted.

14,098 (1907). Goldsmith. Casein compounds or articles. July 29.

17,953 (1907). Kathe. Production of plastic masses from casein. July 22.

20,293 (1907). Lake (Turner Tanning Machine Co.). Machines for treating leather. July 22.

3628 (1908). Wiegand and Rieder. Extraction of tanning materials, dyewood, beet, etc. July 29.

11,292 (1907). Baum. Production of a leather substitute. July 29.

XV.—MANURES, Etc.

Complete Specification Accepted.

20,575 (1907). Pohl. Manufacture of artificial manure July 29.

XVI.—SUGAR, STARCH, GUM, Etc.

Complete Specification Accepted.

3628 (1908). Wiegand and Rieder. *See under* XIV.

XVII.—BREWING, WINES, SPIRITS, Etc.

Complete Specification Accepted.

21,941 (1907). Heymann. Treatment of malt for use in brewing. July 29.

XVIII.—FOODS; SANITATION, WATER PURIFICATION; AND DISINFECTANTS.

(*A.*)—Foods.

Applications.

15,415. Pears. Separating acidulous constituents of lemon juice and lime juice and combining them with sucrose. July 21.

15,474. Quine. Cereal products. [U.S. Appl., July 29, 1907.]* July 21.

15,552. Lloyd. Manufacture of aerated or carbonated water, etc. July 22.

(*B.*)—Sanitation; Water Purification.

Applications.

15,536. Hill. Purification of trade effluents, dyeing, cotton, woollens. July 22.

15,570. Storey. Treatment of vapours from refuse destructors. July 22.

15,854. Cie. Franç. de L'Ozone. Purification of water by ozone. [Fr. Appl., July 26, 1907.]* July 25.

Complete Specification Accepted.

2077 (1908). Reisert. Clarifying water. July 29.

(*C.*)—Disinfectants.

Complete Specification Accepted.

4855 (1908). Schneider. Producing formaldehyde vapours for disinfecting purposes. July 29.

XIX.—PAPER, PASTEBOARD, Etc.

Complete Specification Accepted.

9268 (1908). Verein. Glanzstoff-Fabr. Manufacture of cellulose products. July 22.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

Applications.

14,936. Imray (Meister, Lucius, und Brüning). Manufacture of fatty acid compounds with aldehydes and ketones, and their employment in colour printing. July 14.

14,937. Meister, Lucius, und Brüning. Manufacture of homologues of *p*-aminophenylarsinic acid. [Ger. Appl., July 19, 1907.]* July 14.

15,122. Johnson (Verein. Chininfabr. Zimmer und Co.). Santalol esters. July 16.

15,207. Justice (Boehringer). Obtaining purified or concentrated lactic acid and purified lactates. July 17.

15,573. Newton (Bayer und Co.). Manufacture of purin derivatives. July 22.

15,768. Meister, Lucius, und Brüning. Preparation of diphtheria antitoxin. [Ger. Appl., July 31, 1907.]* July 24.

Complete Specifications Accepted.

14,379 (1907). Dubosc. Manufacture of formic ethers of borneol and isoborneol. July 29.

16,605 (1907). Weizmann, and Clayton Aniline Co. Manufacture of isobornyl esters. July 22.

21,946 (1907). Friedl, Weizmann, and Clayton Aniline Co. Manufacture of camphor. July 22.

1936 (1908). Leemans. Preparation of acetates of borneol and isoborneol. July 29.

2152 (1908). Trivelli. Obtaining radioactive compounds from uranium or its compounds. July 29.

5316 (1908). Redfern (Basle Chemical Works). Manufacture of c.c.-dialkyliminobarbituric acids. July 22.

5513 (1908). Boult (Florizoone). Obtaining camphor from borneol or isoborneol. July 22.

6227 (1908). Knoll und Co. Manufacture of a pharmaceutical compound from casein. July 29.

11,335 (1908). Johnson (Deuts. Gold- und Silber-Scheide Anstalt). Manufacture of compounds of sodium and arylamines. July 29.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Applications.

15,050. Caille. Photographic reproduction of colours. [Fr. Appl., July 16, 1907].* July 15.

15,657. Jeannot and Bremner. Photographic developing and fixing solutions. [Fr. Appl., July 23, 1907.]* July 23.

15,866. Sproule (Nell). Photographic films or plates. July 25.

XXII.—EXPLOSIVES, MATCHES, Etc.

Application.

15,195. Eberle. Explosive or blasting agent for blasting rock, etc.* July 17.

Complete Specifications Accepted.

17,877 (1907). Luck. Treatment of high explosives. July 22.

4046 (1908). Bawden. Explosives. July 22.

XXIII.—ANALYTICAL CHEMISTRY.

Application.

15,666. Baines. Apparatus for testing butter and like substances for water. July 23.

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Photogravure by Rust and Hall London

A. Nobel

Journal of the Society of Chemical Industry.

No. 16, Vol. XXVII. AUGUST 31, 1908. No. 16, Vol. XXVII.

Canadian Section.

Meeting held at Toronto on Thursday, May 16, 1908.

PROF. W. H. ELLIS IN THE CHAIR.

LOSS OF CARBON DURING SOLUTION OF STEEL IN POTASSIUM CUPRIC CHLORIDE.

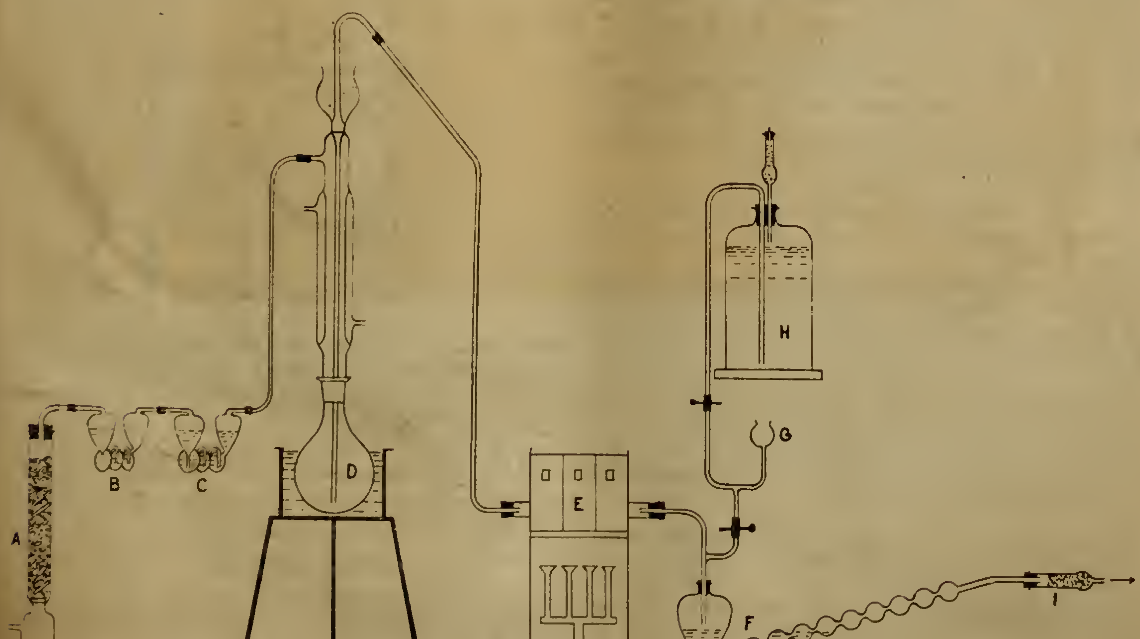
BY E. P. MOORE AND J. W. BAIN.

There has been much uncertainty as to whether carbon is lost by the evolution of gaseous hydrocarbons during the solution of steel in acid potassium cupric chloride solution when this method is used for the determination of carbon in that metal. Dillner(¹) remarks, "As is well known and as has been pointed out on several occasions by various authorities, there is always an evolution of hydrocarbon gases when steel dissolves in copper chloride, which escape"; accounting in this way for the lower results obtained from the indirect processes. He also refers to some observations made by Ledebur(²), but unfortunately the publication was inaccessible. Arnold (³) states that he has seen distinctly bubbles rising through the liquid during the solution of steel in copper chloride.

The problem has hitherto been attacked from the following standpoint. Samples of steel are dissolved in various solvents of various concentrations and the carbon estimated as usual. The highest percentage obtained is selected as a standard and the discrepancies between this and the other results are ascribed to losses during solution. True, these results are confirmed by determinations made by the volatilisation of the iron by chlorine or by direct combustion, but even in these cases the uncertainty of a numerical difference between two results, each burdened with experimental errors, is obvious. For these reasons it appeared to be desirable to determine, by a direct process if possible, whether any carbon was lost during the solution of iron or steel in the solvent so commonly used—potassium cupric chloride.

The following apparatus was used (see figure):—A, A drying tower filled with potassium hydroxide in sticks. B, An absorption bulb filled with potassium hydroxide solution. C, An absorption bulb filled with barium hydroxide solution. D, A Rheindorf(⁴) flask for estimation of carbon, immersed in a water bath maintained at a temperature of 65° C. E, A piece of combustion tubing filled with cupric oxide, heated to redness in a small gas furnace. F, A ten bulb absorption apparatus charged with barium hydroxide. G, A small thistle tube sealed to a glass T as shown. H, A stock bottle containing barium hydroxide. I, A guard tube filled with soda-lime. The introduction of barium hydroxide into the absorption bulb is the only feature which calls for remark. A current of air free from carbon dioxide having been drawn through the bulb, F, for some time, a suitable quantity of barium hydroxide solution was siphoned over, being clarified in transit by passing through a filter of ignited asbestos (not shown). In the first experiments a slight precipitate formed on the inner surface of the delivery tube which protrudes into the bulb, F; by pouring into the funnel, G, a small quantity of recently-boiled distilled water and allowing it to wash down, it was found that this could be entirely avoided.

The flask, D, was charged with a solution of potassium cupric chloride made by dissolving 300 grms. of the salt in 1 litre of water and adding 75 c.c. of concentrated hydrochloric acid. Blank tests were made by placing in the flask, D, the quantity of potassium cupric chloride solution usually employed, and after aspirating for some time to clear the apparatus of carbon dioxide, filling the bulb, F, with barium hydroxide solution, and proceeding to heat the flask, D, to 65° C. After aspirating for two hours, in no case was there more than a very faint cloud of barium carbonate to be observed in the tube, F; efforts were made to collect and weigh this precipitate, but without success. Three grms. of steel were then placed in the solution flask, 200 c.c. of potassium cupric chloride solution added, and the water bath maintained at a temperature of 65° C.; air was also slowly aspirated through the apparatus, the cupric oxide having been previously brought to red heat. When the steel had dissolved completely, the ten bulb tube was removed, and a stopper carrying a soda-lime tube placed immediately in the larger end, while the other opening was connected by rubber tubing to the glass tube in the cork of a filtering funnel. The barium carbonate was transferred as completely as possible to



the filter and washed with recently-boiled distilled water; the absorption tube and the filter were then treated with dilute hydrochloric acid, the asbestos filtered off, and the barium precipitated as sulphate and weighed.

Two samples of steel were employed; the one containing 0·653 per cent. of carbon, the other 1·18 per cent. Four determinations were made on each of these. 3 grms. being used in each case; the results are expressed as grms. of carbon escaping from the flask.

	0·653 per cent. Steel.	1·18 per cent. Steel.
	grm.	grm.
	0·00176	0·00115
	0·00112	0·00121
	0·00142	0·00100
	0·00159	0·00103
Mean	0·00147	0·00110
Loss on 1 grm.	0·0005	0·0004

In the case, therefore, of the 0·653 per cent. steel, a quantity of carbon corresponding to 0·05 per cent. has been lost during solution, making the true percentage 0·703; with the other the true percentage will be 1·22.

These losses are comparatively large, although not much greater than some of the discrepancies between the results obtained by various members of the International Committee. In view of the difficulties in manipulation the authors do not profess that their figures represent the actual loss, but they believe that they have proved that a loss does take place under the conditions given above, and also that the amount approximates fairly closely to the figures given.

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(1) J. Iron and Steel Inst., 66, 255.

(2) Verein zur Beförderung der Gewerbfleisses, Vols. 6, 7.

(3) Steel Works Analysis, 2nd ed., p. 29.

(4) Zeits. angew. Chem., 1904, 467.

Journal and Patent Literature.

Patent Specifications may be obtained by post by remitting as follows:—

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I.—PLANT, APPARATUS, AND MACHINERY.

Patents.

Condensing vapours and gases without a cooling agent; Process and means for instantaneously ——. E. Wiart, La Ferte-Bernard, France. Eng. Pat. 26,052, Nov. 25, 1907.

A vacuum is produced by the method described in Eng. Pats. 2111 and 2240, of 1907 (this J., 1907, 917) in each of a pair of doubly conical vessels, each of which has a flap-valve below, connected by a rod to an inlet-valve at the top of the vessel. When the flap-valve opens, the inlet-valve is closed, and *vice versa.* The vapour or gas to be condensed, is admitted into the vessel and is instantaneously exposed to the full vacuum, with the result that "the molecules of vapours and gases are destroyed or torn" and condensed to a liquid which accumulates in the vessel until it is full. The vacuum being thus destroyed, the flap-valve opens, and closes the inlet-valve, and the condensed liquid flows out. At the same time the inlet to the other vessel is opened and the process is repeated.—W. H. C.

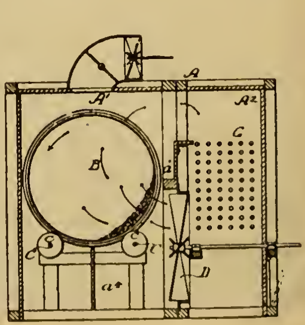
Cold air; Producing ——, *and apparatus therefor.* E. C. Nichols, Orange, N.J., U.S.A. Eng. Pat. 26,741, Dec. 3, 1907.

Air for a compressor, is drawn through a chamber, in which it receives a preliminary cooling by the cold produced by the expansion in a coil placed in the chamber, of a small portion of the compressed air from the compressor cylinder. The chilled air deposits most of its moisture, and is then compressed and passed into a second chamber provided with a coil. Here it is further cooled by the expansion of another small portion of compressed air. The second cooling causes the deposition of the remaining moisture and the dry, cooled, compressed air is conducted to a store-vessel for use.—W. H. C.

Drying apparatus. H. Fairbrother, London. From Moller und Pfeifer, Berlin. Eng. Pat. 2702, Feb. 6, 1908.

In tunnel drying apparatus in which the saturated air is conducted back through tubular heaters to give up its heat to the incoming unsaturated air, it is necessary to provide a larger volume of unsaturated air at the cold end than at the hot end of the dryer, as it is desirable that the rate of drying should be constant throughout the apparatus. This end is attained by withdrawing portions of air at various points along the tunnel and passing this air back directly to the heating tubes. In this way the volume of the air current becomes progressively less as it advances through the tunnel, and its temperature increases.—W. H. C.

Drying machine; Rotary ——. W. M. Schwartz, Assignor to The Philadelphia Textile Machinery Co., Philadelphia, Pa. U.S. Pat. 892,901, July 7, 1908.



The casing, A, is divided into two compartments, A^1, A^2 by the partition, a^1. A heating device, G, is arranged in the compartment, A^2, and a perforated drying drum, B, supported on rollers, C, is rotated in the compartment, A^1. Heated air is drawn from A^2, by the fan, D, and is blown into A^2, where it is forced to take the direction indicated by the arrows, by the partition, a^4. The air, after passing over the material in the drum, returns to the heating compartment, A^2, as shown by arrow.—W. H. C.

Drying-oven. J. Horner, Bristol, Pa. U.S. Pat. 894,145, July 21, 1908.

A central chamber has a floor provided with apertures, and beneath this a space connected at one end to a vertical flue. Gases pass from a furnace, situated at one side of the chamber, through the flue, into the space beneath the floor, and through the apertures into the chamber. At the other end of the central chamber is a vertical flue which communicates with the chamber at the top and with the exterior below.—W. H. C.

Filtering vessel. K. Muller, Dresden, Germany. Eng. Pat. 3786, Feb. 19, 1908.

The claim is for a filtering vessel with a perforated, grooved or corrugated bottom on which filtering paper may be supported. It is provided with extension pieces or flanges below to retain it in a steady position in the neck of the vessel, which is placed beneath to receive the filtrate.—W. H. C.

Filter. C. H. Loew, Lakewood, Ohio. U.S. Pat. 893,806, July 21, 1908.

The claim is for a casing containing filtering elements, and a press, which is supported and moved by a bar, and which can be made to act against the filtering elements. The bar is pivoted on a shaft provided with a stop, so that the bar (and press) may be swung round when withdrawn from the casing until it comes into contact with the stop. —W. H. C.

Regenerative furnaces. N. Lébédeff and B. Pomeranzoff, St. Petersburg. Eng. Pat. 15,533, July 5, 1907.

See Fr. Pat. 379,474 of 1907 ; this J., 1907, 1230.—T. F. B.

Condensing fumes, vapours, and the like ; Apparatus for ——. G. C. Richards, Berkeley, Cal., U.S.A. Eng. Pat. 7094, March 31, 1908.

See U.S. Pat 888,119 of 1908 ; this J., 1908, 619.—T. F. B.

Kiln ; Rotary ——. W. R. Warren, New York. Reissue No. 12,831, dated July 14, 1908, of U.S. Pat. 804,076, Nov. 7, 1905.

See Fr. Pat. 358,227 of 1905 ; this J., 1906, 182.—T. F. B.

Concentrating solutions ; Apparatus for ——. E. Monti, Turin, Italy. U.S. Pat. 893,006, July 14, 1908.

See Fr. Pat. 357,770 of 1905 ; this J., 1906, 113.—T. F. B.

Filtering liquids and fluids ; Apparatus for ——. E. Gobbi, Paris. U.S. Pat. 893,070, July 14, 1908.

See Eng. Pat. 83 of 1906 ; this J., 1906, 802.—T. F. B.

II.—FUEL, GAS, AND LIGHT.

Naphthalene ; Use of anthracene oil in the removal of ——. L. du Pasquier. J. Gas Lighting, 1908, **53**, 43—45.

The author gives his experience of the working of Bueb's process for the removal of naphthalene from illuminating gas by means of anthracene oil (see this J., 1900, 998). A rotary "Standard" washer was used, placed immediately before the purifiers in a covered house. It is stated that practically the whole of the naphthalene is removed by the process (down to 0·03 grm. per cb. m.), so long as the anthracene oil in the last compartment of the washer is not allowed to contain more than 6 per cent. of naphthalene. Water present in the gas, when it condenses in the washer, injuriously affects the absorption of the naphthalene.—A. S.

Carburetted water-gas ; Use of Galician petroleum in the production of ——. A. Teodorowicz. J. Gasbeleucht., 1908, **51**, 673—677.

Galician petroleum has been used at Lemberg in carburetted water-gas plant of the Humphrey and Glasgow type, comprising two producers each having a daily output of 7500 cb. m. A fraction known as "gas oil," which forms about 10 per cent. of the crude oil, has usually been employed, but the author has used a mixture of "gas-oil" and crude oil in equal proportions continuously for five months with satisfactory results. On opening up the carburetting chamber, a considerable deposit of carbon was found ; the chequer brickwork had been damaged, owing to the presence of water in the crude oil. The increased wear and tear is unimportant in view of the saving in the cost of raw material. The quantity of sulphur in the unpurified gas is greater than when using "gas-oil" alone, but is less than when American petroleum is used. By purifying the coal gas and carburetted water-gas together, the deposition of naphthalene has been avoided.—A. T. L.

PATENTS.

Coal briquettes for heating and domestic use. P. Gargana. Fr. Pat. 387,955, March 9, 1908. Under Int. Conv., March 9, 1907.

Briquettes are made by mixing bituminous slack or small coal with anthracite or Welsh steam coal, coke, or wood charcoal, and with lime, and by subjecting the mixture to a temperature of 800—1000° C. in an oven. —R. L.

Liquid fuels. R. Wynne, London. Eng. Pat. 2700, Feb. 6, 1908.

The claim is for the improvement of liquid fuels such as petrol, benzol, alcohol, etc., by passing into them gaseous ammonia derivatives of hydrocarbons, for instance methylamine.—W. H. C.

Combustion of fuel ; Process for facilitating the —— N. W. Bloss, Providence, R.I., Assignor to The Coal Treating Co., Phœnix, Ariz. U.S. Pat. 894,110, July 21, 1908.

The claim is for treating the fuel with a dilute solution of sodium nitrate before burning it.—W. H. C.

Coke-oven. M. E. Rothberg, Pittsburg, Pa., Assignor to The Coal and Coke By-Products Co., W. Virginia. U.S. Pat. 893,017, July 14, 1908.

The claim is for a coke-oven with a number of superposed horizontal flues in the side walls, each of which has a separate gas inlet. Air is supplied to each flue separately by hot-air flues also placed in the side walls, and each flue has a separate connection to the waste-gas downtake flue, so that the combustion in each flue can be separately regulated.—W. H. C.

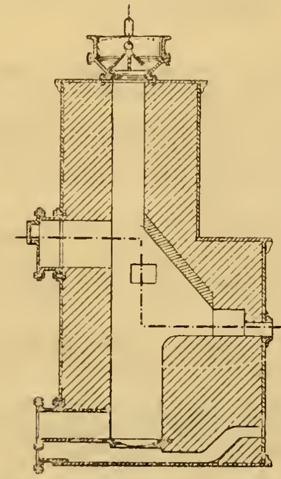
Coke furnace ; Treating the products of combustion from a ——, *for the separation of nitrogen and carbon dioxide* C. Candia and G. Merlini. Fr. Pat. 387,874, March 6, 1908. Under Int. Conv., March 7, 1907.

To obtain carbon dioxide and nitrogen for industrial purposes, coke is burnt in a smokeless furnace, care being taken to maintain an even layer of fuel to produce gas of constant composition. The gases are taken from the bed of incandescent coke, or the furnace exit, and without utilising their sensible heat for other purposes, are passed through a smoke chamber, where they are freed from dust and washed by a spray of atomised water. They are then led through two coke scrubbers, where they are further cleaned by a current of water in the presence of chalk. They then consist of carbon dioxide and nitrogen, possibly with traces of oxygen and carbon monoxide. The carbon dioxide is separated by drawing the gases by means of a fan from the scrubbers and blowing them through a set of vessels containing sodium hydroxide or potassium carbonate. In the case of the sodium hydroxide, solid sodium bicarbonate is formed, which may be separated from the solution and calcined, to obtain carbon dioxide. With potassium carbonate, a bicarbonate solution is obtained, yielding the carbon dioxide upon reheating in another set of vessels. The nitrogen remaining, may be freed from oxygen and carbon monoxide by passing it over copper and copper oxide, heated by the products of combustion, and is then available for the manufacture of cyanamides or nitrates.—R. L.

Gas producers. G. J. C. Parker and The Automobile Gas Producer Synd., Ltd., Glasgow. Eng. Pat. 18,825, Aug. 21, 1907.

The base of the producer consists of a perforated, truncated, conical plate, fitted closely to the bottom, with a central orifice provided with a perforated nozzle or a circle of jets, a water jet extending through the centre. To start the producer quickly, the air is blown through the conical part, the blast being directed over an extended area, thereby enabling the fire to be quickly lighted up on starting the engine. After the production of the gas has commenced, the air is passed through the central orifice only. The change of the air supply is effected by means of a suitable valve.—R. L.

Gas producers. G. L. Morton, Sutton Coldfield, Warwick. Eng. Pat. 3462, Feb. 15, 1908.



The gas producer is provided with a primary air supply pipe opening at or near the top of the "primary" fuel, with supplementary inlets below this. It is constructed with a sloping wall or "roof" extending towards the bottom, from about the height of the primary air supply, but in the opposite wall, the angle being that of the natural incline of the fuel employed (see Fig.). The total thickness of the column of fuel is smaller than usual in order to prevent the formation of a colder zone in the centre and to have an even heating throughout the mass. The air inlets may be provided with suitable steam jets.—R. L.

Gas-producer. W. B. Hughes, Cleveland, Ohio. U.S. Pat. 892,427, July 7, 1908.

The claim is for the use of a baffle-plate, with a V-shaped depression at the centre, placed over the upper end of the blast-pipe which projects upwards from the base of the producer. The V-shaped depression projects down into the mouth of the blast-pipe and splits up the blast, and the horizontal plate of the baffle spreads the divided blast out laterally.—W. H. C.

Water-gas; Apparatus for manufacturing ——. P. Plantinga, Cleveland, Ohio. U.S. Pat. 892,548, July 7, 1908.

During the heating period or "blow," air is supplied through a duct or pipe fitted into the centre of the top of the carburetting chamber. During the gas-making period or "run," oil is supplied to this chamber through a spraying device fixed within the air-duct.—W. H. C.

Gas-producer. E. N. Trump, Syracuse, N.Y., Assignor to The Solvay Process Co., Solvay, N.Y. U.S. Pat. 893,114, July 14, 1908.

The claim is for a producer having beneath its lower opening a stationary table, which forms the grate, and a deflecting arm mounted on a rotating table, supported on anti-friction ball bearings, below the stationary table. —W. H. C.

Gas-producer; High pressure ——. E. P. Noyes, Winchester, and S. A. Reeve, Worcester, Mass., Assignors to C. F. Brown, Reading, Mass. U.S. Pat. 893,192, July 14, 1908.

The fuel is fed to a pressure gas-producer through a liquid seal, provided with a pressure-lock, and is elevated to the inlet of the generator chamber.—W. H. C.

Gas; Method of producing ——. W. B. Dennis, Blackbutte, Oreg. U.S. Pat. 893,462, July 14, 1908.

A column of fuel is gasified in a series of superposed zones, to each of which, except the lowest, a regulated quantity of air is admitted, so that the condition of the zones may progress by regular increments of temperature from incipient to complete combustion. The gases produced pass from zone to zone in a direction towards the hottest zone and from this through the zone to which no air is admitted and which is consequently a reducing zone. The gas is taken off for use from this latter zone. —W. H. C.

Suction gas-producer. J. Bowey, jun., London, Ontario, Canada. U.S. Pat. 893,604, July 21, 1908.

A gas producer is provided with an adjustable water supply and with a mechanical device for removing the ashes, which are so connected with the internal combustion motor supplied by the producer, that they may be operated intermittingly by the exhaust of the motor at some point of the complete cycle, thus controlling the flow of water and the discharge of ash.—R. L.

Gas-producer. W. B. Hughes, Cleveland, Ohio. U.S. Pat. 894,146, July 21, 1908.

The top of a gas producer is formed by a revolving plate, luted by a water seal into the top of the side wall. Above the plate is a hopper, the inlet of which is disposed centrally, and the outlet eccentrically, with respect to the plate. The outlet of the hopper is provided with a conical valve, and the charging of the fuel into the hopper may be controlled by movable horizontal bars across the inlet. The valve and bars are connected by levers in order that they may be operated simultaneously.—R. L.

Distillation of coal; Retort furnace for ——. P. Marcou. Fr. Pat. 387,657, Feb. 28, 1908.

When discharging horizontal gas retorts, arranged in superimposed tiers, the coke drops from the upper ones on to the mouthpieces of the retorts below them. To avoid this inconvenience, the mouthpieces are made of different lengths, each one projecting beyond those of the next lower tier, in order to allow a free fall for the coke into the discharging vessel or conveyer.—R. L.

Grids for gas purifiers. W. Spencer. Fr. Pat. 387,883, March 6, 1908.

The grids consist of a series of vertical frames with horizontal bars. The bars have a triangular cross-section and are fixed in zig-zag fashion at different heights on alternate frames.—R. L.

Mantles; Incandescent gas ——. A. P. White, Caldwell, N. J. Eng. Pat. 3055, Feb. 11, 1908. Under Int. Conv., Nov. 16, 1907.

Incandescence gas mantles of great flexibility are made by burning off a mantle made of artificial silk and coating the burnt web with a mixture of collodion and a solution of thorium and cerium salts, or by dipping it into collodion and subsequently into the solution containing "incandescent material."—R. L.

Metallic filament incandescent electric lamps; Making electrically conducting joints in ——. A. C. Hyde, Ealing. Eng. Pat. 17,817, Aug. 6, 1907.

The metallic filaments are attached to the leading-in wires by a paste of gelatinous oxides or a mixture of such oxides and metal powder. This joint, which should be of sufficient cohesiveness and tenacity to resist breakage during drying, is then heated in a reducing atmosphere by means of a high-tension current of about 1,000 volts, connections being made with the leading-in wires, whilst an arc-discharge through the oxide joint yields the required temperature.—R. L.

Electric conductors; Refractory ——. The British Thompson-Houston Co., Ltd., London. From Gen. Electric Co. of Schenectady, N.Y., U.S.A. Eng. Pat. 24,707, Nov. 7, 1907.

Tungsten powder, obtained by the reduction of purified tungsten oxide with hydrogen, is mixed with 5 per cent. of finely powdered silicon and the mixture is made plastic by a binder which consists of an alloy of equal parts of cadmium and mercury with a possible addition of 5 per cent. of bismuth. This alloy when warmed, is soft and may be intimately mixed with tungsten and silicon by rubbing in a mortar. The mixture is then injected through a diamond die at a temperature of 100 °—150 C. and forms a smooth silver-white wire, both very tough and pliable. It is cut to the proper length and heated for 15—20 minutes in vacuo, by a Bunsen burner. The baked filaments, freed from mercury and part of the cadmium, are then heated by means of an electric current, in order to drive out the remainder of the binder and to sinter and shrink the residue, possibly establishing some sort of chemical reaction.—R. L.

Filaments; Manufacture of metal electric lamp —— *free from carbon.* Siemens und Halske Akt.-ges., Berlin. Eng. Pat. 11,524, May 27, 1908. Under Int. Conv., June 8, 1907.

To remove the carbon left by the destruction of the binding material in tungsten filaments, without detriment to the metallic threads, these are heated to incandescence, by an electric current, in a vacuum tube connected with a vessel containing acetic acid. Under the influence of the vacuum, the acetic acid evaporates and the tube becomes filled with the vapour.—R. L.

Tungsten filaments; Process of manufacture of ——. Comp. Générale d'Électricité. Fr. Pat. 387,792. May 14, 1907.

A process for obtaining tungsten filaments, consisting in making a paste of a mixture of tungsten oxide with an organic nitrogenous composition, such as casein, water and aniline, forming threads of it, and submitting these to a temperature of 1000°—1100° C. in the absence of air, avoiding the formation of tungsten carbide.—R. L.

Electric lamp filaments; Manufacture of metallic —— *by the mechanical combination of ductile and slightly fusible metals, with ductile and more fusible metals, or with powdered metals.* Siemens und Halske Akt.-ges. Fr. Pat. 387,993, March 10, 1908.

The filament obtained by mechanical combination of the two metals by wire-drawing or other methods, is suspended on a suitable support by means of hooks or, in separate pieces, held together by clips. The more fusible or powdered auxiliary metal is then removed by transmitting a strong electric current through the filament in a highly evacuated atmosphere of an indifferent gas. The support may subsequently be freed from deposits of this metal, either mechanically or by the chemical action of acids, to prevent short circuits. The supported filament may be used in the lamp in any position without being damaged.—R. L.

Metal filaments of electric incandescence lamps; Process for making conducting joints between the wire leads and the ——. Electrische Glühlampenfabr. "Watt" Scharf, Löti und Latzko. Fr. Pat. 388,000, March 10, 1908.

Joints are made between the leads of electric lamps and the filaments by connecting the ends with the aid of metals or alloys, the fusion point of which is not too low, but in any case below that of the wire leads. For instance, if the leads are of nickel, silver or gold may be advantageously employed. The metal employed, is reduced to powder, mixed with an indifferent agglutinant to form a paste, and with this, connection is established. The agglutinant is removed, and the joint is fused by transmitting an electric current through the wire in an indifferent or reducing atmosphere, care being taken that no electric arc is formed in the paste.—R. L.

Gas; Manufacture of ——. H. Ries, Munich, Germany. Eng. Pat. 26,593, Dec. 2, 1907.

See Fr. Pat. 384,578 of 1907; this J., 1908, 495.—T. F. B.

Filaments and electrodes for electric lamps. F. J. Planchon, Fr. Pat. 387,942, May 18, 1907.

See Eng. Pat. 12,139 of 1907; this J., 1908, 554.—T. F. B.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

Acetone solutions; Vapour pressure of aqueous ——. A. Makowiecki. J. Russ. Phys.-Chem. Ges., 1908, **40**, 216—227. Chem. Zentr., 1908, **2**, 392—393.

The author's results are given in the following table in which X_1 is the composition of the solution in mols. of acetone per cent., X_2 is the corresponding composition of the distillate, π is the total vapour pressure of the solution in mm. of mercury, and p_a and p_w are the partial pressures of the acetone and water respectively. The determinations were made at a temperature of 30° ± 0·05° C.

X_1	=	100·0	85·0	70·0	50·0	30·0
X_2	=	100·0	94·0	92·0	91·0	89·8
π	=	284·5	270·5	256·0	240·2	220·6
p_a	=	284·5	254·2	235·6	218·6	198·1
p_w	=	0·0	16·3	20·4	21·6	22·5

X_1	=	20·0	15·0	10·0	5·0	0·0
X_2	=	88·3	86·8	84·1	76·2	0·0
π	=	202·0	184·4	157·7	109·2	31·5
p_a	=	178·3	160·0	132·6	83·2	0·0
p_w	=	23·7	24·4	25·1	26·0	31·5

—A.S.

Oilfields, of Trinidad. Council Papers Nos. 60 and 131 of 1907, by the Government Geologist for Trinidad. Bull. Imp. Inst., 1908, **6**, 196—200.

The prospects of oil production in Trinidad are stated to be distinctly good, especially in the central anticline from Port Ligoure to the San Fernando-Siparia road, and the northern anticline from the western coast to the Oropuche Lagoon. A company has been formed to exploit the district about Point Fortin and Point Ligoure. As promising localities for boring are suggested, the synclinal basin north of the central anticline, the central anticline itself, and the northern flank of the northern anticline. The oil rock contains 15 to 18 per cent. of bitumen and appears to form excellent material for road-making. Analysis of the more liquid asphaltum showed 80·4 per cent. of bitumen. Fractional distillation gave, after separation of water, 25 per cent. of illuminating oil, 43·6 per cent. of lubricating oil, and 17 per cent. of residual bitumen. (See President's Address, this J., 1908, 786, col. 1.)—F. C.

Petroleum ; Future of —— as raw material for chemical industries. R. Wischin. Petroleum, 1908, **3**, 1062—1069.

The author reviews the progress which has been made in the use of petroleum as raw material for the manufacture of numerous chemical products, such as substitutes for oil of turpentine, artificial perfumes, etc.—A. S.

Montan wax. J. Marcusson. Chem. Rev. Fett- u. Harz-Ind., 1908, **15**, 193—195.

Tested according to Ubbelohde's method (this J., 1905, 941), the wax begins to melt at 83·5° C. and drops at 84·3° C. As it contains compounds of acids of high molecular weight with alcohols of high melting point, the wax offers so great resistance to saponification that after boiling for eight hours with a large excess of 2N-alcoholic potash, decomposition was still incomplete. Heating with alcoholic potash in a sealed tube for five hours at 105° C. also failed, but complete saponification was effected when the wax was dissolved in benzol and the solution boiled for eight hours with 2N-alcoholic potash. The soap solution was freed from unsaponifiable matter by Spitz and Honig's method (this J., 1891, 1039), and the acids were separated from it by acidification with a mineral acid. They were solid, of a brown colour, and had a saponification value of 143.—J. A.

Carburetted water-gas ; Use of Galician petroleum in the production of ——. A. Teodorowicz. *See* II.

[*Cetosan*] *a vaseline preparation capable of absorbing a large quantity of water.* F. Blatz. *See* XII.

Asphaltum ; U.S. production of ——. U.S. Geological Survey ; through Oil, Paint and Drug Reporter, Aug. 3, 1908. [T.R.]

The following table shows the output of all classes of natural asphaltum that have entered into the market from quarries and mines in the United States during the past five years :—

Year.	Quantity.	Value.
		$
1903	101,255	1,005,446
1904	108,572	879,836
1905	115,267	758,153
1906	138,059	1,290,340
1907	223,861	2,826,489

The production from bituminous rock deposits in 1907 increased nearly 100 per cent. over the production for 1906. There was a decrease in the bituminous rock output from 1904 to 1906, and a relative increase at the same time in the production of oil asphaltum, nearly all of the products coming from California. It therefore appeared that the great increase in the production of oil asphaltum was due to the decline in the production of bituminous rock, but this assumption does not seem to hold for the returns for oil asphaltum production in 1907, which show an increase of more than 100 per cent. over that of 1906, with an increase in value of over 200 per cent. Kentucky stands second in the production of bituminous rock, and is the only producer of mastic or extracted bitumen.

The output of gilsonite has also advanced nearly 100 per cent. The production of ozokerite was revised in 1907, and with it the related hydrocarbon "tabbyite." The production of these two substances, being small and reported from single localities, are combined in the table of production.

The following table shows the production of different varieties of asphaltum in 1907 :—

Variety.	Quantity.	Value.
		$
Bituminous rock	45,526	129,040
Mastic	1,744	16,568
Gum	5,195	78,400
Maltha	13,507	143,758
Wurtzilite (elaterite)	422	35,327
Gilsonite	20,285	531,965
Grahamite	966	7,743
Ozokerite and tabbyite	12	2,148
Oil asphaltum	136,204	1,881,540
Total	223,861	$2,826,489

Patents.

Dry distillation or heating of various materials ; Process and apparatus for the ——. A. B. Singer and D. Harsanyi. Fr. Pat. 387,626, Feb. 27, 1908.

The materials to be heated are caused to gravitate through a narrow, vertical, or highly inclined chamber, the walls of which are movable relatively to one another, in order to assist the downward passage of the materials. The chamber may be prismatic or annular in form, and the sides are provided with sloping projections which assist the passage of the material and partially support it, so that the lower layers, which rest on an endless belt-conveyor forming a grate, are not crushed. As there is only a thin layer of material in constant movement, it is uniformly and progressively heated.—W. H. C.

Tar and pitch : Process of treating —— to render the same more suitable for industrial uses. W. J. and A. Malden. Fr. Pat. 387,674, Feb. 29, 1908.

In order to improve the tenacity, and to raise the softening point of tar and pitch, they are treated in the following manner. The tar or pitch, after the addition of a suitable proportion of oil, is heated to about 60° C. and then well agitated with about 10 per cent. of manganese peroxide and afterwards with 5 per cent. of concentrated sulphuric acid. The mixture is then heated to about 180° C. and maintained at that temperature for such a length of time that during the last fifteen minutes of the heating, only about 0·25 per cent. of the material is evaporated. —W. H. C.

Wood-alcohol and chloroform ; Process of preparing ——. H. O. Chute, Cleveland, Ohio. U.S. Pat. 893,784, July 21, 1908.

Wood spirit containing ketonic impurities such as acetone, is treated with a hypochlorite, and the chloroform, which is thus produced, is isolated by diluting the reaction mixture with water, or with a saline solution, and then distilling off the chloroform.—P. F. C.

Liquid hydrocarbons or hydrocarbon mixtures suitable for motive power, heating, lighting, solvent and other purposes. F. G. Claussen and G. T. B. Cobbett, London. Eng. Pat. 15,593, July 6, 1907.

Heavy petroleum or shale oil having the sp. gr. 0·800—1·000 is heated to about 45° C., and then purified by successive treatments with finely divided metallic lead or iron, sulphuric acid, and lime. After decantation or separation, it is mixed with about 10 per cent. of light-oil obtained by distilling petroleum or shale oil to about 120° C. and with about 2 per cent. of naphthalene. —W. H. C.

Wines, fermented liquors, spirits, etc. ; Distillation of ——. Fr. Pat. 387,558. *See* XVII.

IV.—COLOURING MATTERS AND DYESTUFFS.

Patents.

Leuco compounds of vat [thioindigo] dyestuffs and process of making same. G. Engi, Assignor to Soc. Chem. Ind. in Basle, Basle, Switzerland. U.S. Pat. 893,468, July 14, 1908.

Thioindigo dyestuffs are treated in alcoholic suspension with alkali hydrosulphides, and the resulting leuco-compounds isolated by acidifying the solution. The products are insoluble in water, but soluble in alcohol and benzene, and in dilute alkali hydroxides, the original dyestuffs separating from the latter solutions by treatment with oxidising agents.—T. F. B.

Colouring material [dyestuff] and process of making same. F. J. Maywald, New York, N.Y. U.S. Pat. 893,636, July 21, 1908.

A dry friable dyestuff is prepared from viscous fustic extract by adding a colloidal carbohydrate such as dextrin to the extract and then evaporating the mixture to a dry friable condition.—P. F. C.

Blue dyestuff of the anthracene series; Production of a ——. Badische Anilin und Soda Fabrik. Fifth Addition, dated Feb. 8, 1908, to Fr. Pat. 309,503, Mar. 29, 1901. Under Int. Conv., Dec. 18, 1907. (See this J., 1902, 42, 111, 911; 1903, 141.)

By treating 2-aminoanthraquinone with aluminium chloride in the presence of nitrobenzene, new dyestuffs are obtained which dye unmordanted cotton in reddish-brown shades from an alkaline hydrosulphite vat. Example—10 kilos of 2-aminoanthraquinone are boiled with 100 kilos. of nitrobenzene and 10 kilos. of aluminium chloride until the formation of the dyestuff is complete. The nitrobenzene can be removed by forcing a current of steam through the mixture, or the dyestuff can be directly isolated by the addition of alcohol.—P. F. C.

Thioindigo White solution; Process for preparing ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 198,692, Aug. 28, 1906.

Solutions containing one part of 3-oxy-(1)-thionaphthene-2-carboxylic acid and three parts of free alkali hydroxide are treated with hypochlorites until a permanent precipitate of thioindigo forms; the solution contains Thioindigo White.—T. F. B.

Triphenylmethane series; Manufacture of blue colouring matters of the ——. T. R. Shillito, London. From Aniline Colour and Extract Works formerly J. R. Geigy, Basle, Switzerland. Eng. Pat. 15,204, July 2, 1907.

See Fr. Pat. 384,979 of 1907; this J., 1908, 497.—T. F. B.

Anthracene dyestuff and process of making same. H. Wolff, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 893,412, July 14, 1908.

See Eleventh Addition to Fr. Pat. 349,531; this J., 1908, 800.—T. F. B.

Omega-halogen-methylanthraquinone compound. M. H. Isler, Mannheim, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 893,507, July 14, 1908.

See Eng. Pat. 16,632 of 1905; this J., 1906, 368.—T. F. B.

Anthracene dyestuff and method of making same. M. H. Isler, Mannheim, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 893,508, July 14, 1908.

See Fr. Pat. 383,286 of 1907; this J., 1908, 329.—T. F. B.

Sulphur [thioindigo] dyestuffs and their leuco-bodies; Process of making ——. B. Homolka, Frankfort, and R. Welde, Assignors to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on the Maine, Germany. U.S. Pat. 893,499, July 14, 1908.

See Ger. Pat. 198,509 of 1907; this J., 1908, 801.—T. F. B.

a-Oxythionaphthenes; Process of making ——. B. Homolka, Frankfort, and R. Welde, Assignors to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst, on Maine, Germany. U.S. Pat. 894,004, July 21, 1908.

See Eng. Pat. 1592 of 1907; this J., 1907, 1235.—T. F. B.

Sulphurised leuco bodies and [thioindigo] dyestuffs; Process of making ——. B. Homolka, Frankfort, and R. Welde, Assignors to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. U.S. Pats. 894,005 and 894,006, July 21, 1908.

See Eng. Pats, 1593 and 1594 of 1907; this J., 1907, 1043, 1044.—T. F. B.

Anthracene dyestuff; Green ——. J. Deinet, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 893,837, July 21, 1908.

See Ger. Pat. 198,024 of 1907; this J., 1908, 744.—T. F. B.

Gallocyanine series; Leuco derivative of the ——. W. Lommel, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 893,855, July 21, 1908.

See Fr. Pat. 386,065 of 1908; this J., 1908, 680.—T. F. B.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES YARNS, AND FIBRES.

Cotton and artificial silk; Microscopical examination of dyed fibres of ——. W. Minajeff. Z. Farben-Ind., 1908, 7, 236—237.

The author continuing his observations of the dyed fibres of cotton and "Glanzstoff" (*see* this J., 1908, 681), draws the following conclusions.—The cuticula of the cotton fibre has no influence on the dyeing of that fibre, and the layer-like structure of the fibre walls is also of no substantial importance. The greater density of the cotton fibre compared with that of "Glanzstoff" and also the greater difficulty of penetration by liquids, are of greater importance. The thickness of the fibre has also a special effect on the dyeing of the fibre. The canal of the fibre is of some importance; but its effect is small, since it has been found that on dyeing cotton with mordant dyestuffs, only small aggregates of the colour-lake are found in the canal, and that these only exist about the broken ends of the fibres. More importance is attached to the physical properties of the fibres, *i.e.* rather to the thickness, density, and capillarity of the fibre-substance than to the inner structure of the fibre.—S. H. H.

Degumming of 18 metallic mordants; Simultaneous ——. A. Scheurer and V. Silbermann. Bull. Soc. Ind. Mulhouse, 1908, 78, 108—118.

The authors have determined: (1), which method of degumming is most suitable to employ for a fabric printed simultaneously with 18 metallic mordants; and (2), which process is best adapted for each of these mordants printed separately. In the former case a general method was sought which would not sacrifice certain mordants for the sake of others, more than could possibly be avoided. The mordants employed were salts of iron, aluminium, chromium, uranium, yttrium, bismuth, tin, zirconium, thorium, titanium, glucinum (beryllium), cerium, cadmium, zinc, copper, nickel, cobalt, and lead; of these metals, the acetates or sulphate-acetates were taken, except with bismuth, titanium, and chromium, of which respectively the nitrate-acetate oxalate, and sulphate were used. These mordants, in solutions containing $\frac{1}{30}$ atom-grm. of metal per litre, thickened with Iceland moss, were printed in stripes and fixed by ageing for 12 hours in warm moist air, then left for several days and subjected to treatment of various kinds (" degumming ") to remove the thickening. Separate portions of the patterns were treated with: (1), water only; (2), chalk; (3), sodium silicate; (4), caustic soda at 50° C.; (5), boiling caustic soda; (6), sodium carbonate at 50° C.; (7), boiling sodium carbonate solution; (8), ammonia gas followed by washing; (9), ammonia gas followed by sodium silicate; (10), ammonia gas followed by sodium carbonate; (11), sodium arsenate; (12), sodium phosphate; (13), ammonia in solution. All the patterns were then dyed with Alizarin Bordeaux BD. Taking the mean result, No. 9 proved to be the best treatment, but was not satisfactory with titanium, cobalt, nickel, or zinc. Considering only the more usual mordants, viz., aluminium, iron, chromium, tin, zinc, nickel, and cobalt, two groups could be distinguished. Aluminium, iron, and tin proved to be best degummed with sodium silicate, and chromium, zinc, nickel, and cobalt with sodium carbonate or caustic soda. The results given with nickel and cobalt mordants when fixed with gaseous ammonia and degummed with sodium silicate were found to be improved by the addition of calcium acetate.—R. B. B.

Metallic mordants; Systematic research on double mordants obtained by superposition, two at a time, of eighteen ——. A. Scheurer and V. Silbermann. Bull. Soc. Ind. Mulhouse, 1908, **78**, 119—143.

In the trials described in this paper those dyeings which reacted acid to litmus were neutralised with chalk and therefore some of the dyestuffs were really fixed not on a double but on a triple mordant. The mordants employed were those described in the preceding abstract and the concentration in each case $\frac{1}{60}$ atom-grm. per litre. The single mordants thickened with 40 grms. of Iceland moss per litre were printed in stripes parallel to the lists and fixed with gaseous ammonia; the goods were then allowed to lie for 48 hours and degummed with 25 grms. of sodium silicate of 20° B. per litre for 2 minutes at 50° C., washed, and dried. The second mordant was then printed over the first at right angles to the lists, and fixed, etc., as before. Two swatches each 18 cm. square were dyed in one litre of water containing 1 grm. of dyestuff, with the addition of chalk where necessary. Of the 306 double mordants resulting from 18 mordants in combinations of two at a time, there are only three which give useful results after soaping with any considerable number of the 111 dyestuffs with which experiments were made. These are aluminium-nickel, which gives an interesting result with 31, aluminium-cobalt with 28, and aluminium-zinc with 10 dyestuffs. No other double mordant gives more than four useful results. The metals of which the oxides seem to lend themselves most readily to the formation of double mordants are firstly aluminium, and, following this at a great distance and in order, nickel, cobalt, glucinum (beryllium), copper, yttrium, zinc, tin, chromium, cerium. The following metals form no double mordants suitable for the dyestuffs here investigated: iron, uranium, bismuth, zirconium, thorium, cadmium, lead. It is however possible that double mordants previously mixed and printed in one operation might yield different results from those obtained by superposition.—R. B. B.

Conversion effects produced by printing phenylhydrazin on the diazo derivatives of p-aminobenzaldehyde combined with naphtholsulphonic acids. J. Brandt. Sealed Note 954, March 1, 1897. Bull. Soc. Ind. Mulhouse, 1908, **78**, 104—107.

Dyestuffs obtained by combining diazotised *p*-aminobenzaldehyde with naphtholsulphonic acids, combine by virtue of their aldehyde group with phenylhydrazine to give other dyestuffs either in solution or when dyed on the fibre. These reactions may be utilised in calico-printing by padding the material in sodium-β-naphthol and developing by padding or printing with diazotised *p*-aminobenzaldehyde. An orange colour results, or a cutch-brown, if a copper salt be added to the diazo solution. Both the orange and the brown are converted into bluish-red by printing on a thickened solution of phenylhydrazine and ageing, at about 50° C., the red resists perfectly soaping at 50° C. Other azo dyestuffs containing aldehydic or ketonic groups combine similarly with phenylhydrazine.—R. B. B.

iso-Cyanine dyes; Optical and sensitising properties of the ——. S. E. Sheppard. *See* XXI.

Patents.

Bleaching; Dutch pile for ——. L. E. Gossler. Fr. Pat. 387,627, Feb. 27, 1908.

The patent relates to an improved Dutch pile for the bleaching of chiffons, straws, celluloses, etc., by means of an acid bleach liquor. Instead of employing a washing drum as usual, part of the bottom and of the side wall of the pile is covered with finely perforated draining plates, which retain the fibres, whilst allowing the liquid to pass through to an outlet chamber.—A. S.

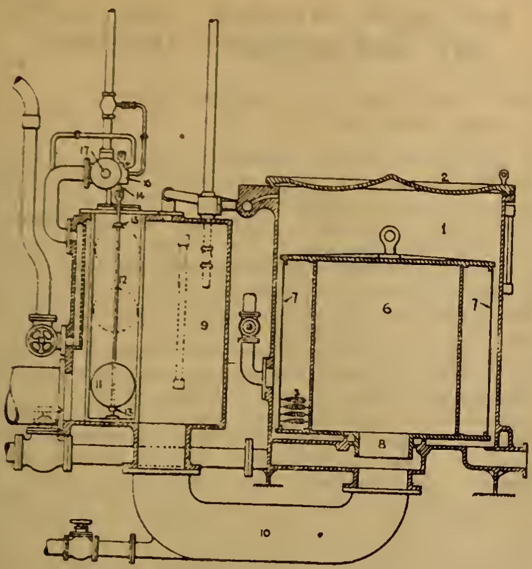
Mercerising cloth and apparatus therefor. A. Ashworth and J. Hall, Bury. Eng. Pat. 15,837, July 10, 1907.

The cloth is impregnated with the mercerising liquid, and then passed into the stretching apparatus. This consists of two oppositely disposed, equal sized gripping wheels, around a considerable part of which the edges of the cloth are passed. The selvedges of the cloth are gripped between the peripheries of the wheels and endless travelling belts, which may be conveniently made of india-rubber with cloth insertion, and are so moulded that they press very tightly on the rims of the wheels. In order to ensure the requisite firm grip being maintained on the cloth, each travelling band is provided on its inner face with a bead, which fits into a corresponding groove in the rim of the wheel with which it operates. The cloth which is interposed between the band and the belt is forced by the bead into the groove and a very tight grip is thus obtained. The framework upon which the gripping wheels are mounted is so arranged that the distance between the wheels can be varied to adapt the machine for fabrics of different widths. In order to impart a stretch to the fabric across its width, the brackets upon which the gripping wheels are mounted are rotatable and can be so adjusted that the rims are closer where the cloth comes upon them than where it leaves them. After leaving the stretching machine, the fabric is led through a similar machine in which it is washed, preferably by discharging fine jets of hot water at high pressure on to the material whilst it is held by the gripping wheels. The caustic soda, which is contained in those portions of the cloth held by the gripping devices, is neutralised by dilute acid supplied to supplementary fine grooves on the surfaces of the gripping wheels before they arrive at the nip of the travelling bands.—P. F. C.

Caustic soda lyes rendered impure during the process of mercerisation; Purification of ——. O. Venter. Fr. Pat. 387,621, Feb. 27, 1908.

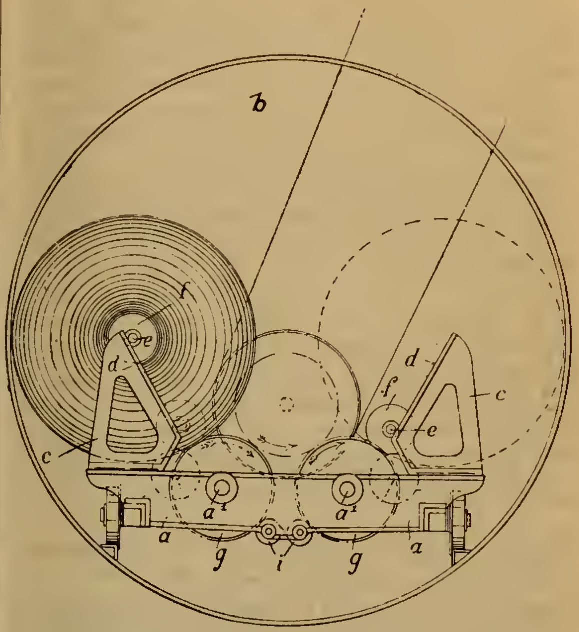
In order to eliminate the soluble starch and other sizing substances, extracted from the material under treatment during mercerisation, the soda lye is treated at the boil with a quantity of milk of lime, many times greater than that theoretically required for converting the sodium carbonate present, into sodium hydroxide. Part of the lime employed may be replaced by the oxides of strontium and barium.—P. F. C.

Dyeing, bleaching, and treating fibrous materials; Apparatus for ——. T. Halliwell, Monton, and Mather and Platt, Ltd., Manchester. Eng. Pat. 14,780, June 27, 1907.



This apparatus consists of a vat, 1, which can be hermetically sealed by a lid, 2. Cops of the material to be treated are placed on hollow perforated conical skewers which fit into holes provided in the periphery of a hollow drum, 6, having solid ends of greater diameter than that of the cylindrical part. The cops are held in position by curved, perforated metal plates, 7. The whole drum, 6, together with the cops which are mounted upon it, can be lowered into the vat, 1. The pipe, 8, which is provided in the bottom of the drum, passes through a hole in the bottom of the vat, 1, making a tight joint. Close to the vat, 1, there is provided a receiver, 9, the bottom of which is in communication by a pipe, 10, with the bottom of the vat. Within this receiver, a float, 11, is arranged, which moves on a spindle, 12, capable of motion in the direction of its length and provided with collars, 13, against which the float impinges. The spindle, 12, passes through the cover of the receiver and is attached to a rod, 14, which operates a piston valve situated in a steam cylinder, 16. On the top of the receiver, 9, is arranged a steam cylinder, 17, containing a slide valve which is operated by steam pressure from the cylinder, 16. By means of this slide valve, the interior of the vat and of the receiver respectively, can be alternately placed in communication with a steam supply and with an exhaust. The machine is operated as follows:—Starting with both vat and receiver empty, the drum, 6, loaded with cops is lowered into the vat, 1, which is then tightly closed. The vat and receiver are both evacuated, and a suitable quantity of the liquor with which the cops are to be treated, is allowed to enter both vat and receiver by means of an inlet pipe, E. The float, 11, is thus raised against the upper collar, 13, on the spindle, 12, and moves the piston valve upwards by means of the rod, 14, thus allowing steam to enter the cylinder, 17, and drive the slide valve, which is inside it, into such a position that the steam supply is connected to the receiver, 9, whilst the exhaust is put in connection with the vat, 1. The inequality of pressure thus produced drives the liquor from the receiver, 9, through the pipes, 10 and 8, into the interior of the drum, 6, and thence through the cops into the vat, 1. When the float in the receiver descends against the lower collar, 13, the piston valve is brought into its lower position, and forces the slide valve in the opposite direction. In this way, the vat, 1, now becomes connected with the steam supply, and the receiver, 9, with the exhaust, and the liquor flows back through the cops and along the pipes, 8 and 10, into the receiver. This automatic circulation of the liquor through the cops is allowed to continue till the treatment is complete.—P. F. C.

Bleaching, scouring, dyeing and otherwise treating fabrics in the open condition; Apparatus for ——. E. W. Hunt and W. Moserop, Middleton, Lancs. Eng. Pat. 15,095, July 1, 1907.



A carriage, *a*, which can be wheeled into a kier, *b*, is provided at its ends with standards, *c*, supporting inclined guides, *d*, upon which rest the journals, *e*, of the batch rollers, *f*. Each end of the carriage, *a*, is also provided with bearings to receive the journals, a_1, of the two drums, *g*. The machine may also be provided with tension rollers, *i*; if these are omitted, the drums, *g*, must be arranged very close together. The axes of these drums are provided at one end with clutch halves which engage with corresponding clutch halves on shafts mounted in bearings in the wall of the kier. The full and empty batch rollers rest in frictional contact with the drums, *g*, the fabric being conducted from the full batch, partly around one drum, over and under the tension rollers, *i*, when such rollers are used, and then around the other drum to the empty batch roller. As the full batch is being lessened in its diameter, it gradually descends on its guide, *d*, whilst the empty batch roller falls and rises on its bearings. The gearing of the machine is so arranged that the drum which is originally in contact with the empty batch roller may be driven by its clutch, whilst the other is running idle. When the fabric has been nearly all unwound from one batch roller and wound on to the other, the clutches are reversed, either manually or automatically, so as to drive the clutch which was previously running free and rewind the fabric on the empty batch roller. When the clutches have to be reversed manually, the machine is provided with a device whereby an alarm bell is automatically sounded when a batch roller is nearly empty.—P. F. C.

Woollen yarns; Apparatus for treating ——. G. Stone, Assignor to M. T., N., S. D., and M. T. Stevens, jun., North Andover, Mass. U.S. Pat. 892,911, July 7, 1908.

The yarn to be treated, is automatically led along a path just above the level of a liquid dressing contained in a vat, provided with an overflow. In order to bring the dressing into contact with the yarn, the machine is so arranged that when the yarn-feeding device is active, a fresh supply of the liquid dressing is automatically delivered into the vat faster than it can drain away through the overflow. The level of the liquid is therefore raised sufficiently to immerse the yarn.—P. F. C.

Silk hanks; Apparatus for treating —— with foam produced from a solution of soap or other substance. Sc. Färberei-und Appretur-Ges. vorm. A. Clavel and F. Lindenmeyer. Fr. Pat. 387,796, Feb. 19, 1908.

Soap solution is introduced into a vat in the bottom of which are steam coils. This vat is provided in its upper part with a number of parallel rollers from which the hanks to be treated, are hung. One end of each roller rests in an open socket, whilst the other is fastened to a hinge, which, in turn, is mounted upon an axle bar. Each axle bar is provided at its end with a cog-wheel, engaged by a rotating screw which extends along the whole machine. By means of the hingeing device, each roller can be raised at will, and hanks which have undergone sufficient treatment can be removed without stopping the machine. Above the rollers is arranged a washing-device for discharging jets of water upon the material, after the principal operation is completed, and in order that the water shall not mix with the soap solution remaining in the vat, the machine is provided above the level of the solution, with a sloping false bottom, consisting of a number of trap doors which can be opened or closed like Venetian shutters. During the principal operation they are opened to allow the froth from the boiling soap solution to reach the hanks. They are afterwards closed for the washing operation, the washing water flowing away through a hole in the side of the vat without coming into contact with the soap solution.—P. F. C.

Reserves for sulphide dyestuffs; Production of ——. Badische Anilin und Soda Fabrik. Fr. Pat. 387,516, Feb. 24, 1908. Under Int. Conv., Jan. 8, 1908.

Antimony compounds can be employed for the production of reserves for sulphide dyestuffs. The addition of zinc oxide, ammonium chloride, or a small quantity of tartaric acid improves the quality of the white obtained. After the application of the reserve, the fabric is dyed with a sulphide dyestuff by any ordinary process, then washed thoroughly, treated with dilute acid if necessary, and finally soaped.—P. F. C.

Azo dyes as reserves under indigo; Process for the production of ——. Kettenhofer Druckfabr. Felmayer und Co. Ger. Pat. 199,143, July 13, 1907.

Unprepared cotton is printed with a thickened mixture of sodium naphtholate and Nitrosamine, to which have been added the necessary substances for reserving or discharging the indigo. It is then passed through a bath of acetic acid, dried, dyed in the indigo vat, and finished in the usual way.—A. S.

Permanent finish on yarns and fabrics; Production of a ——. E. A. F. Düring. Fr. Pat. 387,564, Feb. 25, 1908. Under Int. Conv., May 3, 1907.

The material is impregnated with a solution of albumin or some such substance and then passed through a calendering machine, the cylinder of which is either cold or only moderately warm, so that the albuminous substance is not coagulated at this stage of the process. The material is then dried and finally steamed.—P. F. C.

Finishing material; Preparation of a new ——. Ersk Triester Reisschäl-Fabr. Act. Ges. Fr. Pat. 387,736, Mar. 3, 1908.

Starch paste is partially converted into dextrin, and then thoroughly mixed with a solution containing fatty acids, either in the free state or in the form of soaps. —P. F. C.

Aniline Black upon textile fibres and fabrics; Production of ——. A. G. Green, Leeds. Eng. Pat. 16,189, July 15, 1907.

See Fr. Pat. 386,361 of 1908; this J., 1908, 683.—T. F. B

Soluble starch; Production of —— and removal of starch from textiles. Eng. Pat. 1351. *See* XVI.

VII.—ACIDS, ALKALIS, AND SALTS, AND NON-METALLIC ELEMENTS.

Sodium carbonate; New reaction producing ——. D. Crispo. Bull. Soc. Chim. Belg., 1908, **22**, 292—295.

A solution of sodium metasilicate (100 litres of sp. gr. 1·375) is heated, and 48 kilos. of sifted chalk are added gradually, with constant agitation. The mass, which becomes solid, is broken up and dried. Sodium carbonate can now be extracted by lixiviation. The process is not now of industrial significance, for sodium metasilicate is made by dissolving powdered flints in caustic soda under pressure. The author has devised a process for preparing it from sodium sulphate, however, and if it could be prepared directly from the chloride the preparation of sodium carbonate in this way would be industrially practicable. Sodium sulphate (71 parts) is heated to dull redness with sand (30 parts) and carbon (10 parts). Sodium polysilicate is formed, and sodium sulphide, whilst sulphur in various combustible forms is evolved, and is burnt in the chambers; when no more is evolved, the temperature is raised, and superheated steam passed in. This reacts on the sodium sulphide to form oxide and hydrogen sulphide. The oxide reacts on the polysilicate to form metasilicate, and the hydrogen sulphide is burnt. Two-thirds of the original sulphur are recovered in this way.—J. T. D.

Acid sulphates of potassium; Researches on some ——. L. Arzalier. Compt. rend., 1908, **147**, 129—131.

By evaporation of a dilute solution containing molecular proportions of sulphuric acid and potassium sulphate, rhombohedral crystals of the compound, $3K_2SO_4,H_2SO_4$, are first obtained, next rectangular prisms of the compound, $7K_2SO_4,6H_2SO_4,H_2O$, are deposited. Further evaporation yields crystals of the composition, $4K_2SO_4,3H_2SO_4,H_2O$, which continue to form till the mother liquor attains the composition approximately of $K_2SO_4,3H_2SO_4,50H_2O$, when crystals of the compound, K_2SO_4,H_2SO_4, are formed. If the original solution contain an excess of acid, the crystals of the composition, $3K_2SO_4,H_2SO_4$, are not formed, but the sequence is otherwise unchanged. The double salt, $K_2SO_4,3H_2SO_4$, is prepared by dehydrating at 150° C. in a dry inert gas, the salt, $K_2SO_4,3H_2SO_43H_2O$, obtained in prisms from a solution of 1 mol. of potassium sulphate in 6 mols. of pure commercial sulphuric acid of 98 per cent. strength. A study of the thermal values of the various acid sulphates has not proved the existence of the compound, $K_2SO_4,\frac{3}{4}H_2SO_4$, which is only formed as a hydrated salt in the presence of water by virtue of its heat of solution. The existence of a more acid compound than the salt, $K_2SO_4,3H_2SO_4$, appears *a priori* impossible, as the molecules of sulphuric acid added, would liberate less than 2·4 calories, the heat of combination of sulphuric acid with the salt, K_2SO_4,H_2SO_4, and any compound obtained under such circumstances would be very unstable.—R.L.S.

Bleaching powder; Spontaneous ignition of ——. Von Possanner. Wochenbl. Papierfabr., 1908, **39**, 2611.

The author refers to a recent instance in a paper mill, when a wagon containing bleaching powder was burnt through such ignition. The bleaching powder probably decomposes under the influence of moisture and heat according to the equation: $2CaOCl_2 = 2CaCl_2 + O_2$; and the heat thus developed, is probably sufficient to cause the ignition of the cask in which the powder is packed. The author has had his attention called to another case of spontaneous ignition, but in this instance, linseed oil had accidentally found its way into the cask of bleaching powder.—J. F. B.

Strontium and barium oxides; Hydrates of ——. De Forcrand. Compt. rend., 1908, **147**, 165—169.

In a vacuum at 10° C. the nonohydrate, $SrO,9H_2O$, is slowly dehydrated, forming after a week, the dihydrate, $SrO,2H_2O$; it continues to lose weight and ultimately forms the monohydrate, SrO,H_2O. The dihydrate is produced after two hours' heating at 45—50° C. in a current of hydrogen, the monohydrate after a day's heating. The monohydrate does not lose water at 500° C., but at 540° C. in a stream of hydrogen, it forms a series of hydrates, according to the rate of heating, varying from $SrO, 0{\cdot}22H_2O$ to $SrO, 0{\cdot}06H_2O$. To obtain completely anhydrous strontium oxide, the temperature must be raised to 850° C. and the heating prolonged for some time, when a voluminous amorphous mass is obtained. The nonohydrate of barium oxide, $BaO,9H_2O$, yields the dihydrate after ten days' drying *in vacuo*, but no monohydrate. The same dihydrate is formed after 15 hours' heating in a current of hydrogen at 45° C.; a temperature of 90—95° C. is required thus to convert it into monohydrate. This monohydrate melts at 325° C. without changing in composition and requires heating to 660° C. to form anhydrous barium oxide; no intermediate dehydration products are formed in this case. The heat of dissolution of these oxides is given in the following table:—

	Calories.		Calories.
$SrO+9H_2O$	− 14·27	$BaO+9H_2O$	− 14·5
$SrO+2H_2O$	+ 5·26	$BaO+2H_2O$	+ 7·06
$SrO+H_2O$	+ 10·33	$BaO+H_2O$	+ 11·4
$SrO+0{\cdot}14H_2O$	+ 26·1		
SrO	+ 29·76	BaO	+ 35·64

According to these figures the passage of the monohydrate, SrO,H_2O, to anhydrous strontium oxide, SrO, should be easier than in the case of the monohydrate, the barium compounds corresponding, whereas actually the reverse is the case. This is due to the formation of intermediate hydrates of strontium oxide: these are in reality condensed forms, and strontium oxide is in all probability $(SrO)_x$, a polymeride of SrO. There is abundant evidence contained in the foregoing to show that the polymerisation begins at an early stage and that the hydrates described from the dihydrate downwards are more or less condensed. The same reasoning applies to barium oxide, lime, and other oxides.—E. F. A.

Calcium sulphate; Relation between the solubility and rate of hydration of ——. P. Rohland. Z. Elektrochem., 1908, **14**, 421—422.

The author has further examined the validity of the rule previously advanced (this J., 1903, 906), that the rate of hydration of calcium sulphate is increased by the addition of substances which render it more soluble, and decreased by those substances which lower its solubility. No exceptions to the rule have been discovered, but certain salts, such as sodium chloride and ammonium sulphate, are found to affect the solubility of calcium sulphate, according to their concentration, in opposite directions, and they may be made, therefore, to hasten or retard its hydration. Hydration takes place in solution only, and, as the solubility of the hemihydrate is much greater than that of the dihydrate, the solution becomes supersaturated as regards the latter, which therefore separates as a solid, and this process necessarily takes place more rapidly in the presence of any substance capable of increasing the solubility of the hemihydrate.
—F. Sodn.

Ferrous bicarbonate; Autoxidation of ——, *in aqueous solution.* G. Just. Z. physik. Chem., 1908, **63**, 385—420.

Kinetic experiments, in which the rate of oxidation of dissolved ferrous bicarbonate, when mixtures in various proportions of oxygen and carbon dioxide were bubbled through the solution, was measured, indicate that oxygen enters into the reaction in the molecular condition. The exact process of oxidation is not deducible from the results, which show, however, that one molecule of iron salt reacts with one molecule of oxygen. Possibly a compound of quadrivalent iron $\overset{O}{\underset{O}{|}}\!\!>Fe(OH)_2$, is formed; or possibly there is intermediate formation of hydrogen peroxide, and a derivative of quadrivalent iron, or of the Bredig-Calvert compound, HO_2, and a derivative of trivalent iron.—J. T. D.

Mercuric chloride solutions; Influence of glass and traces of organic matter on ——. W. Van Rijn. Pharm. Weekblad, 1908, **45**, 636—637. Chem. Zentr., 1908, **2**, 191.

The author states that if dilute (1 : 4000 or 5000) solutions of mercuric chloride be kept for some time, mercurous chloride and mercury oxychloride separate, and eventually the solution becomes free from mercury. The decomposition is attributed to the action of the glass and traces of organic matter.—A. S.

Sulphides and oxysulphides of silicon. I. G. Rankin and S. M. Revington. Chem. Soc. Proc., 1908, **24**, 131.

The authors show definitely that the white sulphide of silicon, first prepared by Berzelius, is the disulphide, SiS_2. The orange sulphide, SiS, prepared by Colson, has been investigated, and, in addition, the composition of two sulphoxides, SiSO and $SiSO_2$, has been determined; the former was mentioned by Colson, but was not analysed by him, whilst the latter has been hitherto unknown.

Hydrogen persulphide. R. Schenck and V. Falcke. Ber., 1908, **41**, 2600—2603.

A solution of 112 grms. of potassium hydroxide in 2 litres of water, was saturated with hydrogen sulphide, with exclusion of air, and a further 112 grms. of potassium hydroxide added, followed by about 150 grms. of flowers of sulphur in small portions. After about half an hour, the solution was rapidly filtered, cooled, and poured into 2 litres of pure, concentrated hydrochloric acid. The light yellow oil (yield, 130 grms.) which separated, was washed with dilute hydrochloric acid, dried with calcium chloride, and distilled under a pressure of 4—5 mm. (All the glass apparatus used, was previously steamed and boiled with sulphuric acid.) The distillate obtained at 43°—50° C. at 4—5 mm., was an almost colourless, strongly refractive liquid which proved to be identical with Bloch and Höhn's hydrogen trisulphide (this J., 1908, 748). The solution of the persulphide in dry, freshly distilled bromoform, is fairly stable.—A. S.

Hydrogen; New process for preparing pure ——. Mauricheau-Beaupre. Compt. rend., 1908, **147**, 310—311.

Fine aluminium filings are mixed with a small proportion of mercuric chloride and potassium cyanide, which causes a slight rise of temperature and produces a coarse powder, quite stable if kept from moisture. This powder is treated with water (about 1 litre to a kilo.) and the rise of temperature which occurs as the hydrogen is evolved, is watched, and regulated if necessary by the addition of more water so that the temperature does not rise above 70° C. At this temperature, 1 kilo. of the powder is completely oxidised in about two hours. The advantages of this method, especially as a source of hydrogen for balloons, are that the apparatus needed is of the simplest description, and can be made of almost any materials, as the products are perfectly neutral; that the gas produced is pure; and that a very large volume is yielded by a small weight or volume of the reagent (1 kilo. yields 1300 litres, or 1 cub. decimetre 1770 litres).—J. T. D.

Pyrites; Exports of —— *from Spain.* Mining World, Aug. 1, 1908. [T.R.]

The shipments of pyrites from Huelva, Spain, to all foreign countries except Portugal, amounted in 1907 to

2,394,570 tons. Of this quantity the United States received 522,828 tons, Great Britain 533,706 tons, Germany and Holland 774,827 tons, France 263,928 tons, Italy 110,652 tons, Belgium 81,210 tons, the remainder going to various other countries.

Fluorspar; Production of —— in U.S.A. Oil, Paint and Drug Reporter, Aug. 3, 1908.

The annual report of the U.S. Geological Survey upon the production of fluorspar in 1907 shows a total output of 49,486 short tons, valued at $287,342, which represents a gain in quantity of 8690 short tons and in value of $43,317 over the figures for 1906. The statistics indicate a firm condition in the market, since there was on hand at the close of 1906 a stock of 13,470 tons, which has evidently been absorbed without leaving quite so large a surplus on hand at the close of 1907.

The production of fluorspar in the United States has increased rapidly during the past decade. In 1898 the reported production was but 7675 short tons, valued at $63,050. In the following year the output doubled and continued to increase rapidly until 1902, when it amounted to 48,018 short tons. There was a decline during the following two years, but in 1905 high water mark was reached when the production became 57,385 short tons, valued at $362,488. There was a falling off of nearly 17,000 tons, in 1906, but more than half of this loss was regained in 1907, notwithstanding the industrial depressio in the latter part of the year.

Patents.

Nitric acid and oxides of nitrogen; Manufacture of —— Sir W. Ramsay, London. Eng. Pats. 16,067 and 16,068, July 12, 1907.

The object of the invention is to obtain the higher oxides of nitrogen in a concentrated state from a mixture of gases in which they are present only in small amount, *e.g.*, air which has been passed through an electric arc. For this purpose, the air is passed, preferably on the counter-current principle, over a solid reagent, which will absorb the oxides of nitrogen at ordinary temperatures in the presence of water vapour, and evolve them again on heating to about 300° C. Suitable absorbents are tribasic calcium phosphate, and the oxides of magnesium, aluminium, and iron. If a phosphate or borate, *e.g.*, moist tribasic sodium phosphate, be used as absorbent, and the exposure to the gases be sufficiently prolonged, the oxides absorbed will be completely converted into nitrate. On heating the latter in a current of steam, nitric acid is produced and the sodium phosphate regenerated.
—A. G. L.

Nitrogen peroxide; Process for obtaining —— from mixtures of air and nitric oxide, containing only small quantities of the latter. Elektrochem. Werke G.m.b.H. Ger. Pat. 199,561, May 14, 1907.

The gaseous mixture obtained by subjecting air to electric flame arcs, contains about 2 per cent. of nitric oxide, which is oxidised, on cooling, to nitrogen peroxide, the latter forming a fine mist difficult to condense. According to the present process, the mixture of air and nitrogen peroxide is passed through a drum rotating at a high speed. Either the gaseous mixture is cooled before entering the drum, or the latter is itself cooled. Care must be taken that, as far as possible, the whole of the gas comes in contact with the wall of the drum. The mist of nitrogen peroxide and condensed water is forced by centrifugal action to the wall of the drum, which is provided with a device for continuously drawing off the liquid. The gas before entering the drum may be mixed with a small quantity of steam.—A. S.

Reduction products of sodium sulphate; Process for preparing solid anhydrous ——. [*Sodium sulphide*]. Verein Chem. Fabr. in Mannheim. First Addition, dated Feb. 11, 1908, to Fr. Pat. 383,136, Oct. 19, 1907 (this J., 1908, 282).

For the preparation of solid anhydrous sodium sulphide by the process described in the main patent, the mixture of sodium sulphate and carbon is ground so finely that a sample when heated to 800°—1000° C., with exclusion of air, shows no signs of softening.—A. S.

Stannic chloride; Process for obtaining —— from materials containing stannic oxide. T. Goldschmidt. Fr. Pat. 388,089, Mar. 9, 1908.

Materials containing stannic oxide are first reduced by heating with not too great an excess of carbon to a temperature of 900°—1000° C. The sintered mass containing finely-divided metallic tin is then treated with chlorine under pressure at a temperature not exceeding 100° C., preferably after adding a small quantity of carbon. The stannic chloride formed, is recovered by distillation or extraction.—A. G. L.

Persulphuric acid; Conversion of —— into hydrogen peroxide. Consortium für elektrochem. Ind., G.m.b.H. Ger. Pat. 199,958, July 16, 1905.

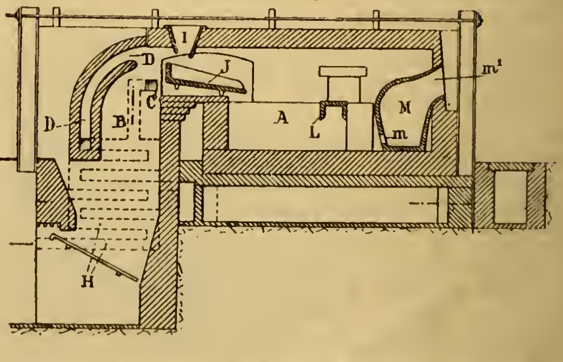
It is found that even with concentrated solutions and raised temperature, the reaction between persulphuric acid or its salts and concentrated sulphuric acid, proceeds sufficiently slowly, if catalysts be absent, to allow of the conversion of concentrated persulphuric acid into hydrogen peroxide without loss of oxygen. The essential condition is the extreme purity of the reacting substances. The apparatus used, should be constructed of acid-resistant material, free from iron, and should be repeatedly heated with dilute sulphuric acid before use. The platinum anodes used in the preparation of the persulphuric acid should contain no metals capable of being dissolved during the electrolysis.—A. S.

Coke furnace; Separating nitrogen and carbon dioxide from products of combustion of a ——. Fr. Pat. 387,874. *See II.*

VIII.—GLASS, POTTERY, AND ENAMELS.

Patents.

Glass smelting furnace. O. Andris, Lodelinsart, Belgium. Eng. Pat. 27,714, Dec. 16, 1907.



The invention applies the tank type of furnace for the manufacture of opaline and similar fine glass. The materials to be melted fall from a hopper, I, on to an inclined platform, J, on which they are melted by a very hot flame which envelops the platform. This flame is produced by hot air from the conduits, C, D, meeting the gases from the producer, B, which is placed close to the actual tank-chamber, A, into which the molten glass runs. In this tank-chamber the glass is refined and then enters the covered pots, M, through the opening, *m*, in the lower part of each pot, a float, L, further serving to keep back impurities. The glass in the pots is worked from their mouths, *m'*. By introducing colouring materials, etc., through these openings, *m'*, a different kind of glass may be produced in each pot.—A. G. L.

Kaolin, clay, etc.; Method of decolorising ——. K. Langenbeck, Washington, D.C. U.S. Pat. 893,590, July 14, 1908.

The material to be decolorised is treated in the presence of water with a reagent which produces ferrous sulphide. The ferrous sulphide is then removed by oxidation and treatment with a solvent.—A. G. L.

Clay, kaolin, and ceramic slips in general; Process of rendering —— *more plastic and easier to cast.* G. Keppeler and A. Spangenberg. Fr. Pat. 387,803 Feb. 24, 1908.

Ceramic slips are rendered very fluid and easy to cast by the addition of small quantities (1—4 per cent.) of substances containing humus, *e.g.*, humic acid, peat, or lignite, and fixed alkalis or ammonia. The process is also suitable for mixtures containing corundum and carborundum.—A. G. L.

Kaolin, ochre, starch, and analogous materials; Process and centrifugal apparatus for treating ——. The W. G. Patents Syndicate, Ltd. Fr. Pat. 388,050, Feb. 15, 1908.

See Eng. Pat. 4155 of 1907; this J., 1908, 227.—T. F. B.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Clay substance; Determination of ——, *a contribution to the rational analysis of clays.* H. Bollenbach. Chem. Ind., 1908, **31**, 445—448.

The most accurate determinations of quartz, felspar, and clay substance are said to be at present given by Berdel's process, briefly as follows:—5 grms. of clay dried at 120° C. are put into a litre dish with 100 c.c. of water and a few drops of caustic soda solution and covered with a clock-glass. After standing for 5 mins., the mixture is boiled till no trace of the substance clings to the walls or bottom of the dish. A mixture of 100 c.c. of strong sulphuric acid and 100 c.c. of water, is added, and the dish is heated over a naked flame till dense acid fumes escape. The liquid is diluted with water, allowed to stand for 8 hours, and the clear portion decanted. About 400 c.c. of a 6—7 per cent. caustic soda solution are poured into the dish, and the whole stirred and heated nearly to boiling. After 4—5 hours the liquid is decanted, and the residue boiled with strong hydrochloric acid. After dilution with water, and standing for 8 hours, the liquid is decanted. The treatments with caustic soda solution and hydrochloric acid are repeated, and the residue is brought on to a double filter, washed with dilute ammonium nitrate solution, ignited, and weighed. The weight of substance taken minus that of the ignited residue gives the amount of clay substance. The felspar is calculated from either the alumina or alkali content in the residue.

With very sandy clays, violent bumping occurs during the decomposition with sulphuric acid; also the finest particles of quartz and felspar pass through the filter paper, and the filtration is slow. In attempting to overcome these difficulties, the author has devised the following new and quicker process. 1 grm. of clay is boiled with 20 c.c. of water, and a few drops of caustic soda solution, in a 400 c.c. Erlenmeyer flask, and whilst being shaken, 10—15 c.c. of strong sulphuric acid and 1—3 c.c. of strong nitric acid are added. The flask is covered with a small funnel, and the liquid heated to boiling on an air-bath, consisting of a clay triangle laid in a small sheet iron dish. When the interior of the flask is filled with white acid fumes, the flame is removed, and after diluting the liquid with an equal volume of water, ammonia is added until the liquid is distinctly ammoniacal. The precipitate of aluminium and ferric hydroxides, and any admixed calcium carbonate, is filtered off, washed with hot water, and dissolved with dilute hydrochloric acid. This solution is made up to 250 c.c., of which 100 c.c. are evaporated to dryness in a platinum dish, and dried at 120° C. to render traces of silica insoluble. The residue is moistened with 5—10 c.c. of strong hydrochloric acid, diluted with water, the silica (generally 1—2 mgrms.) filtered off, and the iron and aluminium precipitated by ammonia. This precipitate is filtered off, ignited, and weighed, and is usually free from calcium; a second precipitation by ammonia is only necessary with clays containing 20 per cent. of lime. The weight of the ignited oxides multiplied by 6·336 gives the amount of clay substance. If much iron be present in the clay, it can be determined in another portion of the solution and deducted from the weight of the mixed oxides. The iron can then be reckoned, in accordance with the chemical analysis, which should always supplement the rational analysis, either as $Fe_2O_3,2SiO_2,2H_2O$, or as free ferric oxide. This new process is specially applicable to calcareous and micaceous clays, as lime, mica, and clay substance can be separately determined. The content of felspathic material is calculated from the percentage of alkali in the clay, and for this determination the author strongly recommends the Lawrence Smith method (see Crookes' Select Methods, 1905, 23), in preference to the hydrofluoric acid method.

The following results are mentioned.

	Per cent. clay substance.	
	By Berdel's.	By new method.
Clay from [illegible]	76·1 ; 75·9	75·8
Zettlitz kaolin	—	97·1 ; 96·8

The kaolin lost 1·2 per cent. of water at 120° C., and contained about 2 per cent. of quartz.

	Per cent. clay substance.	
	By Berdel's	By new method.
Clay from Goldberg	35·2 ; 36·7	35·1 ; 35·1
Sand from Fürstenwalde .	—	15·2 : 15·1

In 6 determinations by Berdel's method, the percentages varied from 14 to 18, and a number of results had to be rejected.

	Per cent. clay substance.	
	By Berdel's.	By new method.
Clay from Velten	—	33·4 ; 33·6
	Per cent. $CaCO_3$.	
Clay from Velten	—	21·5 ; 21·55

By direct extraction with hydrochloric acid, this clay contains 21·6 per cent. of calcium carbonate, and by Berdel's method gave 56 per cent. of material decomposed by sulphuric acid.

	Per cent. clay substance.	
	By Berdel's.	By new method.
Clay from the West Forest	55·75	55·4 ; 54·8

Two per cent. of potash (K_2O) was found in the part decomposed by sulphuric acid. According to Vogt this must be present as mica, and taking the formula of muscovite as $6SiO_2,3Al_2O_3,K_2O,2H_2O$, there is obtained the proportion. K_2O (94·3) : Muscovite (799·3) = 0·021 (grm. K_2O): K or 0·1780 grm. of mica (16·9 per cent.). The amount of aluminium corresponding to the potash must be deducted from the alumina found. Calculating in this way there is obtained $K_2O : 3Al_2O_3 = 0·021 : K$ or 0·0682 grm. Hence by subtraction, 0·2275 − 0·0682 = 0·1593 grm. of alumina, which corresponds to 0·4038 grm. or 38·4 per cent. of clay substance. Assuming then, that Vogt's assumption is correct, and that the potash in question is not to be regarded as the equivalent of water in the clay substance (Seger's assumption), the portion of this clay decomposed by sulphuric acid, consists of 16·9 per cent. of mica and 38·4 per cent. of clay substance. Further investigation must decide which view is correct.

—W. C. H.

Lump plaster [*Plaster of Paris*], *overburnt plaster, and flooring plaster: Studies on* ——. M. Glasenapp. Tonind.-Zeit., 1908, **32**, 1148—1152, 1197—1202, 1230—1235.

A chemical and microscopic investigation of the different forms of plaster has shown that most of the previously published statements on flooring plaster (this J., 1903, 629, 906, 1244) are erroneous. The statement, for example, that flooring plaster can be obtained at temperatures of 400°—600° C., or even lower, has no foundation in fact; further, flooring plaster is not isomeric with soluble anhydrite; does not show the crystalline form of the hemihydrate; and on setting does not give crystals of the dihydrate, as ordinary plaster of Paris does. The following definition is given:—Flooring plaster consists of a mixture of a granular, dense, sintered, hard, refractive, crystalline modification of anhydrite with small quantities of a segregated, amorphous, vitreous, basic anhydrite holding lime in solid solution. It needs a temperature of about 900° C. for its complete formation, and at higher temperatures (up to 1300° C. and over) it becomes coarser in structure and harder, with formation of larger quantities of the basic constituent. It combines with water only slowly, and apart from the production of small quantities of crystallised calcium sulphate dihydrate and calcium hydroxide, without alteration of form, or of its optical properties and hardness. With addition of positive catalysts, *e.g.*, alum (see this J., 1900, 1114; 1902, 1233; 1903, 906, 1244), it is converted into soluble anhydrite, and then sets by crystallisation just as plaster of Paris does (compare this J., 1903, 366). The results obtained as to the temperature of formation of flooring plaster, are of considerable technical value, as showing that the possibility of overburning the charge is practically excluded. The temperature may rise as high as 1300° C., or even higher locally and for a short time, without the setting properties of the plaster being adversely affected, provided the fuel does not exert a strong reducing action. The temperature may also fall as low as 800° C., but a lower limit of 900° C. is preferable. Flooring plaster of normal properties can be prepared from the different forms of natural gypsum and also from voluminous broken plaster (plaster moulds). The technical importance of flooring plaster is pointed out. It sets to a white material as hard as marble and as strong as Portland cement, translucent in thin layers, and with a dense close structure; it is superior to white silicate cements. The slow setting appears to be a disadvantage, but casts prepared from flooring plaster are sufficiently hard to be removed from the mould after a few days, and the hardening may then be completed in a chamber in which the atmosphere is kept saturated with water vapour, the surface of the casts being occasionally moistened with water. The setting may also be somewhat accelerated by addition of about 10 per cent. of slow setting plaster (prepared by burning at 200°—220° C.). The use of the microscope is recommended for differentiating the several varieties of plaster, a small quantity being rubbed on an object glass with a drop of water, and then examined. Particles which appear fibrous, turbid, and of a yellowish-brown colour by reflected light have been produced by burning below 800° C., and are quite distinct from flooring plaster. They almost invariably show fragments of the needle crystals of the original crude gypsum. In the case of flooring plaster, on the other hand, there is no trace of a fibrous structure, except when the temperature of burning is only 800° C. The particles are clear and transparent and strongly refractive, appearing lighter in colour than the surrounding water, and increase in size as the temperature of burning is higher. The time required for crystallisation to set in, as observed under the microscope, serves to distinguish ordinary plaster of Paris from the slow-setting soluble anhydrite. The following classification of the different varieties of plaster is given, with the temperatures at which they are produced.

		107° C. ..	Hemihydrate.	
	Set with water owing to formation of crystals (*i.e.*, set with alteration of form).	107°—170° C.	Mainly hemihydrate.	Lump plaster (Plaster of Paris).
		170°—200° C.	More or less dehydrated hemihydrate. Sets rapidly with water to form the hemihydrate.	
		200°—250° C.	Contains small quantity of water, sets slowly, at first with formation of hemihydrate.	
		250°—400° C.	Contains traces of water, sets very slowly.	
When treated with alum solution, set owing to formation of crystals (*i.e.*, set with alteration of form).	Set slightly or not at all.	400°—750° C.	Anhydrous calcium sulphate, practically dead-burned.	
		750°—800° C.	Beginning of formation of flooring plaster.	
	Set slowly with water, without alteration of form.	800° C. ..	Flooring plaster, with cryptoform of the granular anhydride.	
		900°—1000° C.	Normal flooring plaster, with full development of the granules.	
		1000°—1400° C.	Flooring plaster, with granules of increased size and hardness, and rising content of basic sulphate.	

—A. S.

Calcium sulphate; Relation between the solubility and rate of hydration of ——. P. Rohland. *See* VII.

Wood preservation; The meaning of decay and how it may be checked. W. F. Sherfesee. Scient. American, Suppl., 1908, **66**, 78—80. [T.R.]

Threatened wood famine. Paper and Pulp, 1908, **27** [8], 319—320. [T.R.]

Sweden cuts 106,000,000 cubic feet more wood than she produces. *Russia*, notwithstanding enormous forest resources, is fast approaching the same condition. The *United States* consumes annually from three to four times the wood which its forests produce, and in time will want all the wood that Canada can spare. It is regretfully apparent that unless the countries of the western hemisphere apply systematic forestry promptly and effectively, they will be held responsible for a world-wide timber famine. The *German Empire* has nearly 35,000,000 acres of forest. There is a little over three-fifths of an acre of forest for each citizen, and though 53 cubic feet of wood to the acre is produced in a year, wood imports have increasingly exceeded wood exports for over forty years, and 300,000,000 cubic feet, valued at £16,000,000, or over one-sixth of the home consumption is now imported each year. German forestry has always led in scientific thoroughness, and now it is working out results with an exactness almost equal to that of the laboratory; it has solved the problem of securing an increasing forest output and increasing profits at the same time. *France* has not quite 18 per cent. of its area covered by forest, equivalent to three-fifths of an acre per capita. This produces one-third of the home demand. The country imports annually £6,000,000-worth of wood, and pays £1,200,000 duty and £2,000,000 freight for it. Of the 23,500,000 acres of French forests the State owns 2,707,000, which yield a clear profit of £1,000,000 a year. The Government proposes to expend £10,000,000 before the work of re-foresting for protection is complete. France and Germany together have a population of 100,000,000, in round numbers, against the U.S.A. 85,000,000, and State forests of 14,500,000 acres against 160,000,000 acres of National Forests; but France and Germany spend on their forests £2,200,000 a year and get from them in net returns £6,000,000 a year, while the United States spent on the National Forests last year £280,000 and secured a net return of less than £26,000. *Russia.*—More than 575,000,000 acres, or 39 per cent. of European Russia is forest, and the Siberian forests of Asiatic Russia contain about 350,000,000 acres. The Government owns 65·7 per cent. of the total forest area. The untouched forest resources of Russia comprise two-thirds of the whole forest area of Europe. Over £6,000,000 worth of wood is exported. From the 660,000,000 acres of State forests which are now being worked the net income is now nearly £4,300,000, or 3⅓ cents per acre. *Austria-Hungary.*—*Austria* has 24,000,000 acres of forest, of which 7 per cent. belongs to the State and 58 per cent. is private land. Of the private forests 34 per cent. is in estates ranging from 20,000 to 350,000 acres in area, at least 75 per cent. of the total forest area being held in large, compact bodies. The total net revenue from the Austrian State forests is over £1,000,000. *Hungary* has 23,000,000 acres of forest, of which the State owns 16 per cent. From £2,000,000 to £2,400,000 worth of wood is annually exported. *Canada.*—About one-third of the Dominion of Canada, 1,249,000 square miles, or nearly 800,000,000 acres, is classed as woodland, though the area stocked with commercial timber probably does not exceed 260,000,000 acres. The net exports of wood are over 2,000,000 tons a year. In the Dominion and the Provinces, together, 203,500,000 acres have been made "forest reserves," while the reserves of British Columbia, recently created, nominally cover 100,000,000 acres, it is believed that not more than one-tenth of this area has a growth of commercial timber. *Norway and Sweden.*—But 20,000,000 acres of *Norway*, or 21 per cent. is in forest. The State owns less than 2,000,000 acres of this. Of the forest region one-half has to import timber, one-fourth has sufficient for its needs, and one-fourth is able to export over 1,000,000 tons, valued at £3,600,000 a year. Nearly two-thirds of the exports go to England. Since 1860, the State has been buying cut-over lands in order to plant them to forest, and from £3,000 to £4,000 a year has been spent in this way. *Sweden* has nearly 50,000,000 acres of forest. Since the English import duties were abolished, the wood exports from Sweden have increased till Sweden stands next to Russia, the world leader, in wood exports with £1,800,000 a year, representing nearly 4,500,000 tons. England takes half of this. The total cut from the forest is estimated at 1000 million cubic feet. The State owns about 13,500,000 acres, or 33·2 per cent., and controls 4,000,000 acres more. From the State lands since 1880 the net revenue has risen from £40,000 to nearly £600,000 a year.

Patents.

Lithographic stone [*from blast-furnace slag*]; *Manufactur of —— artificially.* T. M. Thom, Cheshunt, Herts. Eng. Pat. 15,964, July 11, 1907.

Powdered slag, to which natural stone may be added, is mixed with lime and water. The plastic mass is moulded under pressure into slabs, which are hardened by treatment with gaseous carbon dioxide.—A. G. L.

Meadow-lime ["*Wiesenkalk*"]; *Process for the preparation of —— for burning.* W. Virck. Ger. Pat. 199,449, March 1, 1907.

On burning meadow-lime in the usual way, either the mass falls completely to powder, or only a half-burned product is obtained. This is avoided, according to the present patent, by mixing the meadow-lime with quartz sand or other silicious substance.—A. S.

Portland cement; Method of making white ——. C. de la Roche. Fr. Pat. 387,670, Feb. 29, 1908.

An easily fusible aluminium silicate, *e.g.*, glass, is powdered and mixed with sufficient dried or calcined aluminium oxide to form, after burning, an artificial puzzuolana. Sufficient lime is added to this mixture to bring the proportion of lime up to about 64 per cent., and the whole is burnt as usual, or, preferably, the mixture is treated with steam under pressure in an autoclave and subsequently dehydrated by heating to a high temperature.—A. G. L.

Cement from blast-furnace slag; Process of manufacturing a sea-water-resisting ——. H. Colloseus, Berlin, Assignor to Colloseus Cement Co., of New Jersey. U.S. Pat. 893,706, July 21, 1908.

See Eng. Pat. 1647 of 1907; this J., 1907, 1093.—T. F. B.

Cement; Process of manufacturing —— by treating hot liquid blast-furnace slag with solutions of alkaline substances. H. Colloseus, Berlin, Assignor to Colloseus Cement Co. U.S. Pat. 893,707, July 21, 1908.

See Eng. Pat. 1646 of 1907; this J., 1907, 1093.—T. F. B.

Cement; Process of manufacturing —— by treating hot liquid blast-furnace slag with milk of lime. H. Colloseus, Berlin, Assignor to Colloseus Cement Co. U.S. Pat. 893,708, July 21, 1908.

See Eng. Pat. 15,764 of 1907; this J., 1908, 125.—T. F. B.

X.—METALS AND METALLURGY.

Gases; Occlusion of —— in a special nickel steel. G. Belloc. Compt. rend., 1908, **147**, 244—245. (Compare this J., 1908, 76.)

The author has analysed the gases occluded in a nickel steel containing 45 per cent. of nickel and 0·15 per cent. of carbon. The occluded gases consisted of carbon dioxide, carbon monoxide, hydrogen, and nitrogen. The carbon dioxide was expelled completely at a temperature below 520° C., but the nitrogen only began to come off above that temperature; the proportion of the latter gas was always quite small. The wire prepared from this alloy yielded 10 times its volume of total gas, whilst drillings from an ingot of the same batch only yielded 3½ times their volume. Whether this difference is due to an unequal distribution of the gas, or to a loss or absorption of gas in the mechanical preparation of one or the other of the samples, has not been determined. The alloy in question was a reversible one, which changes at 350°—400° C. Most of the gas, therefore, was evolved when the iron was in the γ-state and the nickel was in the β-state. In the case of the drillings, the evolution of gas with rise of temperature was regular; in that of the wire, there are two maximum points, one at 540° C. and the other at 830° C.; in this case the variations of composition of the gases evolved, are not regularly progressive, for at about 540° C. a minimum of carbon monoxide and a relative maximum of hydrogen, were observed, whilst above that temperature the proportion of carbon monoxide relatively increased.—J. F. B.

Iron sheets; Autogenous welding of ——. Goerens. Stahl und Eisen, 1908, 28, 1063—1065.

The research was undertaken for the purpose of discovering whether any difference arises in joints welded by the aid of a hydrogen flame or of an acetylene flame, a possibility suggesting itself that, by the use of the latter, a deposition of carbon might result and cause the iron at that part to become brittle. For this purpose a number of samples were taken and plane sections prepared by cutting vertically through the weld. These were ground and polished in the usual way. A microphotograph of one portion, which had been etched with an alcoholic solution of picric acid, showed that the distribution of ferrite and pearlite was perfectly regular throughout the whole welded sheet, nor did it differ when the hydrogen in the flame was replaced by acetylene. It was however observed that the particles of enclosed slag had lost their thread-like character, produced in the rolling of the original plate, and appeared in the weld as irregular knots, distinguished from those of pearlite by their colour. The speculation that, by the use of acetylene, a brittle joint would be obtained, through separation of carbon from that gas, was not confirmed. But the possibility did not seem excluded that through the use of acetylene, some enrichment in sulphur might have taken place at the welded part. After investigation it was found that, in either case (that of hydrogen or that of acetylene), the weld was poorer in sulphur than the sheet itself. Moreover the distribution in the former was always more uniform.—C. A. W.

Lead in spelter and ores; Determination of ——. E. J. Ericson. Eng. and Mining J., 1908, **86**, 178—180.

The method has been in use for two years, and is claimed to be more accurate and reliable, especially in the case of small percentages of lead, than is the usual sulphate precipitation and volumetric molybdate method. It is necessary to obtain the lead in solution as nitrate free from sulphates or chlorides. Spelter is dissolved directly in nitric acid, but ores are evaporated with sulphuric in the usual way, and the lead sulphate digested with ammonium carbonate, and then dissolved in nitric acid. The solution is made ammoniacal, ammonium persulphate added, and the lead peroxide produced, is filtered off and washed with hot water, or with a hot 10 per cent. solution of ammonia, when copper or zinc is present. The filter, with the precipitate, is placed in the original beaker and an excess of hydrogen peroxide, acidulated with nitric acid, is added to decompose the lead peroxide. The excess of hydrogen peroxide is titrated with a standard potassium permanganate solution, and the lead is calculated from the amount of hydrogen peroxide consumed in decomposing the lead peroxide. The method of working for various types of ore, and for spelter, and the theoretical considerations, are described in detail, and the question of the purity of commercial "chemically pure" lead for standardising, is also incidentally dealt with. An important feature of this process is that lime does not interfere, nor do such traces of iron as the lead sulphate might carry down. A hydrogen peroxide solution suitable for determining the small proportion of lead commonly present in spelter, is prepared by adding 8—10 c.c. of the U.S.P. hydrogen peroxide and 50 c.c. of strong nitric acid to water, and diluting to a litre. A convenient strength for the permanganate solution is for each c.c. to be equivalent to 0·001 grm. of iron. This is theoretically equivalent to 0·00185 grm. of lead, but it is found that this factor gives too low a result, and the empirical factor of 0·00192 grm. of lead per c.c., which gives results agreeing exactly with those obtained by the standard gravimetric method, is recommended. When 1·92 grm. of the sample is taken, each c.c. will therefore represent 0·1 per cent. of lead. For zinc ores containing several per cent. of lead, a solution of hydrogen peroxide two or three times the usual strength should be employed, and if 25 c.c. fail to dissolve the lead peroxide, another 25 c.c. should be added, and a blank run on the same amount of hydrogen peroxide. For lead ores and concentrates, the peroxide should be five times, and the permanganate three times the strength required for spelter.—F. R.

Zinc-copper-nickel alloys; Constitution of —— and of the binary copper-nickel, zinc-copper, and zinc-nickel alloys. V. E. Tafel. Metallurgie, 1908, **5**, 343—352, 375—398, 413—430.

The author has investigated the constitution of alloys of zinc, copper, and nickel by means of a large number of melting-point curves and diagrams, and of microphotographs. Regarding copper-nickel alloys, he confirms the results obtained by Guertler and Tamman (Z. anorg. Chem., **52**, 172). For zinc-copper alloys, Shepherd's results (this J., 1905, 241) are, on the whole, confirmed. The six kinds of mixed crystals described by Shepherd exist in the system. In addition, the existence of the compound, Cu_2Zn_3, with a melting-point of 830° C., is practically certain, being confirmed by the electrical conductivity curve; this compound possesses great hardness and brittleness, a silver-white colour, and considerable resistance towards reagents. The existence of a second compound, Cu_2Zn, is possible; other compounds do not exist. Roberts-Austen's line e'—e'', and Shepherd's lines e_3—e_4, and C—c_1 could not be traced. The line G—F slopes by 6—7° towards the zinc end. Mixtures of about equal parts of the two metals segregate considerably during the melting. In the zinc-nickel series of alloys seven different solid phases exist, namely, pure zinc, a solid solution with 12·2—23·0 per cent. of nickel, the compound, $NiZn_3$, with 23 per cent. of nickel (m.p. 876° C.), a solid solution with 39·7 to 49·0 per cent. of nickel, and three other phases the composition of which could not be ascertained. Mixtures containing more than 50 per cent. of nickel could not be prepared, their melting-points lying above the boiling-point of zinc. The conditions existing in the system of zinc-copper-nickel alloys are exceedingly complicated. No ternary compound or ternary eutectic point could be found. The diagram shows three main mixtures of solid solutions and compounds, the mixture richest in zinc consisting of crystals of Cu_2Zn_3 and $NiZn_3$. The alloys show a great tendency towards segregation. An alloy containing 15·3—20 per cent. of nickel, 73—80 of copper, and 7 of zinc has the colour and ductility of silver; alloys containing 33—40 of nickel, 7—20 of copper, and 40—52 of zinc possess great hardness and toughness.—A. G. L.

White metal and similar alloys; Analysis of ——. E. Schürmann and W. Scharfenberg. Mitt. Königl. Materialprüfungsamt., 1907, **25**, 270—274.

One grm. of the alloy is covered with 10 c.c. of hydrochloric acid (sp. gr. 1·12), and bromine added drop by drop, the mixture being cooled. When the alloy has dissolved, the excess of bromine is expelled by a current of carbon dioxide. A solution of 3—4 grms. of tartaric acid is now added and the liquid then made distinctly ammoniacal. Tin, antimony, and arsenic are separated from copper, lead, etc., by Finkener's method, with sulphuretted hydrogen water, about 0·5 grm. of tartaric acid being added to prevent the carrying down of tin and antimony by the precipitate. The filtrate is acidified slightly with sulphuric acid, warmed to 60° C., and the tin, antimony, and arsenic then precipitated with sulphuretted hydrogen. This precipitate is filtered off, dissolved in a small quantity of a mixture of bromine and hydrochloric acid, and the excess of bromine expelled by means of a current of carbon dioxide. Ammonia is added to very slight alkalinity, followed immediately by about 5 grms. of oxalic acid. The liquid is diluted to 400 c.c., and whilst boiling, a current of sulphuretted hydrogen is passed in, the volume of the liquid being meanwhile kept constant by additions of water. After 30 to 45 minutes the precipitate of antimony sulphide should be well granulated. The boiling is continued for a further quarter of an hour, and the current of sulphuretted hydrogen for another 5 minutes. The precipitate is filtered hot and washed with 1 per cent. oxalic acid solution, which has been saturated with sulphuretted hydrogen. It is next dissolved in bromine-hydrochloric acid and the separation repeated. The re-precipitated antimony sulphide is dissolved in 50 c.c. of 45 per cent. sodium sulphide solution in a weighed platinum dish with a matt surface, and 50 c.c. of a 25 per cent. solution of sodium sulphide added, together with 1 grm. of pure sodium hydroxide. The liquid is warmed to 50 or 60° C. and electrolysed for about half an hour with a current of 1·5 volts and 0·2 ampère until a distinct deposit of antimony is obtained, when the current intensity is increased to 2·0 volts and 0·6 ampère for another 1½ hours. 30 c.c. of sodium sulphide solution are then added and the current increased to 2·5 volts, and when no further deposition of antimony occurs, the liquid is rapidly poured off, the dish washed successively with hot water, alcohol, and ether, dried and weighed. The filtrate, which is now free from antimony, is rendered slightly ammoniacal, then acidulated with acetic acid, heated to boiling, and treated with a current of sulphuretted hydrogen for 3 hours. The solution must be kept slightly acid. After standing for some time on the water-bath, the liquid is filtered and the precipitate washed several times with hot ammonium sulphate solution. The precipitate of tin sulphide is dried at 120° C. and converted into stannic oxide by treatment with nitric acid.—W.S.

Spelter; Production of —— in 1907. *Advance Statement.* C. E. Siebenthal. U.S. Geological Survey, Department of the Interior. [T.R.]

THE production and consumption of spelter in the United States, and the world's production, in tons of 2000 lb., in 1906 and 1907, are given in the following tables:—

General Totals.

	1906.	1907.	Increase in 1907.	
			Quantity.	Percentage.
Production of spelter in the United States .	224,770	249,860	25,090	11·2
Consumption of spelter in the United States.	221,781	228,509	6,728	3·0
Production of spelter in the world	775,871	813,842	37,771	4·9

Consumption of spelter in the United States in 1906 *and* 1907.

	1906.		1907.	
Supply—				
Stock at beginning of year	3,463		3,824	
Production	224,770		249,860	
Imports for consumption	2,043		1,761	
Total available		230,276		255,445
Withdrawn—				
Stock at close of year .	3,824		26,364	
Exports, foreign, in bond	1		9	
Exports, domestic	4,670		563	
Total withdrawn		8,495		26,936
Apparent domestic consumption		221,781		228,509

World's production of spelter in 1906 *and* 1907.

Country.	Quantity.	
	1906.	1907.
Australia	1,131	1,098
Austria and Italy	11,883	12,522
Belgium	168,067	170,307
France and Spain	59,293	61,438
Great Britain	57,971	61,286
Holland	16,150	16,526
Poland	10,595	10,735
Rhine District	75,729	77,459
Silesia	150,282	152,611
United States.....................	224,770	249,860
Total	775,871	813,842

Note.—The figures for the production of spelter in the United States include only spelter derived directly from ore, and exclude all zinc derived from secondary sources.

Copper; Production of —— in United States. L. C. Graton, Mining World (Chicago), August 1, 1908. [T.R.]

THE production of copper in the United States in 1907 was 868,996,491 lb. From the record figures of 1906 this is a decrease of 48,809,191 lb., or 5·6 per cent.—the largest actual decrease ever recorded and the largest relative decrease since the American copper industry became important.

Of the total quantity, approximately 10,075,048 lb. in blister were produced in foreign smelters from domestic materials exported. In addition to the domestic materials handled, smelters in this country turned out as blister, 64,145,648 lb. from foreign ore, concentrates, and matte. Domestic blister containing 42,350,963 lb. was exported unrefined, while blister from foreign sources containing approximately 183,530,132 lb. of fine copper was imported for refining in this country.

The production in 1907 of refined new copper of domestic origin, was 784,271,427 lb., a decrease of 103,410,960 lb., or 13·2 per cent., from 1906. The total output of refined copper (exclusive of domestic scrap, etc.) by domestic refineries in 1907 was 1,032,516,247 lb. The details of production for 1906 and 1907 are shown in the following table, which is based on actual returns from all refineries:—

Production of fine copper in 1906 *and* 1907.

	1906.		1907.	
	Domestic origin.	Foreign origin.	Domestic origin.	Foreign origin.
	lb.	lb.	lb.	lb.
Electrolytic.	648,614,592	191,370,022	592,326,608	245,062,814
Lake.......	205,608,382	—	178,534,141	—
Casting	33,459,413	—	13,410,678	3,182,006
Total	887,682,387	191,370,022	784,271,427	248,244,820
Total output of domestic refineries	1,079,052,409		1,032,516,247	

The 1907 figures for domestic electrolytic include 34,917,988 lb. of Lake copper which were refined electrolytically; those for 1906 contain 24,017,833 lb. of Lake copper. The figures for domestic casting exclude Lake copper and copper recovered from secondary materials. In addition to the above production of refined copper, 25,129,617 lb. (of which 8,316,861 lb. were electrolytic and the balance casting) were recovered during the year by the regular copper refining companies of the country from domestic scrap, drosses, etc., and returns from practically all the known refiners of secondary materials indicate that 35,355,966 lb. additional were turned out by them as casting copper and in alloys. The copper produced from secondary sources in 1907 was therefore somewhat over 60,000,000 lb., or more than 7·5 per cent. of the year's production of new copper.

The following stocks of refined copper were on hand at the beginning and end of the year: Jan. 1, 1908, 125,745,796 lb.; Jan. 1., 1907, 46,497,181 lb.; stocks increased during 1907, 79,248,615 lb.

In addition to these stocks of refined copper, there were at smelters, in transit to the refineries, and at the refineries, blister copper and material in process of refining to the amount of 135,310,239 lb. on Jan. 1, 1907, and of 175,254,659 lb. on Jan. 1, 1908.

The apparent consumption of refined new copper in the United States in 1907 was about 485,000,000 lb., as compared with about 685,000,000 lb. in 1906. One method of deriving these figures is based on the total refinery output. The data are as follows:—

Consumption of refined copper (in pounds).

	1906.	1907.
Total refinery output	1,079,052,409	1,032,516,247
Refined copper imports	28,191,053	(*a*)
Stock, beginning of year......	72,270,417	46,497,181
Total available supply	1,179,513,879	1,079,013,428
Refined copper exported	(*b*)446,750,711	(*b*)465,496,007
Stock, end of year	46,497,181	125,745,796
Total withdrawn	493,247,892	591,241,803
Apparent consumption......	686,265,987	487,771,625

(*a*) Comparison of import and refinery figures indicates that no unmanufactured refined copper was imported into the United States in 1907.

(*b*) Figures furnished by the Bureau of Statistics and reduced to terms of refined copper.

It is probable that, in addition to the consumption above shown, most or all of the 60,000,000 lb. or more or reworked copper was consumed.

British lead trade. Mining World (Chicago), Aug. 1, 1908. [T.R.]

During the six months ending with June, the imports of lead into Great Britain were 117,512 long tons, as against 95,235 tons for the corresponding period last year, showing an increase of 22,277 tons, or about 23 per cent. Of this year's imports Spain supplied 52,311 tons, as against 53,366 tons in 1907; Australia, 29,038 tons against 25,620 tons; the United States, 20,201 tons against 7297 tons; while the remainder came from various other countries.

Exports of lead for the half-year were 27,793 tons, as against 25,807 tons for the same period in 1907; an increase of 1986 tons, or nearly 8 per cent. Of this year's exports Russia received 7339 tons against 5760 tons in 1907; France, 2549 tons against 1339 tons; British India, 2935 tons against 2481 tons; China (including Hong Kong), 1881 tons against 1864 tons; Japan, 1985 tons against 2391 tons; Canada, 1944 tons against 3003 tons; while the remainder went to a number of other countries.

PATENTS.

Vanadium; Process of reducing —— from sulphide ores. F. M. Becket, Niagara Falls, N.Y., Assignor to Electro Metallurgical Co., W. Va. U.S. Pat. 893,128, July 14, 1908.

Vanadium is reduced by smelting its sulphide with carbon and an oxygen compound of a metal "having a relatively high affinity for sulphur," *e.g.*, of an alkali or alkaline-earth metal.—A. G. L.

Zinc; Process and apparatus for refining ——. R. Ziesing, Assignor to The Grasselli Chemical Co., Cleveland, Ohio. U.S. Pats. 893,415 and 893,560, July 14, 1908.

(1). Zinc is separated from heavier metals by charging the alloy into retorts heated only from above, the zinc distilling from the upper surface of the molten mass, whilst the heavier metal (*e.g.*, lead) accumulates in the constricted lower part of the retort. (2). The furnace consists essentially of a combustion chamber, in the lower part of which retorts are placed transversely. The retorts are supported and shielded from heat along the bottom and lower side portions; the upper parts of the retorts are made relatively thin-walled, and means are supplied for directing the heat downwards on to the retorts.—A. G. L.

Metal values from [cyanide] solutions; Method of recovering ——. W. A. Hendryx, Denver, Colo. U.S. Pat. 893,581, July 14, 1908.

A cyanide or other solution containing dissolved metals is intimately mixed with zinc dust or other precipitant, so as to precipitate a part of the dissolved metals. The undissolved zinc and the separated metals are then formed into a layer, through which the solution is passed, whereby the remainder of the dissolved metals is precipitated.
—A. G. L.

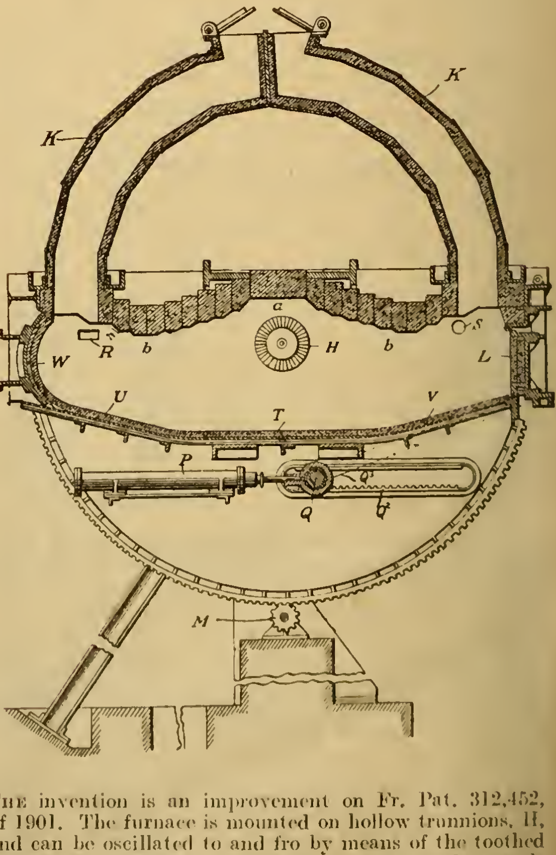
(1). *Copper-clad iron and steel.* (2), (3), *and* (4). *Metal body; Compound —— and process of producing same.* J. F. Monnot, Assignor to Duplex Metals Co., New York. U.S. Pats. 893,932, 893,933, 894,163, and 894,164, July 21, 1908.

(1). Claim is made for a compound metal composed of iron or steel covered with a welded-on, poreless, dense coating of copper, resisting changes of temperature, mechanical stresses, and the action of cutting tools. (2). The surface of a ferrous metal is coated with a non-ferrous metal, such as copper, by heating the latter to a temperature much above its melting point, and bringing it in contact with the ferrous metal, and then molten gold is interspersed between the iron surface and the copper of the copper-coated metal. (3). The surface of a body of metal is brought in contact with another metal heated to a temperature much above its melting point, and after the formation, in this manner, of a "weld-film" upon the first metal, the latter is removed, under conditions precluding oxidation, and then brought in contact with a third metal in a molten condition. (4). The surface of a body of metal is brought in contact with another metal, *e.g.*, copper, heated to a temperature much above its melting point, and the copper-coated metal is then brought in contact with molten silver.—A. S.

Furnace; Metallurgical ——. W. N. Best, Los Angeles, Cal., Assignor to J. H. and E. Best, Quincy, Ill. U.S. Pat. 894,107, July 21, 1908.

The furnace comprises a reducing chamber and a fire chamber, with a "vestibule" between the two, and two lateral crucible chambers on opposite sides of the vestibule, and communicating therewith by passages. The floor of the reducing chamber slopes downwards towards the vestibule, and the floor of the latter is at a lower level than that of the adjoining fire chamber, and slopes downwards on each side towards the crucible chambers. Flames from oil burners are directed: (1), into the fire chamber and across the passages leading from the vestibule to the crucible chambers; and (2), downwards into the crucible chambers and along these passages towards the vestibule. Air is forced through the sloping floors of these passages, under the inflowing molten metal, in the direction of the crucible chambers.—A. S.

Puddling-furnace. J. P. Roe. Fr. Pat. 388,018, Mar. 10, 1908.



The invention is an improvement on Fr. Pat. 312,452, of 1901. The furnace is mounted on hollow trunnions, H, and can be oscillated to and fro by means of the toothed wheels, M. The hearth of the furnace is inclined upwards from the centre, T, towards the ends, U, V, so that the molten iron always forms a thin layer, except when the furnace is tilted right over to one side, when the iron collects in the semi-circular receptacle, W. At the other side of the hearth is placed the door, L, controlled through connecting-rods by the rack arrangement, Q_1, Q_2, Q_3, which is operated pneumatically from the cylinder, P. The furnace is discharged through this door, L, charging taking place through the opening, R, whilst the progress of the puddling can be watched through another opening, S. The roof of the furnace is curved down from the centre, *a*, towards the ends, *b*, *b*, where the two chimneys, K, K, are placed, which meet each other again at the top, as shown.—A. G. L.

Smelting process [*for sulphide ores*]. J. H. Boyd, Denver, Colo. U.S. Pat. 894,111, July 21, 1908.

In the smelting of sulphide ores, claim is made for the separation of the sulphur from the fused ore, in the zone of the furnace below the fusion zone, by bringing the ore matte in contact with the coke, without access of the air blast. It is stated that the sulphur is removed in the form of carbon bisulphide, whilst the lead, gold, and silver are left in the metallic state and the copper as matte.—A. S.

Aluminium alloys. Centralstelle f. Wissenschaftlich-Technische Untersuchungen G.m.b.H., Neubabelsberg, Germany. Eng. Pat. 26,322, Nov. 28, 1907. Under Int. Conv., Jan. 10, 1907.

See Fr. Pat. 384,187 of 1907; this J., 1908, 409.—T. F. B.

Crucible furnaces and the like. L. Rousseau, Argenteuil, France. Eng. Pat. 6028, March 18, 1908. Under Int. Conv., March 20, 1907.

See Fr. Pat. 375,915 of 1907; this J., 1907, 1014.—T. F. B

Metal body; Compound —— and process of producing same. J. F. Monnot, Assignor to Duplex Metals Co., New York. U.S. Pat. 894,162, July 21, 1908.

See Eng. Pat. 8913 of 1906; this J., 1907, 532.—T. F. B.

Ores containing arsenic; Process for treating ——. T. Barton and T. B. McGhie. Fr. Pat. 387,766, Jan. 28, 1908. Under Int. Conv., March 23, 1907.

See Eng. Pat. 7034 of 1907; this J., 1908, 448.—T. F. B.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(*A.*)—ELECTRO-CHEMISTRY.

Copper compounds; Electrolysis of solutions of ——. J. Meyer. Bull. Soc. Chim. Belg., 1908, **22**, 259—291.

The theory of Foerster and others as to the electrolysis of solutions of cupric sulphate, according to which the amount of cuprous oxide formed at potentials too low for the separation of metallic copper amounts to $Cu_2O = 143{\cdot}2$ for 2 × 96540 Coulombs, does not represent the whole of the facts; the amount of cuprous oxide formed is less than half that required. Cuprous oxide, under certain circumstances, dissolves in solutions of cupric sulphate, especially when hot, and its solution is followed by a deposition of basic cupric salt. The formation of cuprous oxide at the cathode is a purely chemical phenomenon. $Cu + CuSO_4 + H_2O \rightleftarrows Cu_2O + H_2SO_4$, and the amount formed is independent of the current and of the concentration of the cuprous ions. The determination of cuprous oxide along with metallic copper can be effected by dissolving a known weight of the mixture in a neutral solution of iron alum, and determining the amount of ferric salt reduced by means of permanganate, a given weight of metallic copper requiring as much oxygen as twice the weight of copper in the form of cuprous oxide.
—J. T. D.

Bismuth; Electrolytic determination of ——. J. Peset. *See* XXIII.

Patents.

Electric cables; Vacuum drying and impregnating apparatus for ——. E. Passburg, Berlin. Eng. Pat. 3507, Feb. 15, 1908.

The apparatus consists of two substantially concentric heaters, in the annular space between which is placed the cable wound on a frame. The heating may be effected by means of steam or electrically. The annular space is evacuated during the heating, and may be used for the impregnation of the cable by liquids at the end of the drying.—A. G. L.

Hypochlorite solutions; Manufacture of —— by electrolytic means. W. P. Digby, London. U.S. Pat. 892,983, July 14, 1908.

See Eng. Pat. 21,949 of 1905; this J., 1906, 1156.—T. F. B

Filaments; Metal electric lamp ——. Eng. Pat. 11,524. *See* II.

Metallic filament incandescent electric lamps. Eng. Pat. 17,817. *See* II.

Electric conductors. Eng. Pat. 24,707. *See* II.

Tungsten filaments. Fr. Pat. 387,792. *See* II.

Electric lamp filaments. Fr. Pat. 387,993. *See* II.

Metal filaments of electric incandescence lamps. Fr. Pat. 388,000. *See* II.

Camphor; Converting iso-borneol into —— by elecrolytic, oxidation. Fr. Pat. 387,539. *See* XX.

(*B.*)—ELECTRO-METALLURGY.

Silver; Electrolytic preparation of chemically active ——. N. Tananajew. J. Russ. Phys.-Chem. Ges., 1908, **40**, 197—203. Chem. Zentr., 1908, 2, 385.

An aqueous solution containing 1·5 per cent. of silver nitrate and about 1 per cent. of nitric acid is warmed to 40° C., and a current from four accumulators is led through it between two platinum electrodes, the cathode being enclosed in a porous earthenware cylinder. A spongy amorphous deposit of silver is obtained which is very active chemically.—A. S.

Patents.

Precious metals from slimes, etc.; Apparatus for the recovery of ——. A. J. Forget, Los Angeles, Cal. U.S. Pat. 893,472, July 14, 1908.

Cyanide solution and slimes are circulated in a tank provided with a central agitator for causing vertical movement of the material therein, and with electrodes disposed tangentially to the vertical movement. The anodes are of lead covered with a thin coating of copper, and the cathodes consist of iron. Both sets of electrodes are protected by permeable coverings.—A. G. L.

[*Copper*] *sulphide ores; Method of treating ——.* W. A. Hendryx, Denver, Colo. U.S. Pat. 893,580, July 14, 1908.

Copper ore is treated with a solution of ferric sulphate and an electric current is passed through the mixture using insoluble anodes, so as to deposit copper and to regenerate the ferric sulphate in presence of the ore. The solution is finally separated from the ore, and the copper in solution deposited by repeatedly passing the liquid between electrodes, after which the solution is used for a fresh batch of ore.—A. G. L.

Zinc; Electric furnace for the continuous extraction of —— from its ores. E. F. Côte and P. R. Pierron. Second Addition, dated Feb. 12, 1908, to Fr. Pat. 385,018, Feb. 22, 1907 (this J., 1908, 342 and 632).

The crucible is provided with a conducting lining forming one of the electrodes, and at the centre of the base is a protuberance, which thus increases the current density in the centre of the bath. At the base of the condenser is a basin in which the liquid zinc collects, one electrode of the condenser dipping into the zinc, so that the latter is electrically heated and submitted to a refining process. The material is introduced, by distributing mechanism, through an opening in the cover of the furnace near to the upper electrode, the mechanism preventing the formation of zinc powder in the charging orifice.—B. N.

Furnace; Electric —— for the manufacture of steel. Soc. des Aciéries et Forges de Firminy. Fr. Pat. 387,747, March 4, 1908.

The furnace is provided with one or more electrodes of the same polarity, the crucible forming the electrode of opposite polarity. The crucible is composed of a series of layers, made from mixtures of bases, such as magnesia and lime, in varying proportions, together with a carbonaceous material, such as graphite, tar, or pitch, the proportions of the latter decreasing in the various layers from the exterior to the interior. During a preliminary heating of the furnace, the internal layers, which are bad conductors when cold, become conductive, and retain this property after cooling to the ordinary temperature.—B. N.

Ores and metallurgical products containing volatile metals; Treatment of —— in the electric furnace. K. Kaiser. Ger. Pat. 199,437, Dec. 13, 1906.

Oxide ores before being reduced to metal by reducing gases in the electric furnace, are treated with air or other gases containing oxygen. This latter treatment is especially suitable for the treatment of ores containing both volatile and non-volatile metals. It is stated that complete separation of the two metals is effected, *e.g.*, of zinc and iron in burnt pyrites. Sulphide ores may also be treated by this process.—A. S.

Electrolytic metal plating; Device for producing ——. A. Schmitz, Brussels. U.S. Pat. 893,814, July 21, 1908.

See Fr. Pat. 362,182 of 1906; this J., 1906, 644.—T. F. B.

Metallic paper or analogous articles; Process for the production of ——. S. O. Cowper-Coles. Fr. Pat. 387,704, Feb. 29, 1908. Under Int. Conv., March 1, 1907.

See Eng. Pat. 4984 of 1907; this J., 1908, 342.—T. F. B.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

Catalytic actions of colloidal metals of the platinum group. IV. Reduction catalyses with colloidal palladium. [Reduction of oils and of oleic acid]. C. Paal and K. Roth. Ber., 1908, 41, 2282—2291.

It has been found possible to reduce oleic acid and vegetable and animal oils (castor oil, olive oil, and fish liver oil) by means of hydrogen in presence of colloidal palladium (see this J., 1904, 208). *Oleic acid.*—0·5 grm. of oleic acid was neutralised with $N/1$ potassium hydroxide, and the solution diluted with water to 10 c.c. To this, 0·081 grm. of a preparation, containing 61·16 per cent. of palladium hydrosol, dissolved in 8 c.c. of water, was added, and the mixture sucked into a special gas burette containing 67 c.c. of hydrogen. After about 19½ hours, 37·2 c.c. of hydrogen (0° C. and 760 mm.) had been absorbed, the volume necessary for the complete reduction of the oleic acid being 39·4 c.c. From the reduction-product, 0·446 grm. of stearic acid was isolated by treatment with acid and extraction with chloroform. In a second experiment with 2 grms. of oleic acid, 1·7 grms. of stearic acid were obtained, or about 60 per cent. of the theoretical yield. *Castor oil.*—0·5 grm. of castor oil was dissolved in 13 c.c. of absolute alcohol, and 0·081 grm. of the colloidal palladium in 6 c.c. of water and 6 c.c. of ether added. 32·86 c.c. of hydrogen were absorbed in 6 hours as against the theoretical quantity (calculated from the iodine value) of 36·8 c.c. The hydrogenised fat was separated by extraction with chloroform. It had the iodine value, 1·9. In a second experiment the product had the iodine value, 0·65, showing that practically complete hydrogenising had been effected. The hydrogenised fat formed a white hard crystalline mass, m. pt. 77°—81° C., soluble with difficulty in hot alcohol, somewhat more readily in ether, and easily soluble in chloroform and carbon bisulphide. 1 grm. of castor oil yielded 1·02 grms. of reduction product. *Olive oil.*—Satisfactory results could be obtained only when an aqueous emulsion of the oil was used. 1 grm. of olive oil was emulsified with 0·5 grm. of powdered gum arabic and 0·75 grm. of water, then diluted with water to 15 c.c., and mixed with a solution of 0·081 grm. of colloidal palladium dissolved in 8 c.c. of water. In about 9 hours 224 c.c. of hydrogen were absorbed (theoretical quantity for complete reduction, 71·8 c.c.). No explanation of the abnormally high consumption of hydrogen could be found. The hydrogenised fat was obtained in quantitative yield as a white crystalline tallow, m. pt. 43°—47° C., soluble with difficulty in hot alcohol and ether, readily soluble in chloroform and carbon bisulphide. Its iodine value was 9. *Fish liver oil.*—2 grms. of the oil were emulsified with 1 grm. of gum arabic and 1·5 grms. of water, then diluted with water and mixed with a solution of 0·081 grm. of colloidal palladium, the total volume of the mixture being 40 c.c. In 12 hours 313·28 c.c. of hydrogen were absorbed, the theoretical quantity being 238 c.c. The hydrogenised fat was obtained in quantitative yield as a white crystalline mass, m. pt. 43°—45° C., easily soluble in hot chloroform and cold carbon bisulphide, soluble with difficulty in alcohol and ether. It had the iodine value, 3, and no longer gave the colour reactions of fish liver oil with concentrated sulphuric and nitric acids.—A. S.

Glycerol esters of saturated monobasic fatty acids; Action of concentrated sulphuric acid on ——. B. W. van Eldik Thieme. Proc. K. Akad. Wetensch. Amsterdam, 1908, 855—860.

The hydrolysis of esters is known to be a reversible reaction, thus: $R.CO_2R'+H_2O \rightleftarrows R.CO_2H+R'.OH$, the equilibrium between the reacting molecules being dependent on the temperature, the nature of the reagent, and the nature of the ester. The speed of the hydrolysis, which is low, is vigorously increased by hydrogen ions, but the equilibrium remains unchanged, so long as the amount of the acid added does not considerably modify the nature of the medium. Consequently the hydrolysis of fats by dilute sulphuric acid cannot be carried to completion, whereas with concentrated acid, the nature of the reagent is changed, and the reaction now proceeds in accordance with the equation: $R.CO_2R'+H_2SO_4 \rightleftarrows R.CO_2H+R'.O.SO_3H$, and the equilibrium may be moved entirely to the right, if the acid be anhydrous (100 per cent.), if an excess of the acid be added to the dry fat, and if the temperature be kept within certain limits. Such data as the following indicate the influence of these three conditions on the hydrolysis:—(i.), Butter-fat is not fully hydrolysed at 30°—32° C., by sulphuric acid of 93·5 per cent. strength; at that temperature 81 per cent. of the butter-fat is hydrolysed by the 93·5 per cent. sulphuric acid; 89·7 per cent. by 98·5 per cent. acid; and 92·2 per cent. by 100 per cent. acid. (ii.). At 18° C., 86·6 per cent. of trilaurin is hydrolysed by 6·5 mols. of 100 per cent. sulphuric acid; 95·5 per cent. by 26 mols. of the same; and 100 per cent. by 52 mols. of the acid. (iii.), By heating the mixture of sulphuric acid and completely hydrolysed trilaurin for 1 hour at 60° C., 12·9 per cent. of the trilaurin is re-formed (see Grün and Schacht, this J., 1907, 536). (iv.), Lauric acid and sulphuric acid must unite to form a molecular compound, since dry benzene will extract both acids from a mixture of trilaurin and sulphuric acid of 100 per cent. (v.), Heated with 52 mols. of 94·6 per cent. sulphuric acid, trilaurin yields 80 per cent. of lauric acid, and 20 per cent. of mixed glycerides. The opinion is expressed that the mono- and di-laurins in this mixture are formed by the action of water on the compounds,

$$C_{11}H_{23}.CO.O.C_3H_5(O.SO_3H)_2 \text{ and } C_3H_5(O.CO.C_{11}H_{23})_2.O.SO_3H.$$

It is stated by Grün and Schacht (*loc. cit.*) that by the action of sulphuric acid on glycerol, only glycerol-mono- and glycerol-disulphuric acids are formed. But it is now proved experimentally that the product of the action of 98·3 per cent. sulphuric acid consists chiefly of the tri- and di-sulphuric acids with only small quantities of the glycerol mono-sulphuric acid. But if this mixture be diluted with water, the trisulphuric acid is partially hydrolysed to form the di- and mono-sulphuric acids.

[*Cetosan*], *a vaseline preparation capable of absorbing a large quantity of water.* F. Blatz. Pharm. Zentralh., 1908, **49**, 537—539.

The higher alcohols of spermaceti, mainly cetyl alcohol and octodecyl alcohol, when mixed with vaseline in the proportion of 1 : 20, form a basis to which the name "cetosan" has been given. This is readily miscible with large volumes of water and other fluids, forming permanent creamy mixtures, and is suitable for pharmaceutical or other uses. To obtain these alcohols, the spermaceti is saponified with alcoholic potash, and the palmitic acid precipitated by means of calcium chloride. After drying, the higher alcohols are removed by means of light petroleum spirit, hot alcohol, or benzine. Besides these spermaceti alcohols, ceryl alcohol from Chinese wax and myricyl alcohol from beeswax, possess similar properties of combining with fluids.—J. O. B.

"Hydrogen value" as a means of determining unsaturated organic compounds. S. Fokin. *See* XXIII.

Olive oil; Exports of —— from Italy in 1907. Oil, Paint and Drug Reporter, Aug. 3, 1908. [T.R.]

The exports of refined olive oil from Italy in the past three years, are given by the Italian Customs authorities as follows:—

	Quintals.		
	1907.	1906.	1905.
Exported to—			
United States	29,188	71,400	38,687
Austria Hungary ..	28,998	22,203	7,752
Germany..........	15,690	11,132	5,490
Great Britain	5,861	9,432	4,102
Holland...........	12,648	23,519	8,403
Switzerland	7,626	11,294	6,936
Egypt	15,353	19,285	4,867
Other countries ...	8,536	8,894	4,900
Totals	124,881	177,172	81,658
Total values	$1,491,122	$2,051,652	$945,600

The second table shows the exports of all other grades of olive oil to the various countries named in the Custom House records:—

	Quintals.		
	1907.	1906.	1905.
Exported to—			
Austria Hungary ..	19,013	25,834	18,293
France............	60,766	116,312	43,191
Germany..........	17,793	21,222	11,058
Great Britain	25,000	29,737	22,184
Russia	26,677	22,854	29,765
Switzerland	7,124	8,819	5,668
Egypt	2,636	5,810	1,956
United States	82,198	95,258	52,577
Brazil	14,495	12,320	8,820
Argentina	90,347	109,194	58,256
Uruguay	9,402	8,190	3,893
Other countries ...	32,976	33,032	17,440
Totals	388,427	488,582	273,101
Total values	$9,370,801	$11,787,041	$6,852,104
Grand totals	513,308	665,754	354,759
Grand total value	$10,861,923	$13,838,693	$7,797,704

Note.—1 quintal=220·46 lb.

PATENTS.

Soap and similar materials; Apparatus for cooling, moulding, cutting, and drying ——. G. S. Baker, London. Eng. Pat. 15,264, July 2, 1907.

The soap leaving the boiler enters a hopper, whence it is delivered on to the surface of a rotating drum, through which circulates a constant or intermittent current of water or other cooling medium. The film of soap, the thickness of which is regulated by means of a gate in the hopper, is removed from the drum by an adjustable scraper, folded upon itself by means of a folder, and delivered to a hopper, at the lower end of which are forcing rollers. These compress the soap and force it through a nozzle of rectangular or other section, whence the bar passes to a cutting table, where it is cut transversely by means of a suitable device. Finally the cakes or tablets are conveyed to the drying chamber by means of two conveying webs, the first of which travels at a slightly greater speed than that carrying the soap to the cutter (so as to separate the cakes). Special claims are made for combinations and modifications of the mechanism for carrying out this process.—C. A. M.

Filter and hydraulic press combined for the separation of cacao butter and similar purposes. M. A. Smith. Fr. Pat. 388,077, March 2, 1908.

See U.S. Pat. 880,588 of 1908; this J., 1908, 324.—T. F. B.

Perfumes, oils, and fats; Extraction of ——. Fr. Pat. 387,889. *See* XX.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(*A.*)—PIGMENTS; PAINTS.

Guignet's green; Colour and composition of ——. L. Wöhler and W. Becker. Z. angew. Chem., 1908, 21, 1600—1606.

Commercial Guignet's green, prepared by igniting a mixture of potassium bichromate and boric acid, and treating the reaction-product with water, contains varying quantities of boron, but Scheurer-Kestner (Dingler's J., 1865, **176**, 386) found that the product could be freed from boron without affecting the colour, by boiling first with dilute sulphuric acid and then with caustic soda. The authors confirm the statement that the presence of boron is without influence on the colour. By using ammonium bichromate or chromic acid in place of potassium bichromate, the first reaction-product (chromium borate) is much more readily hydrolysed on treatment with water, and a pigment [$Cr_4O_3(OH)_6$ or $2Cr_2O_3,3H_2O$] containing only traces of boron is obtained, which has a finer, brighter colour than that prepared by the ordinary method. The difference in colour between the boron-free Guignet's green and the greyish-violet hydrated chromium oxide of the same composition is not due to a difference in the size of the particles, but to a kind of hydrate-isomerism. Specimens of Guignet's green and of the greyish-violet hydrate containing the same percentage of water, lose water at different rates when heated at the same temperature, the former having the higher vapour tension. The colour of the green hydrate is not influenced by the water content when this is above 15·06 per cent. (corresponding to the formula, $2Cr_2O_3,3H_2O$), but becomes darker when the percentage of water falls below the figure mentioned. The grey hydrate can be converted into Guignet's green by heating for some time under water at 250° C., and this conversion is of some technical value, since the preparation of the green hydrate in this way avoids the not inconsiderable loss of boric acid in the ordinary process.—A. S.

Patent.

Paints and other coatings; Process for producing ——. K. Lörincz, Assignor to Lörincz Festekgyár (Topp) Betéti Társaság, Budapest, Austria-Hungary. U.S. Pat. 894,159, July 21, 1908.

See Fr. Pat. 378,363 of 1907; this J., 1907, 1099.—T. F. B.

(*B.*)—RESINS; VARNISHES.

Oil of turpentine; Application of the determination of rotatory dispersion to the study of the composition of ——. E. Darmois. Compt. rend., 1908, **147**, 195—197.

French oil of turpentine is lævo-rotatory and said to contain *l*-pinene; other turpentine oils are as a rule dextro-rotatory but of very variable rotatory power. The rotatory dispersion of a number of these oils has been studied, also of their mixtures. Certain of these have an abnormal dispersion indicating the presence of two optically active constituents of contrary sign and different dispersion. The dextro-rotatory oils of turpentine on fractional distillation are shown to contain dextro-rotatory compounds of high dispersion and lævo-rotatory substances of low dispersive power.—E. F. A.

Oil varnishes; Analysis of ——. P. C. McIlhiney. Oil, Paint, and Drug Reporter, 1908, 16—17.

The union of hard gum and oil to form a varnish, when successfully made and the mixture thinned with turpentine, and stored for a couple of months, cannot be broken up by any solvent acting selectively. The author submits the varnish to the action of caustic potash in alcoholic solution and subsequently acidifies the solution of the potash salts so formed, whereby a quantity of gum, insoluble in light petroleum, is obtained, which approximates closely in amount to the hard gum actually present. The treatment converts the linseed oil into fatty acids which are readily soluble in the petroleum, unless they have been oxidised. 2—10 grms. of the varnish are heated with a large excess of caustic potash dissolved in absolute alcohol, the solvent distilled off, and the residue redissolved in neutral absolute alcohol and titrated with half normal acetic acid likewise dissolved in absolute alcohol, to determine the excess of alkali (Koettstorfer value). Light petroleum and water are added to the alcoholic solution, which separates into two layers. The ethereal layer is transferred to a weighed flask, the solvent distilled off, and the mixture of fatty acids and common rosin weighed. The hard gum separates from the aqueous layer and adheres to the sides of the vessel in which it can be weighed. Glycerin is determined in the aqueous layer. Oxidised fatty acids are precipitated with the hard gum, but may be separated from this when freshly precipitated, by extraction with cold 85 per cent. alcohol and recovered separately by evaporating off the alcohol. An examination of the mineral constituents of varnish is often of value: rosin, when present, being usually combined with lime; the mineral bases may be extracted by shaking the varnish, thinned if necessary, with strong hydrochloric acid. The fatty acids obtained, represent about 92·5 per cent. of the linseed oil. It is often difficult to determine the oil from which these acids are derived.—E. F. A.

(*C.*)—INDIA-RUBBER, &c.

Patents.

Cement [for indiarubber, cloth, wood, etc.] R. Jensen, High Barnet. Eng. Pat. 28, 188, Dec. 21, 1907.

The cement consists of a solution of gutta-percha (4 to 5 oz.) in a mixture of ether (4 oz.) and carbon bisulphide (1 lb.), in approximately the proportions named. (Reference is directed to Eng. Pat. 7313 of 1903; this J., 1904, 329.)—C. A. M.

Rubber; Process for the manufacture of a new synthetic ——. Les Prod. Chim. de Croissy. Fr. Pat. 387,510, Feb. 24, 1908. Under Int. Conv., April 16, 1907.

Plastic materials applicable as rubber substitutes are obtained by the action of dibasic or polybasic acids of the series $C_nH_{2n-2}O_4$, on glycerin or analogous substances in presence of a dehydrating agent. Special claim is made for the product obtained by the action of succinic acid on glycerin.—A. S.

Caoutchouc; Process for regenerating ——. Fabr. Bâloise de Prod. Chimiques. Fr. Pat. 387,652, Feb. 28, 1908. Under Int. Conv., March 4, 1907.

See Eng. Pat. 4714 of 1908; this J., 1908, 633.—T. F. B.

XIV.—TANNING, LEATHER, GLUE, SIZE.

Chamois and formaldehyde tannages. K. Toyomaru. Gerber, 1908, **34**, 177—178.

A short review of the fat and oil tannages is given, and their relation to the formaldehyde tannage is pointed out. Experiments made with the formaldehyde tannage indicate that the strength of the solution in both formaldehyde and sodium carbonate, and the temperature, are the factors which influence the time of the tannage. A short combination tannage with formalin, degras, and water is suggested.—H. G. B.

Leather; Native —— *of West Africa.* Bull. Imp. Inst., 1908, **6**, 175—181.

The leather, consisting of tanned and dyed skins of goats and sheep, is produced in the Sudan, Morocco, Tripoli, and Southern Nigeria. The value of the exports fluctuates considerably, mainly owing to the insecurity of trade routes across the Sahara, and consequent failures of supply. The leather has been recommended as a satisfactory material for bookbinding, as being likely to last longer than East Indian tanned skins. The skins usually come into the market dyed buff, red, yellow, or green. Depilation of the skins is accomplished by wood ashes, after which the hairs are scraped off with a knife. The skins are then tanned by immersion in decoctions of plants, known as "Bonni," "Serri" and "Bagarua," dried, and rubbed with palm oil, etc., when they are ready for dyeing. Samples of "Bagarua" pods analysed in the Institute contained from 26 to 35 per cent. of tannin. They have been identified at Kew as *Acacia arabica*. To produce red leather, the stems of a variety of Sorghum known as "Karrandefti," which has not been identified botanically, are pounded and treated with an aqueous solution of potassium carbonate from wood ashes. The crimson liquid obtained, is rubbed into the skin until the latter acquires the desired tint. The dyewood is identical with a Sudanese dyestuff known as "Sikhtyan," which, according to A. G. Perkin, is a substantive red dyestuff of the same type as camwood, red sandal-wood, and barwood, all of which are supposed to contain the same red colouring principle named "santalin" or "santalic acid." As yellow dyestuff a root known as "Gangammo," probably turmeric, is powdered, mixed with water, and rubbed into the skin. Green leather is produced by a mixture of indigo with the yellow dyestuff, by the use of "Aniline Green" imported from Europe, and by mixing brass filings with a salt called "Sunaderi" (ammonium chloride), to which is added milk mixed with an infusion of tamarind fruit or lime juice. The methods of preparation of these skins vary in details in the different districts. —F. C.

Patents.

Skins; Process for the preparation of —— for the manufacture of leather. E. Leconte père. First addition, dated Feb. 17, 1908, to Fr. Pat. 383,273, Oct. 24, 1907 (this J., 1908, 291).

In addition to the sulphurous acid claimed in the main patent for the preparation of skins for tanning, substances capable of yielding sulphurous acid may be used. For example, sulphite, bisulphite, or hyposulphite of sodium may be used in presence of an acid.—A. S.

Leather board; Manufacture of ——. A. W. Case, Highland Park, Conn., U.S.A. Eng. Pat. 929, Jan. 14, 1908.

See Fr. Pat. 386,420 of 1908; this J., 1908, 696.—T. F. B.

Hides; Treatment of ——. R. Withey, South Bermondsey. U.S. Pat. 894,171, July 21, 1908.

See Eng. Pat. 8514 of 1905; this J., 1906, 130.—T. F. B.

Hides; Process for steeping or fermenting ——. O. Röhm. Fr. Pat. 387,950, March 9, 1908. Under Int. Conv., June 6 and Sept. 9, 1907.

See Eng. Pat. 5377 of 1908; this J., 1908, 581.—T. F. B.

Horn-like substance from casein; Process of producing a ——. P. W. F. G. Betz, Berlin. U.S. Pat. 893,129, July 14, 1908.

See Fr. Pat. 367,407 of 1906; this J., 1906, 1162.—T. F. B.

XV.—MANURES, &c.

Germination and plant growth; Studies on ——. S. U. Pickering. J. Agric. Sci., 1908, 2, 411—434.

Apple trees grown in soil which had been heated, show a much greater development both of wood and leaf than those grown in unheated soil; also the leaves in the former case are richer in nitrogen. Trees in heated soil do not start into growth till long after trees in unheated soil. This delay is attributed to the altered bacterial conditions of the soil. Soil which has been heated without drying, to temperatures from 60° to 150° C. behaves unfavourably towards the germination of seeds. As a rule the total number of seeds germinating decreases, and the time necessary for germination increases with the temperature of heating. The alteration in the soil begins at as low a temperature as 30° C. Sterilised seeds behave in the same way, but require an even longer time for germination. Moreover they do not recover their property of ready germination on being re-inoculated, showing that the seeds have been altered by the sterilising agent. Mercuric chloride was the only sterilising agent found to be satisfactory and efficient. The retarding effect on germination produced by heating, extends progressively at temperatures beyond that sufficient to destroy all bacteria and cannot therefore be explained by an alteration in the bacterial condition of the soil. Moreover, sand does not give similar results even when it has been thoroughly impregnated with soil-bacteria to start with. Re-inoculation of soils previously sterilised by heating, has no effect on the germination. By heating the soil an increase in its soluble constituents occurs, particularly in the soluble organic and nitrogenous matter, in either of which the increase is directly proportional to the increase in the time required for germination. A nitrogenous compound inhibitory towards germination, appears to be formed in the soil: this is sufficiently stable for an extract of heated soil to affect an unheated soil when added to it. It is not of an acid nature. Different soils favour germination to different extents, varying directly with the amount of soluble organic matter in the soil; but on heating these soils their action is reversed, the soil richest in soluble organic matter forming the largest proportion of inhibitory matter and being in consequence least favourable to germination. The inhibitory substance is formed in greatest quantity at about 200° C.; above this it diminishes in amount and disappears entirely at a low red heat. Though inhibitory as regards germination the substance is not necessarily so as regards growth, indeed its presence results in an increase in the soluble nitrogen in the soil, which favours the growth of non-leguminous plants.—E. F. A.

Dicyandiamide bacteria. R. Perotti. Zentralbl. f. Bakter. u. Parasitenk., II. Abt., 1908, 21, 200—231. Chem. Zentr., 1908, 2, 186—187.

Very dilute aqueous solutions of dicyandiamide, *e.g.*, those containing up to 2—2·5 parts per 1000, have no injurious effect on the higher plants, but solutions of 3—4 per cent. strength or over are distinctly poisonous to plants. Different plants possess a specific power of resistance to this injurious action, which further is not so pronounced with lower vegetable organisms, for even in concentrated solutions of dicyandiamide, bacteria are capable of developing to a considerable extent. Calcium cyanamide, even in very dilute solutions, has a much stronger physiological action than dicyandiamide in concentrated solutions.—A. S.

Phosphates of lime; Exports of —— from Christmas Island in 1907. Bd. of Tr. J., Aug. 6, 1908. [T.R.]

The Registrar of Imports and Exports at Singapore reports that the total exports of phosphates of lime from Christmas Island in 1907 amounted to 110,375 tons, as compared with 96,449 tons in 1906. Of the exports in 1907, 54,500 tons were consigned to Japan, 52,600 tons to European ports, and over 3000 tons to Australia.

Superphosphates; Exports of —— from Shimonoseki, Japan, in 1907. Bd. of Tr. J., Aug. 6, 1908. [T.R.]

Superphosphates for fertilisers were exported during 1907 for the first time from Shimonoseki to the value of £23,960. The superphosphates are manufactured out of the phosphate rock (phosphorite) imported from Christmas Island. The works at which the manufacture is carried out are situated at Fuku-ura, on Hikoshima, an island at the western entrance to the Straits of Shimonoseki; £4650 worth of the fertiliser was exported to Australia during the year.

Patent.

Phosphate meal; Process and apparatus for converting —— into superphosphate. F. Krupp A.-G. Grusonwerk. Fr. Pat. 387,739, March 3, 1908. Under Int. Conv., May 5, 1907.

The phosphate meal is fed in a thin stream on to the surface of a rapidly rotating plate, to which also the acid is supplied in the form of fine jets or spray. The mixture is cooled by means of a current of air, and is thrown by the rotating plate into the superphosphate pit, where the conversion becomes completed. The current of air for cooling the mixture may be produced by means of blades disposed on the periphery of the rotating plate. It is stated that the mixture falling into the pit remains in a loose, spongy condition, which favours the completion of the reaction and the subsequent drying operation.—A. S.

XVI.—SUGAR, STARCH, GUM, &c.

Sugar juices; Purification of —— by means of hypochlorites. F. Strohmer. Oesterr.-ung. Zeits. Zucker-Ind. u. Landw., **37**, 199—202. Chem. Zentr., 1908, 2, 269.

The author has investigated a process for the purification of sugar juice by means of hypochlorous acid (Austrian Pat. 30,849). The juice is warmed with a mixture of bleaching powder and milk of lime, and then saturated with sulphur dioxide until neutral or only faintly alkaline to phenolphthalein. The method is applied only to juice from which most of the impurities have previously been removed by the usual process. It is stated to be useful in the preparation of cube sugar. The juice is decolorised and no inversion of sugar takes place.—A. S.

Sugars; Decomposition of the —— I. Action of zinc carbonate on formaldehyde solutions. W. Löb. Biochem. Zeits., 1908, **12**, 78—96.

In a previous paper (this J., 1907, 983) the author put forward a hypothesis of the course of alcoholic fermentation of sugar, to the effect that the sugar molecule suffers a profound cleavage into COH_2 residues, by rupture of the aldol linkages, and that there then follows a synthetic process in which these residues, which may be regarded as labile, tautomeric forms of formaldehyde, reunite with production of alcohol and carbon dioxide. This paper is the first of a series of studies made with a view to trace the close relationships existing between formaldehyde and the sugars, by submitting these bodies to similar treatments, in order to see whether the products which are formed by the breakdown of sugars are also produced synthetically from formaldehyde. By the action of potassium hydroxide on formaldehyde in concentrated solutions, there are produced, besides methyl alcohol and formic acid, polyhydroxy acids, principally erythronic and dihydroxybutyric acids, but no lactic acid, glyceric or glycollic acids. If concentrated formaldehyde solution be boiled for 40 hours with zinc carbonate, volatile products consisting of acetol and methylketol are formed, as well as polyhydroxy acids (erythronic and dihydroxybutyric acids) and sugars (β-acrose), but only minute traces of lactic acid. The primary action of the zinc carbonate is most probably to form sugars, since the sugar isolated from this reaction yields on further treatment, the same products as the formaldehyde. Dextrose also, when boiled with zinc carbonate, yields acetol and methylketol. The acetol is formed without the production of other C_3-bodies and is probably a secondary decomposition product of the erythronic acid, by elimination of water and carbon dioxide. The methylketol is derived in a similar manner from a C_5-saccharinic acid. The cleavage of sugars by zinc carbonate therefore does not go beyond the stage of C_4-residues, whereas the action of alkalis, resulting in the production of lactic acid, resolves them into C_3-residues. Possibly other conditions will be found which will give still further resolution of the aldol bonds with the formation by re-synthesis of quite different products.—J. F. B.

Dextrose solutions; Osmotic pressures of —— at 10° C, H. N. Morse and W. W. Holland. Amer. Chem. J. 1908, **40**, 1—18.

At 10° C., as also at 0° C. and 20° C., the osmotic pressures of dextrose solutions are proportional to their concentrations; the same is true for the freezing point depressions. At 10° C. the osmotic pressure is about 3 per cent. higher than the calculated gas pressure; at 0° C. the excess is about 5 per cent. The closer approximation of the osmotic to the gas pressure at 10° C., as compared with 0° C., is due to the considerably greater increase of the gas pressure between these two temperatures as compared with the increase in osmotic pressure between the same limits. The mean molecular osmotic pressures of dextrose solutions at the temperatures which have been studied are:—at 22°—27° C., 24·01 atmospheres; at 10° C., 23·80 atmospheres; at 0° C., 23·45 atmospheres. The mean ratios of the osmotic pressures to the gas pressures at the same temperatures are: at 22°—27° C., 0·993; at 10° C., 1·031; at 0° C., 1·052.—J. F. B.

Lactose and calcium hydroxide; Products of the interaction of ——. H. Kiliani. Ber., 1908, **41**, 2650—2658.

The product of the reaction of calcium hydroxide on lactose, after the separation of the *iso-* and *meta*-saccharins (Ber., 1908, 158), yields a complicated mixture of residual acids, which the author was unable to study directly owing to their extreme instability. But he has fractionated and oxidised these residual bodies so as to obtain their main oxidation products. The most labile of these substances are oxidised to carbon dioxide and oxalic acid, but the saccharin-like constituents of the mixtures yield di- or tribasic acids which are more accessible than the original bodies. The residual syrup was split up into four fractions by exhaustion with ether and alcohol and mixtures of the two. The first extract, soluble in ether, would contain the lactic acid. The second extract was oxidised with nitric acid of 1·4 sp. gr. at 35° C., the excess of nitric acid was evaporated at a low temperature, and the residue converted into calcium salts. From this fraction there was obtained the acid calcium salt of *αγ-dihydroxypropane-ααγ-tricarboxylic acid*, previously obtained by the oxidation of *iso*-saccharin. A crystalline, basic cupric salt of this acid is characteristic. The free acid is hygroscopic, slightly dextro-rotatory, and readily splits off carbon-dioxide in concentrated aqueous solution, with production of two dihydroxyglutaric acids. The author has proved that this acid could not, in this case, have been derived from any *iso*-saccharin left in the original fraction; hence its mother substance is probably a new saccharinic acid, $(CH_2OH)_2{\cdot}C(OH){\cdot}CH_2{\cdot}CH(OH){\cdot}COOH$. From another portion of the same fraction, a quantity of *l*-tartaric acid was isolated, the mother substance of which was probably a trihydroxybutyric (erythronic) acid. The third extract after elimination of the *para*-saccharin yielded on oxidation smaller quantities of the same two acids which were isolated from the second. The fourth extract had to be oxidised with a more dilute nitric acid (sp. gr. 1·2). The main product from this was a new acid which is not identical with any of those hitherto known. It was separated by means of its sparingly soluble zinc salt. This acid, which has the formula, $C_6H_{10}O_7$, crystallises readily, melts at 159°—160° C., and is dibasic with no tendency to lactone formation. The acid is slightly dextro-rotatory and the author has prepared and characterised its zinc, calcium, and cadmium salts. It is proved to be different from *para*-saccharonic acid and from the trihydroxyadipic acid obtained by the oxidation of *meta*-saccharin.—J. F. B.

Sucrose; Formation of —— from starch flour. H. C. Prinsen-Geerligs. Archief voor de Java-Suikerind., 1908, [5], 267—277. Chem. Zentr., 1908, 2, 257.

The author investigated the formation of sugar from starch in two tropical fruits, the "Mango plum" and "Pisang." When the mature fruits are plucked from the tree, they contain considerable quantities of starch, and little sugar, but during the ripening of the plucked fruits, the starch is for the most part converted into sugar. Sucrose is first formed, changing later into dextrose and lævulose, which, especially the latter, are then slowly oxidised. It is possible to extract a diastatic ferment from the fruits, but this has a relatively weak action, and produces dextrose exclusively from starch. Since, also, the conversion of the starch, present in the fruits, into sugar does not take place when they are kept in an atmosphere of nitrogen, it is concluded that the conversion is a vital process of the fruit.—A.S.

Perséulose: a new crystalline sugar containing seven carbon atoms. G. Bertrand. Compt. rend., 1908, **147**, 201—203.

On oxidising perseitol by means of sorbose bacteria, a new ketonic sugar, *perséulose*, is obtained: it is necessary to make use of a very vigorous culture of the bacterium. After 3 weeks' action the unattacked material is removed, and the liquors concentrated, the new sugar extracted with alcohol, and the alcoholic solution evaporated to a syrup. Perséulose, $C_7H_{14}O_7$, crystallises somewhat like dextrose; it is slightly sweet and melts at 110—115° C. on the Maquenne block. It shows mutarotation, a 10 per cent. solution changing from $[\alpha]_D = -90°$ to $= -81°$. The cupric-reducing power is less than that of dextrose but more than that of sorbose. It forms a crystalline phenylosazone, melting at 233° C. on the Maquenne block, which is characterised by being very sparingly soluble in methyl and ethyl alcohols. This is the first reducing sugar which has been isolated, containing seven atoms of carbon produced by the action of the living cell.—E. F. A.

American honeys; Chemical analysis and composition of ——. C. A. Browne. *Honey pollen; A microscopical study of* ——. W. J. Young. U.S. Dept. of Agriculture. Bureau of Chemistry. Bulletin No. 110, March 14, 1908. Washington Govt. Printing Office, 1908. *The Sugar Convention. Revocation of Prohibition Orders.* Board of Trade, Aug. 7th, 1908.

The "London Gazette" of Aug. 6th contains an Order in Council, revoking, as from the 1st day of September next, the two Orders in Council, dated 11th August, 1903, and the 27th March, 1905, by which the importation into the United Kingdom of sugar from Denmark, Russia, the Argentine Republic, and Spain was prohibited.

As a consequence of the issue of this Order in Council it will be possible after the 1st September next, to import sugar freely into the United Kingdom from any country.

Importers of sugar intended to be subsequently exported from the United Kingdom (whether in a raw or refined condition) to any of the States parties to the Sugar Convention, should continue to obtain "Certificates of Origin" in respect of all such imported sugar, in order to enable the Customs authorities to issue the necessary certificates on exportation to entitle such sugar to obtain the benefit of the Minimum Customs duties on importation into the territory of any of the Contracting States. No such certificates will be required on the exportation of sugared products.

Patents.

Molasses free from potassium salts; Manufacture of —— *and their industrial application.* L. Rivière. Second Addition, dated May 11, 1907, to Fr. Pat. 385,139, Feb. 28, 1907 (this J., 1908, 584, 702).

The construction of the vessels employed in making the hydrofluosilicic acid used in the process is modified so as to facilitate the interchanging of the hoods of the vessels. A description is also given of a process for utilising the molasses after the removal of the potassium salts. The saccharine liquid is treated in an autoclave with chalk, and the ammonia liberated is collected in separate vessels. The liquid is then carbonated, and boiled to remove the excess of carbon dioxide and to precipitate the calcium carbonate, etc. The boiling also effects the inversion of the sugar, the further addition of acid being unnecessary. The resulting solution has a slightly alkaline reaction, due to the presence of a small quantity of sodium carbonate. This alkaline solution is then allowed to ferment and the alcohol produced is recovered in the usual manner.—W. P. S.

Soluble starch; Process for the production of ——, *and removal of starch from textile materials.* F. Fritsche, Rumburg, Austria. Eng. Pat. 1351, Jan. 20, 1908.

100 kilos. of dry starch are mixed with 1 kilo. of sodium perborate, and the mixture is boiled with water. The borax resulting from the reaction may be allowed to remain in the starch solution. An alternative process consists in heating the starch together with a perborate solution to a temperature of about 40° C. The starch is then filtered, washed, and dried. In some cases, commercial starch contains sufficient moisture to effect solution, if the said starch be mixed with a perborate and heated to a temperature of about 100° C. For the removal of starch from textile materials, the fabric is immersed in a solution containing from 1 to 2 per cent. of a perborate. The solution is next heated to boiling for from 30 minutes to 1 hour, and the fabric is then washed.—W. P. S.

Potato, rice, maize, and other starches; Process for increasing the adhesive properties of —— *by the addition of dextrins [obtained from wheat flour].* L. A. Morel. Fr. Pat. 387,897, May 16, 1907.

A solution containing gums and dextrins is obtained by washing wheat flour with water. This solution is concentrated and mixed with potato-, rice-, or maize-starch, and the mixture is then dried so as to form a powder. The admixture increases the adhesive properties of the starches and renders them suitable for use in dressing fabrics, etc.—W. P. S.

XVII.—BREWING, WINES, SPIRITS, &c.

Malt; Colouring substances of —— *and some kindred matters.* C. G. Matthews and F. E. Lott. J. Inst. Brewing, 1908, **14**, 434—453.

The colour and flavour of malt have been attributed to the caramelisation of the sugars and starch of the malt, but these alone do not produce any appreciable amount of colour when dried under ordinary malt-drying conditions. Both colour and flavour of a cold water malt extract increase with the temperature at which the sample is dried. The unfermentable residues in the cold water extracts of both barley and malt consist partly of nitrogenous bodies and partly of sugars which are slightly lævo-rotatory and have a slight reducing action. These residues are readily coloured by heat. The nitrogenous constituents of malt are the principal colouring bodies. The husk produces little colour, and the colour is mainly in the germ but partly in the aleurone layer. The thicker the husk the greater the heat necessary to produce colour in malt. The amount of colour produced in a malt at any given temperature varies with the amount of moisture present, consequently the colour of a malt is dependent upon the rate of curing as well as upon the temperature at which it is cured. The colour of cold-water malt extracts from pale-cured malts increases appreciably on standing for 24 hours. The authors attribute this to molecular changes rather than to simple oxidation. The flavour of malt is largely due to the same nitrogenous compounds which produce the colour; a pleasant flavour is also derived from the endosperm when the malt is properly cured. Unpleasant flavours are usually due to the acrospire when over-grown or burnt in curing; bitterness is not an uncommon accompaniment. Malt extracts made in bright copper vessels are more highly coloured than those made in glass; and are coloured still more deeply when made in oxidised copper vessels. Similarly boiling wort in copper gives more colour, doubtless owing to a partial caramelisation produced by the higher temperature of the better conductor. Acid in malt wort acts as a restraining influence on the production of colour by caramelisation; neutrality has less influence, but even the slightest trace of alkali has a very pronounced effect in favouring colour production.—E. F. A.

Alcohol yeasts; Phenomenon of flocculation or agglutination with ——. Beijerinck. Centralbl. Bakt., 1908, **20**, 642—650. Z. Spiritusind., 1908, **31**, 318—319.

A leading distinction between bottom-fermentation and top-fermentation yeasts lies in the fact that the former possess sticky slimy cell walls and therefore agglutinate together, whereas the top-fermentation yeasts, which do not have sticky cell walls, remain separated. Beijerinck terms the flocculent forms auto-agglutinating yeasts. Some top-fermentation yeasts show this flocculence, similarly some bottom-fermentation yeasts (wine yeasts) exist in dust-like forms. Two of the yeasts present in ordinary bakers' yeast are auto-agglutinating yeasts, *viz.*, the maltose yeast, *S. curvatus*, and a sucrose yeast, *S. muciparus*. The former often forms somewhat curved cells; it is more resistant than the culture yeast and the proportion present in baker's yeast may be increased by letting this begin to autolyse or by cultivation at high temperatures or in presence of chloroform. *S. muciparus* does not ferment maltose and forms large round or elliptical cells, also sometimes long bacteria-like cells. It resembles closely *S. fragans* which has been shown to resist the acidifying temperature in the acid mash. In addition to the autoagglutinating yeasts, other yeasts are rendered flocculent by bacteria. Henneberg has entitled these flocculent lactic acid bacteria. Three species are now described: *Lactococcus agglutinans* is best grown and its proportion increased in wort at 30° C. which has been freed from air by boiling. To preserve its agglutinating properties it must be grown and preserved together with yeast. *Lactobacillus conglomeratus* forms a characteristic mass on wort agar. It grows in rods in wort cultivations and smells disagreeably sour. *Lactobacillus densus* occurs in dead pressed yeast. It forms colonies of a characteristic non-slimy nature, and is probably identical with *Bac. Listeri.*
—E. F. A.

Enzymes; Adsorption analysis of ——. L. Michaelis. Biochem. Zeits., 1908, **12**, 26—27. (*See* this J., 1908, 701.)

In carrying out investigations of the nature of enzymes previously described, it is important to work with dilute solutions. It is well known that the adsorption-coefficient decreases with increased concentration, and when only crude methods are available for the study of the results, it is possible that a considerable adsorption, which is not quite complete, may occur without being detected. The author records an error which has thus arisen in the original work in the case of pepsin. It is stated *loc. cit.* that pepsin is not adsorbed by kaolin, but as a matter of fact, if sufficiently dilute solutions of pepsin be employed (0·125 per cent. of Merck's preparation), there is no difficulty in obtaining complete adsorption of the pepsin by kaolin. The reaction of the medium, so far as it can be modified without injury to the enzyme, has no influence on the adsorption. Thus, pepsin, like all the other enzymes of animal origin which have so far been examined, is amphoteric so far as its electro-chemical adsorption affinities are concerned.—J. F. B.

Alcoholic fermentation; Part played by reductase in the process of ——. W. Palladin. Z. physiol. Chem., 1908, **56**, 81—88.

Sodium selenite in aqueous solution is reduced by the reductase of ordinary zymase, prepared by Buchner's acetone method, and red selenium is precipitated. The fact that no such reduction takes place if the solution be first boiled, proves the enzymatic nature of reductase. The reduction of sodium selenite to red selenium in aqueous solution by reductase is greatly retarded by the addition of dextrose, which, when present in quantity, totally prevents the reduction. In the author's opinion the reductase ceases to attack the selenite whilst taking part in the conversion of the dextrose into alcohol and carbon dioxide. Non-fermentable substances such as glycerin, lactose, and mannitol do not in any way influence the reduction of the sodium selenite. Galactose and sucrose, however, have a similar but weaker retarding influence as dextrose, galactose being the least effective. In other experiments, in which the decolorisation of "methylene blue" by reductase in the absence of air was used as a test, similar results were obtained, dextrose again retarding reduction.—E. F. A.

Mannose and lævulose; Fermentation of —— by yeast-juice. (*Prelim. note.*) A. Harden and W. J. Young. Chem. Soc. Proc., 1908, **24**, 115—116.

1. Mannose is fermented by yeast-juice at almost the same rate as dextrose. 2. Lævulose is fermented somewhat more rapidly than dextrose, the rate varying with different samples of yeast-juice from 1·2 to 1·8, compared with that of dextrose = 1. 3. Mannose and lævulose behave qualitatively towards phosphates in the presence of yeast-juice in a similar manner to dextrose. (*a*) When a phosphate is added to a fermenting mixture containing either of these sugars, the phosphate is converted into a hexosephosphate not precipitable by magnesia mixture; the rate of fermentation is temporarily greatly accelerated, and during this period an extra amount of carbon dioxide is evolved, equivalent to the phosphate added: the rate then rapidly diminishes, and falls to a value equal to, or slightly greater than that which it had before the addition of the phosphate. The fermentation of mannose and lævulose by yeast-juice therefore probably proceeds according to the same two equations as have been previously proposed by the authors for dextrose:

$$(1)\quad 2C_6H_{12}O_6 + 2R_2'HPO_4 = 2CO_2 + 2C_2H_6O + C_6H_{10}O_4(PO_4R_2')_2 + 2H_2O.$$

$$(2)\quad C_6H_{10}O_4(PO_4R_2')_2 + 2H_2O = C_6H_{12}O_6 + 2R_2'HPO_4.$$

(*b*) As in the case of dextrose, an optimum concentration of phosphate exists, which produces a maximum rate of fermentation. Increase of concentration beyond this maximum, diminishes the rate of fermentation produced, until, with a sufficiently great concentration of phosphate, the rate is less than that of the juice in the absence of added phosphate. 4. The quantitative relations of mannose to phosphates are practically the same as those of dextrose. The maximum rate produced by lævulose, on the other hand, is much greater than (about double) that produced by dextrose or mannose. The accelerated fermentation of lævulose in presence of phosphate, moreover, is much less readily inhibited than that of dextrose or mannose by the further addition of phosphate, the difference in this respect being very marked. 5. Lævulose possesses the property of inducing rapid fermentation in a mixture of dextrose or mannose with yeast-juice, in which fermentation has been inhibited by a large excess of phosphate, and in which the concentration of free phosphate is maintained constant throughout the experiment. Dextrose and mannose do not possess this power. The amount of lævulose required to produce this effect is comparatively small. Thus, for a mixture of 15 c.c. of yeast-juice with 15 c.c. of a 0·6 molar solution of potassium phosphate and 2 grms. of dextrose fermenting at the rate of 0·7 c.c. per five minutes, the addition of 0·05 grm. of lævulose was found to be sufficient, the maximum rate produced being 17 c.c. per five minutes. The effect is not due to the preferential fermentation of the lævulose, as the amount of gas evolved far exceeds that which could be derived from this source.

Malic acid; The part played by the fermentation of —— in the manufacture of wine. A. Rosenstiehl. Compt. rend., 908, **147**, 150—153.

It has been shown that in wine, malic acid is converted gradually into carbonic and lactic acids by a *Micrococcus malolacticus* (Seiffert, this J., 1903, 1009). The author has carried out experiments on wines prepared from sterile musts with pure yeasts, and finds that the malic acid remains unchanged and no lactic acid is formed until the wines become contaminated with micro-organisms in the course of the ordinary cellar operations, when the malic acid fermentation sets in, the acidity decreases, and the flavour alters. It is from this gradual fermentation of malic acid that wine obtains the carbonic acid necessary to protect it from premature decay. The proportion of malic acid present would thus appear to be an important factor in the future history of a wine, and in this respect the Rhenish wines are specially favoured, as A. Koch has shown that in some cases they lose 8 per 1000 of acidity corresponding to 16 per 1000 of malic acid, whereas the southern French wines only lose up to 1·5 per 1000, foreshadowing a more rapid ageing. Excessive infection of the wine is guarded against by scrupulous attention to cleanliness, and a too rapid fermentation is checked by a judicious use of sulphurous acid.—R. L. S.

Wines ; Determination of the fixed and volatile acids in ——. E. Pozzi-Escot. Compt. rend., 1908, **147**, 245—247.

The author proposes the following method for the determination of the fixed and volatile acids of wines, according to which the barium salts of the fixed acids are incinerated and the alkalinity of the carbonate titrated:—Two portions of 100 c.c. each of the wine are taken, and one of them is evaporated in a porcelain capsule to a volume of 3—4 c.c. The residue is treated with excess of alcohol, filtered, and the filter is incinerated in a muffle in a porcelain capsule. The insoluble salts of the wine are thus determined, and their alkalinity is titrated with standard nitric acid in presence of methyl orange. The second portion of 100 c.c. is evaporated to 3—4 c.c. in a similar manner, and after neutralisation with baryta water, 100 c.c. of 96 per cent. alcohol containing 2 per cent. of barium bromide are added. The fixed acids are thus precipitated in the form of their barium salts, all of which are insoluble in alcohol with the exception of the lactate. The barium salts of the volatile acids remain in solution, and the precipitate is filtered off and washed with strong alcohol. The precipitate and filter are incinerated and the alkalinity of the ash is determined. The difference between the two titrations, expressed as sulphuric acid, gives the acidity of the fixed acids. The total acidity of the wine being determined by direct titration of 100 c.c. in presence of phenolphthalein, the volatile acidity is obtained by difference. The results are not correct if lactic acid be present, because the latter divides itself between the two fractions, but the presence of lactic acid in wines is very rare. The method of course only applies to the organic acids, but it includes all substances of an acid function such as the tannins.
—J. F. B.

Wine ; Physico-chemical analysis of ——. P. Dutoit and M. Duboux. Compt. rend., 1908, **147**, 134—136.

By adding a solution of barium hydroxide, in small portions, to wine, and determining the electrical conductivity after each addition, it is possible to estimate consecutively the sulphates, total acidity, and tannin substances. The addition of barium hydroxide leads first to a rapid fall in conductivity, corresponding to the precipitation of the sulphates ; continued addition leads to a maximum conductivity corresponding to complete neutralisation, unaccompanied by precipitation of the acids present. On subsequent further addition of barium hydroxide, the conductivity falls rapidly, and a flocculent precipitate of colloidal substances containing much barium is produced ; a second rise marks the completion of this phase of the process. Continued addition of barium hydroxide beyond this point leads to a regular rise in conductivity proportional to the amount added. This method gives good results against direct determinations of sulphates and acidity. The soluble colloids have hitherto not been properly estimated, the chemical methods employed only showing a part of the substances present. From analyses of white and red wines by this method, the authors conclude that the proportion of tannin present varies from 2·5 to 6·0 grms. per litre, whereas the usual methods of analysis show less than 0·5 grm. per litre in white wine.—R. L. S.

Fermented liquids ; Distillation of —— in vacuo. C. Girard, Truchon, and Laroche. Monit. Scient., 1908, 22, 497—503.

The fermented liquid, wine, beer, cider, etc., is distilled *in vacuo* at 10—40° C., the distillate being condensed at 0°—20° C. (see this J., 1907, 886). Spirit thus distilled contains less secondary products than that distilled in the ordinary way and is free from substances, such as furfural, produced by the action of heat ; the natural flavour of the original liquid is thus preserved unimpaired. As vacuum distillation gives a product perfectly bright and of constant composition without necessitating the separation of foreshots and feints, the yield is better than that obtained by the use of fire heat. The product from any given source is of constant composition, whereas the amount of secondary products present in alcohol distilled in the ordinary way is a function of the temperature, method of working, and the quantity of foreshots, etc., removed. The distillation *in vacuo* is more rapid, the authors, with a still containing 250 litres, being able in one hour to obtain at 90—98° strength the alcohol contained in 1 hectolitre of wine or other fermented liquid.
—R. L. S.

Spirit ; Researches on the refining of ——. A. Bogajawlenskij and V. Humnicki. Z. angew. Chem., 1908, 21, 1639—1646.

The authors have studied the influence of filtration through charcoal on the constituents of crude alcohol. The higher alcohols, esters, and furfural are removed by the filtration. Unless the quantity of aldehydes present is very large it is increased by filtration. The alkali salts present in the charcoal neutralise the acidity of the alcohol, any excess of acid remaining in the filtrate. The amounts of higher alcohols, aldehydes, and esters present in a rectified spirit are uninfluenced by the previous filtration of the crude spirit. The authors conclude that the refining of crude spirit by filtration through charcoal does not produce the benefit ascribed to it and that rectified spirit obtained with one of the best modern stills from an unfiltered crude spirit is, if anything, better than that similarly obtained from it after filtration.—R. L. S.

Essences ; Determination of —— in liqueurs. L. Vandam. Bull. Soc. Chim. Belg., 1908, 22, 295—298.

From 100 c.c. of the liqueur 70 c.c. are distilled. The alcohol in the distillate is determined by the hydrometer, and the distillate is then made up with absolute alcohol and water to 100 c.c. of 50 per cent. alcohol. A number of test solutions of the various essences in 50 per cent. alcohol are made, containing 0·5, 1·0, 1·5, 2·0, etc., grms. per litre. The amounts of water required to just produce a permanent turbidity in 25 c.c. of each of these are determined, and 25 c.c. of the distillate from the liqueur to be examined are compared with them in this respect. For ordinary anisettes, essence of green aniseed ; Bordeaux anisettes, equal parts of green aniseed and star anise ; carraway, 9 parts of oil of carraway and 1 of cumin ; curaçoas, equal parts of Portugal orange and curaçoa bigarade ; crêmes de menthe, mint—are the essences used.—J. T. D.

Sugars ; Decomposition of the ——. I. Action of zinc carbonate on formaldehyde solutions. W. Löb. *See* XVI.

Patents.

Wines, fermented liquors, spirits, petroleum, etc. ; Apparatus for the distillation or rectification of ——. R. Vallat. Fr. Pat. 387,558, Feb. 25, 1908.

The invention relates to plate columns of apparatus for distillation or rectification. The liquid under treatment flows down from plate to plate and acts as cooling medium. Above each plate or above the usual hoods on each plate is a large dome, at the apex of which is a depression into which the liquid flows and from which it overflows over the whole surface of the dome, thereby cooling and condensing the ascending vapours in contact with the under side of the latter. The condensed liquid collects in a gutter fixed to the lower inner edge of the dome, and thence flows away through an outlet pipe. A portion of the liquid collecting on the plate may be led away through a valved pipe to a cooler, and then again returned to the outer surface of the next lower dome. The domes may be provided with depending toothed rims and may be used in conjunction with the usual small hoods on the plates, or may replace these hoods.—A. S.

Grape marcs; New process for the distillation of ——. J. B. M. Malpas. Fr. Pat. 387,946, March 9, 1908.

The claim is for a process of direct distillation of grape marcs *in vacuo* at a low temperature, with the object of obtaining spirit free from empyreumatic flavour.—A. S.

Non-alcoholic beverages. C. and H. Jung, Lorch-on-Rhine, Germany. Eng. Pat. 7732, April 7, 1908.

See Ger. Pat. 193,879; this J., 1908, 464.—A. S.

Beverage free from alcohol, and having the aroma and flavour of wine; Process for preparing from wine a ——. C. Jung. Fr. Pat. 388,004, March 10, 1908.

See Ger. Pat. 193,879; this J., 1908, 464.—T. F. B.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

(*A.*)—FOODS.

Maize; Chemical changes taking place during the ensilage of ——. E. J. Russell. J. Agric. Sci., 1908, 2, 392—410.

During the ensilage of green maize there is practically no change in the fibre; all the sugar and some of the less resistant celluloses disappear together with about one-half of the "protein" nitrogen compounds. The non-protein nitrogen compounds become practically double in amount and a number of acids appear. The compounds mainly found in maize silage are fatty acids, hydroxy-acids, amino-acids, basic diamino-acids, and purine and other bases. Three agents are involved in making silage, viz., the living maize cell, enzymes, and micro-organisms. The two former bring about the primary and essential changes, the latter only secondary changes. The formation of acetic and butyric acids appears to be a respiratory effect when the living cell is deprived of oxygen. Sugar disappears during the process. Protein and nucleo-protein are decomposed by enzymes present when the maize is cut, and which continue acting even when the cell is dead. Characteristic products of protein hydrolysis were identified in the silage. Bacteria attack the less resistant celluloses, and the products of hydrolysis, etc. The typical products of their activity—formic acid, higher fatty acids, humus, and amines were identified. At the surface layer air gets in and growth of mould takes place: here no acids are formed, the mass is alkaline, and the non-protein is converted into protein.—E. F. A.

Pepsin; Components of ——. Constitution of the nucleo-proteins. L. Hugounenq and A. Morel. Compt. rend., 1908, **147**, 212—214.

On hydrolysis of crude pepsin with sulphuric, hydrochloric, or hydrofluoric acid, the following results were obtained. The figures are calculated on the ash-free, dry substance and expressed as percentages: Tyrosine, 1·7; alanine, 3·2; valine, 7·5; leucine, 11·4; phenylalanine, 2·2; *pseudo*-histidine, 0·4; lysine, 6·5; *pseudo*-lysine, 0·5; arginine, 2·0: adenine, 0·5; xanthine, less than 0·01; guanine, 0·2; glucosamine, 1·4. It would appear that pepsin extract contains a certain amount of free amino-acids, formed possibly by autodigestion, as immediate analysis before hydrolysis yielded 0·45 of tyrosine and 0·8 of a mixture of leucine and valine. The proportion of monoamino to diamino acids is greater than in the case of the protamines or histones. Histidine was not found, but a new substance, $C_4H_8O_2N_2$, was detected and provisionally termed *pseudo-histidine.* Evidence was obtained of the presence of a dipeptide composed of lysine and glutamic acid. Pyrimidine compounds were not found.—E. F. A.

Patents.

Flour; [Method of] bleaching ——. Sir W. Ramsay, London. Eng. Pat. 15,340, July 3, 1907.

The flour is subjected in a rotating chamber to the action of nitrosyl chloride diluted previously with air or an inert gas. The nitrosyl chloride may be kept in a liquid form in steel bottles; these bottles are provided with valves so that a regulated amount of nitrosyl chloride may be mixed with the air which is then allowed to act on the flour.—W. P. S.

Butter manufacture. E. V. Schou, London. Eng. Pat. 5810, Mar. 16, 1908.

Cream, containing from 75 to 85 per cent. of butter fat, is passed between rollers, cooled internally to a temperature of —10° C., and situated about 1 mm. apart. The films of chilled cream are removed from the rollers by means of scrapers, and the flakes thus obtained are worked between fluted rollers placed about $\frac{1}{8}$ in. apart. The resulting mass of butter may be further worked to remove excess of water.—W. P. S.

Butter; Process and apparatus for the continuous production of ——. A. H. Borgström. Fr. Pat. 387,653, Feb. 28, 1908.

The cream, from which the butter is to be made, is delivered in regulated quantity on to the surface of a plate fixed to the central shaft of a centrifugal drum. The plate is roughened on its upper surface and is inclined upwards from the shaft to the outer casing of the drum; a number of these plates may be fitted on the shaft and separated by stationary plates. The supply of cream is so regulated that a thin film is delivered on to the plates, which are rotated at a high speed. The friction produced by the roughened surface causes the churning of the cream, and the butter and butter-milk are collected in an annular channel placed at the bottom of the drum, whence they are discharged through an opening.—W. P. S.

Fermentation [of solid and liquid foods]; Process for preventing ——. G. P. Harding. Fr. Pat. 387,753, May 13, 1907.

The articles to be preserved, or prevented from fermenting, are placed in receptacles provided with an inlet and an outlet. Carbon dioxide is forced into the receptacles at a pressure of from 3 to 4 kilos. per sq. cm. The orifices of the receptacles are provided with taps, or similar devices, so that when all the air has been expelled and replaced by carbon dioxide, the receptacle may be closed and the pressure maintained. The process is applicable to such articles as meats, worts, fruits, etc.—W. P. S.

Milk for infants; Process of preparing —— from cow's milk. H. Timpe. Fr. Pat. 387,850, Mar. 5, 1908. Under Int. Conv., Mar. 7, 1907.

Cow's milk is mixed, at a temperature of from 25° to 30° C., with a concentrated solution of sodium pyrophosphate; the quantity of the latter employed is such that each litre of the milk receives the addition of from 2·5 to 3 grms. of the dry salt. After the milk has curdled, it is heated to a temperature of from 60° to 70° C., and the precipitate which has formed is separated by filtration. The filtrate constitutes a readily digestible food for infants.—W. P. S.

Casein ; Manufacture of ——. F. H. Fouché. Fr. Pat. 387,948, March 9, 1908.

Casein is separated from milk by heating the latter in a lens-shaped chamber by means of high-pressure steam. The separated casein is compressed, then transferred to a mill, where it is first forced through a grating which divides it into large pieces, then passed between two revolving cylinders, and next forced through a second grating which divides it into small pieces. It then falls into a hopper, and is forced through a third grating, on to a conveyor which carries it to the drying apparatus. —A. S.

Acid-albuminate from albumen and albuminous substances of all kinds ; Method of producing ——. E. Nussbaum, Vienna. Eng. Pat. 15,700, July 8, 1907.

See Fr. Pat. 379,689 of 1907 ; this J., 1907, 1251.—T. F. B.

(*B.*)—SANITATION ; WATER PURIFICATION,

Typhoid bacillus ; Vitality of the ——, *in artificially infected samples of raw Thames, Lee, and New River water, with special reference to the question of storage.* A. C. Houston. Report to Met. Water Board, 1908, 1—32.

The results are given of eighteen series of experiments on the diminution in the number of typhoid bacilli in artificially infected waters on keeping the latter ; the experiments were carried out on samples of Thames, Lee, and New River waters. It is seen from the report that, after being kept for 8 weeks, the waters in sixteen out of the eighteen experiments yielded negative results, and, that after 9 weeks, the whole of the waters gave negative results when tested for typhoid bacilli. Although a few typhoid bacilli may be alive eight weeks after the infection of the water, no serious objection should be taken to limiting the storage of water to four weeks. The advantages accruing from even a few days' storage may be so material that, with the exception of a few cases, the use of raw unstored river water for filtration purposes should be strongly deprecated. Stored water should not be passed through the filters at specially rapid rates in the absence of convincing experimental proof of the reliability of the new process. It is also pointed out that the advantages accruing from adequate storage of water are of a general character and are not limited to the elimination of danger from typhoid fever. A review is given in the Report of the work on this subject which has been done in America by Jordan, Russell, and Zeit (J. Infect. Diseases, 1904, 1, 641). From the experiments recorded, it appears that, under conditions that probably closely simulated those in nature, the vast majority of typhoid bacilli introduced into the several waters perished within three or four days. Whilst it is possible that specially resistant cells may occur which are able to withstand hostile influences for a longer time, the experiments show that these cells must be very few in number. It is not claimed, however, that the behaviour of typhoid bacilli under the conditions described is representative of all conditions obtaining in all natural bodies of water. With regard to these statements, the author thinks that resistant cells almost certainly occur and that they may possibly be more numerous in typhoid excreta than in artificial cultures.—W. P. S.

(*C.*)—DISINFECTANTS.

Patent.

Microbicide agents ; Manufacture of ——. F. W. Howorth, London. From E. Lutz et Cie., Vienna. Eng. Pat. 4535, Feb. 28, 1908.

See Fr. Pat. 387,603 of 1908 ; this J., 1908, 827.—T. F. B.

XIX.—PAPER, PASTEBOARD, &c.

Patents.

Plastic material [celluloid substitute] for the manufacture of combs and moulded objects of all kinds. L. Desvaux and H. Allaire. Fr. Pat. 388,097, March 11, 1908.

The claim is for a plastic material prepared from nitrocellulose, camphor or other suitable substance capable of replacing it in the manufacture of celluloid, and the protein substance "maisin" (see this J., 1902, 1464, 1548 ; 1903, 816, 960 ; 1905, 853) extracted from maize by means of a higher alcohol, such as amyl alcohol.—A. S.

Celluloid substitutes ; Preparation of ——. S. Assadas. Fr. Pat. 387,537, May 8, 1907.

Two of a series of covered, stoneware pots are charged with pure paper cellulose contained in a "basket" of acid-resisting material. A charge of mixed nitric and sulphuric acid is then run into one pot, and nitration proceeds, with exclusion of light and air, at the temperature of a water-bath in which the pots are immersed. This pot is then raised by a pulley and connected by means of a pipe with a funnel in the lid of the other ; the spent acid is tapped off into the second pot, into which a fresh charge of acid is run through the funnel. The two pots are then disconnected. The nitrated cellulose is emptied from the first pot into cold water, a fresh charge of cellulose put in, and the nitrating operation repeated, the position of the pots being reversed. The nitrocellulose is washed, dried, and mixed under pressure in a steam, or water-jacketed autoclave, by using appropriate solvents in desired proportions with either : (*a*) hypophosphorous acid alone or combined with baryta, and the sulphide, sulphite, sulphhydrate, or thiocyanate of aluminium, potassium, etc. ; or (*b*), phosphoric acid with a small quantity of ammonium or barium carbonate, aluminium thiocyanate, and castor oil. To either of these, resin, instead of camphor may be added. Suitable proportions of the above are given. If resin be added it is desirable to use a little more castor oil, or other fatty body, or a liquid hydrocarbon. The colourless pasty material so obtained may be worked up into the forms of threads, etc., by means of a suitable press.—J. W. G.

Celluloid uninflammable and incombustible ; Process for rendering ——. P. Marino, London. U.S. Pat. 893,634, July 21, 1908.

See Fr. Pat. 376,399 of 1907 ; this J., 1907, 989.—T. F. B.

Celluloid ; Manufacture of non-inflammable ——. L. L. Béthisy, Villeneuve-la-Garenne, France. U.S. Pat. 894,108, July 21, 1908.

See Fr. Pat. 368,004 of 1906 ; this J., 1906, 1231.—T. F. B.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, & EXTRACTS.

Chinese corydalis tubers ; Alkaloids of ——. K. Makoshi. Arch. Pharm., 1908, 246, 381—400.

The tubers examined by the author were obtained from the Chinese *Corydalis ambigua*. The powdered tubers were extracted with 96 per cent. alcohol, and the following alkaloids were separated :—corydaline, $C_{22}H_{27}NO_4$; dehydrocorydaline, resembling berberine, but identical with the artificial product obtained from corydaline, and giving inactive corydaline on reduction ; an alkaloid forming a red crystalline hydrochloride, $C_{20}H_{18}NO_4Cl$, and giving a whitish flocculent precipitate with sodium hydroxide, and an aurichloride decomposing at 280° C.; a second alkaloid, soluble in ether, and crystallising in greyish-white compact needles, m.pt. 197°—199° C.; corybulbine; and protopine.—F. SHDN.

Hydrastine; Determination of ——. W. A. Puckner. Pharm. Rev., 1908, **26**, 132—137. Chem. Zentr., 1908, **2**, 266—267.

FOR the determination of hydrastine in the fluid extract and in *Rhiz. Hydrastis* respectively, the author recommends the following methods in preference to those prescribed in the U.S. Pharmacopœia. Five c.c. of the fluid extract are well shaken with 5 c.c. of a 20 per cent. solution of potassium iodide and 25 c.c. of water, filtered, and the precipitate washed twice by stirring with 5 c.c. of a mixture of 19 c.c. of water and 1 c.c. of the potassium iodide solution, the liquid being passed through the filter, and then twice with the same medium on the filter. The filtrate and washings are extracted three times in succession with 20 c.c. of ether and once with 5 c.c. of ether, and the ether solution is filtered through cotton wool, evaporated, and the residue dried at 95—98° C. In the case of *Rhiz. Hydrastis*, 5 grms. of the powdered drug are treated with 50 c.c. of ether, and after 10 mins., 2 c.c. of ammonia solution are added, and the mixture allowed to stand for ½ hour, with frequent agitation. It is then filtered, and the residue extracted with a second 50 c.c. of ether. The combined ethereal extracts are shaken in succession with: (1), 2 c.c. of dilute hydrochloric acid and 18 c.c. of water; (2), 5 drops of dilute hydrochloric acid and 10 c.c. of water; and (3), 10 c.c. of water. The aqueous solution is made alkaline to litmus with ammonia, and extracted three times with 20 c.c. of ether. The ethereal solution is evaporated to dryness at the ordinary temperature, and the residue dried at 98°—100° C.—A. S.

iso-Sparteine; Formation of α-methylsparteine from ——. A. Valeur. Compt. rend., 1908, **147**, 127—129.

WHEN α-methylsparteine is boiled for some time in dilute sulphuric acid and subsequently treated with barium iodide, the hydriodide of *iso*-sparteine iodomethylate is obtained. Moureu and Valeur (this J., 1907, 1292) who discovered this reaction suggested that the α-methylsparteine sulphate was isomerised into the *iso*-sparteine sulphomethylate. The author supports this view, having isolated the sulphomethylate as crystals, containing 9 mols. of water, which give with barium halides by double decomposition the halides of the halogen methylates of *iso*-sparteine described by Moureu and Valeur. The sulphomethylate is decomposed by alkali, with liberation of the hydroxymethylate, which when heated *in vacuo* above 150° C. is converted quantitatively into α-methylsparteine. The author draws attention to the similarity in behaviour of sparteine and N-methylpiperidine through this cycle of reactions.—R. L. S.

Indian hemp; Valuation of ——. D. Hooper. Pharm. J. 1908, **81**, 80. (See this J., 1896, 372; 1897, 950; 1898, 269, 372; 1907, 275.)

SINCE the deterioration of Indian hemp on keeping (this J., 1897, 950) is probably due to the oxidation of cannabinol and other volatile bodies, the author determined the iodine values of several samples of the drug, with a view to ascertain whether this value would afford a means of judging the age of the product. Experiments were made with specimens of "charas," "ganja," and "bhang" of different ages, the resinous essential oil being separated by distillation with steam, and then extracted with 90 per cent. alcohol. Portions of the extract were then saponified with alcoholic potash, and the unsaponifiable matter extracted with chloroform. This varied in amount from 87·6 to 54·8 per cent. and gave iodine values ranging from 183 to 121, in both cases the highest figures corresponding to the freshest and most valuable specimens. The iodine values of the dried alcoholic extract were also determined, the figures obtained ranging from 234 to 112. Here also the best and freshest specimens gave the highest iodine values.—A. S.

Otto of Rose. E. J. Parry, Chem. and Drug., 1908, **73**, 244.

OTTO of rose has probably not been so largely adulterated for many years as appears to be the case this season. Presumably this is due to the last two crops having been short and to the financial troubles of the peasants.

The author does not agree with the figures given in their last "Report" by Messrs. Schimmel and Co. for the specific gravity and the refractive index. The following represent five samples from the best possible sources.

Sp. gr. at 30° C. .	0·8555	0·8549	0·854	0·8557	0·856
Optical rotation.	− 2°40′	− 2°30′	− 3°	− 2°35′	− 2°30′
Refractive index at 25° C.	1·4635	1·4629	1·4622	1·4630	1·4626
Melting-point ...	22°	22°	23°	22·5°	23°

The purity of these samples is farther evidenced by the characters of the stearoptenes and by the absence of alcohol and other adulterants. The following figures are for samples guaranteed pure and of this year's distillation, all of which are grossly adulterated and all in the same manner. It will be noticed that in the main the physical characters of these samples are practically identical with those of pure otto of rose, which shows that the adulterators are fully alive to the usual tests to which the otto is subjected:

Sp. gr. at 30°.	Refractive index at 25°.	Rotation.
0·8535	1·4580	− 2°
0·8555	1·4635	− 2°
0·8534	1·4576	− 2°10′
0·8560	1·4630	− 2°20′
0·8545	1·4569	− 2°
0·8534	1·4587	− 2°20′
0·8555	1·4600	− 2°05′
0·8570	1·4652	− 2°
0·8526	1·4576	− 2°20′
0·8545	1·4601	− 2°10′

It will be noticed that the specific gravity of some of these samples is rather lower than is usual for pure otto. The refractive index is also lower than usual. In every one of the above samples the author was able to extract, with water, sufficient alcohol to give a well-marked iodoform reaction—in some cases, indeed, sufficient to obtain a copious precipitate of iodoform. The otto, which had been twice washed with cold water, was then examined. In every case a marked increase in specific gravity and refractive index were found. For example, in sample No. 1 the washed otto had a specific gravity of 0·8599 and a refractive index of 1·4686. There is no doubt that a mixture of geraniol with a little absolute alcohol is being used to an enormous extent this year. It may be noted that the refractive index of absolute alcohol is about 1·3600. There is no question here of phenyl-ethyl alcohol, as this substance has a much higher specific gravity than otto of rose, and a refractive index of about 1·5220 (determined on a sample which is pure to the extent of 99 per cent.).

Philippine terpenes and essential oils, I. R. F. Bacon. Philippine J. Sci., 1908, **3**, 49—64.

LIMONENE hydrochloride was subjected to the Grignard reaction, and yielded a hydrolimonene magnesium chloride, soluble in anhydrous ether. When this compound is dissolved in water, a dihydroterpene, $C_{10}H_{18}$, is formed. A method based on the Grignard reaction has been devised for passing from terpenes to dihydro- and tetrahydroterpenes. Benzaldehyde reacts with hydrolimonene magnesium chloride as if it contained a hydroxyl group. The solid product of this reaction has the formula, $C_6H_5CO,MgCl$, and is decomposed by the action of dilute acids, with the formation of benzaldehyde. It is very unstable and behaves like sodium-acetone. Acetone also reacts as if it contained a hydroxyl group.—F. SHDN.

Philippine terpenes and essential oils, II. Ylang-ylang oil. R. F. Bacon. Philippine J. Sci., 1908, **3**, 65—86.

The author has shown the presence of the following substances in ylang-ylang oil: formic, acetic, valeric (probably), benzoic, and salicylic acids, all as esters; methyl and benzyl alcohols; pinene and other terpenes, linalool, geraniol, safrol, cadinene and other sesquiterpenes; eugenol, *iso*-eugenol, *p*-cresol, probably as methyl ethers; and creosol. The following esters were prepared and described in order to note their odours: benzyl salicylate, benzyl benzoate, benzyl valerate, benzyl-methyl ether, benzyl formate, geraniol benzoate: also geraniol-methyl ether, and linalool-methyl ether. An attempt was made to synthesise ylang-ylang oil, but the product is not likely to replace the natural oil.—F. Shdn.

Essential oils; Constituents of ——. Constitution of elemicin and iso-elemicin. F. W. Semmler. Ber., 1908, **41**, 2183—2187.

In previous communications (this J., 1908, 641 and 708) the author has given reasons for stating that elemicin is a benzene derivative with either an allyl- or a propenyl-group in the side chain. As it has not been possible to isolate elemicin in a pure state, the author has used formic acid to determine which of these groupings is present. Anethol, for instance, which contains a propenyl group is resinified when boiled with concentrated formic acid, whilst safrol, containing an allyl-group, remains unchanged. When the high-boiling fraction of elemi oil was treated in this way, a substance, $C_{12}H_{16}O_3$, was obtained boiling at 144°—147° C. at 10 mm., with sp. gr. 1·063 at 20° C., and $n_D = 1·52848$. This was converted into *iso*-elemicin by boiling with alcoholic potassium hydroxide, and then boiled at 153°—156° C. at 10 mm., and had the sp. gr. 1·073 at 20° C., and $n_D = 1·54679$. From this substance, *iso*-elemicin dibromide, $C_{12}H_{16}O_3Br_2$, was prepared, which when crystallised from light petroleum, melted at 89°—90° C. Elemicin is therefore allyl-1-trimethoxy-3.4.5-benzene, and *iso*- elemicin the corresponding propenyl derivative.—F. Shdn.

Essential oils; Constituents of —— Elimination of methoxy groups by means of hydrogen. F. W. Semmler. Ber., 1908, **41**, 2556—2557.

When either elemicin or iso-elemicin (this J., 1908, 641, 708) is reduced with sodium and alcohol, a compound, $C_{11}H_{16}O_2$, is produced, which boils at 125·5° C. at 10 mm., has the sp. gr. 0·998 at 20° C., and $n_D = 1·51248$. When this substance is oxidised with permanganate, 3.5-dimethoxybenzoic acid is formed. From this it follows that the substance, $C_{11}H_{16}O_2$, is 3.5-dimethoxy-1-*n*-propylbenzene.—F. Shdn.

Cholesterol. O. Diels. Ber., 1908, **41**, 2596—2600. (See also this J., 1908, 358.)

Five grms. of cholesterol were dissolved in 25 c.c. of dry chloroform and treated with ozone. After about 2 hours the product was freed from chloroform by prolonged evaporation *in vacuo*. The crude ozonide thus obtained was a colourless foam-like mass, very brittle, and giving a white powder when pulverised. It contains more oxygen than corresponds with the formula, $C_{27}H_{46}O.O_3$ (compare Dorée and Gardner, Chem. Soc. Proc., 1908, **24**, 173). When treated with cold alcohol, it loses oxygen, and yields an ozonide of the composition, $C_{27}H_{46}O.O_4$, which is very stable and can be purified by solution in warm acetone, from which it separates as a white powder. This ozonide and also the crude ozonide are decomposed only slowly and incompletely by water, yielding a brittle resin. There is also formed a small quantity of a substance, probably of an aldehydic character, with an intense, pleasant odour resembling that of methylhexylketone. The same odour is produced when the ozonides prepared from cholestenone, cholesteryl acetate and chloride, and cholestene are decomposed by water.—A. S.

iso-Eugenol; Oxidation of ——. Preparation of dehydrodiisoeugenol. H. Cousin and H. Hérissey. Compt-rend., 1908, **147**, 247—249.

iso-Eugenol is susceptible to oxidation, in an exactly analogous manner to that described in the case of eugenol (this J., 1908, 767), with the production of *dehydrodiisoeugenol*, m. pt. 133° C., which crystallises from alcohol in long colourless needles or flat plates grouped in rosettes. This substance is best prepared by mixing 20 c.c. of *iso*-eugenol with 180 c.c. of alcohol, adding, whilst shaking, 40 c.c. of a solution of ferric chloride, sp. gr. 1·26, and then 120 c.c. of water. It is also formed by the action of a glycerol extract of the fungus, *Russula delica*, upon a dilute aqueous solution of *iso*-eugenol with the aid of a current of air. The author has prepared the dimethyl, diacetyl and dibenzoyl derivatives of the new phenol.
—J. F. B.

Triphenocoll citrate (citrocoll); So-called ——. F. Zernik, Ber. der deutschen pharm. Ges., 1908, **18**, 42—44.

Commercial citrocoll which melts at 178° C. is not a uniform substance. It was extracted with absolute alcohol, and the insoluble portion was re-crystallised several times from water. This substance is mono-acid phenocoll citrate, $2C_{10}H_{14}O_2N_2,C_6H_8O_7$; it forms prismatic needles and melts at 198°—200° C. The portion soluble in alcohol is not a salt of phenocoll.—F. Shdn.

Catalytic actions of colloidal metals of the platinum group. III. Reduction-catalyses with colloidal palladium and platinum. C. Paal and J. Gerum. Ber., 1908, **41**, 2273—2282.

The authors have extended their previous work (this J., 1907, 780) to the reduction of salts of unsaturated organic acids and esters. The present paper deals with the reduction of fumaric, maleïc, and cinnamic acids and methyl cinnamate by hydrogen in presence of colloidal palladium and of cinnamic acid by hydrogen in presence of colloidal platinum (see this J., 1904, 208) and palladium black. In all cases reduction took place, with good yields of the reduction product, *viz.*, succinic acid from fumaric and maleïc acids, and hydrocinnamic acid (β-phenylpropionic acid) and its methyl ester respectively from cinnamic acid and methyl cinnamate. Colloidal palladium proved considerably more active than colloidal platinum and palladium black.—A. S.

Nitrates in bismuth salts; Determination of ——. W. H. Simmons. Chem. and Drugg., 1908, **73**, 198.

For the determination of nitrate in bismuth oxide, hydroxide, citrate, carbonate, oxychloride, and phenate, the most convenient method is stated to be titration with a solution prepared by dissolving 5 grms. of "indigo carmine" in water, filtering, adding 50 c.c. of concentrated sulphuric acid, and diluting to 1 litre. This method is not suitable for bismuth salicylate, tannate, and gallate. No satisfactory method has yet been devised for the determination of nitrate in the latter two salts, but for the salicylate, the following modification of Looff's method, depending on the formation of nitrosalicylate, is recommended. From 0·2 to 0·5 grm. of bismuth salicylate is shaken with 5 c.c. of water, 10 c.c. of concentrated sulphuric acid are added cautiously, and the whole mixed. The crimson colour produced is matched against a similar colour produced under identical conditions with a known volume of a 0·1 per cent. solution of potassium nitrate to which 0·1 grm. of sodium salicylate is added. The amount of nitrate ($BiONO_3,H_2O$) in some commercial bismuth salts varied from *nil* to 4 per cent. in six samples of the subsalicylate, from *nil* to 2·6 per cent. in seven samples of the subcarbonate, and from *nil* to 2·49 per cent. in three samples of the citrate.—A. S.

Oil of turpentine; Application of the determination of rotatory dispersion to the study of the composition of ——. E. Darmois. *See* XIII *B*.

"Hydrogen value" as a means of determining unsaturated organic compounds. S. Fokin. *See* XXIII.

Camphor, synthetic ; Import duty on —— in U.S.A. Oil, Paint and Drug Reporter, Aug. 3, 1908. [T.R.]

The U.S. Treasury Department has decided to acquiesce in the decision of the Circuit Court of Appeals, adverse to the Government, holding synthetic camphor to be free of duty under paragraph 515 of the Tariff Act as "crude" camphor. The merchandise involved, was assessed for duty as refined camphor at the rate of six cents per pound under paragraph 12, the chief contention of the Government being that inasmuch as the product was of synthetic origin it must be regarded as a manufactured article and hence not "crude." The Board of General Appraisers and the courts, however, held that a manufactured product need not be regarded as "refined" within the meaning of paragraph 12 of the Tariff Act, and as the importation in question contained a considerable percentage of impurities and could not be sold as refined camphor, it was entitled to free admission.

Citrus by-products law in Sicily. Bd. of Tr. J., Aug. 6, 1908. [T.R.]

With reference to the notice on p. 185 of the Board of Trade J., of 23rd July, respecting the new citrus by-products law in Sicily creating a combination in the citrus by-products trade, H.M. Consul at Palermo has now forwarded an abstract translation of this law, which was published in the "Gazetta Ufficiale" of 17th July.

The translation in question may be consulted by persons interested at the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, London, E.C.

Patents.

Cream of tartar ; Manufacture of ——. G. Tassopoulos, Paris. Eng. Pat. 16.047, July 12, 1907.

Calcium tartrate is decomposed by sulphuric acid, which has been purified with sulphuretted hydrogen. The solution obtained is decolorised with animal charcoal and sodium hyposulphite, and is then saturated with sulphur dioxide, in order to prevent the iron oxide from re-oxidising. The clear solution is finally precipitated with potassium carbonate. The cream of tartar obtained is claimed to be perfectly colourless and pure, if wooden tanks are used.—A. G. L.

Camphor ; Process for converting iso-borneol into —— by electrolytic oxidation. Soc. pour l'Ind. Chimique à Bâle. Fr. Pat. 387,539, May 8, 1907.

iso-Borneol can be oxidised to camphor electrolytically, in presence of catalytic oxidising agents, and of solvents indifferent to the oxidising agent. The oxidation may be carried out in alkaline solution, the electrolyte consisting of 5 per cent. sodium hydroxide solution ; the electrodes may be made of nickel or platinum, using an alkali manganate as oxidising catalyst. The *iso*-borneol is introduced, in benzene solution, into the anode compartment ; the current density may vary between 0·5 and 2 ampères per sq. dcm., the temperature being about 20° C. When the oxidation is performed in acid solution (*e.g.*, phosphoric or sulphuric acid), lead electrodes are used, and a bichromate as oxidising catalyst : the *iso*-borneol is introduced in solution in petroleum spirit. The current used is 0·5 amp. per sq. dcm., and the temperature from 25°—30° C. The oxidising agent may be caused to form during the electrolysis, by using anodes of manganese, chromium, or their alloys with iron. The electrolytes must be vigorously agitated during the process, to ensure efficient oxidation.—T. F. B.

Perfumes, oils, and fats ; Process and apparatus for the extraction of ——. L. Barbé. Fr. Pat. 387,889, Mar. 6, 1908.

The process is similar to, and the apparatus is a modification of, that described in Fr. Pat. 321,542 of 1902 (this J., 1903, 794). The substance to be extracted is filled into perforated vessels which are then fixed to a shaft passing through the centre of a cylindrical chamber. This cylinder is filled with carbon dioxide or other inert gas, and means are provided for forcing the solvent into the cylinder, for heating the cylinder, and for receiving the extracts. During the extraction process the shaft to which the perforated vessels are fixed, is rotated. A still and condenser are provided for the recovery of the solvent, etc.—W. P. S.

Citral hydrate ; Process for isolating an isomeride of ——. P. Coulin. Ger. Pat. 198,714, Nov. 6, 1906.

The mixture of aldehydes obtained by the hydration of the unstable dihydrodisulphonic acid compound of citral by means of acid, and subsequent treatment with alkali, is treated with an aqueous solution of sodium carbonate and sulphite, and extracted with a suitable solvent ; or it is first distilled with steam, and the distillate subjected to the treatment described. The product obtained has an odour resembling that of camphor, and is useful for the preparation of perfumes. For example it condenses with methylethyl ketone, yielding a product with an odour similar to that of orris root oil. —A. S.

Dialkylbarbituric acid ; Process of making ——. M. Conrad, Aschaffenburg, Assignor to E. Merck, Darmstadt, Germany. U.S. Pat. 893,308, July 14, 1908.

See Ger. Pat. 163,200 of 1904 ; this J., 1906, 283.—T. F. B.

Dichlorethoxyethylene ; Process of producing ——. G. Imbert, Nüremberg, Germany. U.S. Pat. 894,148, July 21, 1908.

See Fr. Pat. 375,167 of 1907 ; this J., 1907, 839.—T. F. B.

Glycin derivatives ; Process of producing ——. G. Imbert, Nüremberg, Germany. U.S. Pat. 894,149, July 21, 1908.

See Fr. Pat. 379,830 of 1907 ; this J., 1907, 1274.—T. F. B.

Tartaric acid ; Manufacture of ——. J. McDougall. Fr. Pat. 387,784, Feb. 14, 1908. Under Int. Conv., Feb. 25, 1907.

See Eng. Pat. 4613 of 1907 ; this J., 1907, 1215.—T. F. B.

Wood alcohol and chloroform. U.S. Pat. 893,784. *See* III.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

iso-Cyanine dyes ; Optical and sensitising properties of the ——. S. E. Sheppard. Chem. Soc. Proc., 1908, **24**, 134—135. (See also Sheppard. Photogr. J. 1908, **48**, 300—318.)

The absorption spectra and sensitising power for gelatino-bromide plates have been investigated for a series of dyestuffs of the *iso*-cyanine group. It was shown that solutions in alcohol and chloroform conform to Beer's law, and that the colour is probably independent of ionisation. Further, in different solvents, the absorption follows Kundt's rule, the bands being shifted to the red as the dispersive power of the solvent increases. The influence of different substituted groups on the absorption and sensitising power was measured. It is found that for a group of dyestuffs of similar chemical constitution, the photochemical activity is proportional to the rate of fading in light. Comparison of the sensitising and absorption spectra shows that the bands in the latter are regularly displaced to the red some 10 $\mu\mu$, as would be expected from the behaviour in different solvents. The investigation of the conditions of sensitising by bathing shows that the "taking-up" of the dyestuff is an absorption process comparable with substantive dyeing.

Patents.

Plates or screens for direct-colour photography. C. E. K. Mees, and Wratten and Wainwright, Ltd., Croydon. Eng. Pat. 28,406, Dec. 24, 1907.

This invention relates to plates or screens in which the screen, composed of small colour elements, is interposed between the glass support and the sensitive film. A glass plate coated with gelatin, etc., is stained strongly with a blue dyestuff, then treated with bichromate solution, and exposed under a plate ruled with lines, of three different opacities (opaque, semi-opaque, and transparent). It is then washed, thus removing the dyestuff completely from the unexposed parts and partially from the parts exposed beneath the semi-opaque lines. Staining with a yellow dyestuff converts the faint blue lines into green, and the transparent lines to yellow, the deep blue lines (hard gelatin) remaining blue. A staining with a red dyestuff completes the process, giving a screen ruled in red, green, and blue. The process may be modified by using first a dyestuff which only stains soft gelatin, and lastly one which stains hardened gelatin (*e.g.*, a chrome-mordant dyestuff).—T. F. B.

Photographic and cinematographic films; Process for making ——. G. E. Hüe. Fr. Pat. 387,791, May 14, 1907.

Pure nitrocellulose (8 kilos.) is dissolved in acetone (30 kilos.), amyl acetate (20 kilos.) and methylalcohol (40 kilos.) are then added successively, the solution being well stirred to keep it homogeneous. A small quantity of sodium ricinoleate (*e.g.*, 1 kilo.) is then added to give the film the necessary flexibility, and a little ultramarine or similar substance, to correct the yellow tint. The solution is dried off as usual, after pouring on plates, and after washing with dilute ammonia, is coated with the emulsion.—T. F. B.

Colour photography; Process for making screens with polychrome divisions for ——. Soc. Anon. des Plaques, Pellicules, et Papiers Photographiques J. Jougla, and L. D. du Hauron and R. de Bercegol. Fr. Pat. 387,828, May 15, 1907.

A glass plate is supplied with a film of celluloid or collodion on which are ruled two sets of lines, at right angles to each other, in different coloured inks. When these are dry, the film is stained with a solution of the third dyestuff in a solvent which penetrates the substance of the film, but which has no action on the inks with which the rulings have been made. Thus, amyl acetate or acetone are used on a celluloid film and ether or alcohol on a collodion film.—T. F. B.

Celluloid [*for cinematograph films, etc.*]; *Substitute for* ——. G. C. de Briailles, Paris. Eng. Pat. 8542, April 16, 1908. Under Int. Conv., April 20, 1907.

See Fr. Pat. 386,845 of 1907; this J., 1908, 834.—T. F. B.

XXII.—EXPLOSIVES, MATCHES, &c.

Explosion of gelignite at the factory of Curtis's and Harvey, Ltd., Roslin, Edinburgh, on 26th March, 1908; Report on the circumstances attending an ——. By Capt. A. P. H. Desborough, H.M. Inspector of Explosives.

The explosion was found to be due to the end of a wire stitch in a badly made cartridge box forcibly penetrating a film of frozen nitroglycerin which had exuded from a cartridge. The cartridge was one of a lot that had been made some four years previously. The lot was unsaleable on account of the unusual diameter of the cartridges and because exudation had set in; this exudation was "more than desirable, though hardly dangerous, not increased by freezing and thawing." No blame can, in the opinion of the inspector, be attached to the employees at the Roslin factory; this rests with the box makers at Cliffe (Kent), but it cannot be traced to any individual. The inspector recommends that in future all metal box stitches be covered or so placed that they cannot come into contact with the contents of the box; and that the diameter of blasting cartridges be standardised to enable the turnover of magazine stock to be more rapid and thus prevent the accumulation of old material.—J. W. G.

Patents.

Guncotton charges for explosive projectiles, torpedoes, submarine mines and the like; Manufacture of ——. The New Explosive Co., Ltd., London, and J. A. Carter, Stowmarket. Eng. Pat. 12,378, May 28, 1907.

The charges are made in longitudinal halves or sections of a size to fit the projectile, etc., by compression in moulds, where the pressure is exerted in a direction transverse to the axis of the mould. The sections may then be united by means of collodion solution or the like, to form a single piece, the use of lathe-turning being thus rendered unnecessary. In the apparatus claimed for carrying out this process, the moulds for the separate sections are provided with drainage perforations and are open at the upper part to receive the press-head, whilst mechanical means are provided for bringing them beneath the press-head and removing them after the compression. A moveable transverse partition may be fitted into the mould so as to leave a space at the nose. This partition is removed before the compression, so that the pulp may enter the space, with the result that this portion of the charge does not receive pressure in excess of that exerted upon any other portion.—C. A. M.

Nitro explosives; Means of preventing the spontaneous explosion of ——. J. C. E. Bouchaud-Praceiq. Fr. Pat. 387,612, May 10, 1907.

It is proposed to surround the explosive in the magazine, or store-house, with a packing material consisting of fibrous matter—such as moss, wood fibre, paper, or kieselguhr, mixed with the carbonates, or bicarbonates of the alkalis or alkaline-earths. The whole is coloured with such substances as litmus or the phthaleins. It is claimed that nitrous vapours will be absorbed, with the formation of an atmosphere unfavourable to combustion, the temperature will be kept low by the water already present in the carbonates or resulting from the reaction, while incipient changes may be detected by the colouring matters mentioned above.—J. W. G.

XXIII.—ANALYTICAL CHEMISTRY.

INORGANIC—QUANTITATIVE.

Bismuth; Electrolytic determination of ——. J. Peset. Z. anal. chem., 1908, **47**, 401.

The electrolytic determination of bismuth is not easily carried out, by reason of the slight adhesion of the deposit and the readiness with which it oxidises. If however the electrolytically separated bismuth be covered with a thin layer of similarly separated cadmium of accurately known weight, the determination may be successfully effected. The following process is recommended by the author:— 0·04—0·08 grm. of bismuth salt is dissolved in 3 c.c. of concentrated sulphuric acid, and 4—5 c.c. of water, and the solution is made up to about 140 c.c. with water. Any cloudiness may be disregarded. A cylindrical cathode of 121 sq. cm. in area and a rotating anode are used, with a current of 0·002—0·010 ampère at a pressure of 2 volts. The current is passed for 18—24 hours, the temperature being kept at 50° C. The solution is then tested with a drop of ammonium sulphide. The process is completed as follows. A solution containing 0·08—0·15 grm. of exactly weighed cadmium sulphate dissolved in 10 c.c. of water is added to the electrolyte, and a current at 2·5—3·5 volts and 0·2—0·3 ampère passed for 8 hours. The cadmium thus precipitated, coats the bismuth, increasing the adhesion of the deposit and preventing its oxidation during drying.—J. W. G.

Clay substance; Determination of ——. H. Bollenbach. *See* IX.

Lead in spelter and ores; Determination of ——. E. J. Ericson. *See* X.

White metal and similar alloys; Analysis of ——. E. Schürmann and W. Scharfenberg. *See* X.

Nitrates in bismuth salts; Determination of ——. W. H. Simmons. *See* XX.

ORGANIC—QUANTITATIVE.

"*Hydrogen value," as a means of determining unsaturated organic compounds in a manner similar to the iodine values of Hübl and Wijs.* S. Fokin. J. russ. phys. chem. Soc., 1908, **40**, 700—709. J. Chem. Soc. (Abstr.), 1908, **94**, II., 637.

THE "hydrogen value" of an organic compound, is defined as the number of cubic centimetres of hydrogen (at 0° and 760 mm.), which are absorbed by 1 grm. of the compound. For the test, an apparatus is devised consisting of a distillation flask (50—150 c.c.) having a small beaker fused inside on the bottom, and connected by means of the side-tube to a gas burette and a gasometer containing hydrogen. In the small beaker are placed 0·1—0·02 grm. of molecular platinum, moistened with 0·25—0·5 c.c. of water, and in the flask, the substance to be examined and 20—30 c.c. of alcohol free from dissolved oxygen. The flask is preferably shaken by a shaking machine. The following hydrogen values were obtained by the author, the figures in brackets being either the hydrogen values corresponding with Wijs' iodine value, or, where indicated, the theoretical hydrogen values. Elaidic acid, 78·6—81·4 (78·8); oleic acid, 86·2—87·2 (86·2); fatty acids from sunflower oil, 119·6—120·8 (122·9); fatty acids from linseed oil, 164·9—166·3 (166·0); castor oil, 73·7 (75·5); Croton oil, 260·9 (theoretical, 258·4); undecoic acid, 115·6 (114·1); erucic acid, 39·4 (65·6); maleic acid, 190·6—191·6 (theoretical 191); aconitic acid, 131·0 (theoretical 127·7); citraconic acid, 175·2 (theoretical 171·1); cinnamic acid, 215·0 (150·1). Colophony, naphthalene, benzoic acid, resorcinol, quinol, catechol, pyrogallol, and cymene do not absorb hydrogen under the conditions of the test.

Oil varnishes; Analysis of ——. P. C. McIlhiney. *See* XIII*B*.

Wines; Determination of the fixed and volatile acids in ——. E. Pozzi-Escot. *See* XVII.

Wine; Physico-chemical analysis of ——. P. Dutoit and M. Duboux. *See* XVII.

Essences; Determination of —— *in liqueurs.* L. Vandam. *See* XVII.

Hydrastine; Determination of ——. W. A. Puckner. *See* XX.

Indian hemp; Valuation of ——. D. Hooper. *See* XX.

Prize.

Prize for improvements in the manufacture of ferroboron. Amer. Electrochem. Soc., Bulletin, July, 1908.

THE Committee consisting of Messrs. Isakovics, Roeber, and Baekeland, appointed to draw up the regulations governing the competition for the award of the Pacific Coast Borax Company's prize of $500 as mentioned in June Bulletin, have submitted the following report:—

The sum of five hundred dollars has been paid to the American Electrochemical Society, and deposited in trust, as a research fund, to be awarded as a prize for improvements in the commercial method of manufacturing ferroboron, by a direct process, from colemanite.

It is essential that the process should be sufficiently economical and suitable to be applied on a large scale, so that the finished product may be available for commercial purposes. (Commercial ferro-boron, as now made, contains 20 per cent. or more of boron, less than 3 per cent. of carbon, and sulphur and phosphorus are practically absent).

Competitors are notified that they must comply with the following conditions:—

1. The treatise must be typewritten, and accompanied by a sample produced by the process described in same. It must be enclosed in a plain, sealed envelope, not bearing the author's name, but identified by a pseudonym. The outside of the envelope, containing the paper, must be labelled with the pseudonym, and with it should be sent another plain sealed envelope, also labelled with the same pseudonym, which should contain inside the envelope the name and address of the competitor. Both these envelopes should be sent to Prof. Morris Loeb, 273, Madison Avenue, New York City.

2. All papers competing for the prize must be in the hands of Prof. Loeb, before October 1, 1909. Prof. Loeb shall retain the small sealed envelope, containing the address of the competitor and forward the large envelope containing the treatise, as well as the sample of the product, both merely labelled with the pseudonym, under cover, to the Secretary of The American Electrochemical Society, to be submitted to the Board of Directors, who will award the prize. The competitors for the prize forfeit none of their property rights in the process submitted.

3. As soon as the Board of Directors has agreed upon the best treatise, it will request from Prof. Loeb, the address of the author thereof, who will then be required to demonstrate his process, before the prize will be finally awarded.

4. The Pacific Coast Borax Company, 100, William Street, New York City, has offered to supply anyone who desires to compete for the prize seriously, with all the crude colemanite that the parties making the experiment may require, provided that the request for this colemanite be accompanied by a letter signed by one member of the Board of Directors of the American Electrochemical Society, endorsing the application for the material. Information will be furnished to prospective competitors on application to the American Electrochemical Society.

Trade Report.

Commerce of the Philippines. Mining World, Aug. 1, 1908.

THE total trade of the Philippine Islands during 1907, exclusive of gold and silver, now free government entries, was as follows:—Imports, $30,453,810; exports, $33,097,867; an increase, as compared with 1906, of $4,050,042 in the imports and of $454,975 in the exports.

In cement, out of a total import of $319,319 in 1907, $547 worth was imported from the United States. In chemicals, etc., out of a total import valued at $411,899, the share of the United States was $84,280. In scientific instruments the United States holds the greater part of the trade.

The imports of illuminating mineral oil from the United States in 1907 amounted to $635,734 in a total import of $859,278, which was more than double the imports of the American product in 1906.

New Books.

The Cotton Weaver's Handbook. A Practical Guide to the Construction and Costing of Cotton Fabrics, with Studies of Designs. By Henry B. Heylin. Chas. Griffin and Company, Ltd., Exeter Street, Strand. 1908. Price 6s. net.

8vo volume, containing frontispiece, 318 pages of subject matter, with 358 illustrations, alphabetical index, and a series of blank sheets for notes, sketches, and designs by readers, to be filled in as follows:—A. Notes on weave structure and design. B. Notes on costing. C. Notes on yarn testing. D. Notes on heald and reed counting and warp preparation. E. Notes on power loom mechanism. F. Yarn calculations and coloured pattern quantities. G. Sketches or figures or motions on machines. H. Weaving plans and other woven figures and effects.

The subject matter is classified under the following heads:—I, Weaving. II, Designing. III, Weaves. IV, The Power-loom and its accessories. V, Analysing or dissecting the cloth. VI, Cloth quoting or costing. VII, Division of the cotton industry in England. VIII, Yarns for manufacturing purposes. IX, Selection of warp yarns and yarn testing. X, Reed and heald counting and calculations. XI, Important labour units in a weaving mill. XII, Miscellany. XIII, Illustrations and descriptions of preparing and weaving machinery of various styles.

Leçons sur le Carbone: La Combustion; Les Lois Chimiques. Professées a la Faculté des Sciences de Paris. Par Henry Le Chatelier. Dunod et Pinat, Editeurs, 49, Quai des Grands-Augustins (VIe). A. Hermann, Editeur, 6, rue de la Sorbonne (Ve), Paris. 1908. Price 12 frcs.

Large 8vo volume, containing 450 pages of subject matter with 54 illustrations. The text is subdivided so as to form "Leçons," which are arranged as follows:—I. Henri Sainte-Claire Deville, Moissan. II. and III. Physical properties. IV. Physical and chemical properties. V. Combustibles. VI. Heating. Absorbent power. Allotropy. VII. Metallic carbides. VIII. Carbon dioxide. IX. and X. Metallic carbonates. XI. Carbon monoxide. XII. Combustion of gaseous mixtures. XIII. Origin of the chemistry of combustion, etc. XIV. Resumé of the mechanical laws. XV. Laws of physical chemistry. XVI. Conditions of matter. Law of the conservation of mass, etc. XVII. Molecular and atomic weights. XVIII. Experimental determination of molecular weights.

Die Chemische Analyse. Sammlung von Einzeldarstellungen auf dem Gebiete der chemischen, technisch-chemischen und physikalisch-chemischen Analyse. Unter Mitwirkung von vielen Mitarbeitern, herausgegeben von Dr. B. M. Margosches. IV./V. Band.
Elektro-analytische Schnellmethoden. Elektroanalyse unter Bewegen von Elektrolyt oder Elektrode. Von Dr. Ing. A. Fischer. Technische Hochschule zu Aachen. Ferdinand Enke's Verlag, Stuttgart. 1908. Price M. 9.40.

8vo volume, containing 291 pages of subject matter, a bibliographic list, and the alphabetical indexes of subjects and names. There are 41 illustrations and 136 tables. The subject matter is classified as follows:—I. Introduction. II. Historical. III. Theoretical; (i.) General. (ii.) Theory of rapid precipitation. IV. Apparatus, and Manipulation. V. Practical Section. (i.) Single determinations, (Groups I. to VI.). (ii.) Separations (Groups I. to V.). (iii.) Practical examples, (such as bronze; pyrites; brass; nickel steel, &c.).

Einführung in die Kolloidchemie. Ein Abriss der Kolloidchemie für Studierende, Lehrer und Fabriksleiter. Von Dr. Viktor Pöschl. Theodor Steinkopff's Verlag, Dresden. 1908. Price M. 1.50.

8vo pamphlet, containing 47 pages of subject matter, classified as follows:—A. Introduction and Nomenclature. B. Relation of colloidal solution to actual solution, and suspension. C. Preparation of hydrosols. D. Methods of investigation. E. Most recent views of the nature of the colloidal condition: (Theories of solution, absorption, and suspension.) F. Significance of colloidal chemistry with regard to other branches of science, and the chemical industry.

Kolloidchemische Studien am Albumin. Vorgetragen in der gemeinsamen Sitzung der chemisch-physikalischen und der morphologisch-physiologischen Gesellschaft in Wien, am 2 Juni, 1908. Von W. Pauli. Theodor Steinkopff's Verlag, Dresden. 1908. Price M. 1.

Pamphlet, containing 28 pages.

Die Unterscheidung von Baumwolle und Leinen. Von Prof. Dr. Alois Herzog, Vorsteher der Abteilung f. Flachs-kultur an der preussischen höheren Fachschule f. Textil-Industrie zu Sorau N.L. 2. Auflage. Verlag für Textil-Industrie, Berlin, S.W. 48. 1908. Price M. 1.50.

Pamphlet, small 8vo size, containing 36 pages of subject matter, with 25 illustrations, two of them coloured. The matter is classified as follows:—I. Macroscopic Testing. (i.) Physical. (ii.) Chemical. (iii.) Dyeing methods. (iv.) Mercerised cotton. II. Microscopic Testing. (i.) Cotton. (ii.) Mercerised cotton. (iii.) Silk-finish. (iv.) Flax fibre.

The Analysis of Ashes and Alloys. By L. Parry, A.R.S.M. "The Mining Journal," 46, Queen Victoria Street, London, E.C. 1908. Price 5s. net.

8vo volume, containing 141 pages of subject matter, and an index. The subject matter is classified as follows:—I. Determination of Individual Elements. (Assaying of tin, antimony, arsenic, lead, copper, etc.). II. Analysis of Ashes, etc. (Tin materials; tin ashes, solder ashes, white metal ashes, etc. Brass and zinc; ashes; alloys; mattes and speisses; ores and ashes; slags, etc.) III. Miscellaneous.

Determination of Radicles in Carbon Compounds. By Dr. H. Meyer and J. Bishop Tingle, Ph.D. 3rd Edition, revised. John Wiley and Sons, New York, U.S. America. Chapman and Hall, Limited, London. 1908. Price $1.25 or 5s. 6d. net.

12mo volume, containing 218 pages of subject matter, with 22 illustrations, and an alphabetical index. The subject matter is classified in groups, headed as follows:—I. Determination of hydroxyl. II. Of methoxyl, ethoxyl, and carboxyl. III. Of carbonyl, and methylene. IV. Of the amino-groups, etc. V. Of the diazo-group; nitroso-group; iodoso- and iodoxy-groups; iodine value, etc.

New Customs Tariff of the Australian Commonwealth. Supplement to the Board of Trade Journal, July 30, 1908. Wyman and Sons, Fetter Lane, E.C. Price 3d.

Patent List.

Where a complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, & MACHINERY.

APPLICATIONS.

15,985. Saniter, and South Durham Steel and Iron Co. Dipping apparatus for corrosion tests or any other purpose. July 28.

16,089. Hampson. Diffusion processes for separating gases of different densities. July 29.

16,128. Steynis. Simultaneously treating liquids and gases chemically active upon each other.* July 29.

16,762. Ziegler, and Oberbayische Kokswerke und Fabrik Chemische Produkte A.-G. Method of depriving wet materials of superfluous moisture. Aug. 10.

16,817. Faller. Evaporating boilers for use in the crystallisation of liquids. Aug. 10.

COMPLETE SPECIFICATION ACCEPTED.

4650 (1908). Smith. Filter presses. Aug. 12.

II.—FUEL, GAS, AND LIGHT.

APPLICATIONS.

16,027. Rincker and Wolter. Producing gas from tar and oil. July 28.

16,157. Hiller, and National Boiler Insurance Co. Gas testing burner for producer gas plants. July 30.

16,185. Paull. Mechanical hand controlled apparatus for converting fuel into gas. July 30.

16,448. Bethge. Combustible mixtures for producing actinic light.* Aug. 4.

16,610. Versen. Gas producers.* [Ger. Appl., Jan. 20, 1908.] Aug. 6.

16,614. Lake (International Gas Development Co.). Processes of manufacturing gas.* Aug. 6.

16,623. Frost and Nix. Production of gas from hydrocarbons.* Aug. 6.

16,645. Potter. Mantles for gas-lighting and heating. Aug. 7.

16,670. Sefton-Jones (Hartmann-Braun A.-G., and Santa). Apparatus for detecting presence of combustible gases.* [Appl. under Rule 13 for date Aug. 8, 1907.] Aug. 7.

17,003. Pill. Apparatus for carburetting air, vaporising liquids and producing inflammable gas.* Aug. 13.

17,103. Wheeler and Bone. Construction of gas-producers. Aug. 14.

17,140. Paterson and Tubbs. Carbons for flame arc lamps. Aug. 14.

COMPLETE SPECIFICATIONS ACCEPTED.

15,871 (1907). Parker. Production of gas from volatile hydrocarbons. Aug. 19.

15,872 (1907). Parker. Manufacture of fuel. Aug. 19.

17,154 (1907). Blanc and Caton. Manufacture of illuminating gas. Aug. 6.

17,545 (1907). Collins. Manufacture of fuel briquettes. Aug. 12.

17,546 (1907). Collins. Manufacture of briquettes for metallurgical or other purposes. Aug. 12.

17,580 (1907). Disher and Goldring. Treating smoke and fumes so as to destroy their obnoxious properties. Aug. 12.

17,875 (1907). Glover. Retorts for the production of illuminating gas, coke, and other residuals. Aug. 12.

18,053 (1907). Jahoda, Von Loti, and Latzko. Manufacture of filaments for incandescent electric lamps. Aug. 12.

18,060 (1907). Sefton-Jones. (Hartmann und Braun A.-G. and Della Santa.) Apparatus for measuring dangerous gases in mines, &c. Aug. 19.

19,157 (1907). Imray (Gluhlampen-Fabrik "Union"). Method of manufacturing filaments for electric lamps. Aug. 12.

27,443 (1907). Jones. Coke ovens. Aug. 12.

27,568 (1907). Feld. Treatment of coal gases for their purification and recovery of ammonia. Aug. 6.

28,390 (1907). Feld. Treatment and purification of distillation gases and obtainment of products therefrom. Aug. 6.

8578 (1908). Jowett. Substance or mixture for treating coal. [Addition to No. 14,893 of 1907.] Aug. 12.

10,155 (1908). Schmatolla. Firing of retort or muffle furnaces by producer gas. Aug. 19.

10,233 (1908). Simonini. Manufacture of incandescent gas mantles. Aug. 12.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

APPLICATIONS.

16,617. Hood and Salamon. Treatment of mineral oils. Aug. 6.

16,690. Craig. *See under* VII.

16,881. Testelin and Renard. Apparatus for manufacture of a new spirit by the isomerisation of petroleum.* Aug. 11.

17,156. Evans (W. Graaff and Co.). Process for extinguishing fires from burning benzine, petroleum, oil of turpentine, &c.* Aug. 14.

COMPLETE SPECIFICATIONS ACCEPTED.

17,440 (1907). Burgess and Anfilogoff. Treatment of benzine. Aug. 6.

17,450 (1907). Nikoforoff. Means for treating naphtha and carburetting water-gas to obtain aromatic hydrocarbons. Aug. 12.

28,009 (1907). Wetter (Knoll und Co.). Manufacture of resin-like products from phenols and formaldehyde. Aug. 6.

IV.—COLOURING MATTERS AND DYESTUFFS.

APPLICATIONS.

15,926. Ransford (Cassella). Manufacture of yellow dyestuffs. July 27.

16,011. Newton (F. Bayer und Co.). Manufacture of azo dyestuffs. [Appl. under Rule 13, Oct. 18, 1907, as being comprised in 23,026 of 1907.] July 28.

16,017. Meister, Lucius und Brüning. Manufacture of red dyestuffs. [Ger. Appl., Oct. 23, 1907.]* July 28.

16,092. Newton (F. Bayer und Co.). New disazo dyestuffs for cotton. July 29.

16,207. Durand, Huguenin und Co. Manufacture of leuco-derivatives of anilides of gallocyanines or their sulpho-derivatives.* [Ger. Appl., July 31, 1907.] July 30.

16,372. Merz. Monoazo dyestuff suitable for employment as a blue-red pigment.* [Ger. Appl., Aug. 3, 1907.] Aug. 1.

16,743. Ransford (Cassella). Manufacture of new azo-dyestuffs. Aug. 8.

16,855. Ashworth. Production of colouring matters. Aug. 10.

17,139. Meister, Lucius und Brüning. Manufacture of new acid derivatives of aminoaryl arsinic acids.* [Ger. Appl., Aug. 19, 1907.] Aug. 14.

Complete Specifications Accepted.

17,619 (1907). Imray (Meister, Lucius und Brüning). Manufacture of reduction products of para-aminophenylarsinic acid and its derivatives. Aug. 6. (Samples furnished.)

17,749 (1907). Hirschberger, Maron, and Levinstein, Ltd. Sulphurised dyestuffs and their production. Aug. 12.

18,942 (1907). Imray (Meister, Lucius und Brüning). Manufacture of diamino- and alkylated diamino-benzoylalkamines. Aug. 12.

19,172 (1907). Johnson (Badische Anilin und Soda Fabrik). Manufacture and production of compounds and colouring matters of the anthracene series. Aug. 12.

11,141 (1908). Johnson (Badische Anilin und Soda Fabrik). Reduction of indigo and other similar colouring matters. Aug. 19.

12,810 (1908). Basler Chemische Fabrik. Manufacture of a violet vat dyestuff. Aug. 6.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

Applications.

15,997. Gillies. Dyeing machines. July 28.

16,276. Harrison, and The Bradford Dyers' Association. Preparing, dyeing and finishing piece goods. July 31.

16,329. Kershaw and Cole. Apparatus for dyeing or mordanting slubbing yarn and other fibres.* Aug. 1.

16,330. Leachman. Treating woollen cotton flax and other textiles. Aug. 1.

16,557. Crombie. Apparatus for making fibres from solutions. Aug. 6.

16,659. Chaumat. Indigo dyeing.* [Fr. App., Aug. 15, 1907.] Aug. 7.

16,689. Tomlinson - Haas, Ltd., and Standeven. Apparatus for drying and treating textiles. Aug. 8.

16,756. Buckley. Apparatus for drying, carbonising or cooling fibrous material. Aug. 10.

16,802. Hertel. Washing and bleaching processes. Aug. 10.

17,083. Rhodes. Apparatus for preparing, dyeing, &c., wool, yarn, &c. [Patent of Addition to No. 18,056 of 1908.] Aug. 14.

Complete Specification Accepted.

4719 (1908). Day (Erste Triester Reisschal-Fabriks A.-G.). Process for manufacture of a new finish for cloth, &c. Aug. 19.

VII.—ACIDS, ALKALIS, AND SALTS.

Applications.

16,456. Gartenmeister. Process for purifying chlorates.* Aug. 4.

16,542. Otto. Production of ozone.* [Fr. Appl., Aug. 10, 1907.] Aug. 5.

16,627. Radcliffe. Distillation of ammoniacal liquor. Aug. 7.

16,690. Craig. Extraction of alkaline salts from blast furnace tar. Aug. 8.

16,924. Radcliffe. Purification of ammonia spent liquor. Aug. 12.

16,963. Frank and Caro. Manufacture of pure nitrogen from combustion gases. Aug. 12.

17,220. Hertkorn. *See under* XX.

Complete Specifications Accepted.

16,853 (1907). Finlay. Manufacture of bicarbonate of soda. Aug. 6.

17,971 (1907). McDougall and McDougall. Manufacture of oxalic acid. Aug. 12.

18,135 (1907). Radcliffe. Treatment of certain alkaline effluents. Aug. 19.

23,634 (1907). Schroder. Process of manufacturing aluminic sodic chloride, ferric chloride and phosphatic fertilisers from alumino-ferric and calcic aluminic ferric phosphates. Aug. 19.

25,228 (1907). Pochin and Richardson. Treatment of bauxite or aluminous material. Aug. 19.

24,913 (1907). Holmes and Howell. Ammonia stills. Aug. 6.

27,426 (1907). Thwaites. *See under* X.

273 (1908). Sadtler and Sadtler. Method of making alkali hydroxides. Aug. 12.

1425 (1908). Auzies and Sègoffin. Obtaining magnesia from dolomite or double carbonate of lime and magnesia. Aug. 6.

4471 (1908). Haase. Process for obtaining alkali formates and hydrate of alumina. Aug. 6.

5657 (1908). Pallenberg. Saturator for use in connection with the manufacture of sulphate of ammonia. Aug. 6.

9233 (1908). Allgem. Elektricitäts-Ges. Process for extracting nitrogen peroxide from nitric oxide air mixtures containing only a small quantity of nitric oxide. [Date applied for, May 13, 1907.] Aug. 12.

VIII.—GLASS, POTTERY, AND ENAMELS.

Complete Specification Accepted.

11,175 (1907). Engelhorn. Process for manufacture of ceramic masses and articles containing aluminium oxide. Aug. 19.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Applications.

16,668. Martin. Treatment of clay for the manufacture of pottery. Aug. 7.

17,119. Solomon and Austin. Compound for rendering cements and mortars waterproof. Aug. 14.

17,135. Rowland. Substitute for wood, metal and building or paving materials. Aug. 14.

Complete Specifications Accepted.

1922 (1908). Baekeland. Impregnation of wood and other fibrous or cellular materials. Aug. 19.

5051 (1908). Lorach. Process and preparation for preserving wood.

X.—METALLURGY.

Applications.

15,902. Thoms and Mossop. Preparing aluminium for plating and colouring and plating and colouring same. July 27.

15,956. Germain. Separating precious and other metals from gangue.* July 27.

16,056. New Delaville Spelter and Co., and Shortman. Appliances for refining zinc during extraction by distillation. July 29.

16,093. Carney. Process for manufacturing steel from chromiferous pig iron.* [U.S. Appl., Aug. 28th, 1907.] July 29.

16,127. Macan, and D.E.M.P. Syndicate. Treatment of tailings of dolomitic gangue. July 29.

16,186. Edwards. Separating particles of gold, &c., from gangue. July 30.

16,428. Mennicke. Preparing and smelting metallic sponge and slime obtained in the electrolytic removal of tin from tin-plate scrap.* Aug. 4.

16,521. Hughes. Metallurgical furnaces.* Aug. 5.

16,552. Thompson (Wm. Sauntry Metals Co.). Treatment of steel and iron.* Aug. 5.

16,667. Dick. Treatment of copper and other ores. Aug. 7.

16,806. Marks (Gio Ansaldo Armstrong and Co.). Manufacture of cemented armour plates of steel and alloys of steel.* Aug. 10.

16,807. Marks (Gio Ansaldo Armstrong and Co.). Furnaces for the cementation of iron, steel, and alloys of steel.* Aug. 10.

16,820. Clark. Copperising iron.* Aug. 10.

16,895. Brandenburg. Apparatus for extracting tin from tin plate waste, &c.* [Patent of Addition to No. 2322 of 1908.] Aug. 11.

16,972. Marks (Gio Ansaldo Armstrong and Co.) Manufacture of armour plates, &c., of steel or alloys of steel.* Aug. 12.

17,054. Peat. Apparatus for retorting iron ore and ironstone shale.* Aug. 13.

17,224. Cowper-Coles. Armour plate. Aug. 15.

17,229. Scott. Methods of tin smelting. Aug. 15.

Complete Specifications Accepted.

17,125 (1907). Evans. Utilising products of chemical treatment of mixed ores. Aug. 6.

17,364 (1907). De Bavay. Process for separating parts of ores from the remainder. Aug. 6.

17,546 (1907). Collins. *See under* II.

17,627 (1907). Cowper-Coles. Manufacture of metallic mirrors. Aug. 6.

18,043 (1907). Schmidt. Process for the production of metallic deposits. Aug. 12. [Rights under Section 91 of the Patents Act, 1907, not granted.]

19,348 (1907). Flohr. Manufacture of iron or steel by the open hearth process or electrical furnaces. Aug. 19.

25,099 (1907). Hopkins. Apparatus for smelting zinc ore and galvaniser's dross. Aug. 6.

25,400 (1907). Marks (Rombacher Huttenwerke and Schemann). Process for manufacture of malleable iron and steel. Aug. 19.

25,742 (1907). Cie. des Forges et Acieries de la Marine et d'Homécourt. Steel suitable for the manufacture of armour plates, projectiles, &c. [Date applied for, Sept. 7, 1907.] Aug. 12.

27,426 (1907). Thwaites. Treating or utilising liquor obtained from pyrites, pyrites cinder, and the like. Aug. 12.

419 (1908). Thompson (Conrad Gautsch G.). Process for making dense and uniform castings from copper and copper alloys. Aug. 12.

9554 (1908). Flohr. Manufacture of iron or steel by the basic Bessemer process. Aug. 6.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

Applications.

15,562. Kohler. Electrochemical process for cleaning and polishing silver. July 27.

16,428. Mennicke. *See under* X.

16,534. Coolidge. Manufacture of refractory electric conductors.* [U.S. Appl., Aug. 7, 1907.] Aug. 5.

16,538. Monge and Arzano. Electrolytic processes for covering silver-plated surfaces with a protective metal layer.* [Date, Aug. 12, 1907, applied for under Rule 13.] Aug. 5.

16,539. Monge and Arzano. Electrolytic processes for covering silver-plated surfaces of glasses or mirrors with a protective metal layer.* [Date applied for under Rule 13, Aug. 12, 1907.] Aug. 5.

16,542. Otto. *See under* VII.

16,836. Govan. Electrolysis of liquids. Aug. 11.

17,113. London Electron Works Co., and Kardos. Apparatus for washing detinned material after or before electrolysis.* Aug. 14.

17,115. London Electron Works Co., and De Back. Vehicle or cage for conveying scrap tin for electrolysis.* Aug. 14.

Complete Specifications Accepted.

18,210 (1907). Monge and Arzano. Electrolytic processes for covering silver-plated surfaces of glasses with a protective metal layer. Aug. 19.

21,475 (1907). Basset. Electric battery, also applicable for the manufacture of sulphuric acid. [Date applied for, Oct. 2, 1906.] Aug. 12.

6105 (1908). Siemens Bros. and Co. (Siemens und Halske A.-G.). Means for ozonising air. Aug. 12.

16,538 (1908). Monge and Arzano. Electrolytic processes for covering silver-plated surfaces of glasses with a protective metal layer. Aug. 19.

16,539 (1908). Monge and Arzano. Electrolytic processes for covering silver-plated surfaces of glasses with a protective metal layer. Aug. 19.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS

Applications.

16,642. Lauerman. Apparatus for extracting oil.* [U.S. Appl., Aug. 7, 1907.] Aug. 7.

16,823. Wolffenstein. Process for the preparation of soaps containing peroxides.* [Ger. Appl., Aug. 20, 1907.] Aug. 10.

16,909. Stavenow. Manufacture of margarine from nut fats and vegetable juices. Aug. 11.

17,132. Newton (F. Bayer und Co.). Manufacture of brominated fatty acid derivatives. Aug. 14.

Complete Specifications Accepted.

24,705 (1907). Smith. Process of mechanically combining oils and fats with heavier fluids. [Date applied for, Nov. 12, 1906.] Aug. 12.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(A.)—Pigments, Paints.

Applications.

16,476. Williamson (Taylor). Preservative antifouling and anticorrosive paint.* Aug. 5.

16,520. Hughes. Method of manufacturing sublimed white lead.* Aug. 5.

16,521. Hughes. *See under* X.

17,105. Rowland and Paton. Paints or preservative compositions for marine use. Aug. 14.

Complete Specification Accepted.

9108 (1908). Garzino. Sympathetic inks. Aug. 6.

(*B.*)—Resins, Varnishes.

Applications.

16,528. Les Produits Chimiques de Croissy. Manufacture of resinous products.* [Fr. Appl., Aug. 5, 1907.] Aug. 5.

16,937. Diesser. New substances to be used for varnishes and for impregnation and insulation.* Aug. 8.

16,885. Lake (Standard Varnish Works). Solid insulating compounds.* Aug. 11.

(*C.*)—India-Rubber.

Applications.

15,933. Callender. Manufacture of indiarubber. July 27.

15,934. Callender. Manufacture of indiarubber. July 27.

16,291. Clarke. Manufacture of indiarubber. July 31.

16,679. Gottschalk. Synthetic production of indiarubber. Aug. 7.

16,705. Gottschalk. Synthetic production of indiarubber. Aug. 8.

16,706. Gottschalk. Synthetic production of indiarubber. Aug. 8.

16,971. Rütgerswerke A.-G. Manufacture of indiarubber goods.* [Ger. Appl., Oct. 22, 1907.] Aug. 12.

XIV.—TANNING, LEATHER, GLUE, SIZE, &c.

Application.

17,000. Springborn, and Allen Knight and Co. Cement for strengthening material and fastening it to boots, &c. Aug. 13.

Complete Specifications Accepted.

16,994 (1907). Baum. Method of treating animal tissue for production of fibres. [Post dated Jan. 24, 1908.] Aug. 19.

23,666 (1907). Pochin and Richardson. Manufacture of size for paper makers' use. Aug. 6.

6131 (1908). Lake (Fibre Products Co.). Manufacture of artificial leather and other materials made from fibres. Aug. 12.

XV.—MANURES, &c.

Complete Specification Accepted.

23,634 (1907). Schroder. *See under* VII.

XVII.—BREWING, WINES, SPIRITS, &c.

Application.

16,987. Carroll. Distilling and treating spirits. Aug. 12.

Complete Specification Accepted.

23,544 (1907). Combe. Malting and brewing processes. Aug. 6.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, AND DISINFECTANTS.

(*A.*)—Foods.

Applications.

16,168. Hatmaker. Milk food. July 30.

16,477. Arthur. Pasteurising apparatus for milk. Aug. 5.

Complete Specifications Accepted.

19,163 (1907). Mauvernay. Heating or heating and cooling liquids and apparatus therefor, applicable to sterilising, &c. Aug. 12.

26,200 (1907). Richmond. *See under* XXIII.

26,421 (1907). Charbonneau and Malaquin. Apparatus for the sterilisation of potable water. [Date applied for, Dec. 19, 1906.] Aug. 12.

4527 (1908). Borgstrom. Manufacture of butter. Aug. 12.

4643 (1908). De Vilmorin. Process for preserving fish &c. Aug. 6.

5697 (1908). Guelpa. Composition for closing or lining preserve tins. Aug. 12.

(*B.*)—Sanitation; Water Purification.

Applications.

16,222. Shillington. Filtering water or sewage by use of polarite, cinders, and sand specially arranged. July 31.

16,725. Linden. Purifying or clarifying water or effluent. [Addition to 16,239 of 1907.]* Aug. 8.

16,397. Grossmann. Treatment of sewage sludge. Aug. 4.

Complete Specifications Accepted.

18,135 (1907). Radcliffe. *See under* VII.

3542 (1908). Beall. Treating, purifying and distributing sewage. Aug. 19.

(*C.*)—Disinfectants.

Applications.

15,921. Newton (F. Bayer und Co.). Preserving preparation. July 27.

15,930. Imray (Meister, Lucius und Brüning). New antiseptics. July 27.

15,931. Imray, (Meister, Lucius und Brüning). New antiseptics. July 27.

16,892. Little and Morris. Manufacture of cleansing fluids for use as sheep dips and disinfecting. [Patent of Addition to No. 26,608 of 1908.] Aug. 12.

Complete Specification Accepted.

15,768. Farbw. vorm. Meister, Lucius und Brüning. Process for the preparation of diphtheria antitoxin. [Date applied for, July 31, 1907.] Aug. 12.

XIX.—PAPER, PASTEBOARD, &c.

Applications.

16,104. Sparre. Apparatus for treating fibres employed in paper industry and for manufacturing felt. July 29.

16,114. A. Lumière et ses fils. Manufacture of films for cinematographs. [Fr. Appl., 3rd June, 1908.]* July 29.

16,115. A. Lumière et ses fils. Renovating or repairing worn cinematographic films. [Fr. Appl., June 19, 1908.]* July 29.

COMPLETE SPECIFICATION ACCEPTED.

4804 (1908). Wallace. Manufacture of paper. Aug. 6.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

APPLICATIONS.

17,158. J. B. Lawes and Co., and Davis. Processes for preparing tartaric acid. Aug. 14.

17,220. Hertkorn. Process for obtaining products containing iodine and products obtained thereby.* Aug. 15.

COMPLETE SPECIFICATIONS ACCEPTED.

18,149 (1907). Friswell. Manufacture of phenylglycine and its homologues. Aug. 19.

27,927 (1907). Boult (F. Fritzsche und Co. and Verona Chem. Co.). Process for production of vanillin, heliotropine, and camphor. Aug. 19.

855 (1908). Wellcome and Pyman. Manufacture of therapeutic compounds. Aug. 19.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

APPLICATIONS.

16,114. Lumière. *See under* XIX.

16,115. Lumière. *See under* XIX.

COMPLETE SPECIFICATION ACCEPTED.

3987 (1908). Muller and Rousset. Plate for cinematographic projections and its manufacture. Aug. 6.

XXII.—EXPLOSIVES, MATCHES, &c.

APPLICATIONS.

15,916. Kilburn (Pieper). Explosives. July 27.

16,599. Rudeloff. Explosives.* Aug. 6.

COMPLETE SPECIFICATIONS ACCEPTED.

10,510 (1907). Kilburn (Rickmers). Explosives. Aug. 12.

351 (1908). Haddan (Lehmann). Manufacture of cartridges and explosive charges containing ammonium nitrate. Aug. 6.

XXIII.—GENERAL ANALYTICAL CHEMISTRY.

COMPLETE SPECIFICATIONS ACCEPTED.

18,060 (1907). Sefton-Jones. *See under* II.

22,896 (1907). Thorp. Apparatus for recording the percentage of carbonic acid and other gases in gas mixtures. Aug. 12.

26,200 (1907). Richmond. Apparatus for testing the acidity of milk. Aug. 12.

Journal of the Society of Chemical Industry.

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Obituary.

EDWARD SONSTADT.

Sonstadt was born at Halesworth, Suffolk, on November 25th, 1829. His father seldom lived in one place for more than a couple of years. Inheriting his father's weak health and nervous temperament, Sonstadt was not sent to school, but was educated by his father. About 1844 the loss (owing to the failure of an American bank) of almost his entire fortune proved such a shock to his father, that paralysis and death followed. Sonstadt was thus left—in South Africa—at the age of 16, and though only just recovering from a prolonged attack of brain fever, to make his own living and take care of a younger sister. He returned to England, and for some years was engaged in printing, journalism and bookselling, of which he spent three or four in Canada as reader in the printing office of the Government Journal. He also contributed articles to Welldon's Scientific Register. Working at chemistry in his leisure hours, he devoted himself to the problem of the practicable extraction of metallic magnesium. His patents taken out in 1863 made this commercially practical, and the Patricroft Metallic Magnesium Co. was started at Manchester to work Sonstadt's process. This is still used with but slight modifications. In 1865, Sonstadt went to the Isle of Man and turned his attention to the extraction of iodine from kelp. He effected great improvements in the methods then in use. Sonstadt came to London in 1875 and became chemist to Messrs. Pokorny and Fielder. Whilst there he greatly improved the tests for anthracene, and was recognised as one of the best experts in this subject. He was one of the outside abridgers for the Patent Office, and was promised an appointment as Examiner of Patents, but the fulfilment of this promise was prevented by the introduction of the age-limit for new appointments in that office. He was an abstractor for this Journal from 1893 until his death. Sonstadt was married in 1865 to Mary Lees, of Nottingham, who survives him. He was an enthusiastic and very careful investigator, and contributed a large number of valuable papers to the Chemical Society and to the "Chemical News," his last contribution being an interesting and suggestive paper, "The attractive force of crystals for like molecules in saturated solutions," published in the Transactions of the Chemical Society in 1906. He was the first to detect the presence of traces of gold in sea water. For some years past he lived very quietly at Cheshunt, and though in failing health, continued actively his chemical researches. He died on July 5th, and his body was cremated at Ilford Cemetery on July 10th.

Journal and Patent Literature.

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I.—PLANT, APPARATUS, AND MACHINERY.

Patents.

Evaporator. T. Suzuki, Sunamura, Japan. U.S. Pat. 894,407, July 28, 1908.

See Fr. Pat. 378,978 of 1907; this J., 1907, 1190.—W.H.C.

Drying grain, peat, hops, salt, and other materials; Machines for ——. J. Black, A. H., H. and A. B. Lennox, Newcastle-on-Tyne. Eng. Pat. 24,295, Nov. 2, 1907.

The claim relates to improvements in the apparatus described in Eng. Pat. 12,087 of 1907, and consists in the provision of scrapers in the form of fan-wheels for removing the material from the shelves and conveying it from the collecting boxes to the shelf next below. A spreader, also having the form of a fan-wheel, revolves in a vertical plane above the top shelf between the outer casing and the inner revolving cylinder. Auxiliary means of air circulation are provided consisting of an air inlet at the bottom of the inner revolving cylinder and openings closed by inwardly opening valves placed in the spaces between each pair of shelves.—W. H. C.

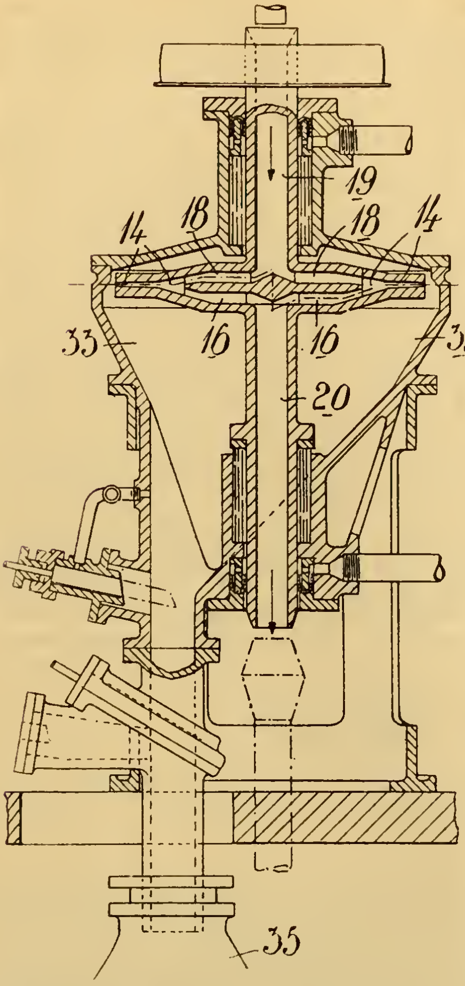
Treating comminuted solids with liquids. A. Adair, Johannesburg, Transvaal. U.S. Pat. 894,417, July 28, 1908.

The claim is for effecting the treatment in stages. In each stage the solid matter is supplied to the top of the tank as a concentrated pulp and the treating liquid to the bottom of the tank. The solids diffuse and gravitate down through the liquid, collecting at the bottom, from which they are withdrawn. The liquid flows upwards and is withdrawn in a clear condition from the top. The solids withdrawn from one tank are fed into the next following, and liquid from this tank is partly fed into the bottom of the preceding vessel and partly agitated with the solids from the preceding tank but one to produce pulp. The first vessel is fed with untreated solids and the last vessel with fresh washing liquid. The concentrated solution is withdrawn from the top of the first vessel of the series, the fresh solids being pulped with liquid from the second vessel. The exhausted solids are withdrawn from the bottom of the last vessel, the solids coming from the last vessel but one being pulped with a portion of the fresh liquid.—W. H. C.

Removing solid matter from liquids, more particularly for removing mud from feed water and for treating liquids in like manner for other purposes. C. S. Watson, Newcastle-on-Tyne. Eng. Pat. 25,907, Nov. 22, 1907.

The muddy water is caused to pass through a vessel provided with vertical partitions supported on a horizontal shaft and which can be moved, when desired, from the exterior of the vessel, or withdrawn. The partitions are so arranged that the liquid flows alternately in an upward and downward direction and that the change of direction in flow takes place in a comparatively quiescent state of the liquid, so that the settling of the mud is not interfered with. The direction of flow is further controlled by baffles of an inverted Y-shape placed between the partitions. The mud is discharged through pipes in the bottom of the vessel.—W. H. C.

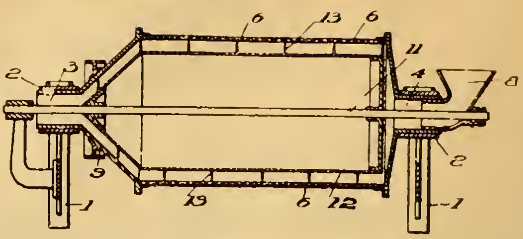
Separation of solid particles held in suspension in a liquid; Process and machine for ——. K. and A. Ward. Fr. Pat. 388,103, March 11, 1908. Under Int. Conv., March 30, 1907.



THE apparatus consists of a casing, 33, filled with a liquid under pressure, and a turbine, 14, 16, 18, connected to the hollow shafts, 19, 20, and which is rotated at a high speed by the pulley shown at the top of the shalf, 19. The liquid containing the solids in suspension is introduced into the hollow shaft, 19, flows along the channels, 18, and being subjected to centrifugal force, tends to be thrown outwards in the channels, 14. As, however, the casing, 33, is filled with another liquid under pressure, the tendency of the liquid portion to be thrown outwards is resisted and only the solid particles are projected from the channels, 14, into the liquid in the casing, 33, where they eventually gravitate to the collecting chamber, 35. The liquid freed from solid particles flows along the channels, 16, to the hollow shaft, 20, by which it is conducted away.—W. H. C.

Filtering apparatus. E. J. White, Guanajuato, Mexico. U.S. Pat. 894,414, July 28, 1908.

AN outer perforated drum, 6, covered with filtering cloth, is mounted on the hollow trunnions, 3, 4, supported in the journals, 2, carried by the supports, 1, and is rotated by a belt which passes over the pulley, 9. A stationary watertight drum, 12, encircled by the fixed helical blade, 13, is supported by the shaft, 11, concentrically within the outer drum. The material to be filtered is fed through the hopper, 8, and the hollow trunnion, 4, into the annular space between the two drums. The material is moved forward by the rotation of the outer drum, 6, and the fixed helix, 13, and is subjected to centrifugal force. The liquid portion passes through the perforations of the outer drum, and the solid portion is pushed forward to the other end, and is finally discharged, free from liquid, through the hollow trunnion, 3.—W. H. C.



Filter-press; Automatic ——. E. H. Alvord, Seattle, Assignor to H. H. Tabor, Tacoma, Wash. U.S. Pat. 894,996, Aug. 4, 1908.

THE materials to be treated are introduced through a valved opening into a movable cylinder and are compressed by a movable plunger against a fixed headpiece. The cylinder is provided with an ejector to remove the pressed solids. The ejector, cylinder, valve and plunger are actuated and controlled by suitable mechanism.—W. H. C.

Filtering, washing, and drying; Apparatus for ——. J. Bebbington and T. T. Mathieson. Fr. Pat. 388,111. March 11, 1908.

SEE Eng. Pat. 23,221 of 1907 ; this J., 1908, 562.—T. F. B.

Filter presses. M. A. Smith, New York. Eng. Pat. 4650, Feb. 29, 1908.

SEE U.S. Pat. 880,588 of 1908 ; this J., 1908, 324.—T. F. B.

Crucibles; Process for treating ——. W. R. Mitchell, New York. U.S. Pat. 894,845, Aug. 4, 1908.

THE crucible is heated to a high temperature and then treated with ferrous sulphate. The heating is then continued until the pores in the walls of the crucible are closed to moisture.—W. H. C.

Distillation, absorption, cooling, heating, and the like; Towers for ——. K. Kubierschky, Brunswick, Germany. Eng. Pat. 27,496, Dec. 12, 1907. Under Int. Conv., Dec. 12, 1906.

SEE Fr. Pat. 384,982 of 1907 ; this J., 1908, 494.—T. F. B.

II.—FUEL, GAS, AND LIGHT.

Coals; Rapid determination of sulphur in ——. R. Komarowsky. Chem.-Zeit., 1908, **32**, 770.

THE coal is treated by Brunck's method (this J., 1905, 1086) ; but the sulphuric acid formed, is titrated by the author's modification (Chem.-Zeit., 1907, 498) of Andrews' chromate method (this J., 1890, 328). The boat containing the burnt coal, sodium carbonate and cobalt oxide, is washed out into a conical flask, a few c.c. of hydrogen peroxide are added, the liquid is boiled and cooled, neutralised with dilute hydrochloric acid, washed into a 200 c.c. measuring-flask, made up to the mark, and 150 c.c. are filtered off. To this are added 1 c.c. of 10 per cent. hydrochloric acid and 5 c.c. of cream of barium chromate, the liquid is boiled very gently for five minutes, neutralised with ammonia, and filtered, and the soluble chromate determined in the filtrate by iodide and sodium thiosulphate according to the author's directions (*loc. cit.*).—J. T. D.

Hydrocarbons; The thermal decomposition of ——. Part I. (Methane, ethane, ethylene and acetylene). W. A. Bone and H. F. Coward. Chem. Soc. Trans., 1908, **93**, 1197—1225.

THE authors summarise the work carried out by others on the decomposition of hydrocarbons by heat, and proceed to give results of their own experiments, in which temperatures ranging from 500° to nearly 1200° C. were employed. The apparatus employed in the experiments above 700° C. consisted of an arrangement of two co-axial tubes of best Berlin porcelain, glazed within and without, similar to that used by Bone and Jerdan in their experiments on the direct union of carbon and hydrogen (Chem. Soc. Trans., 1897, **71**, 46). The inner tube was held in position within the outer tube by means of two special brass end-pieces provided with stuffing-boxes packed with asbestos wool moistened with "Roman" cement, rendering the joints between the two tubes quite gas-tight. A slow current of pure dry hydrogen was maintained through side tubes leading into the annular space between the two porcelain tubes, thereby ensuring the even heating of the inner tube and protecting its contents from contamination with the furnace gases. The temperature of the porcelain tubes was recorded by a Le Chatelier thermo-junction connected with a dead-beat galvanometer. One of the narrow ends of the inner tube was connected to drying tubes and to the glass holder containing the gas under investigation, whilst the other end communicated through a three-way stopcock with a capillary manometer, spiral condenser and the Sprengel pump. For the estimation of ethane in the gaseous products, a portion of the gas, remaining after the removal of acetylene, ethylene, and carbon monoxide, was subjected to the action of oxidised palladium sponge at 100° C. until all hydrogen was eliminated; the residual saturated hydrocarbon was then exploded with excess of oxygen and the ratio C/A determined in the usual manner. Methane was found to be the most stable of the four hydrocarbons examined and is always a principal product of the decomposition of the other three, especially above 800° C. It decomposes directly into carbon and hydrogen, the process being chiefly a surface phenomenon. The carbon deposited from methane is peculiarly hard and lustrous and quite different from the dull soft variety yielded by the other three hydrocarbons. It is probable that the peculiar properties of "gas carbon" formed in the manufacture of coal gas are due to this surface decomposition of methane. The decomposition of the other three hydrocarbons takes place throughout the main body of the gas. Acetylene is the principal product of the decomposition of ethylene but not of methane or ethane. Whenever acetylene is a principal primary product in the decomposition of another hydrocarbon, as in the case of ethylene, there is a marked secondary formation of aromatic hydrocarbons at low temperatures, the polymerisation reaching a maximum between 600° and 700° C. Acetylene and ethylene show a tendency to combine with hydrogen at low temperatures, forming ethylene and ethane. The tendency is insignificant above 1000° C. At temperatures of 800° C. and higher, whenever the atmosphere is rich in hydrogen the chief factor becomes, in the authors' opinion, the direct hydrogenation of such residues as : CH, : CH_2, or possibly, $\cdot CH_3$, to methane. In a lecture delivered on the same subject before the Institution of Gas Engineers (see J. Gas Lighting, 1908, **103**, 321; also this J., 1908, 215) one of the authors, W. A. Bone, adds as follows:—"Methane is one of the most valuable heating constituents of coal gas, having a net calorific value nearly 65 per cent. greater than that of the hydrogen obtained by its decomposition. Therefore it should be the object of the gas manager to, as far as possible, preserve the methane intact during the carbonising process. Now it is not so much temperature in the main body of the gas, as contact with hot surfaces, which decomposes methane, and therefore the amount of surface in proportion to the rate of gas evolution, should be reduced to the smallest limits consistent with complete and effective carbonisation."—W. S.

Coal briquettes; Practical binders for ——. J. E. Mills. Oil, Paint and Drug Reporter, 1908, July 17th, 20th, and 27th, 40.

The article contains the results of experiments carried out at the Government fuel testing plant, St. Louis, for the United States Department of the Interior. The object was to determine the relative values of the various binding agents used in the manufacture of briquettes from small coal. The tests were made in the following manner. 20 grms. of coal were mixed with the chosen percentage of binding agent and the mixture put into a Battersea crucible. After thorough mixing, a little water was added and the crucible and contents heated, with constant stirring, until steam was given off freely. The heating and stirring were continued until only a small amount of water remained and the hot, moist mass was then briquetted in a laboratory press at a pressure of from 3500 to 4000 lb. per sq. inch. Four briquettes, each weighing about 5 grms., were made from each mixing and their behaviour in the fire and their capability of withstanding water, exposure to the weather and mechanical shocks recorded. The results are given below.

Wood products.—Rosin softens at 80° C. and melts at 100° C.; it is completely soluble in carbon bisulphide. Rosin does not work satisfactorily with lignites, but an addition of 6 per cent. to a caking coal, gives a satisfactory briquette which stands well in the fire and bears exposure to the weather, but is inclined to smoke.

Pitch, to the extent of 3—4 per cent. yields a briquette which burns well and stands the weather; it is not satisfactory with lignites but is improved by the addition of heavy oil or tar.

Pine wood tar gave variable results; it is improved by distilling off the lighter bodies up to 270° C.; the briquettes are inclined to smoke; 4 per cent. of tar required.

Hard wood tar, the residue of distillation, could be satisfactorily used in the proportion of 8 per cent.

Fir tar, 6 per cent., gives satisfactory briquettes.

Sulphite liquors.—The waste liquors from the treatment of wood pulp with sulphurous acid yield on evaporation 9 to 10 per cent. of solid residue. When evaporated to one-third of their bulk and used in the proportion of 10 or 12 per cent., a briquette is obtained which is satisfactory in the fire and does not smoke, but which requires waterproofing in order that it may stand exposure to the weather.

Starch; both corn and potato starches used in the proportion of 0·1 to 1 per cent. give satisfactory briquettes which burn well and do not smoke, but they will not stand exposure unless waterproofed. For the latter purpose crude petroleum is suggested.

Tars and pitches from coal.—In ascertaining the suitability of tar or pitch for briquetting, three determinations were made. The material was distilled and all coming off below 270° C. was rejected as valueless. The flowing point was determined; this should not be below 70° C. The tar or pitch was extracted with carbon bisulphide. The smaller the undissolved residue the more satisfactory the material is for briquetting. The higher the flowing point the better the briquette stands in the fire, especially with coals that do not cake readily. If the flowing point is so high that the working of the machines becomes difficult, the pitch may be softened by the addition of heavy tar oil which boils above 270° C. Low boiling-point oils such as creosote are unsuitable. Further if the pitch has too high a flowing point it will not spread over the particles of coal to the best advantage.

Producer gas tar.—Contains about 30 per cent. of water and 6 per cent. of oil distilling between 270° and 330° C. The residual pitch which flows at 70° C. produces a satisfactory briquette when used in the proportion of from 4 to 8 per cent.

Illuminating gas tar.—The tar itself is unsuitable and must be first distilled up to 270° C. The residue, 70 per cent., yields satisfactory briquettes.

By-product coke-oven tar.—Contains more free carbon than the preceding and can only be used after distillation. The residue, 60 per cent., gives satisfactory results.

Coal tar creosote.—Quite useless.

Coal tar pitches vary very much in quality. The presence of free carbon is very detrimental to the satisfactory use of pitch for briquetting purposes. The flowing point of the samples tested varied from 68° to 190° C., and the carbon bisulphide extract from 63 to 86 per cent. Used in the proportion of from 6·5 to 8 per cent., satisfactory briquettes were obtained with caking coals, which stood exposure well but produced some smoke.

Natural asphaltums used in varying proportions gave satisfactory briquettes but could not compete with coal tar pitches in price.

Petroleum products: Crude oil, unsuitable, but might be used for waterproofing briquettes. The same may be said of Pintsch gas tar, the residue left in the iron retorts when making gas by heating petroleum to a high temperature. Petroleum residuum should flow at 90—100° C. and yield over 99 per cent. to carbon bisulphide; when used in the proportion of from 3 to 6 per cent., it yields good results with caking coal.

Water-gas tar is too liquid, but the pitch obtained on distillation flows at 92° C., yields 88·1 per cent. to carbon bisulphide, and when used in the proportion of 5 per cent., gives briquettes with caking coals which are satisfactory in the fire.

Wax tailings, soft at ordinary temperature, pulls into threads and melts at 70° C. to a thin liquid. Three per cent. gives coherent briquettes with caking coal which burn well but will not stand pressure in the fire and cannot be stacked in places exposed to a hot sun.

Acid sludge; 10—12 per cent. are required to make coherent briquettes.

Asphalt tar is a rather thin liquid and cannot be used, but might be suitable for waterproofing briquettes made with starch, sulphite liquor or glucose.

Pittsburgh flux: made by heating petroleum residuum with sulphur is tough and sticky but will not pull out into threads. It melts to a thin liquid at 195° C. and makes a satisfactory briquette when used in the proportion of 8 per cent.

In all cases the percentage of binder used, is calculated on the coal and not on the finished briquette.—W. H. C.

Hydraulic main and retort; Effect on practical working of the seals and pressures in the ——. H. G. Colman. J. Gas Lighting, 1908, **103**, 453—455.

The author points out the great importance of maintaining a steady and slight pressure in the gas-retorts during carbonisation. If the pressure vary, when it is excessive, gas is lost through the porous sides and cracks in the retorts, and when it is insufficient, combustion-gases are sucked into the retort, and the quality of the gas becomes deteriorated. To attain a constant pressure in the retort, it is necessary that the hydraulic main shall be perfectly level, that the dip-pipes are all immersed to the same extent, that the suction produced by the exhauster is constant, that the condensed products are removed from the hydraulic main as fast as they are produced, and that the sealing-liquid is both mobile and of low specific gravity. The use of the retort-house governor is recommended, as it ensures that constant suction is maintained. Continuous flushing of the main with gas liquor ensures a mobile sealing liquid, but the contents of the main should be as tranquil as is consistent with the clearing out of the tar. If the surface of the sealing liquid is broken into waves, constant variation in the seal and consequently in the pressure in the retorts results. To ensure the constant removal of the tar, each section of the hydraulic main is connected by a 2-in. pipe, with a special closed collecting chamber at the end of the main. The connection to the 2-in. pipe is made by a short pipe introduced above the cock which connects the hydraulic to the tar main. The end of the 2-in. pipe is turned up, and projects so far through the bottom of the collecting chamber that its open upper end, which is provided with an adjusting sleeve, is just above the level of the bottom of the dip-pipes. The collecting box is connected to the foul main to equalise the pressures, and also to the tar main. At the point where the 2-in. main is bent upwards, a $\frac{1}{4}$-in. pipe projects upwards through the angle formed, into the interior of the 2-in. pipe and a constant flow of gas-liquor under a constant head is supplied to this small pipe from the overhead tank from which gas-liquor is supplied to the hydraulic main through siphon-pipes. This small stream of liquor acts as the steam or air of an injector and withdraws the viscid tar from the hydraulic main. In order to further reduce the variation in the pressure in the retorts due to the formation of large bubbles, the lower end of each dip pipe is provided with a sleeve having a serrated lower edge which can be so adjusted that the gas bubbling through the seal is broken up.—W. H. C.

Dust explosions in collieries; Cause and prevention of ——. Times Eng. Suppl., Aug. 26, 1908. [T.R.]

A series of experiments, which has the support of the Home Office, is being carried out at Altoft's Colliery, Normanton, at the expense of the coal-owners of Great Britain, to determine, if possible, questions upon which expert mining opinion has long been divided. One of the chief objects is to test the theory that coal-dust is in itself an explosive, apart from fire-damp, and to discover some means of minimising the dangers. A wrought-iron tube, 700 ft. long and 7 ft. 6 in. in diameter, fitted with intake fans and an air shaft, comprises the miniature mine, and coal dust, after being distributed along this tube by means of a disintegrator, is exploded by the agency of a small cannon. An effective explosion was produced quite recently, in the presence of a large party of mining engineers, for the purpose of which 250 ft. of the tube were laid with coal-dust.

The theory that stone-dust, being a non-combustible material, would have the effect of stopping flames arising from the explosion of coal-dust, has been shown by practical tests to be sound. For a distance of upwards of 300 ft. coal-dust was laid in the tube, and stone-dust for a greater length. It was found that the explosion, though severe amongst the coal-dust, exhausted itself on reaching the area laid with stone-dust, and that the flame ceased at once. The next step will be to lengthen the tube and to take note of the effect of an explosion of coal-dust between two areas of stone-dust, a test which will probably take place at the end of September.

The total cost of the investigation is about £10,000. The committee of coal-owners conducting the experiments consists of Mr. W. E. Garforth (chairman of the directors of Altoft's Colliery, representing the Midland counties), Sir Lindsay Wood (North of England), Mr. Pilkington (Lancashire and North Wales), Mr. Hood (South Wales), and Mr. Forgie (Scotland).

Patents.

Coal or other fuel; A new or improved compound for treating ——. R. Driscoll, S. Peckover, and C. Scriven, Leeds. Eng. Pat. 314, Jan. 6, 1908.

The claim is for a mixture in about the following proportions of soda crystals 11, potassium nitrate 30, potassium chlorate 2, potassium bichromate 1, potassium permanganate 1, dilute sulphuric acid 1, dilute phosphoric acid 1, boric acid 1, sodium chloride 11, Glauber's salts 3, Rochelle salts 3, alum 11, ammonium chloride 1, caustic soda 5, white arsenic 3, manganese dioxide 2, calcium oxide 5 parts. The ingredients are mixed in a definite order and allowed to stand at a moderate temperature until a dry powder results. Four ounces of the dry powder are dissolved in three or four gallons of water, and the solution is sprayed over the fuel before use.—W. H. C.

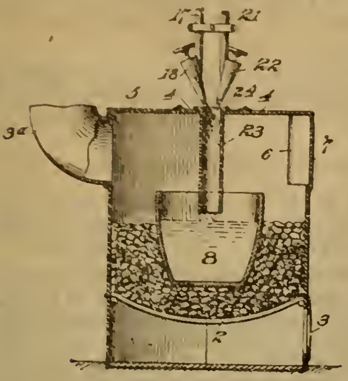
Drying apparatus for peat and the like. W. T. Griffin, Plainfield, N.J., and B. W. Tucker, New York. Eng. Pat. 16,978, July 24, 1907.

See Fr. Pat. 381,272 of 1907; this J., 1908, 113.—T. F. B.

Coke-ovens, muffles, retorts, etc.; Brickwork for ——. F. C. Ghislain, France. Fr. Pat. 388,225, Mar. 17, 1908.

The invention relates to an arrangement of brickwork which permits of the use of thinner walls where heat is to be transferred, for example between the heating flues and the coking chamber of a coke oven, without sacrificing solidity and tightness of joints. Hollow rectangular bricks, or bricks of H section, with grooved and tongued joints, are arranged so as to form channels of rectangular section in which are built refractory pipes forming the heating flues; or bricks of E section are used to form the opposite sides of a flue, the flanges or webs on the bricks projecting inwards into the flue.—A. T. L.

Crucible-furnace. E. Rankin, Lincoln, Ill., U.S.A. U.S. Pat. 894,393, July 28, 1908.



The apparatus consists of an ordinary coke furnace for heating the outside of the crucible, a crucible for use in the same, a hinged sectional top and a flanged, removable burner tube for heating the contents of the crucible from the top, projecting downwards into the furnace from above. There are also a pair of oppositely inclined needle-valves for discharging gasoline and air separately into the burner-tube so that they may mix in the tube and be discharged from the bottom, pipes for supplying the air and gasoline, and a swivel device for supporting these pipes so that the valves may be swung to one side in order to open the top of the furnace.—E. F.

Coke and gas; Manufacture of ——, *and ovens and apparatus therefor.* J. Armstrong, Westminster. Eng. Pat. 18,196, Aug. 12, 1907.

A vertical by-product coke-oven for obtaining hard coke from inferior coal. It is circular in plan and has permanent outside walls containing horizontal air-heating flues, and an internal wall consisting of superposed horizontal combustion-flues constructed of hollow segment-shaped bricks. Each combustion-flue has its own air-heating flue and is in communication with a combustion chamber to which gas is supplied by a branch from a common vertical gas pipe. The combustion gases pass to a common vertical exit flue. The air-heating flues consist of two concentric parts and run around the oven in contact with the outside wall, and back in contact with the combustion flues. The oven may be divided into two or more chambers by vertical partitions formed of horizontal combustion flues. The coke is discharged at the bottom of the oven through horizontal doors, which are hinged, and are lowered or raised by means of vertical screws rotated by bevel gearing.—A. T. L.

Coking ovens. G. Wolters, Dortmund, Germany. Eng. Pat. 7229, April 1, 1908. Addition to Eng. Pat. 9087, April 22, 1903.

See Fr. Pat. 384,841 of 1907; this J., 1908, 495.—T. F. B.

Furnace; Regenerative ——. E. Kirchberg. Fr. Pat. 388,154, March 13, 1908. Under Int. Conv., Oct. 7, 1907.

The regenerator chambers for air and gas on each side of the furnace are placed the one behind the other, and are connected with the dust-chambers and the furnace hearth by vertical flues, so that the dust does not lodge in the flues, and obstruct them. Access to the flues for cleaning purposes is provided for by forming niches in the brickwork supporting the furnace.—W. H. C.

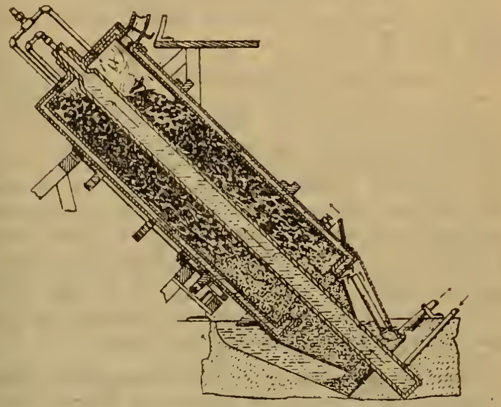
Furnaces and gas-producers. J. M. W. Kitchen, East Orange, N.J., and O. von Bernuth, New York. Eng. Pat. 15,458, July 4, 1907.

The claim is for a combustion-chamber or furnace, combined with a group of "combustion-pits" or gas-generator chambers situated beneath the combustion-chamber, and provided with chain-grates for feeding the fuel and with rocking-bars for discharging the ash. The gas generated in the "combustion-pits" may either be drawn off for use, or may be burned in the combustion-chamber. In the latter case powdered fuel is fed into the combustion-chamber from above, and is burned along with the gas produced. Tubular steam-generators, a steam-condenser, air-heater and water-cooler are grouped around the central combustion-chamber. Induced draught may be obtained by a fan, and a blast of air may be introduced into the combustion-chamber.—W. H. C.

Gas-producers [for pottery ovens, kilns, etc.]. A. Woolley, Normacot, Staffs. Eng. Pat. 16,768, July 22, 1907.

The air for combustion of the producer-gas is heated by its passage through a continuous spiral flue, formed around the outside of the producer-chamber. The flue is open to the atmosphere at its lower end, and the hot air passes direct into the gas-flue at the outlet of the producer.—A. T. L.

Gas-producer. M. E. Crowell, Franklin, Ind., Assignor to F. F. Chandler, Indianapolis, U.S.A. U.S. Pat. 894,877, Aug. 4, 1908.



The shell of the producer revolves in an inclined position above a base containing an ash-pit. A stirrer arranged to assist the revolving motion of the coal in the shell is centrally fixed in the same with its lower end in the base.—E. F.

Gas [carburetted air] producing apparatus. F. C. Lynde. Fr. Pat. 388,118, Mar. 12, 1908.

Petrol or other carburetting liquid is supplied to the carburettor from a float-chamber which is itself supplied from a second float-chamber, and a third intermediate float-chamber may be used if desired. The preferred form of float-chamber comprises a hinged float carrying a mercury cup which seals the end of the petrol inlet pipe as the float rises. The carburettor consists of a chamber divided into an upper and a lower compartment; the lower compartment contains a small depth of petrol through which air is bubbled from the perforated ends of vertical pipes which descend from the upper compartment. In another form, an air inlet pipe terminates in a box arranged above the surface of the liquid and provided with small depending tubes dipping into the liquid. The heavier constituents of the petrol are drawn off from the bottom of the carburettor, heated in a coil, and returned to the carburettor at a higher level, or to the float-chamber. The air pipe between the blower and the carburettor is provided with a valve which is regulated, together with a cock controlling the gas supply to a hot-air engine for driving the blower, by the rise and fall of a gasholder. A by-pass, provided with a regulating cock, allows part of the air to reach the holder without passing through the carburettor. When the production is very small, the gasholder, rising to the full extent, opens a valve in a second by-pass, so that the gas may not become too rich.—A. T. L.

Gas generators. A. J. Boult, London. From Act.-Ges. Görlitzer Maschinenbau Anstalt und Eisengiesserei, Görlitz, Prussia. Eng. Pat. 16,937, July 24, 1907.

See Fr. Pat. 380,177 of 1907; this J., 1907, 1272.—T. F. B.

Fuel gas from a mixture of mineral carbonates and organic substances; Process of extracting and manufacturing ——. C. H. Rider, St. Louis, Mo., U.S.A. Eng. Pat. 19,873, Sept. 5, 1907.

Mineral carbonates are heated in a retort with about ten per cent. of organic matter other than coal or coke such as leaves, straw, cornstalks, sawdust, or barks. Carbon monoxide is formed and is withdrawn from the retorts by suction.—W. H. C.

Coal gases and the like; Treatment of —— for the purification thereof and the recovery of ammonia and other products therefrom. W. Feld, Zehlendorf, Germany. Eng. Pat. 27,568, Dec. 13, 1907. Under Int. Conv., June 1, 1907.

See First Addition to Fr. Pat. 385,628 of 1907; this J., 1908, 677.—T. F. B.

Distillation gases; Treatment and purification of —— and the obtainment of products therefrom. W. Feld, Zehlendorf, Germany. Eng. Pat. 28,390, Dec. 24, 1907. Under Int. Conv., June 14, 1907.

See Second Addition to Fr. Pat. 385,628 of 1907; this J., 1908, 677.—T. F. B.

Gases; Apparatus for precipitating dust or soot contained in —— by the injection of water under pressure. P. Schalenberg, Germany. Eng. Pat. 26,620, Dec. 2, 1907.

The dust-laden gases are caused to pass up a vertical flue, from which they escape by lateral openings at the upper end. A perforated water-pipe in the form of a horizontal ring is arranged level with the lateral openings, concentric with and at a suitable distance from, the flue, and water at 1 or 2 atmospheres pressure is sprayed in upward and downward vertical jets from this pipe. A funnel-shaped hood around the top of the flue collects the sludge, and the downward jets from the spray-pipe, wash this sludge away through drain-pipes.—A. T. L.

Mantles or incandescent bodies for incandescent gas lighting; Preparation of ——. M. Weickert, Plauen, Saxony. Eng. Pat. 2572, Feb. 5, 1908.

Mantles are incinerated directly on the burner to burn away the fabric, so that the process of collodionising is unnecessary. A stiffening substance, such as starch, is added to the impregnating solution, and the mantles thus prepared are packed together in quantities for transport. To allow for shrinkage whilst incinerating the mantle on the burner, a fork with a specially deep fork-opening is used; the mantle at first stands on the lower part of the burner and the asbestos loop rests in the upper part of the fork-opening, but during incineration the loop slides down until the mantle is supported by the fork alone, in the usual manner.—A. T. L.

Tungsten filaments; Attaching —— in electric glow lamps. Deutsche Gasglühlicht A.G. (Auergesellschaft), Berlin. Eng. Pat. 16,503, July 18, 1907. Under Int. Conv., May 6, 1907.

The ends of the tungsten filament are sealed to leads consisting of two different kinds of metal, one of which, *e.g.*, copper or silver, does not alloy with tungsten, while the other, *e.g.*, nickel or iron, does. The two metals may be used in the form of alloy or of a coated wire.
—A. G. L.

Filaments for incandescent electric lamps; Manufacture of ——. R. Jahoda, S. von Loti, I. von Loti, and R. Latzko, Vienna. Eng. Pat. 18,053, Aug. 8, 1907.

See Fr. Pat. 388,161 of 1908; following.—T. F. B.

Filaments of metallic alloys for electric incandescence lamps. R. Jahoda and Soc. entitled "Electrische Glühlampenfabrik Watt" Scharf, S. von Löti and Latzko, Austria. Fr. Pat. 388,161, Mar. 13, 1908.

A metal such as tungsten or molybdenum, is intimately mixed with an oxide of a rare earth metal or of a metalloid, such as the oxide of titanium, thorium, zirconium, vanadium, cerium, boron, or silicon, or with mixtures of these oxides, and with an agglutinant containing carbon; the paste is formed into filaments, and the filaments, which contain only sufficient metal to render them good conductors at the ordinary temperature, are heated to incandescence with exclusion of air. The filaments are finally brought to a white heat in an atmosphere of hydrogen by the passage of an electric current, whereby the oxides are completely reduced. The filaments consist of alloys containing up to 3 per cent. of the reduced metal in the free state; they are more difficultly fusible and have a greater specific resistance than known metallic filaments.—A. T. L.

Filaments for electric lamps; Method of manufacturing ——. O. Imray, London. From Glühlampen-Fabrik Union Ges.m.b.H., Berlin. Eng. Pat. 19,157, Aug. 26, 1907.

See Fr. Pat. 378,022 of 1907; this J., 1907, 1079.—T. F. B.

Illuminating gas. E. E. P. M. Blanc and P. A. Caton, France. Eng. Pat. 17,154, July 26, 1907. Under Int. Conv., July 30, 1906.

The yield of gas is increased by 12 to 20 per cent. without diminishing the illuminating power, by adding to the gas from the retorts, air which has been carburetted with the light hydrocarbons existing in the tar. The carburetted air passes with the gas through the purifiers, so that the oxide is continuously revivified. The process differs from that described in Eng. Pat. 2849 of 1881 in that the tar for carburetting is maintained at about 200° C., and further, the gas thus manufactured is enriched by the addition of about 2 grms. of benzene per cubic metre.—A. T. L.

Carburetting agent which renders an alcohol flame luminous. G. J. C. Vasselon, France. Fr. Pat. 388,274, Mar. 18, 1908.

Naphthalene is dissolved in benzene and added to the alcohol.—A. T. L.

Resin, oils, sulphur, and the like; Improved process for the extraction of ——. Eng. Pat. 21,489, *See* XIII*B*.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

Natural petroleum; Optical properties of —— from Maramaros (Hungary). M. Rakusin and E. Lászlo. Petroleum, 1908, **3**, 1125—1128.

This oil has a density of 0·823 and is of a brownish-green tint. A 6 per cent. solution in benzene is somewhat opaque to polarised light, if examined in thicknesses greater than 75 mm. It belongs to the semi-transparent oils. By distilling the oil at 250° C. under atmospheric pressure, and then *in vacuo*, 90 per cent. of the oil was obtained in the distillate. The products of distillation are optically active, rotating the plane of polarised light to the right.
—C. E. F.

Mineral oils; Distillation of —— in vacuo. E. Graefe. Petroleum, 1908, **3**, 1128—1131.

The advantages of distilling oil *in vacuo* are discussed. It is suggested that, owing to the saving of fuel, and improved yields and quality of product, this method of distillation might be more generally adopted for working on a large scale than at present. Experiment showed that an oil, rich in asphaltum, gave 75 per cent. of oil in the distillate, when distilled *in vacuo*, whilst under ordinary conditions only 72·8 per cent. was obtained.—C. E. F.

"Cell-pitch"; Manufacture of —— from waste sulphite wood liquors. W. Sembritzki. *See* XIX.

Patents.

Crude petroleum; Refining —— by distillation. D. Martini, London. Eng. Pat. 16,432, July 17, 1907.

A current of air, steam, or oxygen is "ionised" by being passed between a number of metallic points between which an alternating electric discharge of high tension and frequency takes place. The ionised air, steam, or oxygen impinges at right angles on to a jet of atomised crude petroleum and both are then subjected to the action of a magnetic field. They are then passed through a heater or still which is heated by a furnace, and they are there also subjected to the action of a high-tension electric discharge. The result is said to be that the ions of the crude petroleum rearrange themselves according to their different specific gravities. The products then pass to a chimney from which pipes lead to condensers, and vibrators are arranged in the chimney in such positions that the nodal points of the waves produced are just opposite the mouths of the pipes leading to the condensers. —W. H. C.

Patents.

Benzine and similar liquids ; Treatment of ——. T. C. J. Burgess, London, and N. Anfilogoff, Grays. Eng. Pat. 17,440, July 30, 1907.

A non-inflammable spirit, suitable for use in cleaning and dyeing, as a solvent for rubber, or for degreasing or extracting fat and oil, or as a drying agent for varnishes, is prepared by treating benzine or other preparation of petroleum spirit with dry chlorine gas. The benzine, etc., is kept at the boiling point in a still provided with a reflux condenser, and dry chlorine gas is passed through it until a trial sample is of a deep yellowish-green colour. The liquid is then distilled, and the distillate coming over below 120° C., in the case of heavy petroleum spirit, is collected, washed with sodium carbonate, dehydrated, and mixed with a small percentage of carbon tetrachloride. The product can be used alone, or some fresh spirit may be added without rendering the mixture inflammable. For the first chlorinating operation, a halogen carrier must be added to the spirit, but afterwards the residue of highly chlorinated derivatives in the still, renders this unnecessary.—A. T. L.

Saturator for use in the manufacture of ammonium sulphate. F. Pallenberg, Dortmund, Germany. Eng. Pat. 5657, Mar. 13, 1908.

According to the present invention, the lead coating used for certain parts of the saturators employed in the manufacture of ammonium sulphate is itself covered with plates of acid-proof material, such as stone, bound by means of an acid-proof binding medium. The bell or partition-wall of the saturator may be constructed entirely of such material, but in this case the crown or cover of the bell is attached loosely with putty to the cylindrical portion, an outer cover, bolted on, keeping the whole rigid and yet allowing each part to expand independently : cracking of the bell is thus avoided. The plates may be provided with feet, in order to support them and the partition or bell in the saturator.—F. Sodn.

Ammonia stills ; [*Removal of sludge from* ——]. P. F. Holmes and H. Howell, Huddersfield, York. Eng. Pat. 24,913, Nov. 11, 1907.

In an ammonia still, in which an intermediate liming chamber is interposed between upper and lower chambers, it is proposed to facilitate the removal of precipitated sludge, by making the floor of the liming chamber dished or conical, so that the sludge tends to settle towards the outlet leading to the sludge valve. Injectors may be placed at intervals around the chamber, so as to produce a current, for preventing any settlement of the sludge near the periphery.—F. Sodn.

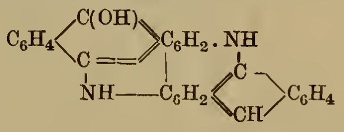
IV.—COLOURING MATTERS AND DYESTUFFS.

Green colours from potassium ferro- and ferri-cyanide. D. Monteil. Répert. Pharm., 1908, 18, 352—353.

Ferrocyanide Green. This cheap colour is easily prepared by heating to 100°C. in 500 c.c. of water, 1 mol. of potassium ferrocyanide and 1 mol. of boric acid. As soon as the colour of the mixture becomes pale yellow and a copious precipitate forms, 1 mol. of picric acid is added. The colour gradually deepens and the mass becomes more soluble in water. On cooling the solution, brilliant deep green crystals are formed. The product does not appear to be a definite chemical compound. It is suggested that the colour may be used as a substitute for copper acetoarsenite ; it is practically non-toxic, and cheaper than Malachite Green. It may be used as a dyestuff for textile tissues, but iron salts must not be employed as mordants, or Prussian blue will be formed. Fabrics dyed with this compound have a pale green colour ; on wood, the tint is deeper. If mononitrophenol be used instead of trinitrophenol, a more intense colour will be obtained. *Ferricyanide Green* is prepared in a similar manner, with 3 mols. of boric acid, 1 mol. of potassium ferricyanide, and 1 mol. of picric acid. The product, of a deep blackish-green colour, is less soluble than Ferrocyanide Green. It gives deeper shades than the latter ; textile fabrics dyed with it have an olive green tint. If too dilute solutions or too prolonged heating be employed, the green colour is lost, and a reddish tint obtained. Neither of these colours will stand alkali.—J. O. B.

Indanthrene and flavanthrene. XI. *Reduction products of flavanthrene.* R. Scholl and W. Neovius. Ber., 1908, **41**, 2534—2540.

Two of the products previously described (this J., 1908, 799) as resulting from the gentle reduction of flavanthrene with zinc dust and caustic soda, viz., dihydroflavanthrene hydrate and *a*-tetrahydroflavanthrene hydrate, are converted by further and more energetic reduction into two new products having the composition respectively $C_{28}H_{20}O_3N_2$ and $C_{28}H_{18}O_2N_2$. At 160° C. they split off one molecule of water. In the free state both compounds are dark blue in colour, but when dissolved, the first product in water, the second in alcoholic alkali, they form dark red solutions with a beautiful fluorescence. The first product appears to be *a*-hexahydroflavanthrene, and the other a hydroxyl derivative of the previously described flavanthrin (loc. cit.) which may be named flavanthrinol. On reduction of *a*-hexahydroflavanthrene, a mixture results of flavanthrinol hydrate with flavanthrin and its hydrate. The formula representing the constitution of flavanthrinol is



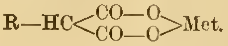
R. B. B.

Triphenylmethyl ; Colourless and coloured modification of ——. J. Schmidlin. Ber., 1908, **41**, 2471—2479.

Triphenylmethyl exists in two isomeric or tautomeric modifications, the recognition and separation of the two being rendered possible by the fact that the yellow form is much more readily oxidised than the other. Colourless crystalline triphenylmethyl dissolves completely in benzene, chloroform, and other solvents to a colourless solution, which however becomes yellow in a few seconds. On shaking the test tube, the colour disappears, the yellow triphenylmethyl being converted into its colourless peroxide. The colour returns on standing, and this alternation can be repeated several times, until finally the solution remains colourless on standing, owing to the complete oxidation of the yellow compound. In the yellow solution there appear to be present two chemical individuals, one colourless and one yellow, and these are mutually transformable one into the other, not only in solution, but also in the solid form. Equilibrium is established when a definite relation exists between the amounts of the two varieties, the colourless being then present in about ten times the amount of the coloured ; this proportion is independent of the solvent, but varies with the temperature. High temperatures are favourable to the production of the yellow, low temperatures to the colourless triphenylmethyl, and a solution which is orange-yellow at 15° C. becomes colourless when cooled to − 63° C. With solid crystalline triphenylmethyl a similar state of equilibrium establishes itself in a few hours, and since the colourless product is less readily soluble than the coloured, the yellow crystals may be decolorised by washing with ether or a little benzene and the crystals then remain colourless so long as they remain in contact with the triphenylmethyl in solution ; as soon as they are separated from it, the yellow colour re-appears. The yellow form absorbs iodine much more rapidly than the other. It is not yet possible to speak with certainty regarding the structure of the molecule in the two cases, but further researches are being carried out to throw light on this subject.—R. B. B.

Mordant dyestuffs ; The theory of ——. A. Werner. Ber., 1908, **41**, 2383—2386.

Liebermann's theory that mordant-dyeing properties are dependent on the metal forming a link in a closed ring complex (this Journal, 1894, 28) is contested by the author. Compounds exist having this formation, which are not mordant dyestuffs, *e.g.*, metallic salts, containing a malonic acid residue

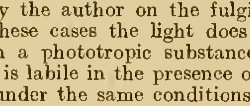


$$R—HC\genfrac{}{}{0pt}{}{<CO—O}{<CO—O}>Met.$$

The closed ring is only a condition of mordant-dyeing properties in so far as it offers the metal the possibility of being united with the organic components of the molecule both by principal and secondary valencies. The classification of mordant dyestuffs into those of the first and second degree, as proposed, appears to be excluded by the very varied character of the individual dyestuffs, which possess every possible degree of mordant dyeing power, nor are any theoretical considerations known to us upon which such a classification can be satisfactorily based.—R. B. B.

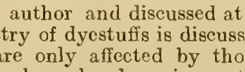
Photochemistry of organic compounds [*dyestuffs*]. H. Stobbe. Z. f. Elektrochem., 1908, **14**, 473—483.

Organic photo-reactions can be divided into reversible and non-reversible reactions. The former have been comparatively little studied ; they include various phototropic phenomena, that is variation of colour of substances according to the intensity and wave-length of the light to which such substances are exposed. These latter phenomena were first investigated by W. Marckwald in the case of quinoquinoline and β-tetrachloroketonaphthalene, and by H. Biltz on certain hydrazones and osazones, also by the author on the fulgides referred to below. In all these cases the light does chemical work when shining on a phototropic substance, converting a substance which is labile in the presence of light into one which is stable under the same conditions ; the latter is however unstable in the dark, reverting to its previous state and evolving the stored up energy in a form not at present known. The non-reversible reactions are much more varied and numerous than the others ; they are classified by the author and discussed at length. Finally the photochemistry of dyestuffs is discussed. It is known that dyestuffs are only affected by those rays of light which they themselves absorb, a circumstance common to all photochemical reactions. It is also known that the degree of sensitiveness to light bears some relation to the chemical constitution of the dyestuff, though comparatively slight differences in this latter respect may affect the sensitiveness to light profoundly. The nature of these photo-reactions has been little studied so far, but Gros has already shown manometrically that the fluoresceins are oxidised in the light. The addition of foreign substances affects the sensitiveness to the action of light ; for some dyestuffs both negative catalysers, which diminish the sensitiveness, and positive catalysers, which increase it, are known. The latter are important from the standpoint of colour-photography, etc. The character of the products of these reactions has been so far but little investigated. The author has studied the photochemistry of the fulgides in detail. Triphenylfulgide ($C_{24}H_{16}O_3$) is orange-yellow in colour, and has the constitution



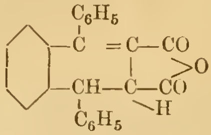
$$\begin{array}{ccc} C_6H_5.C.C_6H_5 & & C_6H_5.C.H \\ \ddot{} & & \ddot{} \\ OC.C & \text{———} & C.CO \\ & O & \end{array}$$

The first product of the action of light on this is its blood-red stereo-isomeride, allotriphenylfulgide,

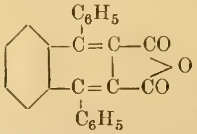


$$\begin{array}{ccc} C_6H_5.C.C_6H_5 & & H.C.C_6H_5 \\ \ddot{} & & \ddot{} \\ OC.C & \text{———} & C.CO \\ & O & \end{array}$$

On further illumination this forms a colourless structural isomeride, diphenyldihydronaphthalenedicarboxylic anhydride,



and this, on further illumination, in the presence of air, is oxidised to the colourless "Photoanhydride III."



The rapidity of these reactions increases with the intensity of the light. The first and second reactions take place most rapidly in blue and violet light, that is under the action of those rays which are absorbed by the initial material. The temperature has comparatively little effect on the speed of the reaction. Iodine acts as a strong catalyser, but the degree with which it hastens the reaction varies from stage to stage. The nature of the solvent influences the effect greatly. In benzene solution the reactions proceed much more slowly than in an acetone-collodion solution. Collodion and similar products promote the reactions greatly.—E. F.

Patents.

Compounds and colouring matters of the anthracene series. Impts. in manufacture of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. Eng. Pat. 16,775, July 22, 1907.

See Fr. Pat. 386,606 of 1908 ; this J., 1908, 745.—E. F.

Para-aminophenylarsinic acid and its derivatives ; Manufacture of reduction products of ——. O. Imray, London. From Farbw. vorm. Meister, Lucius, und Brüning, Hoechst-on-the-Maine, Germany. Eng. Pat. 17,619, Aug. 1, 1907.

p-Aminophenylarsinic acid or its derivatives such as acetyl-*p*-aminophenylarsinic acid or *p*-phenylglycinarsinic acid are submitted to the action of reducing agents. According to the reducing agent employed, *p*-aminophenylarsenoxide, $NH_2C_6H_4AsO$, *p*-*p*-diaminoarsenobenzene, $NH_2C_6H_4As:AsC_6H_4NH_2$, or diaminodihydroxyarsenobenzene, $NH_2C_6H_4As(OH)As(OH)C_6H_4NH_2$, or their derivatives are obtained. The products are soluble in fixed alkalis. The first-named products are produced by weaker reducing agents, such as hydriodic or sulphurous acid, and those named last by stronger agents such as tin and hydrochloric acid or sodium hydrosulphite. *Examples.*—311 parts of sodium *p*-aminophenylarsinate and 520 parts of potassium iodide are dissolved in 1800 parts of water, 1000 parts of sulphuric acid (1 : 5) added, and sulphurous acid introduced until the iodine which is set free has disappeared. Concentrated ammonia is then added until the reaction is alkaline ; white needles of *p*-aminophenylarsenoxide separate on standing. The product may be dried to a white powder ; it is readily soluble in alkali hydroxide solution and in dilute acids, melts at 80° C., and evolves gas at 100° C. Again, 250 parts of sodium aminophenylarsinate are dissolved in 1400 parts of water, 800 parts of crystallised stannous chloride dissolved in 950 parts of hydrochloric acid of sp. gr. 1·19 are added, and the whole allowed to stand for some days at a temperature not exceeding 40° C. The yellow tin double salt which separates is washed, dissolved in hot, dilute (about normal) hydrochloric acid, and poured into sodium hydroxide solution in such excess that the tin oxides remain dissolved. Diaminoarsenobenzene separates in yellow flakes, melting at 139—140° C., soluble in hydrochloric acid. Again, 200 parts of phenylglycinarsinic acid, $C_6H_4(NHCH_2COOH)AsO_3H_2$, obtained by boiling an aqueous solution of sodium *p*-aminophenylarsinate with 2 molecules of chloroacetic acid and crystallising out, are dissolved in 4000 parts of boiling water ; to this solution is added another, obtained by dissolving 2000 parts of sodium hydrosulphite in 10,000 parts of water, adding 600 parts of N_1-sodium hydroxide solution, and 1000 parts of crystallised magnesium chloride and filtering. The mixture is heated for three-quarters of an hour on a moderately boiling water-bath, the precipitate filtered, washed, and dissolved in excess of very dilute, hot sodium carbonate solution. The arsenophenylglycine, $As_2(C_6H_4NHCH_2COOH)_2$, may then be separated by adding excess of acetic acid and forms a red-brown powder readily soluble in sodium carbonate solution to a yellow liquid.—E. F.

Sodium and arylamines; Manufacture of compounds of ——. G. W. Johnson, London. From Deutsche Gold- und Silber-scheide Anstalt vorm. Roessler, Frankfort-on-the-Maine, Germany. Eng Pat. 11,335, May 25, 1908.

It has already been proposed to form sodium and potassium compounds of aromatic amines by heating the latter with the alkali metal with energetic agitation. According to the present patent the reaction is effected more smoothly in the presence of a small amount of a catalytic substance such as copper, nickel, cobalt, or other heavy metal, or an oxide, or salt of any of these. The action can then be effected at a comparatively low temperature, as sodium reacts violently on aniline even at 140° C. in presence of a catalytic substance. For example, 300 parts of aniline are heated to 140° C., about 0·1 to 0·2 part of nickel oxide is added, and then 45 parts of sodium "in several portions at a time," care being taken to await the end of the reaction before adding a further portion of the sodium. Sodium-aniline is formed with evolution of hydrogen, and can be separated from the excess of aniline in the usual manner. Again, 200 parts of monomethylaniline are heated to boiling point with 0·2 part of cobalt oxide, and 20 parts of sodium are added, as described in the previous example. The reaction proceeds in the same manner, but more slowly, and also more slowly than if *o*- or *p*-toluidine is used.—E. F.

Dyes [Azo-dyestuffs]: The manufacture of ——. E. Ulrichs, Charlottenburg, Germany. Eng. Pat. 17,677, Aug. 2, 1907.

The diazo-derivative of 2-naphthylamine-1-sulphonic acid is combined with sodium-β-naphtholate in presence of Turkey red oil. The dyestuff produced, scarcely differs in outward appearance from that produced without the addition of Turkey red oil, but on further treatment with calcium salts, the lake produced is much bluer in shade, and is said to be of great importance owing to this blue shade, its fastness, covering capacity, resistance to water, alcohol, and lime, and insolubility in oil. The dyestuff is produced as follows:—22·3 grms. of 2-naphthylamine-1-sulphonic acid and 5·3 grms. of sodium carbonate are dissolved in 250 c.c. of water, and a solution of 7 grms. of sodium nitrite in 70 c.c. of water is added; the whole is then poured into a solution containing 7·3 grms. of hydrochloric acid in 300 c.c. of water. The diazo-compound is added to a solution of 15 grms. of β-naphthol, 4 grms. of sodium hydroxide and 50 grms. of Turkey red oil of 50 per cent. strength in 1000 c.c. of water. The dyestuff separates as an orange-red precipitate.—E. F.

Tetrazo dyestuff; Manufacture of a new ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 23,182, Oct. 21, 1907.

See Fr. Pat. 383,128 of 1907; this J., 1908, 329.—T. F. B.

Yellow monoazo dyestuffs of the pyrazolone series; Production of ——. Soc. pour l'Industrie Chimique a Bale. Fr. Pat. 388,279, Mar. 18, 1908.

Diazo-derivatives of amines of the benzene series or of their sulphonated or carboxylated derivatives are combined with sulphoaryl-5-pyrazolone-3-carboxylic acids containing a methyl or sulpho group or a halogen atom in the aryl nucleus in ortho position to the nitrogen of the pyrazolone. Yellow dyestuffs of a decided green shade are so obtained and are said to be of great technical importance for the production of lakes for three-colour printing and also as transparent substitutes for Chrome Yellow. For example 20·8 parts of *m*-chloraniline sulphonic acid are diazotized in the usual manner and the liquid so obtained, in which the greater portion of the rather insoluble diazo-sulphonic acid is present in suspension, is poured into an alkaline solution of 32 parts of the monosodium salt of sulphotolyl-5-pyrazolone-3-carboxylic acid. A clear solution is obtained from which the dyestuff is salted out in the usual manner.—E. F.

Orthonitrated aminoderivatives of the benzene and naphthalene series; Manufacture of ——. A. G. Bloxam, London. From Act.-Ges. f. Anilin Fabrikation, Berlin. Germany. Eng. Pat. 20,367, Sept. 12, 1907.

See Ger. Pat. 194,951 of 1906; this J., 1908, 623.—E. F.

Indoxyl, its homologues or derivatives; Improved manufacture of ——. O. Imray, London. From Basle Chemical Works, Basle, Switzerland. Eng. Pat. 5840, Mar. 16, 1908.

According to Eng. Pat. 19,474 of 1904 (see U.S. Pat. 776,884; this J., 1905, 23), indoxyl, its homologues or derivatives are prepared by adding an alkali salt of an arylglycine to a heated mixture of alkali hydroxide and metallic sodium and, after the arylglycine has acted on part of the sodium, forming a sodium-arylamine compound, continuing to heat with an addition of a primary or secondary aromatic amine. According to the present patent the aromatic amine is first added to the heated mixture of alkali hydroxide and sodium, and only when the reaction with the sodium, forming the sodium-arylamine compound, has occurred, is the aryl-glycine salt added to the mass and the heating continued. The advantage of this procedure is said to be that after allowing the arylamine to first react on a melted mixture of alkali hydroxide and metallic sodium, a quantity of arylglycine salt, equivalent to the sodium-arylamine compound, may afterwards be added all at once, only causing an ebullition of the liberated amine and no foaming, whereas it is only possible to add an arylglycine in small quantities at a time directly to a liquid mixture of alkalis and metallic sodium, as the liberation of hydrogen causes the mass to froth violently. *Example.*—To a heated, dehydrated, molten mixture of 120 parts of potassium hydroxide and 80 parts of sodium hydroxide in a boiler provided with an agitator, 13·8 parts of metallic sodium are first added and when the temperature has attained about 220—225° C., are followed by 19 parts of aniline, a reflux condenser being used; when the aniline has combined, 37·8 parts of the potassium salt of phenylglycine are added in such a manner as to avoid waste of liberated aniline. When the aniline has again combined, the heating is continued at a temperature of 225—235° C., until the formation of indoxyl is complete. The mass is dissolved in water, the indoxyl converted into indigo by a current of air, and the indigo filtered and washed with water, hydrochloric acid, again with water, then with alcohol and dried.—E. F.

Indoxyl and its homologues and their derivatives; Process for producing ——. Fabr. Bâloise de Prod. Chimiques. Fr. Pat. 388,105, March 11, 1908. Under Int. Conv., Aug. 2, 1907.

See Eng. Pat. 5840 of 1908; preceding.—T. F. B.

Indoxyl, etc.; Process of making ——. A. Bischler, Assignor to Basle Chemical Works, Basle, Switzerland. U.S. Pat. 894,579, July 28, 1908.

See Eng. Pat. 5840 of 1908; preceding.—T. F. B.

Indigo; Manufacture of a tribromo-derivative of ——. Ges. f. Chemische Industrie in Basel, Basle, Switzerland. Eng. Pat. 6153, Mar. 19, 1908. Under Int. Conv., Nov. 2, 1907.

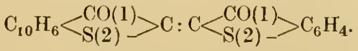
In Eng. Pat. 5122 of 1907 (this J., 1908, 71) is described a method of manufacture of tri- and tetrabromoderivatives of indigo by the action of bromine on indigo at a raised temperature in presence of an indifferent solvent. According to the present patent, indigo is converted into a tribromo-derivative in the cold by the action of bromine chloride. For example, into a cooled mixture of 13·1 parts of indigo and 100 parts of nitrobenzene, 30 parts of bromine chloride cooled to about 5° C. are allowed to flow slowly, the mixture being meanwhile cooled with ice. The whole is then allowed to stand over night, filtered by suction and the residue boiled with alcohol, filtered, and dried. The product is thus obtained as a violet-blue powder with coppery lustre, containing 46·4 per cent. of bromine and only 0·6 per cent. of chlorine. Instead of using previously prepared bromine chloride, bromine may be added to the indigo suspended in a suitable medium and chlorine led in whilst cooling with ice.—E. F.

Violet vat dyestuff; Manufacture of ——. Basler Chemische Fabrik, Basle, Switzerland. Eng. Pat. 12,810, June 15, 1908. Under Int. Conv. July 1, 1907.

Acenaphthene-quinone is heated with indoxyl, dissolved or suspended in aqueous alcohol, and in presence of a small quantity of a condensing agent such as sodium carbonate or a weak base. For example, 18·2 parts of acenaphthene-quinone and 13·3 parts of indoxyl are suspended in 1000 parts of alcohol of 80 per cent. strength and the mixture warmed. 2·5 parts of calcined sodium carbonate in aqueous solution or a little piperidine are then added, when violet crystalline scales of the dyestuff quickly separate from the hot liquid. It can be separated from a small quantity of indigo, which is also formed, by crystallisation from benzene, in which it is soluble. It dyes unmordanted cotton in violet shades from an alkaline sodium hydrosulphite vat.—E. F.

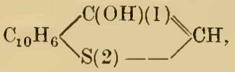
Brown vat dye. K. Schirmacher and A. Brunner. Assignors to Farbw. vorm Meister, Lucius, und Brüning, Höchst-on-the-Maine, Germany. U.S. Pat. 888,852, Dec. 7, 1907.

A new vat dyestuff is claimed, of the constitution.



$$C_{10}H_6\left\langle\begin{matrix}CO(1)\\S(2)\end{matrix}\right\rangle C:C\left\langle\begin{matrix}CO(1)\\S(2)\end{matrix}\right\rangle C_6H_4.$$

It is formed by oxidising hydroxythiophenthrene,

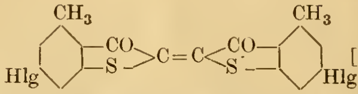


$$C_{10}H_6\left\langle\begin{matrix}C(OH)(1)\\S(2)\end{matrix}\right\rangle CH,$$

which can itself be obtained for instance by fusing naphthalene-2-thioglycollic-1-carboxylic acid with alkali hydroxide and heating the hydroxythiophenthrene-carboxylic acid so obtained with a solution of sodium carbonate. *Example.*—23·9 parts of 1-naphthylamine-2-sulphonic acid are diazotised in the usual manner and the diazo solution introduced into a solution of 25 parts of copper sulphate and 38 parts of potassium cyanide and heated to 60° C. After some time the mixture is filtered and the sodium salt of 1-cyanonaphthalene-2-sulphonic acid precipitated from the filtrate with common salt. 25·5 parts of this sodium salt are heated for some time to 100° C. with 22 parts of phosphorus pentachloride whilst 5 parts of phosphorus oxychloride are added until the mass liquefies. After cooling it is poured into ice-water and the precipitated 1-cyanonaphthyl-2-sulphochloride filtered. 20 parts of this are stirred for 12 hours with a cold mixture of 60 parts of sulphuric acid of 60 B. and 180 parts of water to which 40 parts of zinc-dust are added, and finally warmed gently. When cold the mixture is filtered and the residue dissolved by warming with water and sufficient sodium hydroxide solution to produce a decided alkaline reaction. It is then filtered, a solution of 15 parts of sodium chloracetate added to the filtrate, and the whole heated to 100° C. It is then filtered from a small quantity of dyestuff, and a light yellow product precipitated from the cooled solution by adding hydrochloric acid and common salt. This consists of a mixture of naphthalene-2-thioglycollic-1-carboxylic acid and probably 1-cyanonaphthyl-2-thioglycollic acid. 20 parts of this mixture are added to a mixture of 80 parts of sodium hydroxide and 8 parts of water, and the whole heated to 180—190° C. until the mass suddenly becomes intensely yellow and solidifies. The melt when cold, is dissolved in water, partially neutralised with hydrochloric acid, filtered, and the hydroxythiophenthrenecarboxylic acid precipitated by more hydrochloric acid in white flakes which darken slightly in the air. To obtain the dyestuff, this acid is dissolved in sodium hydroxide solution and potassium ferricyanide added in excess. It is insoluble in water, but dissolves when heated with an alkaline hydrosulphite solution to a yellow liquid from which wool and cotton are dyed in brown shades.—E. F.

Red vat dye. K. Schirmacher and H. Landers. Assignors to Farbw. vorm. Meister, Lucius, and Brüning, Höchst-on-the-Maine, Germany. U.S. Pat. 892,897, Mar. 13, 1908.

The patentees claim the halogen-derivatives of *m*-*m*-dimethylthioindigo having the following constitution :—



[Hlg.=halogen].

which are red dyestuffs, said to be distinguished by their beauty and fastness. They may be prepared by fusing 3-methyl-5-halogeno-phenyl-1-thioglycollic-2-carboxylic acid with alkalis and treating the methylhalogenohydroxythionaphthenecarboxylic acids so produced with oxidising agents. Thus, for instance, 21·6 parts of the chloronitrotoluylic acid "(CH_3 : Cl : $COOH_2$: NO=3 : 5 : 2 : 1)" are dissolved in 5·6 parts of sodium carbonate and the necessary quantity of water and boiled under a reflux condenser with a strong solution of 11 parts of sodium disulphide. On cooling and acidifying with acetic acid, chloroamino-*o*-toluylic acid is precipitated. 17·6 parts of this acid are then diazotised in the usual manner and the diazo solution added to a solution of 18 parts of potassium xanthate and 40 parts of sodium carbonate. After stirring for several hours, 15 parts of sodium chloroacetate and 25 parts of sodium hydroxide solution of 40° B. are added and the solution heated to 100° C. for some hours. When cold the solution is filtered from small quantities of a violet dyestuff and the *m*-methyl-*m*-chlorophenylthioglycollic-*o*-carboxylic acid precipitated by adding hydrochloric acid and common salt. 20 parts of this acid are heated to 180°—190° C. with 100 parts of sodium hydroxide and 10 parts of water till the melt becomes light yellow. When cold it is dissolved in water, and the methylchlorohydroxythionaphthenecarboxylic acid may be precipitated with hydrochloric acid. The vat-dyestuff may be obtained from this acid without previous isolation by treating the aqueous solution of the alkali melt directly with a solution of potassium ferricyanide. The new dyestuff then separates in red flakes. It dissolves in an alkali hydrosulphite solution to form a vat which dyes wool and cotton in fast Alizarine Pink shades.—E. F.

Paradiamines ; Production of acidylated derivatives of ——. Farbenfabriken vorm. F. Bayer und Co. Fr. Pat. 388,454, Mar. 23, 1908.

Acidyl-*p*-diamines are prepared by combining diazo-compounds with amines, acidylating the resulting amino-azo compounds and reducing the acidylated aminoazo-compounds in neutral or acid solution, avoiding an excess of mineral acid. *Example.*—Benzeneazo-*m*-toluidine is prepared in the usual manner by combining diazobenzene with *m*-toluidine. 21·1 kilos. of this compound are then heated to 90° to 100° C., and 11 kilos. of acetic anhydride are added. The mass solidifies on cooling. It is broken into small pieces and these are gradually introduced into a boiling mixture of 30 kilos. of iron turnings and 50 kilos. of water, stirring well meanwhile. In two hours the azo-compound will have disappeared. The aniline is removed by a current of steam, and sodium carbonate added in excess to the residue, which is then filtered. The hitherto unknown aceto-amino-*m*-toluidine

$$(CH_3 : N.CH_3COCH_3 : NH_2\ 1 : 3 : 6)$$

is then isolated from the filtrate by adding common salt. It melts at 71° C.—E. F.

Dyestuffs of the phthaleïn series dyeing on a mordant : Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 22,818, Oct. 16, 1907.

See Fr. Pat. 382,920 of 1907 ; this J., 1908, 218.—T. F. B.

Safranine series; Production of dyestuffs of the ——. Actien-Ges. f. Anilin-Fabrikation. Fr. Pat. 388,188, May 24, 1907.

See U.S. Pat. 872,815 of 1907; this J., 1908, 17. The claim is rather more general than that of the last-named patent as mono- or poly-sulphonic acids of *p*-nitro-*p*-aminodiphenylamine are used instead of the *o*-sulphonic acid only of this substance, as in the U.S. patent.—E. F.

Sulphide dyestuffs; Production of new ——. Farbenfabriken vorm. F. Bayer und Co. Fr. Pat. 388,539, Mar. 26, 1908.

Dyestuffs yielding yellow or yellowish-brown to orange shades on cotton, from an alkali sulphide bath, are obtained by melting sulphur with mixtures of *m*-diamines alkylated in the aromatic nucleus, or their derivatives, and nitroamines such as the nitranilines or their derivatives. The same results are obtained by replacing the nitroamines by the analogous dinitro compounds or their derivatives or by employing mixtures of *m*-diamines not substituted in the aromatic nucleus or triamines derived from such *m*-diamines or their derivatives with nitroamines substituted in the aromatic nucleus or analogous polynitrated derivatives. The products are transformed into soluble colours by treatment with alkali sulphides. Dyestuffs of a more pronouncedly yellow shade are obtained by adding benzidine or its derivatives to the above melts. For example a mixture of 122 kilos. of *m*-toluylenediamine, 138 kilos. of *m*-nitraniline and 1000 kilos. of sulphur is heated to 200—250° C. for 12 hours. The melt is then powdered and added to a solution of 400 kilos. of sodium sulphide in 5400 kilos. of water and heated to 80° to 100° C. till a clear solution is obtained. This is diluted with water and the dyestuff precipitated by the addition of acid.
—E. F.

Sulphurised [sulphide] dyestuff; Manufacture of a black ——. Soc. Anon. des Mat. Col. et Prod. Chim. de St. Denis, Paris. Eng. Pat. 25,080, Nov. 12, 1907. Under Int. Conv., Nov. 14, 1906.

See Fr. Pat. 381,608 of 1906; this J., 1908, 219.—T. F. B.

Sulphide dyestuffs; Process for producing brown ——. Chem. Fabr. Griesheim-Elektron. Fr. Pat. 388,354, March 20, 1908. Under Int. Conv., Aug. 14 and Nov. 16, 1908.

See U.S. Pat. 889,936 of 1908; this J., 1908, 744.—T. F. B.

Friable vegetable dye and process of making same. F. J. Maywald, New York. U.S. Pat. 894,965, Aug. 4, 1908.

A dry friable dyestuff is prepared from viscous extracts of vegetable dyestuff materials (*e.g.*, logwood) by adding a soluble colloidal carbohydrate (*e.g.*, dextrin) and evaporating the mixture to dryness.—H. G. B.

Inks; Sympathetic ——. L. Garzino, Saluzzo, Piedmont, Italy. Eng. Pat. 9108, April 27, 1908.

The writing fluid, or ink proper, consists of an alkaline solution of potassium ferrocyanide, mixed with finely powdered graphite and finely powdered magnesium carbonate, and the characters are made visible by developing Prussian blue on the paper by the application of a solution of iron alum and potassium bisulphate. The ink is made alkaline to retard the formation of Prussian blue, by any iron in the paper; the finely powdered graphite, makes the writing visible, but can be effaced by india-rubber. The potassium bisulphate acts as a mordant, and prevents the writing from becoming blurred, on the application of the developing solution.—W. C. H.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES YARNS, AND FIBRES.

Hydrogen peroxide and magnesium peroxide, obtained by the action of sodium peroxide on magnesium sulphate. A. Scheurer and A. Vernet. Bull. Soc. Ind. Mulhouse, 1908, **78**, 184—187.

Solutions of hydrogen peroxide of varying concentration were prepared by precipitating solutions of magnesium sulphate with sodium peroxide and the alkalinity and amount of active oxygen estimated in the resulting solution and precipitate. The results indicate that an equilibrium is established between the hydrogen peroxide and magnesium peroxide which depends on the degree of dilution and is independent of the temperature. A concentration rather less than that resulting from the solution of 80 parts of magnesium sulphate in 900 parts of water and precipitation with 20 parts of sodium peroxide corresponds to a condition in which 50 per cent. of the active oxygen is present in the dissolved hydrogen peroxide and 50 per cent. in the precipitated magnesium peroxide. With higher concentrations the proportion of active oxygen in the precipitate increases. The hydrogen peroxide solution employed in the experiments on the estimation of this substance on textile fibres (see following abstract and this J., 1907, 1195) was prepared from 30 parts of magnesium sulphate, 960 parts of water, and 10 parts of sodium peroxide.—R. B. B.

Hydrogen peroxide; Determination of —— *on fabrics of cotton, wool, and silk.* A. Scheurer and A. Vernet. Bull. Soc. Ind. Mulhouse, 1908, **78**, 187—190. (Compare this J., 1907, 1195.)

10·5 grms. of white calico, corresponding to about 10 grms. of dry cotton, were impregnated with 13 c.c. of hydrogen peroxide and the pattern hung in the air at the ordinary temperature until it felt dry to the touch, the weight being then about 11 grms. It was found that of a neutral solution of hydrogen peroxide 52 per cent. remained on the fibre after drying, of a solution acidified with sulphuric acid (1 litre = 0·66 grm. H_2SO_4) 44 per cent. and of an alkaline solution (1 litre = 0·54 grm. NaOH) 23 per cent. When acidified with boric acid the loss was not so great as with sulphuric acid. A series of experiments was then made with neutral peroxide on wool, silk, and cotton. Two solutions were employed containing respectively $\frac{1}{4}$ and 1 per cent. of hydrogen peroxide, and six patterns of each material were immersed in each solution. Three of the six were dried in air for 3, 24, and 48 hours respectively, the other three were kept moist in a closed vessel for the same periods. The following table gives the percentage of the original amount of peroxide which was found on the fibre:—

	Cotton.		Wool.		Silk.	
	$\frac{1}{4}$ per cent. solution.	1 per cent. solution.	$\frac{1}{4}$ per cent. solution.	1 per cent. solution.	$\frac{1}{4}$ per cent. solution.	1 per cent. solution.
			After 3 hours.			
Dry .	34	59	11	66	44	52
Moist .	55	100	31	67	76	95
			After 24 hours.			
Dry .	4	3	18	39	24	18
Moist	90	86	34	50	71	86
			After 48 hours.			
Dry .	0·6	0·3	1	17	18	6
Moist .	83	87	17	38	46	75

In consequence of the results described in the preceding abstract, a trial was made in which the cotton fabric was impregnated with the unfiltered solution, *i.e.*, containing the precipitated magnesium peroxide. After drying in air for 3 hours, 54 per cent. of the original hydrogen peroxide was found, whilst the same liquor filtered only gave 24 per cent. or if previously neutralised, 34 per cent.
—R. B. B.

Dyeing; Study of phenomena of ——. *Absorption of dyestuffs by tannin and silk.* P. Sisley. Rev. Gen. Mat. Col., 1908, 12, 225—228.

Anthracene picrate, $C_{14}H_{10}.2[C_6H_2(NO_2)_3.OH]$, is a red crystalline compound formed by the action of anthracene on picric acid in benzene solution on warming. It is readily dissociated by alcohol, and by excess of benzene, and immediately by water. A cold saturated solution of picric acid has no action on anthracene, but the author finds that in presence of mineral acid together with the application of heat, the anthracene is coloured red and may be considered to be superficially dyed, with formation of anthracene picrate. Thus, if 5 c.c. of a 2 per cent. aqueous picric acid solution are boiled with 0·1 grm. of finely powdered anthracene no action takes place; but if the experiment be repeated with the addition of 1 c.c. of pure sulphuric acid, the anthracene is coloured red, and the picrate formed settles down to the bottom of the test-tube. If the treatment with the acidified picric acid solution be twice repeated, all the anthracene is transformed into picrate, identical in every respect with that produced in the usual manner. If less sulphuric acid be employed, the action is less complete and with less than 0·1 c.c., it ceases entirely. Other mineral acids may be employed, concentrated hydrochloric acid acting as vigorously as sulphuric acid, phosphoric acid is less active, and acetic acid does not act at all.

β-Naphthol picrate, $C_{10}H_7OH.[C_6H_2(NO_2)_3OH]_2$, is prepared in orange needles by the action of β-naphthol on picric acid in hot benzene solution. It is also decomposed by water, but is more stable than the anthracene compound and is formed on shaking a cold saturated solution of picric acid with powdered β-naphthol as a bulky orange-yellow precipitate. If the strength of the picric acid solution is only 2 grms. per litre no combination takes place, but if in this case a little sulphuric acid is added (3 grms. per litre), combination takes place instantaneously.

Picrates of indole and skatole.—These picrates are orange coloured compounds, and are readily prepared from benzene solutions of the components. They are only feebly dissociated by water and are obtained on shaking indole or skatole with even fairly dilute aqueous solutions of picric acid. On shaking indole or skatole with an aqueous solution of picric acid containing only 0·5 grm. per litre, no combination takes place, but if 1 c.c. of sulphuric acid per litre be added, combination takes place immediately, with formation of the orange-coloured compound. Dilute aqueous solutions of the free acids of Crystal Ponceau and of Orange II. (this J., 1901, 1203), do not colour indole, but in presence of a mineral acid the latter is dyed by them in the cold. Indole only forms salts with mineral acids with extreme difficulty and the author considers that the phenomena just described are due to the formation of "true addition compounds" and not to ordinary salt-formation. In order to illustrate the difference the behaviour of guanidine was studied.

Absorption of tannin by silk.—It is already known that the addition of a mineral acid promotes the absorption of tannin by silk. The author has observed that in neutral aqueous solution there is a point of dilution at which the tannin is no more absorbed, however large the quantity of silk may be with which it is brought into contact. In presence of an acid, however, the absorption from a dilute solution is almost complete. It is necessary, in carrying out experiments on this subject to use silk which has been purified with soap solution and thoroughly rinsed with distilled water and pure alcohol, and tannin free from all traces of gallic acid. 100 c.c. of freshly prepared tannin solution containing 0·2 grm. per litre are stirred for ¾ hour with 1·5 grms. of silk in the cold; the same experiment is repeated with the addition of 2 grms. per litre of sulphuric acid. It is then easily shown that in the first case the tannin still remains in the liquor, whereas in presence of the mineral acid it has been completely removed. The two skeins of silk are then rapidly rinsed and passed through a solution of a ferric salt; that from the first experiment remains colourless, whilst the other becomes dark grey in colour. From more concentrated tannin solutions the tannin is absorbed by silk even in the absence of mineral acid. Analogous results are obtained in the case of the molecular compound of tannin, ether and water thrown down as a viscous, heavy liquid. when a concentrated aqueous solution of tannin is stirred with an excess of ether, and which has the formula, $(C_4H_{10}O),7(C_{14}H_{10}O),2H_2O$. This substance is dissociated by an excess of water, even though this be saturated with ether, and if the solution contains less than 2 per cent. of tannin it is not formed. In such cases its formation is promoted by the addition of mineral acid.

All the addition-compounds described, in distinction to guanidine picrate, which is a typical salt, are only formed within certain limits of concentration, whilst below these limits their formation is promoted by the presence of mineral acid. These phenomena are in exact accordance with those observed in the absorption of tannin by silk, and also with the fact observed by Knecht, Hallit and the author, that the free acids of the acid dyestuffs do not themselves dye the fibre, except in presence of a mineral acid. The author considers that these experiments tend to prove that chemical affinity plays an important part in the absorption of acid dyestuffs by the fibre, though no regular salt-formation takes place; he thinks that perhaps those "colloidal precipitates" commonly known as "absorption-compounds" may be considered to be molecular combinations of extreme instabilitiy.—E. F

Wool; Dyeing of ——. [*Increased affinity for colouring matters.*] J. Pokorny. Sealed notes 1615 and 1615A, March 7, 1906; 1616, March 10, 1906; and 1623, April 3, 1906. Bull. Soc. Ind. Mulhouse, 1908, 78, 176—182.

The affinity of the wool fibre for colouring matters is increased by treatment with various acids, alkalis, and reducing agents, with subsequent steaming. When woollen fabrics are printed with bisulphites, sulphites or hydrosulphite-formaldehyde or with sodium carbonate or bicarbonate, steamed 1½—3 minutes in the continuous ager, washed, and dyed, the printed portions come out considerably deeper than the unprinted. The strongest effect is produced with a mixture of sodium carbonate and hydrosulphite-formaldehyde, *e.g.*, with a paste of 100 grms. of Hydrosulphite N.F. conc., 100 grms. of sodium carbonate, and 800 grms. of British gum (1 : 1). The action of caustic soda in this respect has been described by Kertesz (this J., 1898, 242). Sodium acetate and phosphate and potassium sulphocyanide produce the same effect. In addition to the substances named, the following also impart to wool an increased affinity for dyestuffs, but require a steaming of ½—1 hour's duration; magnesium chloride, ammonium chloride, sodium chlorate, ammonium persulphate, aniline hydrochloride, hydroxylamine hydrochloride, and a mixture of stannous chloride and acetate.

In the course of the experiments it was observed that wool which has been treated with chlorine and bisulphite, after a previous soaping, dyes a paler shade when it is steamed before dyeing than without steaming; the difference between unsteamed wool and that steamed for 1½—3 minutes, is greater than that observed between the latter and wool steamed for ½—1 hour in moist greys. It was noticed that soaping followed by treatment with bisulphite has an effect equal to that of chlorination in increasing the affinity of wool for basic dyestuffs; for acid dyestuffs successive treatment with soap, chlorine, and bisulphite has the greatest effect.

In a report on the above, E. Noelting and A. Scheurer point out that the effect of most of the substances used in these experiments to contract woollen fabrics and increase the affinity for colouring matters was described by Siefert (this J., 1899, 578). The most novel point now brought forward is the employment of a mixture of sodium carbonate and hydrosulphite-formaldehyde with subsequent steaming.—R. B. B.

Aniline Black and Paranitraniline Red; Production of white and coloured discharges under ——. M. J. Königsberg. Sealed note 973, May 3, 1897. Bull. Soc. Ind. Mulhouse, 1908, 78, 182—183.

The material is printed with a resist consisting of 100 grms. of gum senegal (1 : 1), 150 grms. of zinc oxide in glycerin (1 : 1), 50 grms. of dry ammonium citrate, 150 grms. of stannous chloride, and 200 grms. of White 1K. The White 1K is made with 3·5 kilos. of dry British gum, 4·8 kil. of potassium sulphite of 16° B., and 3·2 kil. sodium bisulphite of 18° B. The Aniline Black is then printed, the goods steamed in the Mather-Platt ager, padded in β-naphthol, and passed into the bath of diazotised paranitraniline or (for claret) α-naphthylamine, and finally soaped for 10 minutes at 50° C.

A. Brand and J. Demant mention in their report on the above that similar resists have been previously described by Koechlin Brothers and by Meister, Lucius, und Brüning, but they assign priority to the present author for a simultaneous resist for Aniline Black and a diazo red or claret.—R. B. B.

Patents.

Fibres and fibrous materials ; Treatment of vegetable ——. The Karsam Soap Co., Ltd., and M. R. A. Samuel, London. Eng. Pat. 20,049, Sept. 7, 1907.

The raw fibrous material is steeped, at a temperature of from 60° to 100° C., in a petroleum emulsion, containing 5 per cent. of soap, 50 to 60 per cent. of petroleum, and 1 to 3 per cent. of an alkali, such as caustic soda, sodium carbonate, etc. The excess of solution is removed and the action is allowed to proceed spontaneously in the fibre, or the material is treated with steam under pressure, or the material may be steeped for a time in the liquor. The material is washed, in order to free it from the reagents or the products of their action on the incrusting matters. —B. N.

Cellulose products [artificial threads] ; Manufacture of ——. Ver. Glanzstoff-Fabr. Akt. Ges., Elberfeld, Germany. Eng. Pat. 9268, Apr. 29, 1908. Under Int. Conv., Sept. 30, 1907.

In Eng. Pat. 27,707 of 1907 (this J., 1908, 624) the use of a concentrated alkaline lye, mixed with sugars such as glucose, saccharose or lactose, was specified for the coagulation of solutions of cellulose in cuprammonium discharged from a suitable orifice. The present specification relates to the employment of this coagulating bath at temperatures ranging from 45° to 75° C. For fine threads temperatures of 50°—60° C. are preferred, whilst for coarse threads temperatures of 60°—75° C. are best. —J. F. B.

Silk ; Ungumming raw ——. P. Schmid, Basle, Switzerland. U.S. Pat. 895,112, Aug. 4 1908.

See Fr. Pat. 381,492 of 1906 ; this J., 1908, 119.—T. F. B.

Scouring ["washing free of soap," etc.] and squeezing machines ; Application of electrolysis to ——. J. M. J. Baudot, Roubaix, France. U.S. Pat. 895,144, Aug. 4, 1908.

The fabric is guided between a pair of electrodes in a trough containing an electrolyte, such as an alkali carbonate, capable of liberating an alkaline product within the fabric when traversed by an electric current, the material being afterwards passed through squeezing or wringing rolls. The process is repeated in a second similar trough, and the fabric is finally cleansed in running water. The process is thus defined as one for "washing fabrics free of soap and similar products."—B. N.

Mercerising process. L. Wallach. Fr. Pat. 388,278, March 18, 1908.

See Eng. Pat. 18,312 of 1907 ; this J., 1908, 331.—T. F. B.

Printing on textile fibre. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 23,793, Oct. 28, 1907.

See Fr. Pat. 383,533 of 1907 ; this J., 1908, 332.—T. F. B.

Wool mixtures ; Production of —— fast to light [by dyeing]. L. Cassella und Co. Fr. Pat. 388,442, May 31, 1907.

See Eng. Pat. 12,831 of 1907 ; this J., 1908, 401.—T. F. B.

VII.—ACIDS, ALKALIS, AND SALTS, AND NON-METALLIC ELEMENTS.

Ammonium persulphate and sodium peroxide ; A reaction between ——. R. Kempf and E. Oehler. Ber., 1908, **41**, 2576—2580.

R. Kempf (Ber. 1905, 38, 3972) has already shown that on allowing an aqueous alkaline solution of ammonium persulphate to stand, large quantities of nitric acid are formed, since the ammonia liberated by the alkali, even at the ordinary temperature, is almost quantitatively oxidised to nitric acid by the active oxygen of the alkali persulphate. The authors find that a mixture of equal parts of dry ammonium persulphate and sodium peroxide, explodes when gently ground in a mortar, or heated, with evolution of flame and smoke. The same effect is produced by passing carbon dioxide over the mixture and then wetting it with water, or even by allowing the strongly hygroscopic mixture to stand exposed to the atmosphere. On treating the mixture with water, solution takes place with rise of temperature. The mixture of ammonium persulphate and sodium peroxide explodes at 135 ° to 140° C. when rather rapidly heated, and at 75° C., when slowly heated. Analysis of the products of decomposition showed that several reactions take place simultaneously. The ammonia, which is first set free by the action of the strongly alkaline sodium peroxide, is oxidised so as to liberate nitrogen by the combined action of the two oxidising agents, according to the equation :—$(NH_4)_2S_2O_8+2Na_2O_2=2Na_2SO_4+4H_2O+N_2$. A mixture of sodium hydroxide and ammonium persulphate is found to have no explosive properties.—W. S.

Heat of combination of acidic oxides with sodium oxide, and heat of oxidation of chromium. W. G. Mixter. Amer. Journ. Sci. 1908, **26**, 125—137.

The author has determined the heats of combination of certain acidic oxides with sodium oxide, using a bomb calorimeter. As a rule, sodium peroxide and a known quantity of carbon were employed. The following results were obtained :—

$$3Na_2O+B_2O_3=2Na_3BO_3+104{,}200\text{ cal.}$$

$$Na_2O+Al_2O_3\begin{matrix}\text{(amorph.)}\\\text{(cryst.)}\end{matrix}=2NaAlO_2+\begin{matrix}40{,}000\text{ cal.}\\30{,}000\text{ cal.}\end{matrix}$$

$$Na_2O+CrO_3=Na_2CrO_4+77{,}000\text{ cal.}$$

$$Cr+3O=CrO_3+140{,}000\text{ cal.}$$

$$2Cr+3O=Cr_2O_3\begin{matrix}\text{(amorph.)}\\\text{(cryst.)}\end{matrix}+\begin{matrix}243{,}800\text{ cal.}\\267{,}800\text{ cal.}\end{matrix}$$

$$Cr_2O_3\begin{matrix}\text{(amorph.)}\\\text{(cryst.)}\end{matrix}+3O=2CrO_3+\begin{matrix}36{,}200\text{ cal.}\\12{,}200\text{ cal.}\end{matrix}$$

$$Na_2O+WO_3=Na_2WO_4+94{,}700\text{ cal.}$$

—F. Sodn.

Steam distillation ; Studies in ——. *The rate of distillation of formic and acetic acids.* H. D. Richmond. Analyst, 1908, **33**, 305—312.

The results of a number of experiments are given which were carried out in order to ascertain the rate of distillation of volatile acids of the formic acid series. The apparatus used, was designed with the purpose of eliminating, as far as possible, the condensation in the retort to which the discrepancies observed by Wilson (this J., 1890, 18) were probably due. The calculated results, as found by the formulæ given in a previous paper by the author (this J., 1908, 705), are recorded together with those found by actual experiment, and it is seen that the rise in value of the ratio of the rate of distillation of the acid to that of water is much more marked in the case of formic acid than with acetic acid.—W. P. S.

Patents.

Nitric acid and nitrites ; Simultaneous preparation of ——. Norsk Hydro-Elektrisk Kvaelstofaktieselskab, Norway. Fr. Pat. 388,276, Mar. 18, 1908.

The nitrous gases obtained by the combustion of atmospheric nitrogen in an electric arc are absorbed, first, by pure water with formation of nitric acid, and subsequently, by caustic alkalis or alkali carbonates with formation of pure nitrites.—O. R.

Nitrogen peroxide from mixtures of air and oxides of nitrogen containing small percentages of oxides of nitrogen ; Process for obtaining ——. Elektrochemische Werke G.m.b.H. Fr. Pat. 388,281, March 18, 1908. Under Int. Conv., May 13, 1907.

See Ger. Pat. 199,561 of 1907 ; this J., 1908, 856.—T. F. B.

Oxides of nitrogen diluted with air or inert gases; Recovery of ——, and apparatus therefor. A. A. Naville, P. A. and C. E. Guye, Geneva. Eng. Pat. 6366, March 21, 1908. Under Int. Conv., March 22, 1907.

See Fr. Pat. 385,605 of 1907; this J., 1908, 627.—T. F. B.

Nitrous compounds; Apparatus for manufacturing —— (electrically). C. P. Steinmetz. U.S. Pat. 894,547. *See* VII.

Magnesia; Process for obtaining —— from dolomite. H. Auzies and A. Ségoffin, Toulouse, Haute Garonne, France. Eng. Pat. 1425, Jan. 21, 1908. Under Int. Conv., Jan. 24, 1907.

Dolomite is burnt to "calco-magnesian" lime which is then slaked and led, by a current of water, into a series of tanks, arranged in steps. The magnesia, being much less dense than the lime, is carried into the furthest tanks, where it is obtained nearly pure.—F. Sodn.

Potash or soda; Process of making [caustic] ——. F. Schäcke. Fr. Pat. 388,464, March 23, 1908. Under Int. Conv., March 25, 1907.

See Ger. Pat. 198,481; this J., 1908, 808.—T. F. B.

Sodium bicarbonate; Process and apparatus for the manufacture of ——. R. H. F. Finlay, Belfast. Eng. Pat. 16,853, July 23, 1907.

In this process, sodium bicarbonate is manufactured according to the well known ammonia soda process, except that the mother liquor is treated electrolytically, for the recovery of ammonia and chlorine. For this purpose, the electrolytic battery, described in a previous patent (this J., 1907, 620), is preferably employed, and a second duct, opening into the lower part of the cathodes, may be introduced, for the supply of carbon dioxide to the cathode chambers, which should be made larger than usual, and adapted for the ready removal of any sodium bicarbonate formed in them. Or, carbon dioxide may be introduced into the liquor, before electrolysis, or added to the mixed gases (ammonia and hydrogen), after leaving the cathode chambers, so that these gases may be used again in the process of manufacture: the hydrogen, not being absorbed, is drawn off in the meantime.—F. Sodn.

Caustic alkali and sulphur; Manufacture of —— from alkali sulphide. P. Lemoult, France. Fr. Pat. 388,191, May 24, 1907.

Hydrated ferric oxide, preferably mixed with charcoal or sawdust, is made into a paste with water, introduced into the solution of the alkali sulphide, and the mixture thoroughly agitated with careful exclusion of air. Caustic alkali and a mixture of iron sulphide and sulphur are formed. The solution of alkali is decanted off, and the residue, in the form of mud, is spread out in thin layers on a suitable horizontal surface of glass, stone, or the like, and subjected to very thorough aeration. Sulphur separates and hydrated ferric oxide is regenerated.—O. R.

Alkali hydroxides; Method of making ——. P. B. and S. P. Sadtler, Philadelphia. Eng. Pat. 273, Jan. 4, 1908.

See U.S. Pat. 877,376 of 1908; this J., 1908, 160.—T. F. B.

Aluminium sulphate; Treatment of residue from the manufacture of ——. W. Pochin and J. H. Richardson, Salford. Eng. Pat. 25,227, Nov, 14, 1907.

The insoluble residue from the treatment of aluminous material with sulphuric acid, either in the form of mud or in a semi-dried state, is heated with sulphuric acid or sodium bisulphate to a temperature of 500°—700° F. and subsequently briquetted, with or without the addition of water or of a saline solution.—O. R.

Sodium nitrite; Process for making —— from sodium nitrate and copper precipitate. H. Gouthière et Cie. Fr. Pat. 388,182, March 14, 1908. Under Int. Conv., March 27, 1907.

See Eng. Pat. 6655 of 1908; this J., 1908, 749.—T. F. B.

Tin chloride or the like; Manufacture of ——. H. Brandenburg, Kempen a/Rhein, Germany. Eng. Pat. 1461, Jan. 21, 1908.

See Fr. Pat. 386,594 of 1908; this J., 1908, 749.—T. F. B.

Alkali formates and aluminium hydroxide; Process for obtaining ——. M. Haase, Berlin, Germany. Eng. Pat. 4471, Feb. 27, 1908. Under Int. Conv., Mar. 15, 1907.

Carbon monoxide, alone or mixed with other gases, is allowed to act, under pressure, on alkali aluminate lyes, such as those obtained by boiling bauxite with caustic alkalis, the lyes being first evaporated, if necessary, so as to contain about 30 per cent. of water. It is claimed that alkali formates are thus produced, much more rapidly and easily than by the action of carbon monoxide on caustic alkalis, and with less corrosion of the apparatus; moreover aluminium hydroxide is obtained as a by-product.—F. Sodn.

Nitrogen compounds from carbides; Process and apparatus for manufacture of ——. A. R. Frank and M. Voigt, Berlin. Eng. Pat. 21,786, Oct. 2, 1907.

In the manufacture of nitrogen compounds by the action of nitrogen on carbides, wherein a part only of the carbide is raised to the necessary temperature, the remainder reaching the reaction temperature progressively as the reaction proceeds, fusion of fine-grained carbide particles occurs at the boundary lines of those portions which are undergoing reaction. To avoid this fusion, which withdraws the material from the action of the nitrogen and hinders the spread of the reaction throughout the mass, the nitrogen is sent across the mass in the opposite direction to that in which the progressive reaction is to occur. The local heating necessary to start the operation is best provided electrically through the agency of one or more vertical carbon resistance rods, each carbon being kept out of contact with the carbide by arranging within the latter suitable heating chambers surrounding the carbons. The walls of these chambers need not be permanent but may be of thin sheet metal or of decomposible organic material.—O. R.

Ammonia into oxides of nitrogen; Catalytic apparatus for transforming ——. W. Ostwald, Gross-Bothen, Germany. Eng. Pat. 7909, Apr. 9, 1908.

Sheets, plates, or the like, of catalytic material are arranged parallel, or approximately parallel, to one another, so as to fill the entire cross-section of the chamber in which reaction takes place. The plates and the spaces between them are inclined to the axis of the chamber and to the direction of the entering gases. The plates are fixed in any suitable manner, care being taken that they make contact at as few points as possible, so as to minimise their resistance to the passage of the reacting gases.—O. R.

"Pyrites fines"; Method of preparing —— for desulphurisation. P. de P. Ricketts and T. C. King, New York, Assignors to National Metallurgic Co., Jersey City, N.J. U.S. Pat. 894,799, July 28, 1908.

"Pyrites fines" are prepared for desulphurisation by mixing with a fusible sulphide or other sulphur compound, and subjecting the mixture to sufficient heat, under reducing conditions, to liquefy the sulphur compound. The now coherent mass is compressed into any desired shape and finally cooled.—F. Sodn.

Precipitates; Process for producing pulverulent ——. N. A. Langlet and E. L. Rinman. Fr. Pat. 388,527, March 26, 1908.

In order to obtain the precipitate in a pulverulent form, the material from which it is desired to produce the precipitate is introduced into the precipitating reagent, which may be gaseous or liquid, in the form of very small drops, or as a fine powder.—W. H. C.

Liquefying air. J. F. Place, Glenridge, N.J., Assignor to American Air Liquefying Co., New York. U.S. Pat. 895,192, Aug. 4, 1908. Also *ibid*, Eng. Pat. 13,529, June 11, 1907.

See Fr. Pat. 379,605 of 1907 ; this J., 1907, 1280.
—W. H. C.

Oxygen generator. A. Beltzer, Quincy, Mass. Assignor to Industrial Oxygen Co., New York. U.S. Pat. 895,331, Aug. 4, 1908.

The patent is for a portable oxygen generator for medical purposes and the like. It consists of an outer cylindrical case and cover. Inside this is a second cylinder or receptacle, open at the top, over which fits, by a bayonet joint, a gas-collecting chamber, open below and attached to the cover. The gas-generating material is contained in the upper part of the receptacle which is divided from the lower part by a horizontal porous partition. Water, placed in the outer casing, can penetrate into the lower part of the receptacle, through the partition, to the gas generating material. A bent sheet of metal, secured to one side of the collecting chamber, constitutes an auxiliary chamber communicating with the first, and into this passes a vertical take-off pipe, connected at its base with a tap, passing through the casing. There is a vent in the cover, outside the gas chamber.—F. Sodn.

VIII.—GLASS, POTTERY, AND ENAMELS.

Glass ; The decomposition of ——. F. Mylius. Sprechsaal, 1908, **41,** 390—393 ; 402—404 ; 418—420.

Many of the changes that occur in glass objects, such as the gradual formation of a superficial iridescent surface, etc., are molecular changes. The actual decay, or decomposition of glass results from the action of chemical agents, amongst which water and carbonic acid are the most important. These agents penetrate the substance and alter its composition, just as in the weathering of rocks. Water decomposes glass, so that free alkali goes into solution, and the silica and other essential constituents of the glass remain undissolved. The decomposition of even powdered glass at temperatures above the ordinary, is not complete, a certain amount of alkali being persistently retained by the insoluble residue. The extent to which decomposition proceeds depends upon the composition of the glass. The formation of an alkali carbonate is not the only sign of weathering in glass. When the saline layer is washed off a glass article, the surface after being dried does not appear to be affected, until the article is warmed, say, to 100° C., when a certain amount of flaking or exfoliation of the surface occurs. The reason for this is that simultaneously with the extraction of alkali, the glass has become hydrated, and the amount of hydration is chemically equivalent to the amount of alkali extracted. This occurs especially with glass that has been in contact for a long time with water, saline, or acid solutions, and is frequently seen in boiler gauge-glasses, where the action is favoured by the higher temperature, and in the tubes used to separate the lead plates in electrical accumulators. The water forming the hygroscopic layer on the surface of glass is known as the "permanent water-skin," as distinguished from a temporary aqueous film formed over it. The decomposition of a definite amount of glass by a definite amount of water gradually proceeds until a condition of chemical equilibrium is reached, in which neither the glass solution nor the glass residue is altered. When a glass tube from an accumulator is heated quickly over a small Bunsen burner, a white porcelain-like patch appears on the surface at a temperature of about 400° C. This devitrified patch is due to the formation of a number of small steam bubbles, like a layer of foam, from the hydrated glass. This devitrified layer is brittle, and can be separated from the bulk of the glass, from which it also differs in composition ; for instance, reckoning upon 100 parts by weight of silica in the original glass, in one case 11·1 parts of alkali were extracted and 8·1 parts of water were introduced. Various tests are used to estimate in a short time the resisting power of a glass to decomposition. In the "dimming test" the glass is exposed to air almost saturated with water, at between 20° and 80° C., and the surface then becomes dimmed with minute drops. The amount of dimming depends upon the temperature, the time of exposure, the character of the polished surface, and the composition of the glass. An atmosphere of hydrochloric acid gas also produces in about 24 hours, a film of alkali chloride, like hoar frost, on the surface of a glass. In another method the actual amount of alkali dissolved out of a glass by pure water has been used as a test, the amount of alkali being measured by the electrical conductivity of the liquid, or colorimetrically, by using litmus, phenolphthalein, etc., or by titration with $N/1000$ acid, in the presence of an ethereal solution of iodeosin as indicator. In the process of blowing, say, a flask, the superficial layer of glass probably loses some alkali by volatilisation, and any process of cleaning the flasks with water extracts a certain amount of alkali, and begins the process of decomposition. Hence for uniformity in such tests, the glass objects are subjected to a preliminary treatment with water at 18° C. for three days. The following table gives the number of milligrams of alkali (Na_2O) dissolved from 1 sq. metre of surface in the glasses described, after the above preliminary treatment.

Kind of Glass.	1 Week. Water at 18° C.	3 hours. Water at 80° C.
A. Quartz	—	—
B. Water resisting glasses, *e.g.*, Jena Glass 59III.	0—0·4	0—1·5
C. Resistant glasses, *e.g.*, Stas's glass	0·4—1·2	1·5—4·5
D. Harder apparatus glasses, *e.g.*, Jena thermometer glass 16III.	1·2—3·6	4·5—15
E. Softer apparatus glasses, *e.g.*, lead crystal glass	3·6—15	15—60
F. Defective glasses	over 15	over 60

The only way to determine the effect of solvents on unaltered, solidified glass is by working upon freshly broken surfaces. If glass powder be used, not only alkalis, but small quantities of silica, boric acid, lime, etc., are extracted, and can be determined by gravimetric processes. The difficulty in using powder is that the surfaces of the particles cannot be measured, and the use of sieves does not ensure uniformity of grain, so that the amount of action produced cannot be referred to any definite unit of surface. The iodeosin test overcomes most difficulties just mentioned. The broken edge of any piece of glass can be easily measured ; a convenient size is 100—200 sq. mm. The broken surface is dipped for a definite time in a solution, composed of 0·5 grm. of iodeosin in 1 litre of water, saturated with ether. The alkali liberated from the glass unites with the iodeosin to form a definite compound, which is insoluble in ether, and is left on the broken glass surface as an amorphous, green, glistening coat, which dissolves in water, and gives a red colour which can be measured colorimetrically. If the time of immersion be more than a minute or so, the test should be made in a wide stoppered glass, filled, so that when the test piece and stopper are introduced all the air is excluded. For measuring the colour, a standard solution of 0·01 grm. of iodeosin in 1 litre of water, made slightly alkaline, is used ; 1 c.c. of this corresponds with 0·00074 mgrm. of Na_2O, or 0·0011 mgrm. K_2O. By this eosin-steeping method definite values can be assigned to various kinds of glass. Results obtained by this method in 1-minute tests with some optical glasses, agreed very closely with the results of some actual "weathering" tests on the same glasses when subjected to the action of air charged with the ordinary amounts of moisture and carbon dioxide for 8 months, and showed whether a glass was suitable for a certain purpose or not. By varying the length of time of immersion, a measure can be obtained not only of the initial attack on a glass, but also of the velocity of reaction. For this purpose two determinations are generally enough ; one say "a minute-test," and the other "a day-test." The increase shown by the "day-test" over the "minute-test" is a measure of the power of resistance of the glass to continued decomposing action. Thus :—

MILLIGRAMS OF IODEOSIN PER 1 SQ. M. OF BROKEN SURFACE.

	Minute test, *a*.	Increase in the day, *b*.	Day test, $c = a + b$.
Glass A	1	—	1
,, B	6	1	7
,, C	17	6	23
,, D	20	14	34
Plate-glass	20	8	28

The optical glasses A, B, and C, with the small increase values 0, 1, and 6 (under *b*), the plate glass with the value, 8, are more resistant to weather than the glass D, with an increase value of 14. The test is applicable to most silicate glasses, but flint glasses with a high content of lead, form an exception, as in the reagent they become coated with a layer composed of lead and eosin, which is insoluble in water. Heavy barium glasses also require a modified test.—W. C. H.

Fluorine in enamel glazes ; The value of ——. B. Bock. Chem.-Zeit. 1908, **32**, 730—731.

A NUMBER of fluorine compounds, such as fluorspar, aluminium fluoride, sodium fluoride, cryolite, etc., are used in the production of enamels, and the author discusses the part played by the fluorine in these fused glasses. He considers that fluorine itself exerts no influence on the density of the opaque glass, but that the salts derived from it possess low melting points, and united with other substances, showing similar properties, tend to lower the melting point of the whole mass. As soon as the mass fuses, the fluorine escapes, combined with silicon as the tetrafluoride, which readily reacts with water to form hydrofluosilicic acid, with the separation of silica, and at higher temperatures the hydrofluosilicic acid is unstable and is decomposed again into silicon tetrafluoride and hydrofluoric acid. When sodium silico-fluoride is used in the melt, the decompositions proceed as in the following equations :—

$$2Na_2SiF_6 = 2SiF_4 + 4NaF.$$
$$4NaF + SiO_2 = SiF_4 + 2Na_2O$$

Thus, in the preparation of the glaze, the flourine escapes as SiF_4, and hence the only effect of adding fluorine compounds is the lowering of the fusing-point of the mass, due to the fluxing action of fluorides. Fluorine vapours should be carried off by as high a chimney as possible, because of their injurious effect upon neighbouring buildings, or in the case of larger works, they should be collected in water, and the fluorine recovered. A recovery process has secured considerable extra profit to manure works dealing with phosphates containing, say, 4 per cent. of fluorine, and should certainly pay in an enamel works, using materials containing perhaps 54 per cent. of fluorine.—W. C. H.

Porcelain ; The burning of ——. A. Heinecke. Tonind.-Zeit., 1908, **32**, 1410—1416.

THE firing of the dipped biscuit-ware is studied in four phases. During the heating-up, which should be regular, no fire-gases must leak into the kiln, and a good draught should exist. At cone 09, the kiln is filled with a reducing atmosphere, which however should not contain more than 5 per cent. of carbon monoxide, and the burning must not be too rapid. The atmosphere is then made almost neutral (1 per cent. of carbon monoxide), and the kiln is fired to cone 8. Iron compounds are kept reduced and do not stain the body. This is followed by an oxidation period long enough to re-oxidise the reduced stains in the glaze.

Glazes containing easily-reducible metallic oxides, may also be fired in a double-walled chamber which protects them from the gases, whilst being heated on all sides.

Plans are given, illustrating a kiln for burning coal or lignite, and of a small kiln for firing under-glaze colours in two days, using wood as fuel.—H. H. S.

Silicate-melts ; Dissociation of ——. *II.* C. Doelter. Monatsh. f. Chem., 1908, **29**, 607—644. (See this J., 1906, 537.)

THE author determined the specific electric resistance of augite, albite, labradorite and several diopsides over a wide range of temperature, the results obtained with an alternating current being used. He shows that melts solidifying in the crystalline condition have an enormously high resistance at ordinary temperatures, and possess a high resistance up to a point about 200° C. below their melting-point ; the resistance then falls rapidly, for a small increase in temperature, until above the melting-point a further increase in temperature lowers the resistance only slightly. Substances which solidify wholly or partly in the glassy (vitreous) or amorphous condition, on the other hand, show a considerably decreased resistance at temperatures not more than 500° C. below their melting-points, and the resistance at temperatures not more than 200° C. below the melting-point is not very much greater than in the fused state. Specific resistance $\left(W = \frac{1}{x}\right)$ and absolute temperature (T) are connected by the equation :

$$\log. W = \frac{v}{T} + C,$$

which is derived from van't Hoff's formula for bad conductors :

$$\frac{d \ln x}{dT} = -\frac{q}{RT^2}.$$

The constants *v* and C in the above equation change with the change from the solid to the liquid state. As the viscosity of the silicates examined by him is very great even in the fused condition, in which the resistance is comparatively quite small, the author does not believe that absence of conductivity in these bodies at ordinary temperatures necessarily implies that they are undissociated. The molecules may be dissociated, but the ions prevented from moving by some condition of the crystalline state. This theory accounts for the behaviour of these substances in the neighbourhood of their melting-points.—A. G. L.

PATENT.

Glass ; Furnaces for melting ——, *heated by a liquid combustible.* Niederrheinische Glashütten, G.m.b.H. Fr. Pat. 388,488, March 24, 1908.

THESE glass-melting furnaces are heated by a mixture of a liquid combustible and compressed air, previously heated. The supply pipes for the compressed air are arranged, partly or entirely, close to the heated walls of the furnace, and lead from the bottom upwards. The supply pipes, opening into the pipe or nozzle of the burner, are arranged to give the length of passage necessary for the required amount of heating, and at the same time to include as few bends as possible, and to be readily accessible for repairs. A pre-heating chamber is arranged above the melting pot or chamber, and serves for the admission, supply, and pre-heating of the external air entering the interior of the furnace, and constantly replacing the air and gases drawn off by the chimney draught.—W. C. H.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Clays and their hydrolysis. Rohland. Sprechsaal. 1908, **41**, 447—448.

THE author ascribes the existence of kaolin in nature to its power of resisting the attack of carbon dioxide, or the hydrolysing effect of water, as also of strongly adhering to its water of constitution. Of other simple silicates, those of the alkali metals are hydrolysed most readily, those of calcium less so, and those of magnesium least. Pure kaolin is to be regarded as a compound of a weak base with a weak acid of very complex structure, very feebly hydrolysed and then giving an acid reaction. Clays, on the other hand, possess a basic reaction owing to their content of felspar. Plasticity depends on hydrolysis, and is due to the separated colloidal hydroxides of silicon, aluminium or iron.—A. G. L.

Portland cement; The "swelling" (absorption of water) of ——. Cabolet. Tonind.-Zeit., 1908, 32, 1019—1024.

Experiments with a large number of cements show that all absorb water and increase in volume, ("swell"), in a remarkable manner when shaken with water in the proportion of 3·5 grms. of cement to 1 litre of water. The treatment consisted in continuously shaking the mixture not too violently for 12 hours, then shaking at least once an hour for another 12 hours, and finally shaking 3 times a day until "swelling" took place. This happens after 1—84 days, generally after 2—3 days, and continues for 5—24 days, generally 6—8 days. Shortly before "swelling" takes place, it was noticed that the cement settled rapidly after shaking. During the "swelling" the cement increases in volume so much that 27 grms. occupy about 5—6 litres; the volume then diminishes slightly and remains constant for an indefinite time. The "swelling" always commenced when the water above the cement had taken up 0·25—0·29 grm. of lime per litre, and stopped when 0·45—0·603 grm. of lime per litre had been dissolved, about 20 per cent. of the lime in the cement being dissolved. Cements shaken with water already containing 0·35 grm. of dissolved lime per litre "swell" within 15 minutes, but the increase in volume is less than when water only is used. Passow cement (poor in lime) only "swells" after 9 months in water, but after 6 days if a solution of lime is used. Cement shaken with 10 per cent. sugar solution did not "swell," neither did it when shaken with strong lime solutions, or with so much water that the minimum concentration (see above) could not be attained. In sea-water no "swelling" occurred until after the whole of the magnesia had been precipitated. With a 10 per cent. solution of sodium chloride "swelling" was delayed and less voluminous; calcium sulphate solution acts similarly. If the "swollen" cement was filtered off, the water pressed out as far as possible, and the very soft pats obtained left in air for 24 hours and then placed in water, a marked hardening took place, some of the pats so obtained standing the boiling test well. Analysis of the lime solutions obtained during the tests showed that they were quite free from silica if zinc bottles were used, but that small quantities of silica were present if glass bottles were employed.

During the discussion on the paper, Michaelis sen. stated that by removing the water as far as possible by pressure from colloidal hydroxides, and then leaving them to harden, very high compression tests had been obtained, the maximum values being: For lime, 105 kilos. per sq. cm.; silica, 985; alumina, 635; and ferric hydroxide, 805. He also found that a solution containing 1 part of lime in 20,000 of water dissolved silica to the extent of 1 part in 24,000, whilst a 0·1 per cent. lime solution only dissolved 1 part of silica in 1,360,000 parts of solution.—A. G. L.

Titanic acid; The fluxing effect of —— upon silica, alumina, and kaolin. R. Ricke. Sprechsaal, 1908, **41**, 405—406.

Many kaolins and clays contain titanic oxide in quantities varying from traces up to 2 per cent. or more, and bauxites frequently contain from 2 to 4 per cent. As titanic oxide has a fluxing effect, its presence may have a serious effect upon the refractoriness of a material, and the author has determined the effect produced by varying quantities, admixed with silica, alumina, and Zettlitz kaolin containing 98·5 per cent. of clay substance. In the case of mixtures of silica and titanic oxide, the melting point falls with increasing amounts of the latter, until the mixture consists of 60 per cent. of silica and 40 per cent. of titanic oxide. This forms an eutectic mixture, with a molecular composition of $1TO_2 : 2SiO_2$, and melts at Z-cone 20. The melting point then rises with increasing amounts of titanic oxide, until a mixture of 40 per cent. of silica and 60 per cent. of titanic oxide is reached, which melts at Z-cone 30. The melting point then falls gradually towards the melting point of pure titanic oxide, *i.e.*, about Z-cone 27. The melting point of mixtures of alumina and titanic oxide, falls with increasing amounts of the latter, until this forms 40 per cent. of the mixture, which however is not an eutectic, and melts at Z-cone 33. Then, as in the former case, the melting point rises slightly, until the mixture contains 60 per cent. of titanic oxide, and from that it falls away gradually to the melting point of pure titanic oxide. In the case of mixtures of Zettlitz kaolin and titanic oxide, the effect of the latter upon the softening temperature of the aluminium silicate is greater than that on either alumina or silica alone. The kaolin melts at Z-cone 35, and comparatively small percentages of titanic oxide cause a rapid fall in the melting point, which was below cone 26 in a mixture containing 20 per cent. of the oxide. The lowest melting point, between cones 19 and 20, was given by a mixture of equal parts of the kaolin and oxide, and as the percentages of the latter increase there is a slight rise in the melting point. All the mixtures with from 20 to 90 per cent. of titanic oxide melt between cones 19 and 26, and no marked maxima and minima (or eutectic) occur as in the silica and alumina mixtures. The following table gives a *résumé* of the author's observations:—

Percentage of TiO_2.	Percentage of SiO_2.	Melts at Z-cone.	Percentages of Al_2O_3.	Melts at Z-cone.	Percentages of Zettlitz kaolin.	Melts at Z-cone.
0 +	100	36	100	42	100	35
10 +	90	33—34	90	—	90	30
20 +	80	29—30	80	37	80	−26
30 +	70	26	70	−35	70	20
40 +	60	20	60	33	60	−20
50 +	50	27	50	+33	50	19—20
60 +	40	+30	40	33—34	40	20
70 +	30	29	30	31	30	+20
80 +	20	29—30	20	−29	20	−26
90 +	10	−29	10	−28	10	26
100 +	0	−27	0	−27	0	−27

—W. C. H.

Patents.

Wood; Process and preparation for preserving ——. D. Lorach, Mulhausen, Elsass, Germany. Eng. Pat. 5051, March 5, 1908.

Wood is preserved against splitting and rotting by the application of a special coating, consisting of about 65 per cent. of plaster (calcium sulphate), 30 per cent. of resin oil, and 5 per cent. of benzine varnish (a 10 per cent. solution of colophony in purified benzine).—W. C. H.

Cement clinkers; Method and apparatus for utilising the heat from ——. T. C. King, New York, Assignor to National Metallurgic Co., Jersey City, N.J. U.S. Pat. 894,507, July 28, 1908.

The hot cement clinker issuing from the kiln is charged into chambers, into which, as soon as they have become heated by the clinker, a "heat absorbing medium" is introduced, the charging of hot clinker into a chamber thus alternating with the introduction of the "heat absorbing medium." This medium is then withdrawn and conveyed to the place where it is utilised.—A. G. L.

Cement; Apparatus for treating ——. O. Gerlach, Iola, Kansas. U.S. Pat. 894,825, Aug. 4, 1908.

The lower end of a rotatory kiln is provided with a stationary closure, which carries the burner and has an opening at the bottom. The burnt clinker drops through this opening into a tank of water situated immediately beneath the opening. A conveyor worked by the rotatory kiln removes the clinker from this tank.—A. G. L.

Cement medium compound. C. H. Land, Detroit, Mich. U.S. Pat. 895,094, Aug. 4, 1908.

The cement consists of an oxide which can combine with phosphoric acid, sodium phosphate, copaiba balsam, oil of tar, and oil of lavender.—A. G. L.

Puzzolane [puzzuolana] and other volcanic earths ; Process for the further treatment of —— for the purpose of facilitating their admixture and binding with lime and cement. E. Bougleux, Pisa, Italy. Eng. Pat. 467, Jan. 8, 1908.

See Fr. Pat. 384,930 of 1907 ; this J., 1908, 506.—T. F. B.

Peat ; Manufacture of a material from —— for electric and heat insulation, sound deadening, and other purposes. H. Branco and G. Gumpert, Charlottenburg, Germany. Eng. Pat. 8017, April 10, 1908.

Moist or air-dried peat is treated in breakers to disintegrate it, and to entangle or "felt" the fibres, and separate foreign substances ; the mass is treated with dry steam for 2 or 3 hours, and moulded under pressure into plates, blocks, strips, spheres, rope, or other forms. —A. T. L

X.—METALS AND METALLURGY.

Aluminium and zinc ; Production of hydrogen peroxide from ——. H. T. Barnes and G. W. Shearer. *See* XI*B.*

Iron and steel ; Determination of vanadium in ——. E. de M. Campbell and E. le G. Woodhams. J. Am. Chem. Soc., 1908, **30**, 1233—1236.

The detection depends upon the fact that where vanadium is present in iron or steel, and the metal is dissolved in dilute sulphuric acid, a considerable proportion of the vanadium will remain in the insoluble residue, from which it may be extracted by fusion with sodium carbonate, and its presence may be detected by oxidation to the red pervanadic acid, by addition of hydrogen peroxide to the cold solution, after acidification with nitric acid. The quantitative separation of the vanadium is based upon two principles, new, as the authors think, in their application to analytical work. *First*, that when vanadium and chromium are in solution, as sulphates in a concentrated solution of ferrous sulphate, this latter may be almost completely precipitated as coarse, easily filtered crystals, by the addition of not less than three volumes of alcohol, whilst the vanadium and chromium remain in solution. *Second*, that where a mixture of oxides containing iron, manganese, chromium, and vanadium is first fused with sodium carbonate alone, and then the fusion continued after the addition of a small amount of some reducing agent, such as charcoal, the sodium chromate formed during the first portion of the fusion will be reduced to insoluble chromic oxide, so that the soluble sodium vanadate may be readily extracted with water, thus effecting a quantitative separation of vanadium from chromium.

To detect vanadium, 5 grms. of the sample in a 250 c.c. flask, are dissolved in 14 c.c. of sulphuric acid of sp. gr. 1·51, and 25—30 c.c. of water, the liquid being boiled till action ceases. The insoluble residue is filtered off and washed with water acidified with sulphuric acid. The filter is burnt off (and in the case of pig irons, the temperature is raised till all the graphitic carbon is burnt off, and the silica is removed by hydrofluoric acid), and the residue is then fused with 3 grms. of sodium carbonate for 10 minutes. The cooled mass is digested with 25—30 c.c. of hot water, filtered, the filtrate acidified with nitric acid and concentrated to 10—12 c.c. After cooling, a drop or two of hydrogen peroxide is added ; the presence of vanadium is indicated by a pink or red coloration, and the depth of the colour is some guide to the amount present.

To determine vanadium, 5 grms. of the sample are dissolved as above, the insoluble residue washed with hot water instead of sulphuric acid, and treated as above, till ready for fusion with sodium carbonate. The filtrate and washings are boiled down to about 50 c.c., saturated with hydrogen sulphide to precipitate copper and arsenic, boiled down further to about 35 c.c., cooled, and 100 c.c. of alcohol gradually added. The flask is stoppered, frequently shaken during 5 or 10 minutes, and the precipitated ferrous sulphate filtered off and washed with alcohol diluted with one-third of its volume of water. (In all these operations denatured alcohol may be used.) The filtrate and washings are rinsed into a 600 c.c. beaker, 15—20 c.c. of hydrogen peroxide added to peroxidise the small amount of iron remaining in solution, the liquid heated to boiling, made just alkaline with sodium carbonate, and kept at boiling point till the precipitate (iron, manganese, chromium, vanadium) has become flocculent. It is filtered, washed with hot 0·5 per cent. solution of sodium carbonate till free from sulphates, and dried. It is now placed in a platinum crucible with the original insoluble residue, carefully burnt off, then fused for 15—20 minutes with 5 grms. of sodium carbonate, at as low a temperature as possible. Then 0·3—0·4 grm. of powdered charcoal is added (which reduces any chromate formed) and the fusion continued for ten minutes more. After cooling, the fusion is treated with hot water, filtered and washed. To the filtrate 20 c.c. of sulphuric acid (sp. gr. 1·51) are added, then 3—4 c.c. of 3 per cent. solution of permanganate, the liquid is boiled for 5 minutes, and sulphurous acid added till the permanganate and the vanadic acid are reduced. The liquid is now concentrated till it fumes freely, cooled, diluted with water to about 60 c.c., and titrated warm with N/20 permanganate solution.—J. T. D.

Steel ; Determination of vanadium, molybdenum, chromium and nickel in ——. A. A. Blair. J. Am. Chem. Soc. 1908, **30**, 1229—1233.

The method consists broadly in treating the hydrochloric acid solution of the metals with ether, which removes most of the iron and the whole of the molybdenum ; precipitating chromium and nickel (and iron) from the acid solution by means of sodium hydroxide ; and after filtering and acidifying with nitric acid, separating the vanadium as lead vanadate. Two grms. of the sample are dissolved in nitric acid, with addition of hydrochloric acid if necessary, evaporated to dryness, redissolved in hydrochloric acid, and evaporated to a syrup. This is then dissolved in a little hydrochloric acid of sp. gr. 1·1, cooled in ice-water, and washed into a 250 c.c. separating funnel with as little of the acid as possible. Ether (80 c.c.) is now added, well shaken, and allowed to separate ; the lower layer is run into a second funnel, the sides of the first are washed down with 10—15 c.c. of the acid, the shaking and settlement repeated, and the lower layer run off into the second funnel. The liquid in this is shaken up with 50 c.c. of ether, allowed to separate, the lower layer run into a beaker, and evaporated nearly to dryness. Nitric acid is now added, the solution evaporated to a syrup to expel hydrochloric acid, 20 c.c. of water added, and a few drops of sulphurous acid to reduce any chromate that may have been formed. The liquid is boiled, and poured slowly, with stirring, into a boiling solution of sodium hydroxide (100 grms. in the litre) ; the boiling is continued for a few minutes, the precipitate allowed to settle, filtered, and washed, twice by decantation, then on the filter till the filtrate measures about 300 c.c. The filtrate is made just acid with nitric acid, then alkaline with a few drops of sodium hydroxide, boiled and filtered again. To the filtrate 10 c.c. of 10 per cent. lead acetate solution are added, then enough acetic acid to make it decidedly acid ; it is boiled and filtered, and the precipitate (containing all the vanadium as lead vanadate) washed with hot water. It is now dissolved in dilute hydrochloric acid, evaporated nearly to dryness, evaporated again with 50 c.c. of hydrochloric acid, and again with 10 c.c. of strong sulphuric acid until it fumes freely. When cold it is diluted with water to 150 c.c., heated to 60°—70° C., and titrated with permanganate. ($V = 0{\cdot}9157 \times Fe$). The sodium hydroxide precipitates and filters are burnt off and fused with 2 grms. of sodium carbonate and 0·5 grm. of potassium nitrate, the fusion extracted with water and filtered. On the filter are the nickel, copper, iron, and part of the manganese, and in the filtrate the rest of the manganese and the chromium. In the filtrate the sodium salts are converted into nitrates by adding enough ammonium nitrate, and the liquid is evaporated to small bulk, a few drops of ammonia being occasionally added. It is now diluted to 50 c.c., boiled, filtered, and the precipitate washed. The filtrate is boiled to expel ammonia, the chromium reduced by sulphurous acid, and (after boiling off the excess) precipitated by ammonia, filtered, washed, ignited, and weighed. The filter with the insoluble matter from the fusion is returned to the crucible in which the fusion was made, burnt off, dissolved in hydrochloric acid, diluted, the copper precipitated by hydrogen sulphide and filtered off, the filtrate evaporated with sulphuric acid to expel hydrochloric acid, diluted, excess of ammonia added, and the nickel deposited electrolytically. The ethereal solution is shaken with water, which dissolves the iron and molybdenum; the solution is drawn off and evaporated to dryness, then again evaporated with 10 c.c. of strong sulphuric acid to fuming. After cooling, it is dissolved in 100 c.c. of water, carefully deoxidised with ammonium bisulphite, the excess of sulphurous acid boiled off, the liquid cooled, transferred to a 200 c.c. pressure bottle, saturated with hydrogen sulphide, and the closed bottle heated in a water-bath for several hours and slowly cooled. The precipitate is collected on a Gooch crucible, and washed first with water containing a little sulphuric acid and then with alcohol. The Gooch crucible is now placed on a small triangle inside a large porcelain crucible so as not to touch it, the porcelain crucible covered with a watch-glass and carefully heated till there is no longer a smell of sulphurous acid, then covered with a porcelain lid and heated till the molybdenum sulphide becomes bluish-white. The Gooch crucible is now heated directly to faint redness till constant in weight; it is then connected with the vacuum flask, and the molybdenum trioxide washed out with ammonia, its amount being given by the loss of weight of the crucible.—J. T. D.

Slags: Alumina in copper blast furnace ——. C. F. Shelby. Eng. and Min. J. 1908, **86**, 270—275.

The paper deals at considerable length with the important, but unsettled question, as to whether the alumina in blast furnace slags has basic or acidic properties, or if it only acts as an inert foreign substance thickening the slag. The author maintains that the alumina is an active acid and enters into definite chemical combination with the bases present, and that the slag produced by the great majority of copper-matting blast furnaces is a true bi-silicate-aluminate, the ratio between the oxygen in the silica and alumina together, to that in the bases, being 2—1. He tabulates the analyses of a number of typical American slags taken at random from the different copper-smelting districts. These slags, many of which are the average of hundreds of assays, vary greatly in composition, the silica ranging from 34·3 to 48 per cent., alumina from 2 to 12·6, ferrous and manganous oxides from 20 to 37·6, lime from 8·2 to 25·8, magnesia from nil to 13, and baryta from nil to 6·2 per cent. In spite of this diversity of composition, the oxygen ratios of acid to base, counting alumina as an acid, is almost exactly 2 to 1. Zinc oxide, where present, is however not included in the calculation, as its action is doubtful, the author favouring the opinion that it is largely held in suspension in the slag and not chemically combined with it. He includes in his paper an extensive analytical table, from the research of H. O. Hofman, showing the effect of replacing in turn, and step by step, according to their oxygen equivalents, each of the elementary constituent parts of a "standard" mono-silicate slag, by alumina. On substituting alumina for the base, until the slag became a bi-silicate, counting alumina as an acid, no ill effect was produced, but the attempt to substitute alumina for silica, immediately raised the melting point of the slag. In the case of the Mansfeld slag, with its high silica and alumina content, it is suggested that the strong alkalis present, account for much of the excess of silica, and that the remainder, together with the alumina, unite with the earthy bases to form a tri-silicate slag. Two analyses of glass and a number of iron blast furnace slags are given for comparison. —F. R.

Mineral production of Cape Colony. Board of Trade J., Aug. 27, 1908. [T.R.]

The following statistics of the production of certain minerals in Cape Colony during the year ended Dec. 31, 1907, with corresponding figures for the preceding year, are taken from the Report of the Inspector of Mines, Kimberley:—

——	1906.		1907.	
	Quantity.	Value.	Quantity.	Value.
		£		£
Diamonds. . Carats	2,742,868	6,992,811	2,580,954	6,315,289
Coal— Tons of 2000 lb.	142,877	117,852	144,040	118,776
Copper— Tons of 2240 lb.	85,353	496,812	78,935	601,824
Tin*— Tons of 2240 lb.	106	11,564	144	14,400
Asbestos— Tons of 2000 lb.	522	9,600	604	9,060

* From statistics furnished by the Customs Department, it appears that the quantity of tin ore exported in 1906 was 2119 cwt., valued at £11,564, while in 1907 it was 3569 cwt., valued at £18,541.

Antimony mining in New Brunswick. Board of Trade J., Aug. 27, 1908. [T.R.]

A company have commenced working the antimony deposits at Lake George, York County, New Brunswick. The property extends over two square miles and contains two well defined veins of antimony ore. Two main shafts have been sunk to a depth of 220 and 260 feet respectively, having the usual levels; eight other shafts have been sunk to a depth of 25 to 100 feet each, all showing pay ore, thus proving the veins for more than a mile in one prevailing direction. The ore is of good quality, the veins varying from 6 inches to 4 feet in thickness. The property is about 24 miles from Fredericton, the capital of New Brunswick, and access to both that city and St. John, the chief shipping port of the province, is obtained either by rail or by water navigation on the St. John River during the summer.

Manganese ores; Production of —— in the United States. U.S. Geol. Survey, 1908. [T.R.]

The production of true manganese ores in 1907, *i.e.*, other than "manganiferous ores," amounted to 5,604 long tons. Toward the close of 1902 there occurred a sudden drop in production, due to the cessation of mining operations in North-western Georgia, after which there was a steady increase from the 2,825 tons produced in 1903 to 6,921 tons in 1906. The bulk of the production was, as usual, in Virginia, amounting to 4,604 tons. South Carolina joined the rank of producers for the first time since 1903, and produced more ore than in any previous year, being credited with 800 tons. Tennessee, which reported 100 tons, also showed an increase and a fair promise of becoming something more than a mere intermittent producer. California produced 100 tons more ore than in any year since 1902. On the other hand, Georgia and Arkansas, which contain some of the most important manganese deposits in the country, were not in the list of producers of manganese in 1907, although Arkansas produced considerable manganiferous iron ore. The Utah mines, which gave fair promise for several years, were again idle. During 1907 there were 209,032 tons of manganese ore, valued at $1,793,143, imported for consumption into the United States. The importation of 1906 amounted to 221,260 tons, valued at $1,696,043. On account of the small domestic production of manganese ores and the small portion of even this product used in making spiegeleisen and ferro-manganese the importation of foreign manganese ore is a matter of considerable and increasing importance as the iron and steel industry in this country develops. By far the largest quantity of manganese ore was obtained from India.

The total production of manganiferous ores in the United States in 1907 was 425,160 long tons, as follows:—Arkansas, 4,133 tons; Colorado, 99,711 tons; Lake Superior region, 314,316 tons, and New Mexico, 7,000 tons. The only portion of this production used in the manufacture of manganese and spiegeleisen was 67,514 tons of manganiferous smelted ore produced in the Leadville district.

During 1907 manganiferous residuum from zinc roasting at certain zinc oxide works in New Jersey was produced to the amount of 93,413 long tons valued at $280,239. This was used in the manufacture of spiegeleisen and manganese. The crude ore consists of a mixture of franklinite and willemite, the former being predominant. During the roasting the bulk of the zinc is removed as zinc oxide and the residuum consists of a mass of manganese and iron oxides.

The total production of ferromanganese and spiegeleisen in the United States in 1907 was 339,348 long tons, of which 55,918 tons were ferromanganese and 283,430 tons were spiegeleisen. This total exceeds the production of 1906 by 38,848 tons. The production in 1906 was 300,500 long tons, of which 55,520 tons were ferro manganese and 244,980 tons were spiegeleisen. Of the total output in 1907 251,747 tons were produced in Pennsylvania, and the rest in New Jersey, Maryland, Illinois, and Colorado. The production of spiegeleisen was begun in the United States in 1870 from the manganiferous residuum of New Jersey zinc oxide works.

Mineral exports from Brazil. Eng. and Min. J., 1908, 303. [T.R.]

The following are the official figures for the exports of minerals from Brazil in 1906 and 1907, in metric tons :—

	1906.	1907.
Manganese ore	121,331	236,778
Monazite sand	4,352	4,437
Mica	6,123	4,501

Exports of gold bullion were 4,548 oz. in 1906, and 3,779 oz. in 1907 ; this does not give the full amount of gold shipped, however ; only that in the form of bullion.

Patents.

Tantalum ; Process for hardening ——. Siemens und Halske Aktienges., Berlin. Eng. Pat. 6051, Mar. 18, 1908. Under Int. Conv., Mar. 26, 1907.

Tantalum is hardened by adding 1—10 per cent. of silicon. For this purpose, a mixture of powdered tantalum and silicon is moulded under high pressure into a suitable shape, and then melted by an electric arc, preferably between tantalum electrodes, in a vacuum. For making wire, 2—3 per cent. of silicon is added ; for parts of machines or tools, 5—10 per cent. is preferred.—A. G. L.

Armour plates and other articles ; Manufacture of ——. Cammell Laird and Co., Ltd., W. A. Hartley and B. H. Deby, Sheffield, Yorks. Eng. Pat. 15,976, July 11, 1907.

An armour plate or the like is reheated in such a manner that only a desired thickness of the face portion attains a temperature higher than the critical temperature of the alloy of which it consists, the remainder of the plate being kept below its critical temperature. The temperature of the face is then allowed to fall, and that of the remainder of the plate to rise, until the temperatures are equalised at a point below the critical temperatures, when the plate is chilled as usual. The object of the invention is to avoid unequal strains in the plate.—A. G. L.

Iron or steel ; Improvements in the manufacture of —— by the basic Bessemer process. J. Flohr, Dudelange, Luxembourg. Eng. Pat. 9554, May 2, 1908.

To assist in purifying the metal, briquettes of calcium hydroxide are added to the converter charge towards the end of the decarburising stage, or during dephosphorising.—F. R.

Iron and steel wire and other rolled iron ; Improved process for preventing the oxidation of ——, *through cooling immediately after being rolled.* C. P. Debuch, Coblenz, Germany. Eng. Pat. 17,038, July 25, 1907.

The hot wire, or other rolled metal, immediately on leaving the rollers, is led into a bath of molten lead, of the same temperature as the rolled material, where it is allowed to cool, out of contact with the air, to about 340° C. On removal from the cooled bath no oxidation takes place.—F. R.

Metals ; Raising the elastic limit of —— and relieving them of injurious strains. A. H. Emery, Stamford, Conn. U.S. Pat. 894,428, July 28, 1908.

The metal is first hardened and then tempered "by annealing." It is next loaded, in the direction of the load it is to bear, sufficiently well to give it a permanent set, and increase the limit of its elasticity, and is then annealed at a low temperature, not sufficient to reduce the limit of elasticity, but sufficient to greatly reduce the curve of fatigue. The operations of loading and annealing are repeated as often as is necessary.—A. T. L.

Cyanide tank. R. S. Browne, Alameda, Cal. U.S. Pat. 894,254, July 28, 1908.

The bottom of the tank is furnished with a number of inverted conical pockets, each provided with a valve-controlled discharge pipe, and vertical air-pipes are provided extending from the upper part of the tank to points near the bottom of each pocket.—A. T. L.

Precious metals ; Extracting —— from ores. I. Kitsee, Philadelphia, Pa. U.S. Pat. 894,215, July 28, 1908.

The ore, for example an ore of gold, is subjected to the solvent action of two solutions ; one solution is the chlorinated liquid obtained in the positive compartment of an electrolytic cell in which an alkali or alkaline earth chloride has been electrolysed, and the second solution is obtained similarly from an alkali or alkaline earth nitrate. —A. T. L.

Ores ; Improvement in the concentration of ——. A. J. Francois de Bavay, Kew, Victoria, Australia. Eng. Pat. 17,364, July 29, 1907.

A weak solution of sulphurous acid, or other chemical having a great affinity for oxygen, is added to the water used in ordinary concentration, to prevent the formation of, or to remove, air films from the metallic particles. —F. R.

Sulphide ores ; Furnace for roasting ——. H. Petersen, Berlin. Eng. Pat. 15,941, July 11, 1907.

A composite muffle furnace for roasting zinc blende or similar ore is provided with one fire-place for every two adjoining furnaces. The hot gases from the fire-place first heat the lowest muffles of the two furnaces and are then divided into two parts by means of a flue provided with a partition. One part serves to heat the upper muffles of one furnace, the other part heating the corresponding muffles of the second furnace. The ore is charged into the highest muffles, and travels downwards to the lowest muffles. By these means the lowest muffles only are strongly heated, the heating in the upper muffles being comparatively gentle.—A. G. L.

Iron ; Smelting ores of ——. E. D. Kendall, Sewaren, N.J., Assignor to E. N. Dickerson, Stovall, N.C., and A. R. Ledoux, New York. U.S. Pat. 894,796, July 28, 1908.

The comminuted ore is thoroughly mixed with a comminuted slag-forming substance such as limestone, and the mass is mixed with petroleum, comparatively non-volatile at ordinary temperatures, in sufficient quantity to form the sole reducing agent.—A. T. L.

[Oxygenated] Products and by-products of the chemical treatment of ores, especially mixed ores ; Process for the utilisation of ——. G. Evans, Stroud Green, Middlesex. Eng. Pat. 17,125, July 26, 1907.

It is proposed to utilise comparatively worthless residues of oxides, sulphates, or carbonates, or mixtures of these, for the reduction of valuable sulphide (or selenide) ores, without previous roasting, so as to give a metal or alloy and sulphur dioxide in a practically undiluted state. For instance, a mixture, containing lead sulphate and ferric oxide, would be heated with, say, galena, in the following proportions :—$mPbSO_4+2nFe_2O_3+(m+7n)PbS = (2m+7n)Pb+4nFeS+(2m+3n)SO_2$. Or, a residue containing ferric oxide and stannic oxide, might be similarly treated to furnish an alloy of tin and lead. The heating is preferably carried out in closed pots or crucibles, provided with an outlet for the gas above and for the molten metal below, and with an inlet near the top, for supplying the mixture.—F. Sodn.

Zinc ores, dross, etc.; Apparatus for use in smelting ——. E. H. Hopkins, Addlestone, Surrey. Eng. Pat. 25,099, Nov. 12, 1907.

A perforated fire-clay tube, filled with coke or charcoal, is fitted into the outer end of the ordinary fire-clay condenser to prevent access of air. Carbon monoxide escapes into the annular space between the tube and the condenser, obviating the necessity for luting. A similar tube may be fitted into the inner end of the condenser, to separate the lead fumes vaporised with the zinc.—F. R.

Tin; Extraction of —— *from ores, slag or refuse.* H. Mühlinghaus, Wiesbaden, Germany. Eng. Pat. 25,460, Nov. 16, 1907.

The material is melted in any suitable furnace, and the molten tin-bearing ore, or slag, continuously flows into and through another furnace containing glowing coke. The tin is reduced to metal by the coke and is then oxidised and volatilised by a blast of hot air passing up through the furnace. The fumes carrying the tin pass directly from the second furnace into condensing chambers.—F. R.

Copper; Recovering —— *from ores.* W. B. Potter, St. Louis, Mo., Assignor to Esmeralda Copper Precipitating Co., Chicago, Ill. U.S. Pat. 894,902, Aug. 4, 1908.

The ore is leached with a reagent suitable for forming a cupric sulphate solution. Free acid is neutralised by means of limestone, and the neutral solution is charged with sulphur dioxide, and heated to about 260° F. under a pressure of about 100 lb. per sq. in., to precipitate metallic copper. The spent solution containing free acid is used for dissolving copper from a new lot of ore. —A. T. L.

Metals [especially copper]; Apparatus for converting ——. R. L. Lloyd, Cananea, Mexico. Eng. Pat. 15,963, July 11, 1907. Under Int. Conv., Aug. 4, 1906.

The apparatus comprises two cylindrical rotatable converters connected by a hearth. In the first converter a mixture of impure copper matte and flux is "blown" to pure copper matte and slag. The latter overflows over a dam at the end of the converter into the hearth, from which it is tapped. On then rotating the converter, the copper sulphide flows into the hearth, from which it is allowed to flow into the second converter, where it is "blown" to metallic copper, which flows into a second hearth, where it may be poled, etc. The first converter is charged with matte and flux from a hearth fed by two separate rotatable feeding cylinders. This third hearth is provided with a furnace, which serves as a source of auxiliary heat when necessary. The blast from the first converter traverses the feeding cylinders and the second converter on its way to the chimney, thereby facilitating the reaction in the second converter, in which little heat is generated.—A. G. L.

Zinc and other volatile metals; Process of extraction of —— *from ores and metallurgical products.* W. Troeller. Fr. Pat. 388,503, March 25, 1908.

A thick bed consisting of a mixture of the ore, etc., and of the combustible is charged on to the grate of a furnace, which can be easily emptied by turning (*e.g.* a converter). After lighting, a current of air is driven through the mass, so violent that the temperature of reduction and volatilisation spreads quickly, and is maintained as uniformly as possible in the whole mass under treatment. At the beginning of the operation, a gentle current of air may be used to drive off the moisture and gases and render the charge porous; and at the close of the operation the air current may be increased to such an extent that the mass liquefies. The converter furnace of iron or steel is surmounted by a hood, or gas receiver, to collect the volatilised oxides of zinc, etc.—W. C. H.

Cast iron; Purifying —— *in the manufacture of basic open-hearth steel.* W. Muirhead, Shettleston. U.S. Pat. 894,779, July 28, 1908.

See Eng. Pat. 7946 of 1907; this J., 1908, 451.—T. F. B.

Metals; Art of converting ——. R. L. Lloyd, Cananea, Mexico. Eng. Pat. 15,962, July 11, 1907. Under Int. Conv., Aug. 4, 1906.

See U.S. Pat. 851,816 of 1907; this J., 1907, 619.—T. F. B.

Smelting furnace heated with oil and having two or more chambers acting alternately as smelting or preliminary heating chambers. A. Koch, Hanover-List, Germany. Eng. Pat. 17,687, Aug. 2, 1907. Under Int. Conv., Aug. 4, 1906.

See Addition to Fr. Pat. 367,470 of 1906; this J., 1907, 1283.—T. F. B.

Ores; Process of roasting and sintering ——. A. S. Dwight and R. L. Lloyd, New York. Eng. Pat. 17,343, July 29, 1907.

See U.S. Pat. 882,518 of 1908; this J., 1908, 409.—T. F. B.

Ores; Treatment of —— *by means of the precipitation process.* A. H. Imbert, Grand-Montrouge, France, Assignor to Imbert Process Co., New York. U.S. Pat. 894,382, July 28, 1908.

See Eng. Pat. 16,834 of 1907; this J., 1908, 688.—T. F. B.

Ore; Process of treating ——. J. H. Reid, Cornwall, Ontario, Assignor to S. L. Tingley, Ottawa, Canada. U.S. Pat. 895,196, Aug. 4, 1908.

See Fr. Pat. 379,566 of 1907; this J., 1907, 1242.—W.H.C.

Tungsten filaments; Attaching —— *in electric glow lamps.* Eng. Pat. 16,503, 1907. *See* II.

Filaments of metallic alloys for electric incandescent lamps. R. Jahoda and Soc. "Electrische Glühlampenfabrik "Watt" Scharf, Löti und Latzko. Fr. Pat. 388,161, 1908. *See* II.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(*A.*)—ELECTRO-CHEMISTRY.

Hydrogen peroxide; Production of —— *from aluminium and zinc.* H. T. Barnes and G. W. Shearer. J. of Phys. Chem., 1908, 12, 468.

In a previous paper (this J., 1908, 452), the authors described the production of hydrogen peroxide in measurable quantities in pure water, in which air was dissolved, and containing clean aluminium metal (keeping the water charged with air by bubbling or shaking causes a marked increase in the yield of peroxide). The experiments have been repeated, using zinc instead of aluminium, and considerable quantities of the peroxide obtained in this case also. The peroxide is found to decompose, however, fairly rapidly by standing in contact with zinc, whereas with aluminium, the peroxide is only slowly decomposed, because of the protection afforded by the surface-film. Copper, platinum and iron have given negative results, whilst magnesium metal gives a faint reaction for peroxide. Probably all metals which show anomalous anodic conductivity, are likely to develop free peroxide.—W. S.

Patents.

Nitrous compounds; Apparatus for manufacturing —— *(electrically).* C. P. Steinmetz, Schenectady, New York, Assignor to General Electric Co., New York. U.S. Pat. 894,547, July 28, 1908.

An air chamber is provided with a number of independent high tension electric circuits traversing the same, each circuit having a number of air gaps in series within the chamber. The current is supplied from a low potential multiphase current generator, and, by means of a step-up transformer, the independent circuits are inductively charged in periodic succession with high potential by and in the order of the phases of the generator. Means are provided for establishing, lengthening, and breaking the electric arcs in the different series of air gaps, in the order of succession of the phases of the generator.—B. N.

Ozone ; Production of ——. B. Jirotka, Berlin. Eng. Pat. 6453, Mar. 23, 1908. Under Int. Conv., Mar. 25, 1907.

Air is ozonised by passage through a spiral, in which are placed metallic shavings, spirals, or wire-gauze connected with the two poles of a high tension circuit.—A. G. L.

Ozone ; Process and apparatus for producing —— *by means of high-tension currents.* B. Jirotka. Fr. Pat. 388,466, March 23, 1908. Under Int. Conv., March 25, 1907.

See Eng. Pat. 6453 of 1908 ; preceding.—T. F. B.

Ozone ; Apparatus for generating ——. W. Elworthy, Wellington, Somerset. Eng. Pat. 2974, Feb. 10, 1908. Under Int. Conv., July 31, 1907.

See Fr. Pat. 386,869 of 1908 ; this J., 1908, 817.—T. F. B.

Camphene ; Production of ——. Badische Anilin und Soda Fabrik. First Addition, dated Feb. 29, 1908, to Fr. Pat. 368,170, July 18, 1906. Under Int. Conv., April 3, 1907.

See Eng. Pat. 5674 of 1908 ; this J., 1908, 832.—T. F. B.

Electrode for the evolution of ozone from oxygen or atmospheric air. J. R. Craig, Glasgow. U.S Pat. 894,818, Aug. 4, 1908.

See Eng. Pat. 8036 of 1907 ; this J., 1908, 453.—T. F. B.

Electric battery also applicable for the manufacture of sulphuric acid. L. P. Basset, Enghien, France. Eng. Pat. 21,475, Sept. 27, 1907. Under Int. Conv., Oct. 2, 1906.

See Fr. Pat. 370,170 of 1906 ; this J., 1907, 209.—T. F. B.

Flour ; Apparatus for oxidising [electrically] ——. W. L. Jones. U.S. Pat. 895,405. *See* XVIII *A.*

Scouring and squeezing machines ; Application of electrolysis to ——. J. M. J. Baudot. U.S. Pat. 895,144. *See* V.

(*B.*)—ELECTRO-METALLURGY.

Patents.

Ordnance and the like ; Removal of copper and other metallic fouling from the bores of ——. King's Norton Metal Co., Ltd., and T. R. Bayliss, London, and R. A. E. Payne, Edgbaston. Eng. Pat. 25,137, Nov. 13, 1907.

See Fr. Pat. 387,117 of 1908 ; this J., 1908, 818.—T. F. B.

Metals ; Electro-chemical deposition of —— *or making metallic articles by electro-chemical deposition, and apparatus therefor.* H. C. Harrison, Leeds. Eng. Pat. 16,735, July 22, 1907.

Vertical anode plates are spaced apart in a depositing chamber, with a row of vertical revolving mandrels, acting as cathodes, between each pair of anode plates, and a vertical frame, carrying a series of burnishers, is arranged so as to reciprocate the latter along the mandrels. The fresh electrolyte is constantly supplied, by means of a series of vertical pipes, between each pair of anode plates, the electrolyte overflowing from the depositing chamber, and passing into a settling tank, from which it is returned to the depositing chamber.—B. N.

Gold ; Recovery of —— *from cyanide solutions.* S. O. Cowper-Coles, London. Eng. Pat. 11,297, Nov. 14, 1907.

The cyanide solution containing gold is circulated through a vat between a rotating cathode, consisting of two concentric cylinders of aluminium or iron, and a stationary anode of platinum or a platinum alloy stiffened by a wooden or glass framework placed between the two cathode cylinders. A current density of 20 ampères per sq. ft. of cathode surface is used. The anode may be enclosed by porous partitions, and the vat may be given a gas-tight cover. (See Eng. Pat. 24,985 of 1906 ; this J., 1907, 1205.) —A. G. L.

Copper ; Electrodeposition of ——. S. O. Cowper-Coles, London. U.S. Pat. 895,163, Aug. 4, 1908.

A current of electricity, of a density of 200 ampères per sq. ft. of cathode surface, is passed from an anode to a cathode, the latter being turned, at a speed of 1,500 or more revolutions per minute, in an electrolyte containing approximately 12·5 per cent. of copper sulphate and 13 per cent. of sulphuric acid.—B. N.

Amalgams or alloys ; Method of producing —— *(electrolytically).* C. F. Carrier, Jr., Elmira, N.Y. U.S. Pat. 895,159, Aug. 4, 1908.

An electric current is passed, from one or more anodes, to one or a number of independent fluid metal cathodes, beneath a common electrolyte, each anode being parallel to the level of the corresponding cathode and having a greater active area. The fluid metal is supplied intermittently to each cathode, and the amalgam or alloy is removed by "establishing a substantially radial flow of the fluid metal" in each cathode "out of contact with any retarding surface."—B. N.

Metallic mirrors ; Manufacture of ——. S. O. Cowper-Coles, London. Eng. Pat. 17,627, Aug. 1, 1907.

Metal is stamped, spun or cast to the desired curvature and copper electrolytically deposited on the back, until the required rigidity is attained. Silver or other metal is then deposited on the front surface which is afterwards ground and polished.—F. R.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

Fixed oils, Indian ; Characters of certain ——. D. Hooper. Annual Report, Indian Museum, 1907—1908, 13—17.

Terminalia or Myrabolan oils.—*Terminalia catappa.* "Country almond."—The kernels of the seeds from trees growing in Sibpur yielded 48·3 per cent. of fat ; m. pt. 3·5° C. ; sp. gr. at 15° C., 0·9206 ; acid value, 7·77 ; saponification value, 203·04 ; iodine value, 81·8 ; fatty acids, per cent., 95·2 ; titer test, 42° C. *Terminalia belerica* nuts from the Central Provinces were stated to yield 25 per cent. of "Baheda" oil, which was odourless and tasteless, clear, and yellow in colour. Two samples had the following characters :—M. pt. 11° C. and 4° C. ; sp. gr. at 15° C., 0·9168 and 0·9193 ; acid value, 2·48 and 3·97 ; saponification value, 205·8 and 205·3 ; iodine value, 79·04 and 85·38 ; Reichert-Meissl value, 0·76 and 0·78 ; fatty acids, per cent., 94·2 and 93·6 ; titer test, 39° and 38° C. *Terminalia chebula.*—Chebulic myrabolans gave only a small proportion of kernels which yielded 36·71 per cent. of yellowish, semi-drying oil. Acid value, 8·91 ; saponification value, 192·66 ; iodine value, 87·5 ; fatty acids, 96·2 per cent.

Oils of Cucurbitaceous Seeds.—*Cucurbita pepo :* the seeds of the pumpkin, or vegetable marrow, yield to solvents about 25 per cent. of fixed oil ; two samples had the following characters :—Sp. gr. 0·926 and 0·928 ; acid value, 12·78 and 10·86 ; saponification value, 195·7 and 196·2 ; iodine value, 126·0 and 129·6 ; Reichert-Meissl value, 0·43 and 0·52 ; fatty acids, 94·97 and 94·7 per cent. ; titer test, 31° and 32° C. *Cucurbita maxima,* or squash gourd seeds, yield oil with the following characters :—Sp. gr. 0·919 to 0·926 ; acid value, 6·38 to 17·65 ; saponification value, 194·9 to 197·1 ; iodine value, 88·7 to 133·4 ; Reichert-Meissl value, 0·47 to 0·67, fatty acids, per cent., 94·3 to 95·8 ; titer test, 32° to 38° C. *Cucumis sativus,* or cucumber seeds, gave a pale yellow, slowly drying oil. Two specimens had the following characters:—Sp. gr. at 15° C., 0·924 and 0·923; acid value, 11·49 and 10·68; saponification value, 195·2 and 196·9; iodine value, 117·6 and 118·5; Reichert-Meissl value, 0·52 and 0·52; fatty acids, 94·2 and 94·6 per cent.; titer test, 35·5° C. *Luffa ægyptica* seeds gave a dark greenish oil with a high acid value, slowly drying; sp. gr. 0·921 to 0·926 at 15° C.: acid value, 33·0 to 36·4; saponification value, 193·0 to 195·8; Reichert-Meissl value, 0·49 to 0·52; fatty acids, 93·5 to 94·2 per cent.; titer test, 34° to 35° C. *Citrullus colocynthis*, colocynth seeds, from Baluchistan, gave 17·8 per cent. of drying oil; acid value, 5·90; saponification value, 202·9; iodine value, 129·3; fatty acids, 92·2 per cent.; titer value, 29° C.

Mesua ferrea, the iron-wood or "Nag Kesur" of Assam, bears seeds yielding 41·6 per cent. of fixed oil, the kernels alone giving 72·9 per cent. It is deep yellow, or brown, and deposits a white crystalline fat at ordinary temperatures. Sp. gr. from 0·9166 to 0·9359 at 15° C.; m. pt. 16·5° to 26·7° C.; acid value, 38·4 to 115·0; saponification value, 203·7 to 205·8; iodine value, 87·0 to 89·1; Reichert-Meissl value, 7·7 to 11·54; fatty acids, 92·2 to 94·1 per cent.; titer test, 33·5 to 34·5° C. The solid fatty acids consist mainly of stearic acid.

Sterculia fœtida, Java almonds.—The seeds yield 34 per cent. of bland, light yellow, non-drying oil; sp. gr. 0·919 at 30·5°; acid value, 6·5; saponification value, 199·3; iodine value, 83·0; fatty acids, 95·6 per cent.; titer value, 31·5° C.

Chrozophora verbascifolia, or Tannoom seeds, yield about 35 per cent. of an oil said to be used by the Bedouins of Arabia instead of ghee; the oil is thick, yellowish and drying; acid value, 3·3; saponification value, 200·2; iodine value, 137·0; titer value, 30·5° C.
—J. O. B.

Ochoco fat. J. Lewkowitsch. Analyst, 1908, **31**, 313—315.

Ochoco fat is contained in the seeds of *Scyphocephalium ochocoa*, War., a tree found on the West Coast of Africa, and belonging to the *Myristicaceæ*. The kernels contain about 59 per cent. of fat, and the seeds are obtainable in large quantities. By whatever process the fat is prepared from the seeds, a dark brown colouring matter is at the same time extracted which it is impossible to separate from the fat. This colouring matter is contained not only in the husks, but in the membranous extension of the husk (spermoderm), which passes through the whole of the endosperm in the form of irregular lamellæ. The white endosperm, cut out carefully by hand, when extracted in the usual manner, yielded a perfectly white fat which had the following characteristics:—Sp. gr. 0·8899 at 60°/4° C.; saponification value, 238·5; iodine value, 1·72; Reichert-Meissl value, 0·65; the insoluble volatile acids required 4·0 c.c. of $N/10$ alkali; melting point, 45°—48° C.; unsaponifiable matter, 0·37 per cent.; mean molecular weight of the fatty acids, freed from unsaponifiable matter, 221·9; melting point of the fatty acids, 47·2° C. The extracted fat had an acid value of 1·42. From the above figures it is seen that the fat consists of practically pure myristin, or more precisely, of about 98 per cent. of myristin and 2 per cent. of olein. Laurin is not present in the fat.—W. P. S.

Beeswax; Chemistry of ——. [Detection of stearic acid] R. Berg. Chem.-Zeit., 1908, **32**, 777—780.

Experiments with Hehner and Mitchell's method of determining stearic acid having proved unsuccessful, the author has devised a method in which a mixture of acetone and water, of sp. gr. 0·8450 15° C. (about 85 per cent. of acetone), is used. The solubility of stearic acid in this liquid at 0° C. is 0·069 grm., and that of palmitic acid 0·690 grm., per 100 c.c. On treating beeswax with this solvent a small amount of cerotic acid separates out, but not in sufficient quantity to interfere with the test for stearic acid. In testing a wax containing, *e.g.*, 1 per cent. of commercial stearine, 100 grms. of the sample are boiled for 30 minutes under a reflux condenser with 500 c.c. of 80 per cent. alcohol, then cooled to 30°—40° C., made up with 80 per cent. alcohol to the original weight, and allowed to stand for 24 hours. The mass is then filtered, 375 c.c. (= 75 grms. of the wax) evaporated, and the aqueous residue taken up with ether, and shaken with 20 c.c. of 10 per cent. sodium hydroxide solution. The emulsion is left for 30 minutes to decompose any ethyl esters present, and then treated with 500 c.c. of acetone. The precipitate is collected, washed with acetone, dissolved in 100 c.c of hot water, and immediately decomposed with dilute sulphuric acid. When cold, the fatty acids are shaken out with ether, and the residue from the ethereal extract (*e.g.* 1·97 grms.) dissolved in the requisite proportion (*e.g.* 300 c.c.) of the acetone of sp. gr. 0·8450. After standing for 24 hours at 0° C. to + 1° C., any deposit should melt, after drying, at about 67° C., and consist of practically pure stearic acid. From its amount the proportion of stearic acid present in the original wax may be calculated.—C. A. M.

Explosion in a Liverpool oil-cake works. Times, Aug. 24, 1908. [T.R.]

An explosion, by which two men were killed and four seriously injured, occurred on the night of Aug. 22 at the oil-cake works of Messrs. John and James Bibby, Liverpool, where 1,500 men are employed. The explosion took place in the drying room, where the meal is dealt with after the oil has been extracted from the oil seeds. The process causes an accumulation of fine dust, which is removed every Saturday. At the time of the accident six men were working in the drying room, and they were blown with great force about the room. Great damage was caused to the interior of the building. The roofs of the drying and refining rooms were completely destroyed, three of the floors fell to the bottom of the building, and the heavy iron doors and hoist doors were blown into the street.

At the inquest, the manager of the works stated that he knew of no works in the world where oil meal dust had previously exploded. It was now proved that it was explosive. The evidence of an expert showed that the accident was caused by the firing of an accumulation of dust and oil in a fan, which exploded the dust.

Lard from oily hogs. W. D. Richardson and F. O. Farey. J. Amer. Chem. Soc., 1908, **30**, 1191—1192.

Lard derived from animals known to packers as "oily" hogs differs markedly from ordinary lard, resembling rather lard oil and the fat derived from the wild boar. Six samples recently examined, derived from animals outwardly of the usual type, gave the following results:—

Kind of fat.	"Titer" test, °C.	Melting point.		Refr. Index.			Free acid (as oleic), per cent.	Saponif. value.	Iodine value (Hanus.)		Liquid fatty acids, per cent.		Bromides insoluble in petroleum ether at 8° C., per cent.
		Open capillary, lower limit, °C.	Closed capillary, upper limit, completely clear, °C.	Fatty acids, 60° C.	Fat.				Fat.	Liquid fatty acids.	(Basis of fat).	(Basis of fatty acids).	
					60° C.	40° C.							
Back fat ..	21·2	− 1·5	12·0	1·4452	1·4541	1·4620	0·16	189·0	93·9	104·5	84·4	89·4	——
Leaf lard ..	21·6	− 1·6	17·0	1·4452	1·4540	1·4620	0·16	191·0	95·2	106·8	84·2	89·2	——
Leaf lard ..	23·8	− 0·8	22·0	1·4453	1·4542	1·4621	0·26	192·5	92·6	110·0	81·5	86·3	——
Leaf lard ..	23·4	+ 0·9	21·0	1·4448	1·4542	1·4621	0·14	190·5	93·8	106·9	82·9	87·8	——
Ham fat ..	21·8	0·0	18·0	1·4450	1·4540	1·4620	0·20	189·0	92·8	108·3	82·2	87·1	1·51
Ham fat ..	19·3	− 2·4	13·0	1·4455	1·4560	1·4640	0·16	190·5	95·1	109·7	81·1	85·9	——

It was not found possible to obtain the bromides insoluble in petroleum ether in a crystalline condition. None of the six samples gave the Halphen reaction for cottonseed oil.—A. S.

Patents.

Oils, fats, and the like; Process of mechanically combining —— with heavier fluids. T. E. Smith, Weehawken, N.J., U.S.A. Eng. Pat. 24,705, Nov. 7, 1907. Under Int. Conv., Nov. 12, 1906.

See U.S. Pat. 855,071 of 1907; this J., 1907, 700.—T. F. B.

Distilling glycerine; Processes of ——. F. J. Wood, Brooklyn, U.S.A. Eng. Pat. 21,658, Sept. 30, 1907.

See U.S. Pat. 881,525 of 1908; this J., 1908, 345.—T. F. B.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(A.)—PIGMENTS, PAINTS.

Mineral paints [pigments]; Production of —— in the United States in 1907. U.S. Geol. Survey, 1908. [T.R.]

In 1907 the total production of the natural pigments—ochre, umber, sienna, metallic paints, mortar colours, slate and shale, and of those produced directly from the ores, consisting of zinc oxide, "zinc lead," sublimed white lead, and sublimed blue lead, reported to the survey amounted to 143,757 short tons, valued at $9,469,818, as compared with 140,713 short tons, valued at $8,160,836, in 1906. In the tables for 1906 and 1907 the production classified under "other pigments," has been omitted since the substances so classified consisted almost entirely of colour lakes. Certain chemical colours were also included under the caption "other pigments," and these have been omitted. The following table shows the production of these various mineral paints in 1906 and 1907:—

	1906.		1907.	
	Short tons.	Value.	Short tons.	Value.
		$		$
Ochre	15,482	148,049	16,971	164,742
Umber and sienn	657	17,394	730	19,309
Metallic paint	17,992	204,026	16,225	195,176
Mortar colours	10,309	111,720	10,490	110,719
Sublimed blue lead	—	—	1,211	135,632
Sublimed white lead	7,988	958,440	8,700	1,026,600
"Zinc lead"	8,124	681,292	13,516	1,286,440
Zinc oxide	74,680	5,999,375	71,784	6,490,660
Slate	5,481	40,540	4,130	40,540
Totals	140,713	8,160,836	143,757	9,469,818

Chemical pigments and colours.—Under this head are included basic carbonate of lead, or corroded white lead, litharge, red lead, orange mineral, lithopone and Venetian red. The production of corroded white lead in 1907 reported to the survey was 92,216 short tons, in oil, valued at $12,138,932, and 35,035 short tons, dry, valued at $4,309,392. This represents a slight decrease both in quantities and values from the production reported in 1906.

In the following table is given the production of these various chemical pigments and colours for the years 1906 and 1907:—

	1906.		1907.	
	Short tons.	Value.	Short tons.	Value.
		$		$
Corroded white lead—				
In oil	93,763	12,357,632	92,216	12,138,932
Dry	33,313	4,571,618	35,035	4,309,392
Red lead	13,808	1,924,288	20,078	2,802,454
Litharge Orange mineral	18,910	2,551,346	20,838 669	2,854,987 129,410
Lithopone	4,300	311,500	10,275	750,350
Venetian red	13,526	198,394	7,566	134,167

The following table gives the quantity of the imports of corroded white lead, red lead, litharge, orange mineral, and Venetian red in 1906 and 1907:—

	1906.	1907.
	Pounds.	Pounds.
Corroded white lead	647,636	584,310
Red lead	1,093,639	679,171
Litharge	87,230	90,475
Orange mineral	770,342	615,015
Venetian red	5,432,732	4,738,148

(B.)—RESINS, VARNISHES.

Patents.

Resin oils, sulphur, and the like; Improved process for the extraction of ——. W. E. Lake, London. Eng. Pat. 21,489, Sept. 27, 1907.

The process is applicable to the extraction of resinified and bituminous bodies such as asphalt sand, retinite, cotton-waste, gas-purifying masses, &c. It is brought about by mixing the masses to be extracted with melted naphthalene which dissolves the resinous bodies. The solution is separated from the insoluble residue, and the naphthalene removed and recovered for subsequent use by distillation in steam, direct or superheated. The advantages of the process are (1) the substitution of the comparatively non-volatile naphthalene for the solvents of low boiling point usually employed for such extractions, and hence less loss of solvent and no necessity for reflux condensers; (2) the wide range of temperature at which the operation can be carried out, 80° C. to 218° C.; (3) the relatively low temperature at which the solvent may be removed.—H. G. B.

Resin-like products; The manufacture of —— from phenols and formaldehyde. J. Wetter. London. From Knoll und Co., Ludwigshafen a/R, Germany. Eng. Pat. 28,009, Dec. 19, 1907.

Resin-like condensation products from phenols and formaldehyde, are made by heating, in the presence of neutral, acid, or alkaline salts, mixtures of phenols with formaldehyde, or with one of its polymerisation products, or with a material adapted to yield formaldehyde. The condensation is started, preferably, by relatively short heating, and completed either in the presence of the condensing agent, or after the latter has been removed. In the case of neutral sulphites, the quantity of the condensing agent is less than one molecule to one molecule of the phenol and one molecule of formaldehyde, and in the case of acid salts, less than 30 per cent. of the quantity of phenol used. The condensation may be effected either in two distinct stages, with a further addition of formaldehyde, if required, or in the presence of an excess of formaldehyde. Steam or the vapours of substances acting as solvents of the condensation products, may be introduced into the mixture during the condensation.

—W. C. H.

Turpentine ; Process of purifying ——. H. O. Chute, Cleveland, Ohio. U.S. Pat. 895,003, Aug. 4, 1908.

THE turpentine is agitated with a quantity of an alcohol (*e.g.*, wood spirit) sufficient to form an immiscible layer from which the purified turpentine is afterwards removed. A hydrocarbon immiscible with or insoluble in the alcohol may also be used in addition.—H. G. B.

(*C.*)—INDIA-RUBBER, &c.

Hevea Braziliensis ; Presence of an oxidising enzyme in the latex of ——. D. Spence. Bio-Chem. J., 1908, **3**, 351—352.

THE author has succeeded in obtaining marked evidence of the presence of an oxidising-enzyme in four separate samples of latex from *Hevea Braziliensis*, collected on the Jugra Estate, Ceylon. The methods employed in the examination of the latices were those described in the case of *Funtumia elastica* (this J., 1908, 633), and positive reactions were obtained both in the absence and in the presence of hydrogen peroxide. By diluting the latices with water, coagulating with 40 per cent. alcohol, and adding absolute alcohol to the aqueous mother liquor, the oxydase was separated in an impure state as a gummy mass, drying to a brown vitreous solid.—E. W. L.

Rubbers from Trinidad. Bull. Imp. Inst., 1908, **6**, 135—144.

IT is shown that samples of Para rubber from Trinidad are of good quality and would realise satisfactory prices. Two samples of Castilloa rubber contain exceptionally high percentages of resin, and other samples contain much higher percentages than those usually recorded for Castilloa rubber. A single specimen of Funtumia rubber submitted, was of very fair quality. Analysis yielded the following results :—

Para rubber.

	Tree A.	Tree B.
	per cent.	per cent.
Moisture	2·0	3·7
Caoutchouc	93·0	89·3
Resin	3·1	3·6
Proteids	1·6	2·6
Ash	0·3	0·8

"A" was valued at 5s. 1d. per lb., and "B" at 4s. 11d. per lb. in London, as compared with 4s. 7d. per lb. for fine hard Para rubber from South America. A sample prepared from the mixed latex of trees, "A" and "B," was valued at 4s. 3d. per lb.

Castilloa rubber.

	No. 10.	No. 11.	No. 15.	No. 17.	No. 19.	No. 21.	No. 22.
	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.
Moisture	2·5	2·5	8·0	0·8	0·1	1·0	0·1
Caoutchouc	46·4	57·6	69·2	76·1	60·9	75·4	83·0
Resin	50·6	36·0	21·2	21·5	37·2	20·4	15·6
Proteids	0·5	1·0	0·6	0·5	0·4	0·6	0·4
Insoluble matter	*nil*	2·9	1·0	1·1	1·4	2·6	0·9
Ash	0·24	2·4	1·99	0·71	0·37	2·17	0·51
Valued in London, per lb.	2s.	3s.	3s. 6d.	3s. 5d.	2s. 3d.	3s. 6d.	4s. 6d.

	Funtumia rubber.	Balata.	Loranthus rubber.
	per cent.	per cent.	per cent.
Moisture	3·2	1·8	4·7
Caoutchouc	84·8	45·7	54·4
Resin	8·7	44·2	17·7
Proteids	2·6	3·0	4·1
Insoluble matter	0·7	5·3	19·1
Ash	0·71	1·28	1·70
Valued in London, per lb.	3s. 8d.	1s. 7½d.	not valued

—F. C.

PATENTS.

Caoutchouc ; Process for the production of pure ——. A. Foolsing, Offenbach on Maine, Germany. U.S. Pat. 894,490, July 28, 1908.

SEE Fr. Pat. 368,958 of 1906 ; this J., 1907, 59.—T. F. B.

Rubber substitute ; Process for treating vegetable albumin with animal casein for the formation of a ——. F. G. Weichmann. Fr. Pat. 388,492, March 24, 1908.

VEGETABLE protein is submitted to the solvent action of a solution of animal casein in acetic acid or caustic potash by constant agitation of the mixture. The product is afterwards treated with sulphur, chalk, celluloid, drying oils, diatomaceous earth or other substances which regulate the elasticity of the product. The mass is then moulded and vulcanised. The proportion of vegetable protein employed may be varied according to the desired quality of the product.—H. G. B.

Plastic compositions from fibrous materials ; Manufacture of ——. N. Reif, Hanover, Germany. U.S. Pat. 895,197, Aug. 4, 1908.

SEE Fr. Pat. 370,490 of 1906 ; this J., 1907, 265.—W. H. C.

XIV.—TANNING, LEATHER, GLUE, SIZE.

Hides and skins ; The preservation, disinfection and cure of ——. A. Seymour-Jones. Leather Trades Rev., 1908, **41**, 546.

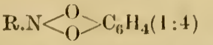
A METHOD is proposed for both preserving and disinfecting hides and skins before depilation. The method is similar to that proposed by the same author for the pickling of sheep pelts (this J., 904, 720), in which the use of an organic acid, especially formic acid, is suggested as a substitute for sulphuric acid in the ordinary vitriol and salt pickle. The author relies not only upon the physico-chemical effect of the cure, but also upon the fatal effect of the organic acids on the putrefactive and disease bacteria and their spores, and hopes thus to eliminate all danger of anthrax to those who handle such goods. The hides and skins are well washed in water immediately after flaying to free them from blood and dirt, and are then immersed in a 0·125 per cent. solution of formic acid of 90 per cent. strength for 20—40 minutes, stirring occasionally until fully swollen. The effect is increased by mechanical motion. The hides or skins may then be stored in this wet state for months without any detriment. For shipment, a partial dehydration is suggested, which may be effected either by a liberal use of salt or by drying. Such goods may be also "flint-dried" without using salt and can be speedily wet back by soaking in tepid water acidulated with a little organic acid. After further washing in water they are ready for the lime-yard. The advantages claimed for the method, are the ease with which the cure is both applied, and removed, the total disinfection and prevention of mould, and the fact that there is no alteration in the structure of the hide-fibre.—H. G. B.

Tanning with organic compounds ; Theoretical studies on ——. L. Meunier and A. Seyewetz. Collegium, 1908, 195 ; 202.

THE authors have investigated the conditions under which gelatin is rendered insoluble, and have applied this knowledge in further experiments on hide fibre, undertaken with the object of throwing light on the theory of tanning with organic compounds. Solutions of gelatin are precipitated by adding aqueous solutions of ordinary phenol, resorcinol, catechol, hydroquinone, gallotannic acid, pyrogallol, para-aminophenol, chlorophenol, picric acid, monochlorhydroquinone, "acid R" or β-naphthol disulphonic acid (2 : 3 : 6), "acid G" or β-naphthol disulphonic acid (2 : 6 : 8) "acid S" or β-naphthol-monosulphonic acid (2 : 6). The gelatin thus precipitated, however, keeps its ordinary properties and will dissolve in hot water and gelatinise as before. If the action of the substances mentioned, on gelatin be investigated under conditions favourable to their oxidation, *i.e.* in presence of alkalis and air, the result is different and the product is quite insoluble even in boiling water. The exclusion of air in most cases prevents, and in all cases retards, the production of this insoluble condition, even if alkali be present. The case of gallotannic acid has been especially studied. Without alkali, the gelatin is not rendered insoluble even after 26 days' contact, whether air be excluded or not. In the presence of alkali, it becomes insoluble in 4 days in an open vessel, but if sodium sulphite be also present, 8 days are necessary, and if thiocarbamide be used instead of the sulphite, 10 days are required for making the gelatin insoluble. The time also extends to 8 days by the exclusion of air. The conferring insolubility on gelatin by means of phenolic bodies, is therefore strongly assisted by atmospheric oxygen, and is retarded by bodies which hinder oxidation. The action of the oxidation products of the phenols, especially ordinary quinone, was therefore studied, and it was found that gelatin in aqueous solution was both precipitated and rendered insoluble. A solution of 4 grms. of quinone also rendered 20 grms. of sheet gelatin completely insoluble in 1¾ hours at 15° C. The authors also state that gelatin made insoluble by quinone, is more stable than any other known form, resisting the action not only of boiling water, but also of acids and alkalis. The quinhydrones produce the same effect but act more slowly.

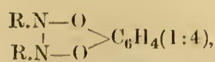
Further experiments with pieces of pelt were now undertaken to bear out the above conclusions. Equal weights of pelt were submitted to the action of hydroquinone (1) in a closed vessel, and (2) in an open vessel, occasionally agitated, and in the presence of alkali. In the first case the pelt was not either coloured or tanned and remained soluble in boiling water; in the second case the pelt became coloured rose, then reddish violet, violet, and finally brown, the fibre was tanned and it resisted boiling water. Hence hydroquinone alone cannot render hide fibre insoluble, whilst its oxidation products tan perfectly. This was further confirmed by experiments with quinone and quinhydrone which yield the same colour changes and form a leather the resistance of which to water, alkalis, and acids, exceeds all known leathers. This latter also dyes well with acid, basic, and mordant colours. (See this J., 1908, 580.)

If a quinone bath be quite exhausted by repeated use with fresh pelt it is always possible to obtain a quantity of hydroquinone from the liquor thus showing that part of the quinone has been reduced by the hide fibre, and thus that the latter has been oxidised during its action. The authors believe the action to be analogous to that of quinone on aniline, whereby aniline-quinone and dianilino-quinone are formed along with hydroquinone, and they regard the compounds formed with the hide fibre as of the following types:—



$$\mathrm{R.N}\!\left<\begin{matrix}\mathrm{O}\\\mathrm{O}\end{matrix}\right>\!C_6H_4(1:4)$$

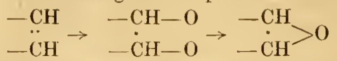
and



$$\left.\begin{matrix}\mathrm{R.N{-}O}\\|\\\mathrm{R.N{-}O}\end{matrix}\right>\!C_6H_4(1:4),$$

where $R—NH_2$ stands for the albuminoid molecule. The authors also regard this action as general in tannages with phenolic bodies, especially when oxydases are also present.

The rendering insoluble of the fibre by the action of marine oils, as in the ordinary process of chamoising, is also discussed in the light of the above experiments. The theory of Fahrion (this J., 1903, 919) is confirmed. The active agent in this tannage is regarded as an unsaturated fatty acid with four double bonds, ($C_{17}H_{26}O_2$), which, as free acid or triglyceride, is oxidised by the air when the skins are hung up, to a peroxide in which each double bond takes up a molecule of oxygen. This peroxide tends to give up part of its oxygen to the hide fibre and to the oil, not yet oxidised, thereby giving rise to a monoxide. These changes are represented thus:—



$$\begin{matrix}\mathrm{—CH}\\\ddot{}\\\mathrm{—CH}\end{matrix}\rightarrow\begin{matrix}\mathrm{—CH—O}\\\cdot\\\mathrm{—CH—O}\end{matrix}\rightarrow\left.\begin{matrix}\mathrm{—CH}\\\cdot\\\mathrm{—CH}\end{matrix}\right>O$$

Fahrion thought that the fibre was rendered insoluble by the combination of oxidised fibre with the monoxide forms of the fatty acids of the oil, but the authors, drawing an analogy with the quinone tannage, regard it as more probable that the oxidised fibre combines with the peroxides, leaving as residual oil, afterwards expressed, the monoxides which will not tan. They also think that the ordinary drying oils *e.g.* linseed oil, will not do for chamoising, because of the inability of their unsaturated fatty acids to form peroxides. Bromine water, chlorine water, ceric sulphate, gold chloride, and platinic chloride are also added to the list of reagents which will render gelatin insoluble, and it is noted that all these confirm the affinity of the fibre for oxygen.

With regard to the theory of tanning with vegetable tannins, the authors criticise the views of previous workers on this subject and on the theory of dyeing, the work of Knapp, Knecht, Vignon, Witte, Sisley and Zacharias being reviewed. The authors emphasise the difference between the fixation of tannin and the rendering insoluble of the fibre by tannin. The difference between the action on a piece of pelt, of gallotannic acid and of oak bark liquor is pointed to, for in the first case boiling water gelatinises the product and destroys its fibrous structure, whilst in the second, the fibrous structure is preserved. The authors therefore regard the fixation of gallotannic acid by the fibre as a physical phenomenon of solution followed by molecular combinations easily dissociated by water, analogous to those isolated by Sisley in the case of dyes. In the oak bark tannage, however, it is thought that capillarity, diffusion, osmosis, &c., are preliminary phenomena, and are followed by phenomena of purely chemical order resulting in the complete insolubility of the fibre, which latter are explained in the light of the oxidation of phenolic bodies as already stated. It is pointed out that the fixation of gallotannic acid involves insolubility of the fibre if alkali be present, and that the position of the phenolic hydroxyl groups in the molecule of any vegetable tannin will determine both the readiness with which it forms quinones and the rapidity with which it tans. The most thorough tannage is therefore obtained from the most oxidisable tannins. As part of the oxidation products oxidise the fibre whilst acting on the amino groups with which another part of the oxidation products combine, these are reduced again to the phenolic form, just as hydroquinone is formed in the quinone tannage. This is in agreement with the idea of the "mellowness" of used liquors, which is explained by the disappearance of the most oxidisable tannins. Oxidation during leather drying is only beneficial to a certain extent, and when the tan liquors are not too concentrated. With strong, neutral tan liquors—such as may be made from extracts,—the oxidation is apt to be excessive and result in dark coloured and "tender" leather. It is also again stated (compare Boettinger and Fahrion), that the only tannins forming a true leather are those which yield phlobaphenes. The phlobaphenes are considered as bodies of quinhydronic nature arising from the combination of peroxides with unoxidised tannins. The peroxides are soluble, whilst the quinhydronic combinations are insoluble, being therefore precipitated. In the presence of bodies susceptible of oxidation (*e.g.* sodium sulphite) the formation of phlobaphenes is retarded. Gallotannic acid which does not yield a phlobaphene, does not form a true leather.

The action of formaldehyde is also investigated. It is found to render gelatin insoluble, but by repeated treatment with hot water the product is slowly decomposed, and brought into solution. When the product is dried by heating, formaldehyde is slowly evolved, and it can also be separated by the action of dilute acids and alkalis in the cold. The authors therefore conclude that the product is unstable and has more of the nature of a molecular

addition compound than of a true chemical individual. It is pointed out that this agrees with the observation that formaldehyde leathers, perfectly supple after manufacture, eventually become hard and brittle, as if they had gradually lost their tannage. (See this also J. 1908, 759.)
—H. G. B.

Gelatoses. Z. H. Skraup and F. Hummelberger. Monatsh. Chem., 1908, **29**, 451—469.

The authors have studied the partial hydrolysis of gelatin by 25 per cent. sulphuric acid, the products being separated by means of their varying solubility in ammonium sulphate solution. The yields of glycocoll, glutamic acid, lysine, arginine, and histidine from the gelatin and from the different products of hydrolysis were also determined. The yield of glutamic acid on the hydrolysis of gelatin varies according to the method adopted. One and the same sample of gelatin yielded 13·9 per cent. (referred to dry substance) when treated according to Horbaczewski's method of hydrolysis with hydrochloric acid in presence of stannous chloride, and direct crystallisation of glutamic acid hydrochloride, after removal of the tin with hydrogen sulphide, and only 10·1 per cent. when hydrolysed according to E. Fischer's method. Fischer himself obtained only 0·9 per cent. of glutamic acid from gelatin. The yield of glycocoll was found to be 9·6—9·7 per cent. as compared with 16·5 per cent. found by Fischer and 16·38 per cent. by Levenne. The gelatin also yielded 0·4 per cent. of histidine, 6·2 per cent. of arginine and 4·4 per cent. of lysine when completely hydrolysed by Fischer's method. With respect to the partial hydrolysis of gelatin into albumoses and peptones by 25 per cent. sulphuric acid, it was found that acid of this strength acts very slowly at the ordinary temperature, but much more rapidly at 50° C. The albumoses and peptones were separated by repeated fractional precipitation or salting-out with ammonium sulphate. The peptone fractions soluble in ammonium sulphate solution were further purified by dialysis. In the method of separating albumoses and peptones by salting out with ammonium sulphate, there are two sources of error, which have not hitherto been taken sufficiently into consideration. First, in the removal of ammonium sulphate by precipitation with barium hydroxide, the barium sulphate carries down considerable quantities of organic matter, and secondly, the ammonium sulphate separated by crystallisation also retains organic matter. In the authors' experiments a total quantity of about 14 kilos. of ammonium sulphate was recovered by crystallisation and by washing with dilute alcohol, and this was found to retain altogether 115 grms. of organic matter. The albumoses and peptones obtained in the manner described are almost white in colour, and when freed from water and alcohol are only slightly hygroscopic. They consist of mixtures of substances readily soluble and soluble with difficulty respectively in 75 per cent. alcohol. The solubility in 75 per cent. alcohol decreases as the solubility in ammonium sulphate solution increases. On complete hydrolysis the albumoses and peptones yield approximately the same quantity of histidine and arginine as the gelatin from which they were derived. The yields of lysine and glutamic acid are smaller the more readily the protein is precipitated by ammonium sulphate, whilst the reverse is the case with respect to the glycocoll.—A. S.

Patents.

Tannage of skins; Employment of the products of oxidation of phenols and especially of quinones for the ——. A. Seyewetz and L. Meunier. 1st Addit. dated May 21, 1907, to Fr. Pat. 385,057, Feb. 25, 1907. See this J., 1908, 580.

The use of the commercial "adurol," chlorhydroquinone, and of its quinone and quinhydrone, for tanning by the method of the principal patent is claimed. The use of quinone chlorimide is also covered. A combination chrome and quinone tannage is described in which hydroquinone is employed in conjunction with potassium bichromate and a mineral acid. The mordanting of chrome leather for colours may be also brought about by a subsequent quinone tannage.—H. G. B.

Tannin extract and process of producing same. F. J. Maywald, New York. U.S. Pat. 894,277, Aug. 4, 1908.

A dry, friable tannin extract is prepared from viscous tannin extracts by adding a colloidal carbohydrate (*e.g.* dextrin) and evaporating the mixture to dryness.
—H. G. B.

Tanning materials, dyewood, beet, and the like; Process and apparatus for the extraction of ——. W. Wiegand, Merseburg, and R. Rieder, Frankfort, Germany. Eng. Pat. 3628, Feb. 18, 1908. Under Int. Conv., Feb. 23, 1907.

See Fr. Pat. 386,820 of 1908; this J., 1908, 760.—T. F. B.

Leather from flesh splits, —— Process for obtaining impervious and well coloured. S. Pianko and M. Knaster, Russia. 1st Addit. dated March 9th, 1908, to Fr. Pat. 385,900. Princ. Pat. Jan. 3rd, 1908. (See Eng. Pat. 28,743 of 1907; this J. 1908, 459.)

Flesh and middle splits are made equal in quality to a grain split by forming an artificial grain on the split by means of celluloid or by a mixture of nitrocelluloses and non-drying oils to which colouring matters have been added.—H. G. B.

Leather; Method of producing a material for substituting ——. F. Baum, Potsdam, Germany. Eng. Pat. 11,292, July 24, 1907.

See Fr. Pat. 380,302 of 1907; this J., 1908, 30.—T. F. B.

Artificial leather; Improvements in and relating to the manufacture of ——. H. R. Müller, Limbach, Saxony. Eng. Pat. 25,528, Nov. 18, 1907.

A process for producing a "soft touch," in imitation leather articles composed of knitted or woven fabrics cemented by gutta-percha. The goods are passed through a soap-bath, either before or after the cementing process, the gutta-percha thus being rendered soft.—H. G. B.

Leather board; Manufacture of ——. A. W. Case, Highland Park, Conn., U.S.A. Eng. Pat. 13,777, June 29, 1908. Addition to Eng. Pat. 929, Jan. 14, 1908.

See Fr. Pat. 386,420 of 1908; this J., 1908, 696.—T. F. B.

Casein insoluble; Process for making ——. H. Morin. Fr. Pat. 388,441, May 30, 1907.

Trioxymethylene is mixed with the casein before moulding, and by the slow decomposition of the former, formaldehyde is produced, the casein being rendered insoluble, infusible and non-putrescible throughout its mass.—H. G. B.

Casein compounds or articles. B. B. Goldsmith, New York City. Eng. Pat. 14,098, June 18, 1907. Under Int. Conv., Aug. 28, 1906.

See U.S. Pat. 840,931 of 1907; this J., 1907, 332.—T.F.B.

Plastic masses from casein; Process for producing ——. J. Kathe, Cologne, Germany. Eng. Pat. 17,953, Aug. 7, 1907. Under Int. Conv., Aug. 8, 1906.

See Fr. Pat. 368,704 of 1906; this J., 1907, 27.—T. F. B.

Bone, ivory, stag-horn and like horn, except cow and buffalo horn, and in the manufacture of articles therefrom; Improvements in the treatment of ——. W. C. Parkin and A. Williams, Sheffield. Eng. Pat. 1021, Jan. 16, 1908.

After the removal of mineral salts from the bone by means of dilute acid, the residue (solid, granulated, or pulverised) is saturated with glycerin or with animal or vegetable oils and pressed to any required shape in heated dies.

It is then saturated with liquid or gaseous formaldehyde, which renders the article insoluble in water. Articles so produced will bleach and dye well, and are capable of receiving and retaining a high polish.—H. G. B.

XV.—MANURES, &c.

Soils; Isolation of picoline-carboxylic acid from ——, and its relation to soil fertility. O. Schreiner and E. C. Shorey. J. Am. Chem. Soc., 1908, **30**, 1295—1307.

A poor soil was treated for twenty-four hours with 2 per cent. sodium hydroxide solution, the dark solution siphoned off after settlement, made acid with dilute nitric acid, the precipitate filtered off, the acid filtrate exactly neutralised with sodium hydroxide, the precipitate filtered off, and the filtrate precipitated with silver nitrate. From this precipitate an acid was obtained which after purification, proved to be picoline monocarboxylic acid. This was no doubt formed from the decomposition of proteid compounds in the soil; for pyruvic acid (from which picoline carboxylic acid can be derived) has been shown to be a decomposition product of protein, and, indeed, some evidence has been obtained of the existence of pyruvic acid in the soil experimented on. Direct experiments have shown that picoline-carboxylic acid in low concentrations is a stimulant, and in higher concentrations (over 100 parts per million) is toxic to wheat seedlings; uvitonic acid is much more toxic. In all probability the poorness of the soil studied was due to the toxic character of these pyridine derivatives contained in it.—J. T. D.

Patent.

Manure; Process of making artificial —— preferably from alumina and silicic acid or from natural or artificial materials containing alumina, silicic acid, and potassium. E. Pohl, Honnef on Rhine, Germany. Eng. Pat. 20,575, Sept. 16, 1907.

See Fr. Pat. 381,975 of 1907; this J., 1908, 237.—T. F. B.

XVI.—SUGAR, STARCH, GUM, &c.

Cane sugar solutions; Osmotic pressure of —— at 15° C. H. N. Morse and B. Mears. Amer. Chem. J., 1908, **40**, 193—213.

As experience is accumulated, errors in some of the earlier observations have been exposed; the results recorded for temperatures of about 20° C. are to be discarded and are in course of revision. But the values recorded for the temperatures of 0° and 5° C. are subject only to slight corrections, and are available, together with the still more accurate observations at 10° C. (this J., 1908, 760) and 15° C., for the purpose of formulating general conclusions. The molecular osmotic pressure of cane sugar solutions at 15° C. decreases at first with increased concentration and then increases. For 0·1 grm.-mol. per litre concentration, it is 24·74 atmos.; for 0·3—0·4 grm.-mol., it is at a minimum of 24·44; and for 1·0 grm.-mol., it rises to 25·40 atmos. The mean molecular osmotic pressure of cane sugar solutions at concentrations from 0·1 to 1·0 grm.-mol. per litre increases with rise of temperature. At 0° C. it is 23·95 atmos.; at 5° C. it is 24·12 atmos.; at 10° C. it is 24·50 atmos.; and at 15° C. it is 24·98 atmos. But the increments are not strictly proportional to the temperature intervals. The results suggest that the temperature co-efficient increases with rising temperature; but this must be stated with some caution, because the results recorded at the lower temperatures are not finally established. Excluding the least reliable series of results at 0° C., the increase of the osmotic pressure between 5° and 15° C. is practically identical with the increase of the gas pressure between the same temperatures. There is strong evidence that between these limits the osmotic pressures of weight-normal solutions of cane sugar obey Gay Lussac's law for gases. The mean ratios of the osmotic pressures to gas pressures recorded for concentrations from 0·1 to 1·0 grm.-mol. per litre are: at 5° C., 1·065; at 10° C., 1·061; at 15° C., 1·064; thus the temperature co-efficient is practically identical both for osmotic and gas pressures. —J. F. B.

[*Maple sugars and syrups.*] *Malic acid; Determination of ——, in food products.* H. W. Cowles. J. Am. Chem. Soc., 1908, **30**, 1285—1288.

The method has been applied chiefly to maple sugars and syrups. The sample (6·7 grms.) is dissolved in 5 c.c. of water, and 2 c.c. of 10 per cent. calcium acetate solution are added. Then 100 c.c. of 95 per cent. alcohol are added with stirring (so as to make the alcoholic strength of the whole nearly 85 per cent.), and the liquid is warmed on the water-bath till the precipitate settles. The precipitate is then washed free from calcium salts with 85 per cent. alcohol, ignited, the residue dissolved in excess of $N/10$ hydrochloric acid, boiled to expel carbon dioxide, and titrated back with $N/10$ sodium hydroxide. —J. T. D.

Sugar molecule; Depolymerisation of the ——. C. Neuberg. *See* XXIV.

XVII.—BREWING, WINES, SPIRITS, &c.

Hops, and their practical value to the brewer. P. K. Le May. J. Inst. Brewing, 1908, **14**, 414—424.

The presence of seeds in a hop detracts from the value of the sample not only by their being of no brewing value, but also by their containing an oil possessing a markedly persistent bitter flavour. The seedless hops also are found to make better yearlings. The practice of picking hops while yet hardly ripe is to be deprecated although many brewers will buy such a green hop in preference to one of a slightly yellow colour, notwithstanding that such a fully ripened hop contains more resin and has a greater brewing value. Hops dried in hot air kilns are usually tougher and less broken than those dried over the fire, but less bright coloured and, particularly as yearlings, less aromatic. As regards storage, tight packing and storage in a "cool, absolutely dark room" is to be preferred to the usual methods of cold storage. In buying hops the author considers the selection should be made without any knowledge of the price, sort, mark or owner, and to this end suggests that samples from two or three merchants should be set out and privately marked before being seen by the buyer whose selection of the best hop for any given purpose is thus unbiassed. The question of best value is determined afterwards by reference to the list. The author points out the value of calculating the hop rate per barrel of beer collected as well as per quarter of malt used. He is of opinion that hops should in no case be boiled for less than one hour and that they should never be boiled a second time. For hopping down, which is considered essential in all cases, the author regards East and Mid-Kent Goldings, Mathons, Farnham Whitebines, and Bramblings, according to season, as unsurpassed in delicacy of flavour by any foreign growths.—R. L. S.

Wines; Physico-chemical [*conductivity*] *analysis of ——.* P. Dutoit and M. Duboux. Compt. rend., 1908, **147**, 351—353.

The method of electrical conductivity, when applied to the distillates of wines, gives more complete results than the acidimetric method. If the wine be distilled with sodium hydroxide and the bases in the distillate be progressively neutralised with hydrochloric acid, the conductivity curve takes a sudden bend upwards corresponding with the point of neutrality. If the volatile acids of the wine be distilled with steam and the neutralisation of the distillate by standard potassium hydroxide be controlled by measurements of electrical conductivity, the form of the curve of conductivities affords a differentiation between the strong acids and the weaker acids of the wine. The conductivity method also promises to lead to important results in connection with the colloidal tannin constituents of the wine; for this purpose the conductivity is measured when the wine is progressively neutralised with baryta water. Thus, wines derived from "piquettes" give curves of a different form from those of natural wines. (See this J. 1908, 871.)—J. F. B.

Wines; Quantity of arsenic introduced into —— by the use of arsenical preparations in viticulture. P. Breteau. J. de Pharm. et de Chim., 1908, **27**, 154—158.

The author has determined the quantity of arsenic occurring in a number of wines made from grapes from vines that had been treated with arsenical preparations, for the destruction of parasites. The organic matter of the wine was oxidised by a mixture of nitric and sulphuric acids and the residue treated in a Marsh apparatus for seven hours, all the details prescribed by Gautier and Bertrand being followed. The insecticides employed on the vines comprised preparations both of arsenious and arsenic acids, used either alone or in conjunction with copper preparations. The quantities of arsenic found in the wines ranged up to 0·2 mgrm. per litre, but in those cases where 0·1—0·2 mgrm. were found, the arsenic could not have been derived from the arsenical dressing, but must have been introduced with substances subsequently added to the wines, such as sulphuric acid, bisulphites, etc. Normal wines from vines which have received no arsenical dressing may contain nearly 0·01 mgrm. of arsenic per litre. The author concludes that the maximum quantity of arsenic introduced by the use of such dressings must be less than 0·03 mgrm. per litre.—J. F. B.

Wines containing natural free tartaric acid, and also those to which free tartaric acid has been added. Astruc and J. Mahoux. Ann. Chim. anal., 1908, **13**, 307—315.

The authors state that, of the official methods of wine analysis established in France in 1907, that for the determination of the total tartaric acid gives too low results, especially with new wines, and that for the potash, gives too high results. Consequently if the estimation of the free tartaric acid be based on the difference between these two values considerable quantities of free tartaric acid may be overlooked. The equilibrium between the acids and bases in wine is very complex, and no method yet devised gives the absolute value of the tartaric acid actually existing in the free state. But so far as can be judged by the addition of known quantities of tartaric acid to natural wines, and the recovery of approximately the quantities added, the best results are obtained by observing the difference between the potassium bitartrate found by concentration and crystallisation direct, and that similarly obtained with the previous addition of potassium bromide. The quantity of potassium bromide added must not be disproportionately large: 1 grm. per 50 c.c. of wine is about right as a rule. The results are approximately correct in average cases, but tend to be slightly low for poor wines and slightly high for full-bodied wines. The determination of the potash may be made on similar lines, adding sodium bitartrate to the wine instead of potassium bromide. The results thus obtained are of the same order as those afforded by the official method for the determination of potash, but both methods yield values considerably in excess of the actual potash present in the wine, determined as platinum salt. Since the calculation of the free tartaric acid on the basis of the potash, is absolutely unjustified, the authors see no necessity for an accurate method for the determination of the potash. They rely for approximate values for free tartaric acid on the potassium bromide method mentioned above, but since very many natural wines contain considerable quantities of free tartaric acid, the authors can see no way of certifying the artificial addition of this acid, except when the quantity added is so large as to render the wine undrinkable. In the case of reduced wines, tartaric acid may be added to disguise the dilution, but the chemist must consider the general analytical characters which indicate reduction, before he certifies that the free tartaric acid has been added artificially.
—J. F. B.

Tartaric acid; Determination of —— in the presence of malic and succinic acids [Wines and fruit juices]. L. Gowing-Scopes. Analyst, 1908, **33**, 315—319.

The author has investigated the method proposed by J. von Ferentzy (Chem.-Zeit., 1907, **31**, 1118), which is based on the insolubility of basic magnesium tartrate in 50 per cent. alcohol, and finds that tartaric acid may be accurately determined in fruit juices by this method, and also in wines, if the tannic acid be first removed. More accurate results are obtained if the basic magnesium tartrate is titrated with permanganate than when it is ignited as recommended by Ferentzy. The following are the details of the process:—A solution of the substance under examination, containing not less than 0·05 grm., and not more than 0·10 grm., of tartaric acid, is taken for the determination; if the bulk of the solution be large, or if alcohol be present, the solution is evaporated to about one-half of the original volume. To the cooled solution is then added an equal volume of absolute alcohol, and the precipitate which forms in the case of fruit-juices and wines is filtered off, and washed with 50 per cent. alcohol (by volume). Ten c.c. of ammonia and 10 c.c. of absolute alcohol are added to the filtrate, any precipitate which forms being again removed by filtration and washed with 50 per cent. alcohol. To the filtrate thus obtained are added 10 c.c. of "magnesia mixture" and 10 c.c. of absolute alcohol, the mixture being thoroughly stirred meanwhile. After standing overnight, the solution is filtered through double filter papers, the precipitate is washed with 50 per cent. alcohol, and is then dissolved off the filter with boiling water, about 400 c.c. being used. The solution is evaporated to a volume of about 200 c.c., or until all the alcohol has been removed, then cooled, and diluted to a volume of about 400 c.c., after the addition of 10 c.c. of concentrated sulphuric acid. The solution is next heated to a temperature of 90° C., and potassium permanganate solution is run in a little at a time, until two or three drops have been added in excess; this excess is then titrated back with oxalic acid solution. The potassium permanganate solution should contain 6·9745 grms. of the salt per litre; 1 c.c. corresponds with 0·0050 grm. of tartaric acid, and the oxalic acid solution should be of equivalent strength.—W. P. S.

Fusel oil; Notes on Röse's method for determining ——, and comparison of results by the Allen-Marquardt method. W. L. Dudley. J. Am. Chem. Soc., 1908, **30**, 1271—1276.

The Herzfeld apparatus is preferable to the more recent apparatus of Bromwell; but the Röse method under any circumstances can only yield concordant results if the most minute precautions are taken at every stage of the process; and the author prefers the Allen-Marquardt method, because it is not only more rapid and liable to fewer causes of error, but gives more nearly the true amyl alcohol content.—J. T. D.

Patents.

Malting and brewing processes; [Application of electricity to ——]. B. Combe, Cheltenham. Eng. Pat. 23,544, Oct. 25, 1907.

The use of a current or currents of electricity is claimed at the following stages of the malting and brewing processes: In the steep; during the withering process; during the drying process on the kilns; during the mashing or infusion of the goods; in the wort in the underback; in the copper or boiling pan; in the hop-back; in the coolers; in the refrigerators; in the settling-backs or dropping-squares. A steady current, *e.g.*, of two ampères, is passed through the liquor or moist grain at intervals at discretion, carbon grid-electrodes being preferred.—J. F. B.

Malt; Method of treating —— for use in brewing. A. Heymann, Mannheim, Germany. Eng. Pat. 21,941. Oct. 4, 1907.

See Fr. Pat. 381,149 of 1907; this J., 1908, 136.—T. F. B.

Brewery mashes; Filter press for draining and extracting ——. C. G. Gillmann. Fr. Pat. 388,429, Mar. 21, 1908.

In the improved pattern of brewery-mash filter press described, the plates and frames are made circular or oval, instead of square, in order that they may resist a higher internal pressure. A portion of the upper part of each filtering plate is blocked up, either by plates reaching down from the top of the spacing frames or by the omission of grooves from that portion of the filtering plate. The object of this is to prevent the short-circuiting of the washing water along the top of the filter press when the compartments are not completely full of grains. Blank plates may be inserted at any part of the filter press when the quantity of mash is too small to fill the whole press. The plates and frames are clamped together by hydraulic pressure, which is prevented from releasing itself by leakage by screwing up a vice after the pressure has been established.—J. F. B.

Musts, wines, mistelles, spirits, vinasses and extracts of tartar or lees; Treatment for ageing of or removal of sulphurous acid from ——. A. Hubert. Fr. Pat. 388,158, Mar. 13, 1908.

For the removal of sulphurous acid from musts, etc., the liquid is treated with a quantity of calcium peroxide equivalent as regards active oxygen to the quantity of sulphurous acid to be destroyed. For the artificial ageing of wines and spirits, quantities of calcium peroxide ranging from 10 to 50 grms. per hectolitre are introduced into the liquids. For the precipitation of calcium tartrate from vinasses and tartar extracts, the use of calcium peroxide gives a purer and less highly coloured product. —J. F. B.

Wines; Clarification of sparkling ——, *under pressure of an inert gas and in absence of air.* A. Marone. Fr. Pat. 388,256, Mar. 17, 1908. Under Int. Conv., Mar. 27, 1907.

The apparatus consists of a filter of the Chamberland type and a pump situated in a circuit of tubes. At one side, between the pump and the filter, the bottle of wine to be treated is inserted in the circuit, and on the other side is a clean empty bottle. The air is expelled from the clean bottle by a stream of carbon dioxide from a gas reservoir; the bottle is then filled under pressure with the inert gas. The gas from the empty bottle is drawn by the pump through the tubes and forced into the bottle of cloudy wine which is inverted. The wine is thereby expelled from this bottle, passes through the filter and finally arrives in the clean bottle. When the latter is filled, it is removed and corked without loss of gas. —J. F. B.

Wines; Apparatus for the continuous clarification of sparkling ——, *under pressure of an inert gas and in absence of air.* A. Marone. Fr. Pat. 388,257, Mar. 17, 1908. Under Int. Conv., Mar. 27, 1907.

An apparatus is described for applying the principle specified in Fr. Pat. 388,256 (see preceding abstract) in a continuous manner. Instead of a single bottle of wine inserted in the circuit, an arrangement is provided which holds six bottles, disposed radially around a central hollow turn-table connected with the tubes of the pump and filter circuit. The machine is manipulated so that every bottle of wine is emptied by the time it has made a complete revolution round the turn-table, and can be replaced by a fresh bottle without interrupting the treatment of the other five. The recipient bottles for the filtered wine are disposed and operated in an exactly similar arrangement on the other side of the circuit. —J. F. B.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, AND DISINFECTANTS.

(*A.*)—FOODS.

Sulphurous acid in foodstuffs, particularly gelatin; Determination of ——. L. Padé. Ann. Chim. anal., 1908, **13**, 299—301.

For the determination of sulphurous acid in gelatin, 20 grms. of dry gelatin, or a corresponding quantity of jelly, are steeped in a distillation flask with about 500 c.c. of boiled water for 12 hours. The flask is provided with a tap-funnel, and a tube reaching to the bottom, through which a current of carbon dioxide can be passed; the delivery tube is connected with a Will's absorption tube containing 50 c.c. of a 0·5 per cent. solution of iodine in potassium iodide. Carbon dioxide is first passed through the flask in a rapid stream for 10 minutes to expel the air. The flask is then heated in a water bath at 70° C., whilst a slow current of carbon dioxide is passed through (2—3 bubbles per second). When the gelatin has dissolved, 25 c.c. of a 10 per cent. solution of syrupy phosphoric acid are introduced through the tap-funnel, and the speed of the gas is increased to 4—5 bubbles per second. After about one hour, the whole of the sulphurous acid will have been carried over and converted into sulphuric acid by the action of the iodine, when it can be determined gravimetrically. A volumetric determination of the iodine reduced, does not yield good results owing to volatilisation by the current of gas. Samples of gelatin examined by the author have contained up to 0·7 per cent. of sulphur dioxide. Dry gelatins never contain free sulphurous acid, but this is sometimes present in jellies. In order to separate the free sulphurous acid from the sulphites, the determination is carried out in two stages: first without the addition of phosphoric acid, and subsequently, with the acid.—J. F. B.

Benzoic acid and benzoates [*in foodstuffs*]; *General results of the investigation showing the effect of* —— *upon digestion and health.* H. W. Wiley. U.S. Dept. of Agric., Bureau of Chemistry, Circular No. 39, 1908.

It is evident, from the results of an investigation during which benzoic acid and sodium benzoate were administered to twelve healthy men, that both these substances are highly objectionable when taken internally, producing very serious disturbance of the metabolic functions, attended with injury to digestion and health. This injury manifests itself in a number of different ways: indigestion, nausea, headache, vomiting, loss of body weight, etc. As regards the elimination of these preservatives from the body, it was found that benzoic acid is converted into hippuric acid, though there is a tendency for it (benzoic acid) to be retained in the body for a considerable length of time, and this is much more marked in the case of sodium benzoate, than in the case of the acid itself. As stated, twelve men were experimented upon. "In the first period there was given to Nos. 1 to 6, inclusive, 1 grm. of benzoic acid per day; to Nos. 7 to 12, inclusive, 1 grm. per day, with the exception of the first day, when only 0·9 grm. was given." During the second period, 1·5 grms. of benzoic acid were given each day to each member. In the third period, 2 grms., and in the fourth, 2·5 grms. were given each day. The maximum quantity of benzoic acid, given during the entire period, was 35 grms., and only three men were able to take this amount. In all of the other cases, it became necessary to withdraw a portion or all of the preservative. The injurious effects are produced more rapidly by benzoic acid than by sodium benzoate, though the total harmful effect finally produced is practically the same in both cases. It is concluded emphatically, that in the interests of health, both benzoic acid and sodium benzoate should be excluded from food materials.—W. P. S.

Patents.

Flour; Apparatus for oxidising [*bleaching*] —— (*electrically*). W. L. Jones, Stockton, Cal. U.S. Pat. 895,405, Aug. 4, 1908.

A chamber, having inlet and outlet openings, is provided with means for blowing a current of air through it. The terminals of a battery, inside the chamber, are short-circuited, thus generating "gaseous compounds possessing bleaching properties."—B. N.

Extracts of coffee, tea, and the like; Process and apparatus for making ——. W. Gebhardt, Friedenau, Germany. Eng. Pat. 14,342, June 21, 1907.

Caffeïne does not exist in coffee in the free state, but as a complex potassium compound of caffeïne and caffeetannic acid, which, it is stated, has no injurious effect on the system. The claim is for a process of extraction in which the decomposition of this compound is avoided. The powdered coffee, etc., is made into a thin pulp with water at 5° to 20° C., the mixture slowly heated to 60° C., or 70° C., at most, preferably by means of steam or an internal heater, and the resulting extract filtered. Various forms of apparatus for this purpose are claimed, such as, *e.g.*, an incandescent lamp surrounded by a hollow casing, which is suspended within the vessel containing the coffee and water.—C. A. M.

Fish and other alimentary products; Process for preserving ——. J. de Vilmorin, Paris. Eng. Pat. 4643, Feb. 29, 1908. Under Int. Conv., Mar. 2, 1907.

Fish or other alimentary products are cleaned and steeped in brine; they are then treated once or several times, according to size, with crude pyroligneous acid and finally dried in the air or artificially. The pyroligneous acid, which imparts a smoked flavour to the goods, may be applied by immersion or by sprinkling with a brush. The treated fish may subsequently be preserved in oil if desired.—J. F. B.

Butter; Manufacture of ——. A. H. Borgstrom, Hangö; Finland. Eng. Pat. 4527, Feb. 28, 1908.

See Fr. Pat. 387,653 of 1908; this J., 1908, 872.—T. F. B.

(*B.*)—SANITATION; WATER PURIFICATION.

Patents.

Water; Process and apparatus for clarifying —— [*after treatment with barium carbonate for the removal of sulphates*]. H. Reisert, Cologne, Germany. Eng. Pat. 2077, Jan. 29, 1908.

The water is conducted through a pipe to the bottom of a vertical cylindrical tank where it mixes with powdered barium carbonate (see Fr. Pat. 365,449 of 1906; this J., 1906, 1000). The water then rises in the tank carrying with it barium carbonate in suspension. Towards the top of the tank are placed a number of concentric, funnel-shaped partitions through which the water passes and deposits the greater part of the suspended barium carbonate. Above these partitions is a collecting chamber, and above this again a filter.—W. P. S.

Water; Apparatus for purifying ——. H. Reisert, Cologne, Assignor to Hans Reisert Co. U.S. Pat. 895,198, Aug. 4, 1908.

See Fr. Pat. 369,056 of 1906; this J., 1907, 40.—T. F. B.

Water; Impts. in, and apparatus for the sterilisation of potable ——. A. Charbonneau and A. Malaquin, Paris. Eng. Pat. 26,421, Nov. 29, 1907. Under Int. Conv., Dec. 19, 1906.

See Fr. Pat. 372,752 of 1906; this J., 1907, 548.—T. F. B.

Sewage; Method of treating ——. C. C. E. Beddoes, Wallingford, Pa. U.S. Pat. 895,229, Aug. 4, 1908.

The invention relates to a process for supplying oxygen to sewage in order to bring it into a suitable condition for supporting bacteria. The sewage is treated with air or gas, and the moving body of sewage and air or gas is then subjected to an increased pressure; the sewage thus saturated with oxygen is finally subjected to the action of bacteria while at rest.—J. F. B.

(*C.*)—DISINFECTANTS.

Patent.

Formaldehyde vapours; Method of producing —— *for disinfecting purposes.* H. Schneider, Hamburg. Eng. Pat. 4855, Mar. 3, 1908. Under Int. Conv., Mar. 18, 1907.

Gaseous formaldehyde is formed by the action of permanganates, or other per-acid salts, on compounds of formaldehyde with alkali bisulphites in the presence of water. For instance, 7·5 kilos. of a 40 per cent. solution of formaldehyde are mixed with 26 kilos. of a 40 per cent. solution of sodium bisulphite. When from 1 to 4 parts of the solution thus obtained are poured on 1 part of powdered potassium permanganate, a violent reaction takes place accompanied by the liberation of formaldehyde vapour and steam. If desired, formaldehyde, or paraformaldehyde, may be added to the solution of the formaldehyde-bisulphite compound.
—W. P. S.

XIX.—PAPER, PASTEBOARD, &c.

Papers; Absorption of moisture by ——. Papier-Fabrikant, 1908, **6**, 2074—2075. [T.R.]

Several papers were examined, mostly cartridge papers, from the point of view of absorption of moisture. The tests were made by suspending weighed sheets of paper in a room containing humid air, at 85—90 per cent. saturation and at a temperature of 20° C., until equilibrium was established (3 days), and weighing the amount of moisture taken up from the air. Other tests were made by floating weighed sheets of paper on the surface of water, one side only, draining and pressing between bibulous paper before weighing again. The results showed that the sizing [rosin] had no influence on the amount of moisture absorbed by the paper from a damp atmosphere, but that this depends chiefly on the degree of beating of the pulp and is influenced also by the composition and weight per sq. metre of the paper. The quantity of moisture absorbed was lowest in the case of a very soft-sized, wood-pulp tissue paper (9 per cent.), and highest in that of an imitation parchment paper (15·1 per cent.); the various cartridge papers examined, showed absorptions ranging from 11·9 to 14·4 per cent. In direct contact with water the quantity of moisture taken up depends almost entirely on the degree of sizing, ranging, under the conditions of the test, from 29 per cent. for a very hard sized paper up to 78 per cent. for a filter paper. The influence of the degree of beating of the pulp plays a minor part which could be discerned in the case of the unsized papers. In applying one or the other of these tests, regard must be had to the manner in which the paper is likely to come in contact with moisture in practical use. For cartridge cases, which are protected from direct contact with water, imperviousness to the moisture of a humid atmosphere is required; for insulating electric wires, the paper may have to resist water directly, in the form of rain. Very few papers are good in both respects.
—J. F. B.

"Cell-pitch"; Manufacture of —— *from waste sulphite wood liquors.* W. Sembritzki. Wochenbl. für Papierfabr., 1908, **39**, 2866—2867.

The evaporation of the waste sulphite wood liquors at the Walsum factory (see this J., 1908, 466) to a solid pitch, which is used for briquetting blast-furnace dust, promises to develop into a profitable industry. The liquors have a sp. gr. of 1·05 and an acidity of 0·32 per cent. calculated as sulphur dioxide. The thick syrup of 35° B. from the evaporators has the composition: water, 28·88 per cent.; insoluble matter, 13·96; extract, 57·16; tanning matters, 22·96; non-tannins, 34·24 per cent. The solid "cell-pitch" contains: water, 13·76; soluble extract, 86·60; tanning matters, 31·84; non-tannins, 54·76 per cent. The non-tannins of the syrup consist of organic matter, 24·76; mineral matter, 9·44 per cent. The non-tannins of the "cell-pitch" consist of organic matter, 36·08; mineral matter, 18·68 per cent. If the evaporators are constructed of iron, it is necessary to neutralise the acidity of the liquors with lime before concentration, but the incrustation of the tubes with calcium compounds is then somewhat troublesome. In copper evaporators the liquors may be concentrated in their acid state. The author thinks that neutralisation with lime is essential for the proper coking of the

briquettes in the blast furnace. If, on the other hand, the concentrated liquors are intended for tanning purposes, neutralisation is a drawback, as the calcium compounds make the leather brittle. The success of the Walsum experiments is attributed in large part to the sextuple-effect Kestner evaporator used. Each effect has a heating surface of 55 sq. m.; the first vessel is heated with steam at 3—4 atmospheres, and the boiling point in the last effect is 50° C. The liquor requires about 3 hours for its concentration to 35° B. This syrup is converted into solid pitch by two steam-heated drums which dip below its surface. The first drum concentrates the syrup from 35° to 60° B.; the second converts it into a solid film which is removed by a scraper. 10 kilos. of waste lye yield 1 kilo. of dry substance. It is stated that a selling price of 40 marks per ton would show a good profit.
—J. F. B.

Patent.

Size for papermakers' use; Manufacture of ——. W. Pochin and J. H. Richardson, Salford. Eng. Pat. 23,666, Oct. 26, 1907.

A powdered size consisting chiefly of aluminium sulphate and sodium silicate is specified. It is prepared by treating alum cake or aluminium sulphate with a concentrated solution of sodium silicate, drying the mass and grinding. The preparation may either be used alone or in conjunction with rosin size.—J. F. B.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

Amphicome emodi; Alkaloid in ——. D. Hooper. Annual Report, Indian Museum, 1907—8, 21.

The root and stem of this plant, a native of Jammu and Kashmir, afford a bitter drug known as "kaur." It contains an intensely bitter alkaloid, which is probably the active principle, also an acid fat, a wax, yellow colouring matter, and a sugar.—J. O. B.

Berberine; Microchemical detection of —— in plant-tissues. — Bauer. Pharm. Zeit., 1908, **53**, 618.

Sections of the material are floated in a few drops of water, on an micro-slide, allowed to macerate for a few seconds, then warmed with a few drops of 10 per cent. caustic soda solution, and treated with 4 or 5 drops of acetone. The cover glass is then put on, and the growth of the crystals of the characteristic berberine-acetone compound observed. In many cases these are evident in 5 mins. Some portions of the tissues may show the growth only after several hours, and some portions not at all. This indicates that berberine is localised in certain cells of the plant tissues and not uniformly distributed.
—J. O. B.

Solanum sodomæum ("um-Tuma") in South Africa. G. E. Oliver. Chem. and Drug., 1908, **73**, 325.

Solanum sodomæum is a common weed growing on cultivated ground, rubbish heaps and near cattle kraals in South Africa. The whole plant, which grows in favourable situations 5 to 6 ft. high, is well armed with spines; the leaves are divided and the flowers typical of the order *Solanaceæ*, being whitish or purple with a yellow central column of joined anthers. The parts used medicinally are the fruit (apple of Sodom), which, when ripe, is a large pale yellow berry, averaging an inch in diameter, and the leaves. The drug is used for destroying parasites, etc. The juice of the fruit is extremely acrid and bitter, and contains solanine.—W. S.

Rhamnus frangula and Rhamnus purshianus barks; Comparative examination of ——; [*and influence of magnesia on the therapeutic properties*]. A. Tschirch and J. F. A. Pool. Archiv Pharm., 1908, **246**, 315—325.

The emodin removed by percolation of *Cascara sagrada* and buckthorn barks with alcohol, is the same in both cases. $C_{15}H_{10}O_5$ m.pt. 225° C., giving identical derivatives. The identity of the so-called "cascara-emodin" and "frangula-emodin" is therefore established. The influence of magnesia, as employed in the preparation of "bitterless" galenical preparations of these drugs and of rhubarb was investigated. The powdered material, mixed with 5 per cent. of magnesia, was percolated to exhaustion with a mixture of equal volumes of 90 per cent. alcohol and water. Similar experiments, with the same drug and menstruum, but without magnesia were made for controls. It was found that the amount of combined oxymethylanthraquinones is increased by the use of magnesia, and that of those compounds in the free state is lessened, the total quantity not being materially affected, as shown by the following figures:—*Without magnesia. Frangula bark;* free oxymethylanthraquinones 1·40; combined 1·84; total 3·24 per cent. *Cascara bark;* free oxymethylanthraquinones 0·06; combined 0·20; total 0·80 per cent. *Rhubarb root;* free oxymethylanthraquinones 1·10; combined 2·47; total 3·57 per cent. *With magnesia. Frangula bark;* free oxymethylanthraquinones 0·75; combined 2·24; total 2·99 per cent. *Cascara bark;* free oxymethylanthraquinones 0·18; combined 0·5; total 0·68 per cent. *Rhubarb root;* free oxymethylanthraquinones 0·43; combined 2·53; total 2·96 per cent. Since the physiological action of the drugs is chiefly dependent on the combined oxymethylanthraquinones, and the use of magnesia slightly increases these, the therapeutic value of preparations treated therewith is not lessened.—J. O. B.

Orthovanillic aldehyde. F. Nœlting. Proc. Soc. ind. de Mulh., **1908**, 24; J. Pharm. Chim., 1908, **28**, 173.

Although Tiemann and Roppe have described orthovanillic aldehyde, $CHO.C_6H_3.OH.OCH_3$, as well as its isomeride, vanillin, as being formed by the action of chloroform, in presence of alkali, on guaiacol, it has always, until recently, been regarded as a yellow liquid. It is now found, when pure, to form fine, bright yellow needles, m.pt. 45—46° C. It is separated from vanillin by steam distillation at a temperature below 115°—120° C. It is notable that orthovanillic aldehyde which is bright yellow only differs from salicylic aldehyde, which is colourless, by the addition of 1 mol. OCH_3, thus indicating the auxochromic influence of the methoxyl group. The sodium salt of orthovanillic aldehyde is yellow, and soluble in water; the phenylhydrazone is yellowish-white, m.pt. 130—131° C., the bisulphite compound is white, and the aldazine crystallises in bright yellow needles, m.pt. 198—199° C.—J. O. B.

Creosotal; Colourless ——. Aufrecht. Pharm. Zeit., 1908, **53**, 480.

"Creosotal" or "creosote carbonate," which is widely used in medicine, is usually met with as a syrupy liquid with a slight yellowish tint. Recently, however, a practically colourless form has appeared, with the inference of greater purity. This however is incorrect; the colourless appearance is attained merely by the addition of a trace of a blue dyestuff to cover the yellow tint. Such "colourless" creosotal in a 10 per cent. solution in absolute alcohol shows a faint, but distinct bluish-violet fluorescence; normal creosotal does not show this. When the fictitious creosotal is shaken out with ether and caustic soda solution, the ether acquires a brownish red colour with a bluish violet fluorescence, and leaves, on evaporation, a violet residue. The same ether solution gives absorption bands in the green, on spectroscopic examination.—J. O. B.

Chloroform; Decomposition of —— by alcoholic potassium hydroxide. G. Mossler. Monatsh. f. Chem., 1908, **29**, 573—581.

When chloroform is allowed to react with alcohol and potassium hydroxide, either by treating chloroform with an alcoholic solution of potassium hydroxide, or by treating an alcoholic solution of chloroform with dry powdered potassium hydroxide, ethylene, carbon monoxide and formic acid are produced. The proportion of ethylene to carbon monoxide is as 1 volume to 3 volumes, except when less than 5 mols. of alcohol to 1 of chloroform are present, and is not affected by the use of 50 per cent. alcohol; the proportion of formic acid varies from 15 to 55 per cent. of the theoretically possible. Similar results are obtained with bromoform and chloral hydrate. The author believes the reaction to be due to the formation of an intermediate substance CCl_2, which at once reacts with alcohol to form the two possible esters; the decomposition of these esters by potassium hydroxide results in the formation of ethylene and carbon monoxide. This view is confirmed by the production of phosgene, $COCl_2$, when air laden with chloroform vapour is passed over dry potassium hydroxide. The formation of formic acid is due to an entirely separate reaction.—A. G. L.

Pitch-blende residues; Treatment of ——. L. Haitinger and K. Ulrich. Monatsh. f. Chem., 1908, **29**, 485—496.

The paper deals with the extraction of radium salts from 10,000 kilos. of pitch-blende residues, corresponding to about 30,000 kilos. of ore, about 5,000 kilos. of residues being treated per annum. The residues, in batches of 100 or 200 kilos. at a time, were subjected to a preliminary boiling with sodium hydroxide solution, followed by extraction with hydrochloric acid. This acid solution was free from radium, but contained polonium and actinium, which were precipitated as hydroxides by ammonia. The radium and allied metals in the residues, were next converted into carbonates by three treatments with boiling sodium carbonate solution alternating with three extractions with pure hydrochloric acid. The treatment of each batch up to this point required about six months, the intermediate washings being very tedious. From the combined acid extracts, a crude sulphate was precipitated by the addition of sulphuric acid. This sulphate was again converted into chloride through the carbonate as before, and the bulk of the calcium removed by extraction with concentrated hydrochloric acid. The crude chloride left, amounting to about 20 kilos., and consisting chiefly of barium chloride, was then subjected to about 35 series of fractional crystallisations, radium chloride being the most insoluble chloride present. The first fraction obtained (about 9 grms.) was then freed from lead by means of hydrogen sulphide, and crystallised four times in quartz vessels. Finally, there were obtained 1·05 grm. of radium chloride with an atomic weight of 225 and an activity of 27,200,000, about 0·5 grm. of equally pure bromide, and four fractions of chloride amounting in all to 8·3 grms., with atomic weights of 143—185, and activities of 3,100,000—17,000,000, as well as 11 kilos. of barium chloride very poor in radium. The activity of radium preparations appears to be exactly proportional to their radium content, as calculated from the atomic weight. It is mentioned that on keeping a sample of radium bromide for a year, it decreased in weight by about 20 per cent., and became nearly insoluble in water. On heating, it lost 5·4 per cent. of its weight, and on treatment with hydrogen bromide gained 17·2 per cent.—A. G. L.

Patents.

Formic ethers [esters] of borneol and isoborneol; Manufacture of ——. O. L. A. Dubosc, Rouen, France. Eng. Pat. 14,379, June 21, 1907. Under Int. Conv., Oct. 6, 1906.

See Fr. Pat. 370,293 of 1906; this J., 1907, 278.—T. F. B.

Barbituric acid; Process of manufacturing ——. O. Wolfes, Darmstadt, Germany. U.S. Pat. 894,994, Aug. 4, 1908.

Dialkylbarbituric acids are formed by condensing guanylurea with dialkylcyanacetic esters, for instance the ethylic ester of diethylcyanacetic acid, by heating a mixture of the substances and hydrolysing the resulting condensation products by treatment with acids. (Compare Fr. Pat. 357,968; this J., 1906, 197.)—J. F. B.

C. C.-Dialkyl-imino-barbituric acids; Manufacture of ——. C. G. Redfern, London. From Basle Chemical Works, Basle, Switzerland. Eng. Pat. 5316, Mar. 9, 1908.

C.C.-Dialkyl-imino-barbituric acids (dialkyl-malonic guanidines) are obtained by treating a dialkyl-malonic acid and a salt of guanidine dissolved in 100 per cent. sulphuric acid with a powerful acid dehydrating agent, such as fuming sulphuric acid, chlorosulphonic acid or phosphorus pentoxide. (Compare Eng. Pat. 14,014 of 1904; this J., 1905, 749.)—J. F. B.

iso-Bornyl esters; Manufacture of ——. C. Weizmann and The Clayton Aniline Co., both of Manchester. Eng. Pat. 16,605, July 19, 1907.

See Fr. Pat. 386,552 of 1908; this J., 1908, 712.—J. F. B.

Acetates of borneol and isoborneol; Preparation of ——. P. J. Leemans, Vieux Turnhout, Belgium. Eng. Pat. 1936, Jan. 28, 1908. Under Int. Conv., Feb. 11, 1907.

See Fr. Pat. 386,347 of 1908; this J., 1908, 712.—T. F. B.

Acyl-salicylic anhydrides; Production of ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 388,167, Mar. 13, 1908. Under Int. Conv., Aug. 21, 1907.

The anhydrides of acyl-salicylic acids are prepared (1) by treating acyl-salicylic acids (acidyl group in the phenolic hydroxyl position) with acid halides, such as phosgene or the halogen derivatives of phosphorus, sulphur, etc., in presence of bases; (2) by treating the halides of the acyl-salicylic acids with tertiary bases and water; or (3) by causing the halides of the acyl-salicylic acids to react with acyl-salicylic acids, in presence of tertiary bases or other alkaline agents, or with the salts of the acyl-salicylic acids.—J. F. B.

Nitriles of aromatic a-hydroxy-acids; Process of preparing ——. J. L. Turner, Philadelphia, Pa., and C. E. Vanderkleed, Collingswood, N.J., Assignors to H. K. Mulford Co., Philadelphia, Pa. U.S. Pat. 895,316, Aug. 4. 1908.

Nitriles of aromatic *a*-hydroxy-acids are prepared by forming an addition compound of a pyrocatechol derivative with sodium bisulphite and acting on this compound with a cyanide. For instance: 100 grms. of a pyrocatechol derivative are heated with 500 c.c. of a concentrated solution of sodium bisulphite; 80 grms. of potassium cyanide dissolved in 150 c.c. of water are added and the nitrile is separated.—J. F. B.

Camphor; Manufacture of ——. A. Friedl, C. Weizmann, and The Clayton Aniline Co., all of Manchester. Eng. Pat. 21,946, Oct. 4, 1907.

In the manufacture of camphor by the oxidation of *iso*-borneol by means of chromic acid, the use of acetone as a solvent is claimed. For instance: 260 parts of 33 per cent. sulphuric acid are mixed with 100 parts of *iso*-borneol and 100 parts of acetone; 65 parts of potassium bichromate are then added gradually with agitation, and the mixture is heated under a reflux condenser for 2 hours. It is stated that the presence of acetone maintains the *iso*-borneol and the camphor in solution and prevents them from subliming; it also prevents the contamination of the camphor by the salts of chromic oxide and prevents the temperature of the reaction from rising above 56° C., the boiling point of the acetone.
—J. F. B.

Camphor from borneol or isoborneol. A. J. Boult, from O. Florizoone, Switzerland. Eng. Pat. 5513, Mar. 11, 1908.

Camphor can be made from borneol or isoborneol by dissolving the latter in a non-oxidisable immiscible solvent, and oxidising with a mixture prepared from potassium bichromate, sulphuric acid and water.
—F. Shdn.

Methane ; Oxidation of ——. [Obtaining methyl alcohol, formic acid and formic aldehyde.] M. von Unruh, Charlottenburg, Germany, Assignor to Sauerstoff- und Stickstoff-Industrie Hansmann und Co., Vienna, Austria. U.S. Pat. 891,753, Oct. 29, 1907.

METHANE is oxidised to formaldehyde, formic acid and methyl alcohol by oxygen, air or other gases containing oxygen at 30° to 50° C. under the catalytic influence of bark. Bark of any origin may be used, such as the oak-bark used for tanning, or similar substances such as bast. Gases containing methane, such as natural gas, may with advantage be used. The natural gas found in the neighbourhood of oil-fields is stated to contain 95—98 per cent. of methane. *Example.*—12 litres of methane and 36 litres of oxygen, both well mixed and previously heated to 45·5° C., are slowly passed through a reaction-chamber of 4 litres capacity filled with oak-bark in pieces of 2 to 3 mm. diameter during 12 hours. The products are 1520 grms. of formaldehyde, a small quantity of methyl alcohol and some formic acid. If 24 litres of methane are mixed with 180 litres of air and passed in 12 hours through the same reaction-chamber after heating to 45° C., 1565 grms. of formaldehyde are obtained.—E. F.

Casein ; Manufacture of a new pharmaceutical compound from ——. Knoll und Co., Ludwigshafen a/R., Germany. Eng. Pat. 6227, Mar. 20, 1908. Under Int. Conv., Mar. 28, 1907.

CLAIM is made for a preparation of arsenic and iron which is insoluble in the juices of the stomach, but soluble in the alkaline intestinal fluid. It is obtained by concentrating the solution resulting from the artificial digestion of casein with pepsin and hydrochloric acid, and (*a*) treating it with a solution of arsenic acid or other arsenic compound, *e.g.*, meta-arsenic acid or arsenious acid, and then with a solution of an iron salt, such as iron ammonium sulphate ; or (*b*) adding alcohol, dissolving the resulting precipitates in water, and treating the solution as in (*a*).—C. A. M.

Radioactive bodies from uranium or from compounds of the same ; Process for obtaining ——. A. P. H. Trivelli, Scheveningen, Holland. Eng. Pat. 2152, Jan. 30, 1908. Under Int. Conv., Jan. 31, 1907.

SEE Fr. Pat. 386,751 of 1908 ; this J., 1908, 769.—T. F. B.

Ozone ; Production of ——. B. Jirotka. Eng. Pat. 6453. *See* XIA.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

PATENT.

Yellowish light filters for polychrome exposures ; Impts. in ——. E. Wandersleb, Jena, Germany. Eng. Pat. 23,738, Oct. 28, 1907.

THE invention refers to the yellowish light-filter used with a photographic plate having a polychrome layer between the sensitive surface and its support, such as the Lumière "Autochrome" plate. Such a light-filter may be interposed between the lens and the plate, inside the camera, but as this causes many obvious inconveniences, it is usually placed in front of the lens during exposure. When the latter arrangement is used it is necessary, with the light-filter hitherto employed, to focus on to a ground glass screen of the same thickness as the photographic plate, reversely placed in the camera, so that the ground glass surface is at the back, and then to reduce the distance between the objective and the plate by an amount slightly less than the thickness of the latter. To avoid the necessity for this latter adjustment, according to the present patent, the ordinary bi-planar light-filter is replaced by one having the form of a weak dispersive lens the focal length of which equals about two-thirds the thickness of the support of the sensitive surface of the plate. This decreases the effective focal length of the combination to such an extent that further adjustment after focussing is unnecessary.—E. F.

XXII.—EXPLOSIVES, MATCHES, &c.

Xyloidins ; Studies on the ——. III. C. Haeussermann. Z. ges. Schiess. u. Sprengstoffw, 1908, **3**, 305—306.

XYLOIDINS are the amorphous products of the action of nitric acid on the polysaccharides. Excluding the starch nitrates, the xyloidins may be classified as follows :—*Group* 1. The products obtained by warming wood- or cotton-fibres, filter paper, "hydral-cellulose" (acid-cellulose lactone) or pyroxylin with nitric acid of sp. gr. above 1·4, until the substance is dissolved, and pouring the solution into water or into strong sulphuric acid. *Group* 2. Products obtained by dissolving loose cotton-wool in cold nitric acid of sp. gr. 1·47, and allowing the solution to stand, or diluting it with water. Spun or felted fibres are changed by this treatment, but are not dissolved like loose cotton. *Group* 3. Products obtained by dissolving cotton in concentrated sulphuric acid at a low temperature, and adding strong nitric acid, keeping the temperature low. When washed and dried, all these xyloidins are white, amorphous, but not homogeneous, powders. They differ widely in their solubility relations and nitrogen contents. The reaction between cellulose and nitric acid depends so largely on the temperature, and the concentration of the acid, and is accompanied by the production of such variable amounts of by-products soluble in water, that the yields and properties of products made in the same way may vary considerably. The xyloidins are all compounds of nitric acid, but whether they are all true esters, or whether some of them are merely adsorption compounds, has not yet been decided. On treatment with alkali hydrosulphides, the xyloidins of groups 1 and 2 yield "acid-cellulose" in the form of a hydrated jelly. Collodion cotton and gun cotton, when dissolved in warm concentrated nitric acid, are not actually decomposed, but undergo changes, with the result that the amorphous products obtained on dilution, differ considerably from the amorphous colloids formed by the action of organic solvents. The product of the ordinary nitration of Girard's hydrocellulose differs from the xyloidins, in the fact that its organised structure is preserved, and the amorphous starch nitrates differ from the cellulose xyloidins in that they yield soluble starch or dextrin when denitrated. It is unlikely that the xyloidins will attain any industrial importance as explosives, their cost of production being higher than that of pyroxylin, and they are characterised by lack of uniformity and by instability on storage. It has, however, been proposed to utilise products which occupy an intermediate position between the ordinary pyroxylins and the xyloidins.—J. F. B.

Supplemental regulations for the transport of explosives. Rules prescribed by the American Railway Association—Opinions of Dr. Schieffelin for the Bureau for the Safe Transportation of Explosives. Oil, Paint and Drug Rep., 1908, 9 and 41. [T.R.]

"THE prevention of leakage of the contents of such packages as contain inflammable articles and acids, is of supreme importance.

"To exercise proper care, information as to the physical contents of the packages is necessary.

"Simplicity and conciseness of regulations require the greatest possible reduction in the number of groups into which such articles are divided, and in the kind of placards and labels used for the guidance of railway employés."

For transportation purposes, all inflammable articles and acids are divided into the following groups :—

Inflammable liquids, "Inflammables," Acids.

The general order issued by the Association reads :—

" A. Shipments of the articles referred to will be received for transportation on the ———— railroad on and after September 1, 1908, provided the methods of packing and contents of packages so far as they affect safety in transportation are open to inspection by the authorised representative of this company or of the Bureau for the Safe Transportation of Explosives and other dangerous articles.

B. Shipments of inflammable articles or of acids destined for points on or beyond the lines of this company will be subjected to these and any additional regulations of the roads over which the shipments are to be moved. Shipments offered by connecting lines will be received, subject to these regulations."

Shippers are directed to be careful in packing, marking, labelling and certifying to the packages and their contents.

When any package containing inflammable material and acids, or some such similar article, such as illuminating and other oils, paints, drugs, chemicals, etc., is offered for shipment by rail, the shipping order delivered to the railway agent for his file must properly describe the articles by name and state the colour of the label applied, or state " no label required." It must also show over the signature of the shipper or of his duly authorised agent as part of the shipping order the following printed, written or stamped certificate :—

" This is to certify that the articles in this shipment are properly described, packed and marked, and that all necessary labels have been attached to packages as required by general notice—R. R."

Packing boxes are required to be strong enough to stand without rupture all ordinary shocks usual in transportation when properly loaded in cars and when the experience of the Bureau of Explosives shows that any packing fails to meet this requirement its further use will be prohibited.

In less than carload shipments, all outside packages containing inflammable materials or acids in quantities exceeding those hereinafter described, must have securely and conspicuously painted or pasted on them near the names of the consignee, a label of diamond shape. The colour of the label is red for packages in group one ; yellow for packages in group two ; and white for acids. The prescribed labels will not be required on packages in a carload shipment loaded by the shipper and to be unloaded by the consignee but the shipper must attach to all cars loaded by him, the proper placard, and must see that the cars containing inflammable liquids are ventilated. A tank car must bear the placard prescribed for its contents.

As the maximum quantity that can be accepted without a label would depend upon circumstances such as flash point, quantity in one inside package, method of packing, etc., the bureau of explosives is authorised to make tests, and to prescribe this quantity for the articles tested. The material required for any test made on application of a shipper must be delivered by him without charge to the Chemical Laboratory, Building of Explosives, South Amboy, N.J., and a reasonable charge for the services of the laboratory employés must be paid.

Grouping of Inflammable Articles.

Group 1—*Inflammable liquids, red diamond label.*—This group includes any liquid cement, drier, lacquer, metal polish, paint, paste, solvent, varnish or any other compound or mixture that gives off inflammable vapour (as determined by flash point from Tagliabue's open-cup tester, as used for test of burning oils) at or below a temperature of 100 degrees F.

The following list shows some examples of substances that may place any mixture containing one or more of them in the group, but the list is not intended to be complete, since the flash point is the guide :—

Acetone ; amyl-, grain-, wood-alcohol ; amyl acetate ; benzine, benzol ; bisulphide of carbon ; coal tar naphtha, crude oil, cylinders containing inflammable compressed gases, ether, fusel oil ; gasoline (includes automobiles with charged tanks) ; naphtha ; nitrocellulose, wet with solvents ; nitrocellulose solutions ; petroleum ether ; spirits of nitroglycerine ; coal-tar undistilled ; toluol ; turpentine, xylol.

Packing for Group 1 :—All articles in this group must be packed (1) in well-stoppered bottles of not to exceed one gallon capacity ; or (2), in boxed carboys and demijohns ; or (3), in strong and tight barrels ; or preferably (4) in metal drums or vessels, and all inside packages must be securely closed and protected against breakage by shock. Tank cars containing inflammable liquids must be of approved design, and they must be provided with satisfactory safety valves.

Nitrocellulose wet with solvent must contain not less than 30 per cent. of a solvent whose flash point is not less than 40° F., and must be packed in strong galvanised iron vessels, of the milk-can type, with a satisfactory means for keeping them securely closed. It must be marked " Wet Nitrocellulose—30 per cent. Inflammable Solvent, Flash Point—F."

" Spirits of nitroglycerine " must not contain more than 10 per cent. of nitroglycerine in solution, and must be packed in tightly stoppered cans containing not more than ten pounds of liquid each. Each can must be packed in a box surrounded by a satisfactory absorbent, such as kieselguhr or wood pulp, sufficient in quantity to absorb and hold without leakage all the liquid in the box. The absorbent must be at least two inches thick at every point and must be packed about the cans so that they are separated from one another, and from the sides, top and bottom of the box. The box containing the cans must be tight and strong and plainly marked on the top " Spirits of Nitroglycerine—This Side Up." Not more than ten cans will be accepted for shipment at one time.

Packages containing inflammable liquids or liquefied gases must not be entirely filled. Sufficient interior space must be vacant to permit expansion of liquid and vapour and to prevent distortion of containers.

A red label, of diamond shape, measuring not less than 5¾ inches in each diagonal, and bearing the following inscription in black letters, must be pasted or painted on each outside package that contains :—(1) Any quantity of solutions of nitrocellulose or nitroglycerine, ether, gasoline, benzine, or carbon bisulphide ; (2) more than one gallon of a liquid with flash point below 50° F. ; (3) more than five gallons of a liquid or mixture with flash point between 50° and 100° F.

" Notice to railway employés—Caution, Inflammable Liquid, Keep away from fire stoves, radiators, lighted matches, lanterns and direct sunlight. Any leaking packages must be removed to a safe place. Shipper has certified on shipping order to compliance with all regulations that apply to this package."

When the total quantity of inflammable liquids in the shipment exceeds the above limits, all outside packages containing any of them and in any quantity must be labelled.

Group 2—*Inflammable* (*yellow diamond label*).—This group includes (1) all materials subject to spontaneous combustion ; and (2) materials, other than acids, that are liable to cause fires by friction, by concussion, by absorption of moisture, or by contact with organic matter, or otherwise, when packages containing them are ruptured.

The following list shows some examples, and the net weight and quantity of each that will require the yellow label when packed in one shipment (not package). When not otherwise specified, the net weight for any substance in this group will be ten pounds. This list is not complete, and the above definition will be the guide in any case.

Barium peroxide, one pound ; bromine, one-half gallon ; calcium carbide, any quantity ; charcoal, 100 pounds ; chlorates, 25 pounds ; cotton waste, oily, any quantity ; fertilisers (dessiccated leather scrap, tankage, etc.), 100 pounds ; matches (friction), any quantity ; matches (safety), 25 pounds ; metallic sodium or potassium, one pound ; nitrates, 100 pounds ; nitrocellulose, wet with 25 per cent. water, any quantity ; phosphorus yellow, any quantity ; potassium permanganate, 25 pounds ; potassium peroxide, one pound ; sodium peroxide, one pound.

Packing for Group 2.—Packages must be tight and strong, and the interior packages must be so cushioned and secured that no rupture of either package can result from the ordinary shocks incident to transportation.

Calcium carbide must be in substantial, hermetically sealed metal packages marked "Calcium Carbide—Keep Dry."

Bottles of bromine must be surrounded by incombustible packing material.

Metallic sodium or potassium, in quantity not greater than one pound, must be placed in neutral oil, and this in a well stoppered bottle protected by a tin box, or these substances may be packed in a hermetically sealed tin cylinder.

Yellow phosphorus must be packed in water in sealed metal cases.

Freshly made charcoal (less than three days old) and fertilisers (less than four days old) made from desiccated leather scrap, tankage, etc., must not be offered or accepted for shipment.

Nitrocellulose, uniformly wet with not less than 25 per cent. of water, must be wrapped in waterproof material, securely packed in a strong and tight box, and marked "Wet Nitrocellulose 25 per cent. Water."

Matches must be packed in pasteboard, wooden or metallic boxes, containing not more than 1,000 matches each, and these boxes must be packed in strong outside cases, or boxes, plainly marked "Friction Matches" or "Safety Matches."

A yellow label, of diamond shape, measuring not less than 5¾ inches on each diagonal, and bearing the following inscription in black letters, must be pasted or painted on each outside package in a less than carload shipment, containing, when not otherwise specified, more than ten pounds of substances belonging to this group:—

"Notice to railway employés. This package contains an inflammable article. Keep fire and lights away. Sweep up and remove carefully contents of broken packages. Shipper has certified on his shipping order to comply with all regulations that apply to this package."

Group 3—*Acids* (*white diamond label*).—This includes the liquid mineral acids and similar liquids that may cause fires or damage other shipments, and consists principally of the following:—Hydrofluoric acid; hydrochloric acid; sulphuric acid (oil of vitriol); nitric acid.

Packing for Group 3.—Hydrofluoric acid must be packed in indiarubber or ceresine bottles, hermetically sealed, or in lead carboys, well stoppered, and the bottles and carboys must be packed in strong cases, barrels or casks; or hydrofluoric acid may be packed in tight hard wood barrels lined with asphaltum. The barrels must be securely hooped and carefully inspected by shipper.

Sulphuric or hydrochloric acids, chloride of sulphur, etc., must be packed in earthen jars, or glass bottles, or moulded carboy bottles, all well stoppered to prevent leakage, or in drums or tank cars. Jars or bottles must be packed in strong cases and well cushioned; carboy bottles must be packed in cases provided with strong handles or cleats, and the necks of carboys must be protected.

Nitric acid of gravity below 1·43, must be packed as described above for sulphuric or hydrochloric acid, except that the bottles, jars or carboy bottles must be well cushioned by elastic incombustible packing. When the gravity is 1·43, or above, the bottles, jars or carboys must, in addition to the elastic packing, be surrounded by a sufficient quantity of incombustible absorbent material.

Mixed nitric and sulphuric acids must be shipped in iron drums or tank cars.

Not more than one pint of an acid must be packed in an outside package that contains one or more substances with which the acid might, on rupture of inside packages, combine chemically and cause either a dangerous generation of heat or a combination of gas and corrosive materials that might injure a railway employé handling the package.

A white label of diamond shape, measuring not less than 5¾ inches on each diagonal and bearing in black letters the following inscription, must be pasted or painted on each outside package containing more than five pints of an acid of this group:—

"Notice. Handle carefully. Acid. Do not load with explosives or inflammables. Shipper has certified on his shipping order to comply with all regulations that apply to this package."

Cautions and directions for railway employés.

Agents must utilise their general knowledge of the business of shippers in their territory to supply the shippers with copies of these regulations and to check their compliance with the directions. When an agent deems it advisable, he will request permission from the proper official of his line to ship, freight prepaid, to the Chemical Laboratory, Bureau of Explosives, South Amboy, N.J., for examination, a sample of any article offered for shipment. Letters of advice relating to such samples, and stating the nature of the examination desired, should be mailed to the chief inspector of the Bureau of Explosives, 24, Park Place, New York City.

The forwarding agent must see that, for an inflammable substance (groups 1 or 2), or an acid (group 3), or articles of a similar nature, whether requiring labels or not, such as illuminating and other oils, paints, drugs, chemicals, etc., the shipping order bears the certificate prescribed.

Revenue waybills prepared from the shipping order must properly describe these articles by name and state colour of label applied or "no label required." On its face must be written or stamped, whether the packages require labels or not, the words "Shippers' certificate on file." The shipping order bearing these certificates must be kept on a separate file.

Agents must keep on hand an adequate supply of labels and placards. Shipments must not be delayed, and in cases of emergency, labels and placards must be prepared by hand.

All packages loaded by railway employés and needing this protection must be stayed by the agent or employé designated by him. The agent must keep on hand the material necessary for this purpose.

Packages of Inflammable Liquids protected by Red Diamond-shaped Labels.

Leakage from packages of inflammable liquids forms a gas that may be ignited by the flame of a match or lantern. Confinement of such gases increases the danger, and the box-cars containing them, should have proper ventilation. Use stock cars, when available, for carload shipments. Cylinders containing compressed gases, even when such gases are not inflammable, may explode if dropped or struck a sharp blow. The danger of explosion is increased by heat.

Where practical, less than carload lots of explosives and inflammable articles, should be received respectively on different days. Packages of inflammable articles not properly labelled when offered for shipment must be returned to the shipper.

Packages protected by red diamond labels, must never be stored or loaded into cars with explosives.

Packages must be loaded in car so that all labels prescribed herein will be as conspicuous as possible to freight handlers.

When necessary to store these articles at freight stations or on platforms they must be kept as far away from other freight as practicable.

A car containing inflammable material must not be entered with a lighted lantern. It is recommended that station agents be supplied with portable electric lanterns where other electric lights are not available.

Lost or detached labels must be replaced from information given on revenue waybill.

Upon detection of any strong odour, similar to that of gasoline, benzine, ether, carbon bisulphide, or of alcohol, the broken package must be sought and removed, but a lantern or other flame must not be used in the search. Open both doors first to ventilate car. If necessary, a guard must be placed on the car to keep lighted lanterns and other fire away.

Packages of Inflammables protected by Yellow Diamond Labels.

Such packages must not be loaded in the same car or stored near explosives or acids.

Should not be loaded or stored with packages protected by red diamond labels when avoidable.

Sweep up and remove carefully, substances spilled from broken packages. Mixtures of some of these substances with sweepings and other combustible materials are liable to ignite by friction and cause fires.

Packages of calcium carbide must be kept dry, since with moisture this substance produces an inflammable gas.

If a package of matches ignites do not break open the package. The fire may be smothered if air is kept away from the burning matches.

Prompt removal by consignee must be enforced, to decrease danger from storage and to avoid violating State or municipal laws or ordinances.

PACKAGES OF ACIDS PROTECTED BY WHITE DIAMOND LABELS.

If acid be spilled on excelsior, cotton, shavings, sawdust, etc., fires may result.

Leakage may injure floors and general merchandise.

Acids must not be loaded in same car with explosives, or with inflammable articles protected by yellow diamond labels.

When necessary, acids may be loaded with packages protected by red diamond labels, but this is undesirable.

Carboy bottles must be so blocked and braced that they cannot change position during transit. Less than carload shipments, in addition to being securely blocked and braced, should be loaded near the doorway and must have wooden strips, not less than one inch thick, nailed to the car-floor six inches from the carboy bottles and so arranged that acid from a broken package will not spread, but will drain towards the doorway and outside the car. The space between the carboys and strips must be liberally covered with clean, dry sand. Sawdust or other combustible material must not be used.

Placards, and handling cars.—The railway agent, or an employé designated by him, must attach the proper placard, or verify the attachment of it by the shipper, as soon as he receives a tank car containing an inflammable liquid or an acid. Cars, assigned for loading inflammable articles, must have the placards attached to outside ends and sides by the railway agent, or by the shipper, before loading.

As soon as the inflammable articles are removed from ordinary cars, placards will be removed by agents, yardmasters or conductors; but the warning placard must remain on tank cars until such cars are known to have been cleaned by steam. Placards found improperly attached to cars will be removed, and a report of such removal must be made to the proper officer.

Empty barrels, used previously for alcohol, gasoline, benzine, etc., must retain their labels; they should be loaded with bung holes closed or down and in open or stock cars when practicable. Railway employés must be careful not to carry a flame of any kind near these barrels. Cars containing these barrels must be protected by the "inflammable" placard.

A conductor must not move a car known to require placards from a station or siding until the proper placards are attached. Placards for temporary use may be made by hand in case of emergency, but must be replaced at first opportunity by the regulation placards. Placards lost in transit must be replaced in a similar manner.

In making up trains, cars loaded with inflammable articles must not be placed next to cars loaded with explosives, charcoal or cotton.

Tank cars placarded "Inflammable" must be placed in trains, if possible, at least five cars from the engine and five cars from the caboose. When length of train does not permit this, they must be placed as near the middle of the train as practicable.

When cars protected by "Inflammable" placards are received or held in yards, particularly at night, yardmasters must see that the train and yard employees are informed of the position of such cars, and that all necessary precautions are taken to prevent accidents. These precautions must include provision for quickly isolating them in case of fire.

In classification yards, and in switching, it must be determined by inspection and trial that such a car has its brakes in first-class condition before a draft containing it, is cut; and it must not be started down a ladder track, incline, or hump, until the preceding car has cleared the ladder. It must also get clear of the ladder before another car is allowed to follow.

Cars bearing these placards, and cars adjacent to them, must be watched with extra care to discover if hot journals exist.

Upon discovery of leakage accompanied by a strong odour similar to that of gasoline, ether, carbon bisulphide, or of alcohol, the damaged package must be removed when practicable. When necessary the car must be placed on the first available siding and the agent and yardmaster at that point notified. The division-superintendent must also be notified by wire.

A white placard of diamond shape, printed on strong, thin paper, for pasting on tank cars and on strong tagboard for tacking on wooden cars, measuring fifteen inches on each diagonal and bearing in red and black letters the following inscription, must be placed on each outside end and side of a car containing any quantity of smokeless powder for cannon, or ammunition for cannon with empty projectiles, or fireworks, or one or more packages protected by the red, or the yellow, diamond label:—

"——— R. R. Co. Inflammable (to be printed in red).

"Keep lights and fires away. (Black) (red) (black) (red) (black).

"——— Station, ————, 190—.

"1. This car, if a tank car, must not be less than five cars from the engine and five from the caboose; or near centre of train. 2. This car must not be next to car containing explosives or charcoal or cotton. 3. Yardmasters and employees must note position of this car in yard, and be prepared to isolate it quickly in case of fire. 4. Test brakes before cutting loose and let preceding car clear the ladder track, incline, or hump. Hold next car until this one gets clear. 5. Watch this, and adjacent cars, for hot boxes. 6. Sweep up and remove carefully the contents of broken packages protected by diamond yellow labels. 7. For leaking liquid with strong odour remove damaged package, if practicable; place car on isolated siding, if necessary, and wire superintendent. 8. When inflammable packages are all unloaded, agents, yardmasters and conductors must remove placards."

There must be attached to each outside end and side of a car containing one or more packages protected by the white diamond label, a white placard, of diamond shape, on strong, thin paper for pasting on tank cars, and on strong tagboard for tacking to wooden cars, measuring twelve inches on each diagonal, and bearing in black letters the following inscription:—

"——— R. R. Co., Acid. Handle carefully.

"When package protected by white diamond labels are unloaded, remove this placard. ——— Station, ————, 190—."

In connection with these regulations the following letters, written by Dr. William Jay Schieffelin to Major B. W. Dunn, of the Bureau for the Safe Transportation of Explosives, will be interesting as setting forth the view of an expert upon the subject of various kinds of explosives and inflammable materials and the care which should be exercised in the transportation of each:—

New York, Nov. 26, 1907.

Dear Sir,—In behalf of the wholesale druggists of New York, I beg to submit the following suggestions with regard to the rules for the transportation of inflammable materials.

Shipments by wholesale druggists usually include small quantities of these materials. A large majority of the orders from retail druggists include one or more alcoholic extracts and patent medicines which contain alcohol. The forty thousand retail druggists in the United States are receiving these packages by freight or express every day with perfect safety. To require warning labels on so many packages would not only cause inconvenience and delay, but would diminish the attention such labels should command.

Many medicinal products are expensive, and wholesalers do not wish to incur the risk of having their packages placed in cars with dangerous goods.

Nor do they wish to endanger their shipments by including materials which should be packed alone, therefore it is now usual to ship acids, naphtha and carbon bisulphide separately, duly labelled.

But such articles as alcohol, ether, permanganate or chlorates are always safely included with other goods. We respectfully urge that a stated amount of these articles, when properly put up, be permitted to be placed with other goods, as is now done, without special labels.

Our experience is that ether or ethyl nitrite when put up in bottles containing not more than one pound each, the bottles in tin boxes, or ether in cans up to five pounds, can safely be packed with other goods, and we suggest that not to exceed ten pounds be permitted in each package.

Ethyl chloride when put up in metal or glass tube should be permitted to the extent of three dozen three ounce metal tubes or three dozen two ounce glass tubes. Alcohol or alcoholic fluid extracts or preparations should be permitted up to five gallons, if in one demijohn or can, or up to six one-gallon demijohns or cans. If in bottles not to exceed fifty pounds. Amyl alcohol, turpentine and wood alcohol up to five gallons.

Potassium chlorate or permanganate should be put up in strong parcels not exceeding twenty-five pounds, and two such parcels should be permitted in each package with other goods.

Bromine and strong mineral acid should have sufficient absorbent material around the bottle to hold the contents in case of breakage. They should not be packed in quantities greater than one pound with other articles.

Metallic sodium in neutral oil, the bottle protected by a tin box, should be permitted up to one pound.

Celluloid articles, combs, etc., can safely be included with other goods. Coal tar up to five gallons in tin cans.

In closing I beg to repeat that we do not object to labelling packages which require separate transportation, but ask that we be spared the unnecessary expense of dividing shipments now safely made in one package.

Yours very truly,
(Signed) Wm. Jay Schieffelin.

New York, Jan. 24, 1908.

Dear Sir,—Referring to the galley proof of the proposed regulation for the transportation of inflammable materials, I beg to say that the regulations as amended will not needlessly interfere with the business of wholesale druggists, provided under the exceptions authorised under paragraph 2, medicinal preparations containing alcohol and water be permitted up to five gallons, if in one demijohn or can, or up to six one-gallon demijohns or cans.

Alcohol in quantities of one gallon or more, if packed in cans, up to five gallons.

Amyl alcohol, turpentine and wood alcohol, if in quantities of one gallon or over, should be packed in cans and then should be allowed up to five gallons.

Potassium chlorate or permanganate, if put up in strong parcels not exceeding twenty-five pounds, should be permitted to be packed with other goods, but not more than two such parcels in any one package.

Coal tar up to five gallons in tin cans.

Ethyl nitrite in bottles of not more than one pound each, the bottles in tin boxes, should be allowed up to ten pounds.

Ether in cans up to five pounds should be authorised in quantities not exceeding ten pounds.

Ethyl chloride in metal or glass tubes should be allowed to the extent of three dozen three-ounce metal tubes or three dozen two-ounce glass tubes.

Experience has shown that alcohol vapour is difficult to explode at ordinary temperatures. An attempt to start an alcohol engine before the cylinder becomes hot will confirm the statement.

Ninety per cent. of the fluid medicines shipped by druggists, which would come under group 1 of the regulations, are in a menstruum of alcohol and water (of varying percentage of alcohol), so we hope you will not think it necessary to have tests made on these preparations, because there are such a large number of them.

We think it is unwise to put the same limit on very dangerous fluids like bisulphide of carbon (of which no careful man would ship a quart without a caution label, say nothing of a gallon) which is permitted, and medicinal preparations which may or may not flash when heated at a hundred, but certainly will not give off inflammable vapours.

There are certain substances which should not be shipped in quantities greater than one pound without a caution label. Among these should be included picric acid, chromic acid, bromine, phosphorus, zinc dust (blue powder), calcium carbide, carbon bisulphide, rhigolene, and gasoline.

The writer will be present at the afternoon session of the meeting to be held on Monday, the 27th, at 25, Broad Street.

Yours very truly,
(Signed) Wm. Jay Schieffelin.

New York, Feb. 23, 1908.

Dear Sir,—I have obtained the following results with the Tagliabue open-cup tester :—

	Deg.
Whiskey, U. S. P.	81
Alcohol, 92½ per cent.	60
Denatured alcohol	55
Absolute alcohol	53
Turpentine	90
Methyl alcohol	45
Acetone, about	34

From which it would appear that the proposed regulation allowing five gallons of liquid which flashes at or above 50° F. will not interfere with the shipping of alcoholic liquors or medicines, and that if the point is reduced to 40° F. it will admit wood alcohol, of which a large amount is used and which is not considered hazardous, but keep out acetone, which is considered dangerous.

The only further suggestion that I have to make regarding the inflammable liquids is that ether and ethyl nitrite should be allowed in small packages if packed in tin or glass within tin up to five pounds, and that ethyl chloride is allowed in tubes to the extent of three dozen three-ounce metal tubes or three dozen two-ounce glass tubes.

I understand that your committee proposes to allow the following maximum quantities to be packed without warning labels :—

Barium peroxide	1 pound.
Bromine	½ gallon.
Charcoal	100 pounds.
Chlorates	25 pounds.
Metallic sodium or potassium	1 pound.
Nitrates	100 pounds.
Permanganates	25 pounds.
Potassium peroxide	1 pound.
Peroxide plastics (celluloids)	100 pounds.

These amounts appear to me to be entirely reasonable.

Allow me to express great satisfaction at the consideration you have shown to the needs of shippers engaged in the wholesale drug trade.

Yours very truly,
(Signed) Wm. Jay Schieffelin.

Patents.

Cartridges and explosive charges containing ammonium nitrate ; Manufacture of ——. H. J. Haddan, London. From J. F. Lehmann, Munich, Germany. Eng. Pat. 351, Jan. 6, 1908.

The invention consists in utilising the binding properties of dissolved nitro-hydrocarbons, or of dissolved nitrocellulose, without admixture of nitroglycerin, for the purpose of moulding granular or pulverised ammonium nitrate explosives, and forming cartridges for blasting charges. It is essential that the solvent for the nitrocellulose or nitrohydrocarbon should be a volatile liquid, *e.g.*, acetone. The admixture of from 1 to 2 per cent. of dissolved nitrocellulose, etc., is sufficient for the purpose of enabling an ammonium nitrate explosive to be moulded by pressure.—G. W. McD.

Explosives. F. W. Bawden, Johannesburg, Transvaal. Eng. Pat. 4046, Feb. 22, 1908.

An explosive of the chlorate class improved as regards lessening the hygroscopic properties, producing plasticity and lessening sensitiveness to friction. The invention is said to consist in the use of molasses or "golden syrup" as an ingredient of chlorate explosives. An example of such a composition is given as potassium chlorate (75) and sugar and syrup (25 parts). A non-hygroscopic explosive is composed as follows:—Potassium chlorate (65), lamp-black (7·5), benzol (12·5), sugar (5) and syrup (10 parts). —G. W. McD.

High explosives; Impts. in the treatment of ——. A. C. Luck, Ipswich, England and Zarate, Argentine Republic. Eng. Pat. 17,877, Aug. 6, 1907.

The invention relates to high explosives and smokeless powders, containing nitroglycerin or nitrocellulose or both, which, especially after being stored in hot or damp places, are liable to decompose and form bodies which accelerate further decomposition. The claims are for (1) The treatment of high explosives which are in a condition which will not comply with the recognised heat test for stability by placing them in a receptacle, and exhausting from the receptacle the air and decomposing bodies emanating from the explosive, with, or without warming. (2) The treatment of high explosives by subjecting them to active exhaustion in closed vessels containing also matter which will absorb or destroy any acid or injurious bodies which may be set free in the explosive. It is said that cordite of a size of 0·45 inch diameter, giving a heat test of only 4 minutes, is, after treatment as above, at the ordinary temperature for 8 days raised in heat test to over 15 minutes; whilst if a temperature of 38° C. be maintained, it will, after 36 hours, give a heat test of 25 minutes.—G. W. McD.

Explosive compound. G. Schultz and F. Gehre, Munich. Assignors to E. Blecher and C. Lopez, Hamburg, and C. Distler, Munich. U.S. Pat. 894,707, July 28, 1908.

See Eng. Pat. 19,565a of 1907; this J., 1908, 421.—T. F. B.

XXIII.—ANALYTICAL CHEMISTRY.

INORGANIC—QUANTITATIVE.

Alkalimetry; Use of organic acids and anhydrides as standards in ——. I. K. Phelps and L. H. Weed. Amer. Journ. Sci., 1908, **26**, 138—142.

Succinic acid, succinic anhydride, malonic acid, benzoic acid, phthalic acid, and phthalic anhydride may be used, with great exactness, as standards for decinormal solutions of sodium hydroxide and barium hydroxide, with phenolphthalein as indicator.—F. Sodn.

Radium emanation in the atmosphere; Determination of ——. G. C. Ashman. Amer. Journ. Sci., 1908, **26**, 119—122.

By passing atmospheric air through a copper coil immersed in liquid air, the radium emanation present can be completely condensed, and its amount subsequently determined by transferring the volatilised emanation to a gas electroscope. Six measurements made at Chicago show that the average amount of radium emanation, per cubic metre of air, could be maintained by $1{\cdot}0 \times 10^{-10}$ grm. of radium, but the amount was found to vary considerably at different times.—F. Sodn.

Coals; Rapid determination of sulphur in ——. R. Komarowsky. *See* II.

Steel; Determination of vanadium, molybdenum, chromium and nickel in ——. A. A. Blair. *See* X.

Iron and steel; Determination of vanadium in ——. E. de M. Campbell and E. le G. Woodhams. *See* X.

ORGANIC—QUANTITATIVE.

Beeswax; Detection and determination of stearic acid in ——. R. Berg. *See* XII.

[Maple sugars and syrups] Malic acid; Determination of ——, *in food products.* H. W. Cowler. *See* XVI.

Fusel oil; Notes on Röse's method of determining ——, *and comparison of results by the Allen-Marquardt method.* W. L. Dudley. *See* XVII.

Tartaric acid; Determination of —— *in the presence of malic and succinic acids.* L. Gowing-Scopes. *See* XVII.

Sulphurous acid in foodstuffs, particularly gelatin, Determination of ——. L. Padé. *See* XVIIIA.

XXIV.—SCIENTIFIC & TECHNICAL NOTES.

Radium emanation; Action of the —— *on copper salts.* Mme. Curie and Mlle. Gleditsch. Compt. rend., 1908, **147**, 345—349.

Ramsay and Cameron (Chem. Soc. Trans. 1907, **91**, 1593) stated that copper salts, under the influence of the emanation from radium, undergo a degradation into salts of elements of the same group of lower atomic weights, *e.g.*, potassium, sodium and lithium. The authors point out that these elements are practically always present in reagents and water which have been in contact with glass, and that even quartz apparatus contains notable traces of lithium. They have repeated the experiments of the English chemists, working exclusively with platinum apparatus, and using a copper salt which showed no lithium when the residue from 2 grms. was examined. The authors have been unable to confirm Ramsay and Cameron's observations; no trace of lithium could be detected. The residue from the treatment of the copper salt consisted mainly of sodium with a little potassium. It is true that the residue from the experiment with radium emanation weighed 0·1—0·3 mgrm. more than the residue from the blank experiment, but this is attributed to the introduction of foreign matter with the emanation. Ramsay and Cameron's results are attributed to the action of the liquid in presence of the emanation on the glass apparatus used, and their conclusions cannot be regarded as established.—J. F. B.

Colour of red grapes; Origin of the ——. P. Malvezin. Compt. rend., 1908, **147**, 384—386. (See also Laborde, this J., 1908, 763.)

The author has carried out experiments showing that the formation of colour in red grapes is probably due to one single chromogenic substance, which is converted into colouring matter by the simultaneous influence of air and heat, and, possibly, also of light. Thus, when green grapes from a red Médoc vintage were kept in contact with distilled water in an open vessel at 85° C., they became dark yellow after 17 hours, and wine-red after 24 hours. When the same grapes were sealed in a tube free from air and containing only water, no red colour developed; admission of air to the tube was, however, soon followed by the appearance of a red coloration. In nature, the coloration of grapes is probably also effected by the combined influences of air, heat, and light, the action being induced by the presence of appropriate enzymes. Green grapes from a white vintage are also coloured red when subjected to the conditions described above. The absence of red colour from these grapes in nature is probably owing to the absence of the necessary specific enzymes.—T. H. P.

Cigar-smoke; Some of the constituents of ——. J. Habermann and E. Ehrenfeld. Z. physiol. Chem., 1908, **56**, 363—372.

The results of determinations of sulphur, ammonia, nicotine, moisture, and ash of various brands of cigars sold in Austria are given. The cigars were smoked by means of an aspirator connected with suitable absorption vessels. It is seen from the results that the amount of sulphur in the smoke of the cigars was, on an average, 0·02 per cent. In the case of cigars known as "Specials" the average quantity was 0·015 per cent., but, on the whole, the quantity of sulphur in the smoke yielded by different brands was so small that it could not be used as a criterion of the value of the cigars. On the other hand, the great variations in the amount of ammonia in the various smokes made it impossible to arrive at a general average. The quantity of nicotine found in the cigar-smokes varied from nothing to 0·15 per cent. (referred to the weight of the tobacco). It appeared to be concentrated in the unsmoked stumps of the cigars, which contained from 3·22 to 4·71 per cent., whilst the cigars themselves contained from 1·02 to 1·53 per cent. of this base. But little difference was found in the quantities of ash and moisture in cheap and better class cigars, that is, in cigars costing from threepence to sixpence each.—W. P. S.

Sugar molecule; Depolymerisation of the ——. C. Neuberg. Biochem. Zeits., 1908, 12, 337—341.

In connection with the theory of alcoholic fermentation and other physiological processes, the possibility of a depolymerisation or dissociation of the hexose molecule into monocarbon residues has been suggested. Löb (this J., 1907, 983) formulates the dissociated sugar molecule as a group of carbon monoxide-hydrogen residues, $CO.H_2$, isomeric with formaldehyde. It is well known that hexose sugars may be synthesised by the polymerisation of simple aldehydes, such as formic, glycollic and glyceric aldehydes, under the influence of alkalis. The author argues that, whereas the formation of hexose sugars may be explained by the direct polymerisation of C_2- or C_3-aldehydes, that of pentose sugars from these aldehydes can only be explained on the assumption of a dissociation, at some stage of the process, into monocarbon residues. He allowed 32·7 grms. of glycollic aldehyde to remain for more than three months in presence of 1 litre of a methyl alcoholic solution of colloidal barium carbonate (see this J., 1906, 926), equivalent to 12 grms. of barium oxide. He then tested the product for the presence of pentoses by distilling with hydrochloric acid, and obtained 1·24 grms. of furfural nitrophenylhydrazone. Previous observers have identified tetroses and hexoses among the products of the condensation of glycollic aldehyde, but the author thinks that the depolymerisation, which is necessary for the production of pentoses, may be specifically assisted by the colloidal condition of the medium which he employed. (See Löb.; this J. 1908, 868.)—J. F. B.

New Books.

The Extra Pharmacopœia of Martindale and Westcott. Revised by W. Harrison Martindale, Ph.D., and W. Wynn Westcott, M.B., D.P.H. 13th Edition. H. K. Lewis, 136, Gower Street, W.C. 1908. Price 10s. 6d. net.

This, the 13th edition of the Extra Pharmacopœia, is of med. 24mo. size, and contains 1022 pages of subject-matter, and a copious index and posological table, followed by a therapeutic index of diseases and symptoms. The supplementary list of drugs is in this edition, considerably extended, and a list is given of some 81 new drugs, etc., which are now added. In this edition, too, all previous calculations of substances containing bismuth and nitrogen are now altered, to make them agree with International atomic weights of 1908. Various comments of the Committee of Reference in Pharmacy, March 4, 1907, are now embodied in the text of the present edition with the letters C. R. attached, whilst "F.I." indicates "Formula Internationalis," *i.e.* of the International Agreement Committee respecting the unification of pharmacopœial formulæ for patent drugs, signed at Brussels, Nov. 29, 1906. At special request, a list of poisons is now supplied with the most suitable antidotes and means of treatment, in an abbreviated form.

Traité Complet d'Analyse Chimique Appliquée aux Essais Industriels. Par. J. Post et B. Neumann, avec la collaboration de nombreux Chimistes et Specialistes. Deuxième edition française entièrement refondue, par le Dr. L. Gautier. Tome Premier. Second Fasicule. Librairie Scientifique, A. Hermann, 6, Rue de la Sorbonne, 6, Paris. 1908. Price 10 frcs.

This is the second part of Vol. I. of Post and Neumann's work (See this J. 1907, 782, 895, and 1298). It contains 560 pages of subject-matter, with 109 illustrations, and the subject-matter treats of the following branches: I, Illuminating gas. II, Calcium carbide and acetylene. III, Petroleum. IV, Fatty oils. V, Tar oils. VI, Paraffin and paraffin wax. VII, Ozokerite. VIII, Asphaltum. IX, Fatty matters and fatty oils. X, Glycerin. XI, Candles. XII, Soaps.

Royal Commission on Whiskey and other Potable Spirits. Minutes of Evidence taken by the Royal Commission on Whiskey and other Potable Spirits, with Appendices. Volume I. Printed for His Majesty's Stationery Office by Jas. Truscott and Son, Ltd., 1908. Price 3s. 9½d. To be purchased, directly, or through any Bookseller, or from Wyman and Sons, Ltd., 109, Fetter Lane, E.C.

Contains 437 pages of subject-matter, classified as follows: I, List of Witnesses, in the order in which they appeared before the Royal Commission. II, Minutes of Evidence, and III, Appendices.

Die Theorie der Faerbervorgaenge. Geschichte und Kritik. Zusammenfassung unter einheitlichen Prinzipien. Dr. Procopios Zacharias, Privatdozent an der Universität Athen. Deutsche Ausgabe, Commissions-Verlag: Verlag für Textil-Industrie, Berlin, S.W. 1908. Price M.5.

8vo volume, containing 420 pages of subject-matter, treating of the following topics: Introduction. I, Review of methods of dyeing. II, Historical review. A, Older work prior to 1888. B, More recent work from 1888 to 1900. C, Translation of the Greek work of P. D. Zacharias. D, Recent work to 1908. III, Theory of Adsorption. IV, General Review. V, Summary.

Wood Products, Distillates and Extracts. Part I. The Chemical Products of Wood Distillation. Part II. Dyeing and Tanning Extracts from Wood. By P. Dumesny and J. Noyer. Translated from the French by Donald Grant. Scott, Greenwood and Son. "The Oil and Colour Trades Journal" Offices, 8, Broadway, Ludgate Hill, London. E.C. 1908. Price 10s. 6d.

Large 8vo. volume, containing 314 pages of subject-matter, with 107 illustrations and 59 tables, and the alphabetical index. The subject-matter is classified under the following headings, being first grouped as parts

I. and II.—Part I. The Distillation of Wood. (i), Generalities. (ii), Principal methods of carbonising or "coaling" wood. (iii), The acetic acid industry. (iv), Secondary products of wood distillation. (v), Analysis of raw materials and finished products. (vi), Appendix to the Distillation of Wood:—(i), The destructive distillation of olive oil residuals. (ii), Methyl alcohol. Table of density. Part II.—The Manufacture and Testing of Tan Wood Extracts and their Utilisation in Modern Tanneries. (i), Chestnut wood extract. (ii), Plant and equipment for treating chestnut wood. (iii), Specification of model type of an extract factory. Capital required, etc. (iv), Number and capacity of extract factories, &c. (v), Method of using chestnut wood extracts in tanning. (vi—viii), Methods and use of oak wood, quebracho, and sumac extracts. (ix), Khaki substitute for quebracho, and its use in tanning. (x), Extracts from various tanning substances: their manufacture and uses. Divi-divi, Valonia, Chinese galls, Myrabolan, Palmetto, Mimosa, Tara, Mangrove, etc. (xi), Manufacture and use of logwood extract. (xii), Analysis of tanning substances. The official method of the International Association of Leather Chemists. Appendix to Chap. III., Part I. Guillaume's recent improvements in the continuous rectification of wood-spirit, acetone, and methyl alcohol.

Komprimierte und Verflüssigte Gase. Industrielle Herstellung und Eigenschaften der im Handel Vorkommonden verdichteten Gase. Von Dr. H. Teichmann. Wilhelm Knapp's Verlag. Halle a S. 1908. Price M. 6.80.

8vo volume, containing 192 pages of subject-matter, with 38 illustrations. The subject-matter is classified and subdivided as follows:—I. Physical laws, etc. II. Mechanical section. A, Theoretical. B, Technical. III. Tables of constants. IV. Description of manufacture of:—(i), Sulphurous acid. (ii), Ammonia. (iii), Chlorine. (iv), Carbonic acid. (v), Nitrous oxide. (vi), Hydrogen. V. Holders for compressed and liquefied gases. VI. Laws and ordinances with respect to the carriage and transport of liquefied and condensed gases.

Dyeing and Cleaning. A Practical Handbook. By Frank J. Farrell, M.Sc. Chas. Griffin and Company, Ltd., Exeter Street, Strand, London. 1908. Price 5s. net.

Small 8vo. volume, containing 229 pages of subject-matter, with 78 illustrations, and an alphabetical index. The subject-matter is classified as follows:—I, Technology of the textile fibres. II, Dry cleaning. III, Wet cleaning. IV, Dyeing. V, Dry dyeing. VI, Special methods. Cleaning and dyeing skin rugs, feathers, and hats. VII, Finishing.

House Painting, Glazing, Paper-hanging, and Whitewashing. A book for the Householder. By Alvah H. Sabin, M.S. First edition. John Wiley & Sons, New York. Chapman and Hall, Limited, London. 1908. Price 4s. 6d. net.

12mo. volume, containing 121 pages of subject-matter, and an alphabetical index. The subject-matter is classified as follows:—I, Materials. II, Pigments. III, Care of paint brushes. IV, Exterior painting. V, Painting structural metal. VI, Interior painting. VII, Varnishing. VIII, Coloured finish without paint. IX, Floor-finishing. X, Glazing. XI, Papering. XII, Whitewashing. XIII, Kalsomining. XIV, Cold-water paints.

Benzoic Acid and Benzoates [in Foodstuffs]; General Results of the investigation showing the Effect of —— upon Digestion and Health. H. W. Wiley. U.S. Dept. of Agriculture. Bureau of Chemistry. Circular No. 39, 1908. Pamphlet. (See also page 914.)

Patent List.

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

Applications.

17,494. Zeitlin. Vacuum pump. Aug. 20.

17,589. Langlet and Rinman. Method of producing pulverulent precipitates.* Aug. 21.

17,609. Schmatolla. Kilns for burning limestone, dolomite, etc.* Aug. 21.

17,756. Arbuckle and Osborne. *See under* X.

17,808. Mirrlees Watson Co. (Ordway). Recovery of substances from liquids and drying the same.* Aug. 25.

17,946. Challis. Filtering apparatus. Aug. 26.

18,129. Kirkham, Hulett, and Chandler, Ltd., and Hersey. Apparatus for effecting intimate contact of liquids and gases. Aug. 28.

Complete Specifications Accepted.

18,750a (1907). Beilby and Beilby. Apparatus for rapidly exposing powdered material in thin layers to heat. Aug. 26.

21,346 (1907). Petersen. Packing material for gas purifiers, condensers, reaction chambers, etc. Aug. 26.

27,312 (1907). Acheson. Transferring suspended solid substances from aqueous to non-aqueous media. Aug. 26.

2421 (1908). Müller. Machines for cooling, drying, evaporating, or aerating liquids, disintegrating ores, etc. Sept. 2.

5943 (1908). Feix. Frame filter presses. Aug. 26.

12,252 (1908). Furowicz. Centrifugal mixing apparatus. Sept. 2.

II.—FUEL, GAS, AND LIGHT.

Applications.

17,419. Little. Arc lamp electrodes. [U.S. Appl., Sept. 3, 1907.]* Aug. 19.

17,596. Von Unruh. Manufacture of incandescing bodies for gas lighting.* Aug. 21.

17,603. Glasgow. Manufacture of water-gas. Aug. 21.

17,693. Glasgow. Manufacture of water-gas.* Aug. 22.

17,818. Potter. Mantles for gas lighting and heating. Aug. 25.

17,978. Crossley and Rigby. Recovery of by-products in gas producer plants primarily designed for the recovery of ammonia. Aug. 27.

18,180. Lessing. Coke kilns. Aug. 29.

Complete Specifications Accepted.

19,100 (1907). Bernheimer and Gut. Incandescent mantles. Aug. 26.

25,262 (1907). Jones. Coke ovens. Aug. 26.

1673 (1908). Ries. Retort and chamber furnaces for treating coal, ore, etc. Aug. 26.

7594 (1908). Rutgerswerke A.-G. Utilising naphthalene and similar substances as motor medium for internal combustion engines. Aug. 26.

8370 (1908). Ries. Retort furnaces. Sept. 2.

8715 (1908). Pettibone. Apparatus for making water gas and producer gas. Sept. 2.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

Complete Specification Accepted.

11,140 (1908). Edeleanu. Purifying crude petroleum or petroleum products or distillates. Sept. 2.

IV.—COLOURING MATTERS AND DYESTUFFS.

Applications.

17,352. Ransford (Cassella und Co.). Manufacture of sulphide colours. Aug. 18.

18,023. Meister, Lucius, und Brüning. Manufacture of brominated derivatives from indigo white or a substitution product, and of dyestuffs therefrom. [Ger. Appl., Aug. 31, 1907.]* Aug. 27.

18,107. Newton (Bayer und Co.). Manufacture of anthracene derivatives. [Addition to No. 28,755 of 1906.] Aug. 28.

Complete Specifications Accepted.

16,584 (1907). Imray (Meister, Lucius, und Brüning). Manufacture of vat dyestuffs. Aug. 26.

19,158 (1907). Imray (Soc. Chem. Ind. in Basle). Manufacture of red vat dyestuffs. Aug. 26.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

Applications.

17,267. Ransford (Cassella und Co.). Method of treating dyeings with sulphide colours. Aug. 17.

17,653. Fraser. Bleaching or boiling kiers for linen or cotton, piece goods, or yarns. Aug. 22.

17,681. Weinzirl. Production of designs on sealskin, plush, and velvet by dyeing.* Aug. 22.

17,713. Calico Printers' Association, and Davis. Calico printing. Aug. 24.

17,734. Ashworth. Manufacture of reducing agents and method of printing with their aid. Aug. 24.

Complete Specification Accepted.

8002 (1908). Turner and Turner. Hawking machines for indigo dye vats. Aug. 26.

VII.—ACIDS, ALKALIS, AND SALTS.

Applications.

17,356. Peniakoff. Rendering silica contained in sodium aluminate insoluble for the purpose of obtaining pure alumina. Aug. 18.

17,498. Johnson (Badische Anilin und Soda Fabrik). Manufacture of compounds containing sulphur. [Addition to No. 28,240 of 1906.] Aug. 20.

17,520. Kühne. Rendering harmless gases containing sulphurous acid and recuperating the sulphur dioxide in the form of sulphuric acid or sulphates. [Ger. Appl., Aug. 20, 1907.]* Aug. 20.

17,608. Mond. Production of iron carbonyls. Aug. 21.

17,609. Schmatolla. *See under* I.

17,734. Ashworth. *See under* V.

17,956. Johnson (Robeson). Treatment of waste sulphite liquor. Aug. 26.

17,976. Pochin and Richardson. Manufacture of ferric sulphate and cakes or slabs containing it. Aug. 27.

17,978. Crossley and Rigby. *See under* II.

18,184. Steynis and Chaumat. Production of ozone. [Fr. Appl., Jan. 25, 1907. Comprised in No. 412 of 1908.]* Aug. 29.

Complete Specifications Accepted.

18,750 (1907). Beilby and Beilby. Manufacture of sodium ferrite and aluminate. Aug. 26.

6259 (1908). F. Krupp A.-G. Grusonwerk. Decomposing ground phosphates. Aug. 26.

8102 (1908). Matignon, Trannoy, Urbain, Feige, and Verley. Manufacture of sulphuric acid and anhydride by the contact process. Aug. 26.

VIII.—GLASS, POTTERY, AND ENAMELS.

Applications.

17,432 and 17,433. Ling and others. *See under* XXI.

Complete Specifications Accepted.

4722 (1908). Bührer. *See under* IX.

15,669 (1908). Imray (Window Glass Machine Co.). Apparatus for drawing glass. Sept. 2.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Application.

18,131. Auner. Production of a substitute for wood, horn, rubber, etc. [Addition to No. 8478 of 1907.]* Aug. 28.

Complete Specifications Accepted.

69 (1908). Caspar. Manufacture of refractory substances. Sept. 2.

437 (1908). Weithaler. Production of artificial stone slabs, etc. Aug. 26.

4722 (1908). Bührer. Kilns for bricks, pottery, etc. Aug. 26.

X.—METALS AND METALLURGY.

Applications.

17,350. Siemens und Halske A.-G. Improving the ductility of tungsten. [Ger. Appl., Sept. 14, 1907.]* Aug. 18.

17,379. Simpson. Reduction of metallic oxides. Aug. 18.

17,427. Bryant and Ivinson. Treatment of metals. Aug. 19.

17,432 and 17,433. Ling and others. *See under* XXI.

17,610 and 17,611. Siemens und Halske A.-G. Improving the ductility of tungsten. [Additions to No. 17,350 of 1908. Ger. Appls., Sept. 26 and Dec. 9, 1907.]* Aug. 21.

17,633. Poulson. Recovery of spent foundry sand. Aug. 22.

17,756. Arbuckle and Osborne. Separating comminuted ores or other solid matter from liquids.* Aug. 24.

17,759. Churchward. Heat-treating and quenching alloyed steels.* Aug. 24.

17,979. Liversedge. Manufacture of steel castings. Aug. 27.

18,088. Rouse. Preparation of copper ore concentrates for smelting. Aug. 28.

18,175. Hodgkinson and Peck. Production of alloys of copper such as brass. Aug. 29.

Complete Specifications Accepted.

12,607 (1907). Moon and Moon. Manufacture of iron and steel. Sept. 2.

16,238 (1907). Miller. Treatment of metals. Aug. 26.

19,016 (1907). Richter. Removal of copper from copper, tin, antimony, and lead alloys. Aug. 26.

22,283 (1907). Côte and Pierron. *See under* XI.

24,213 (1907). Felten und Guilleaume Lahmeyerwerke. Manufacture of steel. Aug. 26.

27,556 (1907). Röchling and Schoenawa. Treatment of iron for conversion into steel. Aug. 26.

1673 (1908). Ries. *See under* II.

2421 (1908). Müller. *See under* I.

10,835 (1908). Cremer. Converters. Sept. 2.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

Applications.

17,281. Imbert. Electric furnaces.* Aug. 17.

17,588. Bradley and Jenkins. Electrodeposition of metals and alloys. Aug. 21.

17,618. Arsem. Manufacture of refractory electric conductors. [U.S. Appl., Aug. 24, 1907.]* Aug. 21.

17,619. Fuller. Manufacture of refractory electric conductors. [U.S. Appl., Aug. 24, 1907.]* Aug. 21.

17,620 and 17,621. Coolidge. Manufacture of refractory electric conductors. [U.S. Appls., Aug. 24, 1907.]* Aug. 21.

Complete Specifications Accepted.

22,283 (1907). Côte and Pierron. Electric furnace for the continuous extraction of zinc from its ores. Aug. 26.

24,486 (1907). Hagen. Electrodes. Sept. 2.

25,553 (1907). Lévy. Electrodeposition of metals. Sept. 2.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

Applications.

17,670. Van der Lande. Oil decolouring, bleaching, and thickening apparatus.* Aug. 26.

18,031. Gilbert and Ralph. Machines for cooling soaps, fats, etc. Aug. 27.

Complete Specification Accepted.

9572 (1908). Claessen. Manufacture of polyglycerines. Aug. 26.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc.

(*A.*)—Pigments, Paints.

Application.

17,576. Harger. Manufacture of lamp black or carbon black. Aug. 21.

(*C.*)—India-Rubber.

Applications.

18,048. Austerweil. Regenerating and devulcanising old rubber and extraction of caoutchouc from raw materials. [Ger. Appl., May 13, 1908.]* Aug. 27.

18,131. Auner. *See under* IX.

Complete Specification Accepted.

25,091 (1907). Grummel. Separating vulcanised india-rubber from fibrous and other materials. Sept. 2.

XIV.—TANNING, LEATHER, GLUE, SIZE, Etc.

Applications.

17,957. Johnson (Robeson). Tanning and obtainment of improved products thereby. Aug. 26.

17,958. Robeson. Treatment of hides, skins, and leather. Aug. 26.

18,131. Auner. *See under* IX.

Complete Specifications Accepted.

25,182 (1907). Feuerlein. Decolorising tannin extracts. Sept. 2.

4627 (1908). Fairweather (Hartmann). Production of imitation leather. Aug. 26.

XVI.—SUGAR, STARCH, GUM, Etc.

Applications.

17,887. Mills (Arabol Manufacturing Co.). Process of liquefying organic colloids.* Aug. 25.

17,888. Mills (Arabol Manufacturing Co.). Treatment of starch.* Aug. 25.

17,961. Ephraim. Gum and process of extracting same. [U.S. Appl., Aug. 28, 1907.]* Aug. 26.

XVII.—BREWING, WINES, SPIRITS, Etc.

Application.

17,595. Sleeman. Non-intoxicating beer and process of brewing the same. Aug. 21.

XVIII.—FOODS; SANITATION, WATER PURIFICATION; AND DISINFECTANTS.

(*A.*)—Foods.

Application.

17,450. Wallis, and Wallis, Ltd. Treating germ of wheat to obtain a preparation for incorporation with flour. Aug. 19.

Complete Specification Accepted.

24,375 (1907). Erfurt. Homogeneously emulsifying milk, and preparing homogeneous milk from milk powder. Aug. 26.

(*B.*)—Sanitation; Water Purification.

Application.

17,644. Waite. Purification of trade effluent or the like. Aug. 22.

COMPLETE SPECIFICATION ACCEPTED.

2307 (1908). De Bouillanne. Sterilising potable water by ozone. Aug. 26.

XIX.—PAPER, PASTEBOARD, ETC.

APPLICATIONS.

17,956. Johnson (Robeson). *See under* VII.
18,041. Strange. Manufacture of paper. Aug. 27.

COMPLETE SPECIFICATIONS ACCEPTED.

9653 (1908). Mills (Harrington Co.). Waxing composition for paper. Aug. 26.

21,880 (1907). Self-Developing Plate Co., and Bolas. Manufacture of celluloid. Aug. 26.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

APPLICATIONS.

18,047. Austerweil. Converting borneols or isoborneols into camphor or camphor-like material. [Ger. Appl., May 13, 1908.]* Aug. 27.

18,049. Austerweil. Making borneol and borneol esters from pinene. [Ger. Appl., May 13, 1908.]* Aug. 27.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

APPLICATIONS.

17,432 and 17,433. Ling, Rendle, and Colbrook. Reproduction of images on glass, ceramic, metallic, or other surfaces.* Aug. 19.

XXII.—EXPLOSIVES, MATCHES, ETC.

APPLICATIONS.

17,762. Hale. Explosive grenades. [Addition to No. 15,045 of 1908.]* Aug. 24.

17,788. Toccaceli. Composition for impregnating torches. [Ger. Appl., Aug. 25, 1907.]* Aug. 25.

17,960. Hale. Explosive grenades. [Addition to No. 15,045 of 1908.] Aug. 26.

COMPLETE SPECIFICATION ACCEPTED.

15,195 (1908). Eberle. Explosive or blasting agent for blasting rock, etc. Sept. 2.

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I.—PLANT, APPARATUS, AND MACHINERY.

Patents.

Heating or heating and cooling liquids, and apparatus therefor, applicable to sterilising and other purposes. P. M. C. Mauvernay, Lyons, France. Eng. Pat. 19,163, Aug. 26, 1907.

The liquid to be heated or sterilised, after passing through a vessel in which the dissolved gases are extracted by means of a vacuum produced by a steam-jet exhauster, is pumped through a heat-interchanger constructed in a similar manner to a filter-press. The liquid to be treated passes through the apparatus on one side of the plates, and cools, and is itself heated by, the hot liquid from the steriliser proper, passing through on the other side of the plates. From the heat interchanger the liquid passes under pressure through the coil of the steriliser, which is fixed in a tank, and is heated by steam or vapour, and air or gas, circulated through the tank and round the coil. "Interceptors" are placed at intervals in the coil to cause the liquid to flow from the axis to the periphery of the coil and *vice-versa.* This is done to ensure that the whole of the liquid passing through the coil is raised to the sterilising temperature. From the steriliser the liquid, still under pressure, passes to a reservoir from which it flows under pressure through the heat interchanger, where it is cooled.—W. H. C.

Extracting the volatilisable contents of sedimentary strata; Apparatus for ——. D. R. Baker, Delaware, Ohio. U.S. Pat. 895,612, Aug. 11, 1908.

Two separate wells or shafts are sunk into the earth to the level of the material it is desired to extract. The wells communicate with one another underground only through natural fissures in the strata. A heated gaseous fluid is forced down one of the wells, and passes through the fissures in the strata into the other well, by which it returns to the surface, carrying with it the volatile material. The wells have an increased diameter near the surface and are protected by a non-conducting casing to prevent loss of heat.—W. H. C.

Filter-frame. G. H. Clevenger, Palo Alto, Cal., Assignor to The Butters Patent Vacuum Filter Co., Nevada. U.S. Pat. 896,436, Aug. 18, 1908.

The claim is for a filter-frame with an adjustable "filler-plate" formed of crossed wooden strips having interconnecting grooves on their outer surfaces. The "filler" is rigidly secured at one side and at the bottom, to the frame, whilst at the other side and at the top, it is so connected as to be free to slide.—W. H. C.

Powders and crystals; Apparatus for the automatic solution of ——. F. J. de Bruno-Austin. Fr. Pat. 388,884, April 3, 1908.

The material to be dissolved, is placed in a container made either partially or entirely of diatomite or fossil-meal. The container is suspended in the solvent, and solution takes place through the porous walls of the container.—W. H. C.

Lixiviating apparatus. Fürstlich Stolbergsche Maschinenfabr. Ger. Pat. 198,011, March 26, 1907.

In lixiviating apparatus, in which the solution from the lixiviator passes to an evaporator, the vapour from which is condensed and returns to the lixiviator, there is a loss of heat, since the condensed solvent is cooled to a greater extent than is necessary. In order to prevent this, two condensers are provided, with the necessary connections, one or both being used as required. One of the two is an air condenser, and is in general use, whilst the second water-condenser is used only when the former is insufficient.—A. S.

Liquefied gases; Receptacle for ——. P. Winand. Ger. Pat. 197,713, Sept. 8, 1906.

In vacuum-jacketed receptacles for liquefied gases, the struts connecting the inner and outer walls of the vessel, are made hollow, and serve for the withdrawal of vapour of the liquefied gas.—A. S.

Evaporator with separate chambers and fixed tubular heating device for saline liquids. F. H. Eydmann. Ger. Pat. 199,145, March 21, 1907.

The liquid spaces below and above the vertical heating tubes are divided by radial partitions into compartments, through which the liquid passes in succession on its way through the evaporator, flowing alternately upwards and downwards through the heating tubes from one compartment to another. Circulation is effected or accelerated by means of a special centrifugal pump.—A. S.

Vacuum filtering apparatus. C. Butters, Berkeley, Cal. U.S. Pat. 896,360, Aug. 18, 1908.

See Eng. Pat. 20,979 of 1906; this J., 1907, 415.—T. F. B.

Evaporating and concentrating liquids; Apparatus for ——. C. L. Prache and C. G. V. Bouillon, Paris. U.S. Pat. 896,460, Aug. 18, 1908.

See Fr. Pat. 364.408 of 1906; this J., 1906, 874.—T. F. B.

II.—FUEL, GAS, AND LIGHT.

Pit-coal; Dangers of ——. Spontaneous ignition. M. Dennstedt and R. Bünz. Z. angew. Chem., 1908, 21, 1825—1835.

The liability of different coals to ignite spontaneously during storage or transport may be compared by heating a powdered sample in a current of dry oxygen at 135° C. or at 150° C. In making the test, the sample is first passed through a sieve of 144 meshes per sq. cm., and then placed in a brass tube, 7·5 cm. long and about 4·8 cm. diameter, fitted with a thermometer. The tube is heated in an oil-bath at the desired temperature. The coal is dried by a current of carbon dioxide previously heated to the temperature of the bath, and when the temperature of the coal reaches 110—115° C., the carbon dioxide is replaced by oxygen, which is passed through the apparatus at the rate of 2 to 3 litres per hour. The temperature of the coal is read at intervals for 2 or 3 hours, and if it exceeds that of the bath, the current of oxygen is increased. The coals tested by the authors may be divided into four classes: (1), those with which the temperature does not exceed that of the bath; (2), those which show a marked rise of temperature and in some cases ignite, if the sample is first heated in oxygen at 135° C. for two hours and is then brought to 150° C.; (3), those which at first show only a slight rise of temperature, either at 135° C. or at 150° C., but can be caused to heat up or ignite by increasing the current of oxygen; and (4), those which heat up rapidly, even at 135° C., and ignite during the first or second hour. Coals belonging to classes (3) and (4) must be regarded as dangerous for storage or sea-transport. The liability of a coal to ignite spontaneously is also indicated by a high result in the Mauméné test, and by a high iodine absorption; the amount of iodine absorbed depends on the fineness of the sample, and the test must be made by a method of comparison. The authors' experiments also show that the quantity of moisture in the air-dry coal, and the quantity of moisture absorbed by the dry coal on standing in air, are greater with the more readily inflammable coals; and this moisture is taken up by the organic part of the coal. Neither the mineral constituents, including pyrites, nor the organic sulphur and nitrogen, appear to promote spontaneous ignition. The less readily inflammable coals contain more "available hydrogen," *i.e.*, more hydrogen in excess of that required to form water with the oxygen in the coal. Spontaneous ignition is due to the oxidation of unsaturated organic constituents of the coal. The more readily inflammable coals contain more oxygen, and a certain degree of oxidation is necessary to render further oxidation, with spontaneous ignition, possible; this is also shown by the behaviour of coals in class (2) described above. The final product of slow oxidation is humic acid, which is present in greater quantity in the more readily inflammable coals and accounts for their hygroscopic nature.—A. T. L.

Coke; Yield of —— from coal. F. W. Hinrichsen and S. Taczak. Stahl u. Eisen, 1908. **28**, 1277—1279.

The yield of coke is determined by heating 4 to 5 grms. of the finely powdered coal in a current of hydrogen, in a Rose crucible of 40 to 50 c.c. capacity. The hydrogen is passed for at least 10 minutes to remove all air; the crucible is then heated gently for 2 minutes and strongly for 5 minutes. The current of hydrogen is continued until the crucible is cold. Complete coking can be ensured by heating strongly, and loss by oxidation is prevented. The process gives higher results than any of the well-known processes, and the results agree well with the yield of coke obtained in practice at Dahlhausen, which has always exceeded the laboratory tests.—A. T. L.

Power-production from waste gases. C. Dantin. Le Génie Civil, Paris, **51**, 137—142. Proc. Inst. Civil Eng., 1908, **171**, 98. [T.R.]

The facility with which surplus power can be converted into electric energy, and in that form distributed over large areas with the minimum of loss, has given a great impetus to the employment of the waste gases both from blast-furnaces and from coking-ovens. For every ton of coal carbonised, about 8475 cubic feet of gas are set free, and in the more modern form of oven, only 65 per cent. of this is required for effecting the carbonisation, the remaining 35 per cent. being available for outside purposes. The gas thus generated is of high calorific value, *viz.*, 3500 to 4500 calories per cubic metre (393 to 506 B.Th.U. per cubic foot), its principal constituents being hydrogen and methane; thus for every ton of coal carbonised 2965 cubic feet of gas become available, which is equivalent to 3707 cubic feet, of a total value of 420,000 calories (1,666,560 B.Th.U.), per ton of coke produced. In the blast-furnaces about 63,560 cubic feet of gas are set free per ton of pig-iron produced, but here the value is as low as 950 calories per cubic metre (107 B.Th.U. per cubic foot): thus 1,710,000 calories (6,785,280 B.Th.U.) become available per ton of pig produced. A gas-engine of about 1000-kilowatt power absorbs 3600 calories per kilowatt; thus in a large works a very considerable power is available at a direct cost of little beyond the attendance on and the upkeep of the machines. The Cockerill Company of Seraing was the first to use waste gases on a large scale, and this Company is now distributing, from two stations, no less than 5800 kilowatts, after having supplied all the power and light required in connection with the works themselves. Assuming that the machines work 50 per cent. of the time, or 4380 hours per annum, the total cost per kilowatt, including a sinking-fund so arranged as to extinguish the capital outlay in 10 years and allow 5 per cent. interest on the loan, is 0.176d. This sum would of course increase or decrease according as fewer or more hours per annum were worked.

Pyrophoric alloys. B. Weiss. *See* X.

Patents.

Gases in mines and the like; Apparatus for measuring dangerous or obnoxious ——. H. Sefton-Jones, London. From Hartmann und Braun Akt.-Ges., Frankfort a/Main, Germany, and E. A. della Santa, Brussels. Eng. Pat. 18,060, Aug. 8, 1907.

Two of the devices described in Eng. Pat. 10,342 of 1907 (this J., 1907. 1110) may be employed; they are connected with a galvanometer, and whilst one is exposed to the atmosphere to be tested, the other is kept in an atmosphere of pure air. Instead of a flame, a catalytic agent such as platinum and platinum black may be used, and this catalytic agent may be embodied in the thermopile. A gas lamp, working under constant pressure, is described for use with the apparatus.—W. P. S.

Fuel; Manufacture of ——. T. Parker, London. Eng. Pat. 15,872, July 10, 1907.

A free-burning fuel, which ignites easily and is suitable for domestic purposes, is obtained by discharging gas-coke from the retorts into a tank containing heavy tar oil covered with a layer of water, the depth of water being 1 inch per cwt. of coke. The coke is thus brought into contact with the oil at a sufficiently high temperature, without danger of the whole mass igniting. The water is run off, and the oil is drawn away from the bottom of the tank, leaving the coke still hot enough to dry rapidly. —A. T. L.

Fuel briquettes; Manufacture of ——. W. F. Collins, Mong-tse, China. Eng. Pat. 17,545, July 31, 1907.

The powdered coal, or other carbonaceous material, is mixed with from 3 to 6 per cent. of powdered sodium silicate (with or without the addition of a metallic oxide or a calcium compound). The mass is subjected to heat, in the presence of steam, in a mixer and is subsequently pressed into a mould.—W. H. C.

Fuel; Process for controlling the combustion of ——. H. J. Williams, Assignor to The Coal Treating Co., Phœnix, Ariz. U.S. Pats. 896,875 and 896.876, Aug. 25, 1908.

The fuel is coated with a solution of calcium chloride or of a salt of the copper-iron group of metals and allowed to drain. The non-volatilisable film, it is stated, causes the carbon of the fuel, when it is ignited, to be set free in the form of a combustible gas.—W. H. C.

Smokeless fuel; Manufacture of ——. G. Contal. Fr. Pat. 388,559, March 27, 1908.

Natural or artificial fuels are heated in closed vessels, until all smoke disappears, at such a temperature that the fuel is not converted into coke. Coal in lumps or in the form of briquettes is heated first on a conveyor passing through a retort, so that the separate pieces are not in contact, and when the fuel has been rendered non-caking, it is heated in the mass in a second retort. Small coal or dust is heated in the mass, and the caked product is afterwards broken up.—A. T. L.

Liquid combustibles, especially petroleum ; Conversion of readily inflammable —— into the solid state. G. Hagemann. Ger. Pat. 199,169, May 2, 1907.

The process depends on the observation that the condensation products of formaldehyde with amino-derivatives of benzene, phenols, etc., have the power, at the moment of their formation, of taking up large quantities of petroleum and similar substances. *Example.*—60 kilos. of aniline are dissolved in 100 kilos. of petroleum, and 60 kilos. of 40 per cent. formaldehyde are added to the warm solution. On heating and stirring the mixture first emulsifies and then coagulates, the reaction product (containing the petroleum) finally separating in a solid amorphous condition. The anhydroformaldehydeaniline formed by the condensation of the formaldehyde and aniline exerts no oxidising action during the combustion of the product, but increases the production of soot. No other residue besides soot is left after combustion.—A. S.

Coke-ovens. A. O. Jones, Whitley Bay, Northumberland. Eng. Pat. 27,443, Dec. 12, 1907.

Two regenerative chambers are constructed below the level of, and parallel to, the battery of ovens, which may be either of the horizontal or vertical type. The air passages and waste-gas flues from each oven are branched where they enter the regenerators, one branch of each going to one of the regenerators and one to the other. A sliding valve, which controls both the air passage and waste-gas flue from each oven, has its spindle attached to an eccentric. All the eccentrics are mounted on a shaft which is fixed parallel to the entire length of the ovens. When the shaft is rotated, all the valves are operated simultaneously, and the direction of flow through the regenerators is reversed.—W. H. C.

Coke ovens ; Process of heating ——. F. C. Ghislain. Fr. Pat. 388,641, March 20, 1908.

In a battery of coke ovens, the burnt gases are not allowed to escape from the heating flues of each chamber to the main flue, but are used in conjunction with a sufficient quantity of combustible gas in the heating flues of the other chambers. The process may be applied to ovens of any type.—A. T. L.

Retorts for the production of illuminating gas, coke, and other residuals. T. Glover, Norwich. Eng. Pat. 17,875, Aug. 6, 1907.

Gas retorts are constructed of substantially rectangular cross-section and built in groups or sets within an ordinary main arch of a retort bench. A convenient size of the retorts is 3 ft. deep, 13 in. wide tapering to 12 in., and 21 ft. long. The top and bottom parts are constructed in solid sections of convenient length, having rebated joints where the sections meet and skew-backs from which the key bricks forming the sides start. The sides are shaped with a slight camber, to allow for expansion when heated and to resist the lateral thrust. The employment of charging machinery of the projector type and of discharging rams similar to those used with recovery coke ovens, makes it possible to advantageously work these retorts with a deep layer of coal of comparatively narrow section. By this means the space between the top of the charge and the crown of the retort is considerably diminished, and thus the excessive "cracking" of the hydrocarbons evolved, is prevented. The retorts have a capacity of about 1 ton of coal, as compared to one of about 8 cwt. in the ordinary type ; the costs of operation are less ; and the resulting coke is of greater density and more nearly resembles the product of metallurgical coke ovens, owing to the depth and consequent pressure of the charge. At the same time it is claimed that the requirements for the constant production of gas of uniform composition are satisfied through the arrangement of the retorts in settings and their charging and discharging at regular periods.—R. L.

Retort or muffle furnaces ; Firing of —— by means of producer gas. E. Schmatolla, Berlin. Eng. Pat. 10,155, May 11, 1908. Under Int. Conv., Nov. 1, 1907.

The producer-gas passes directly from the generator, which is built close to the furnace, to a combustion-chamber above the retort or muffle. The products of combustion pass along the sides of the muffle, and then beneath it, to another flue lower down, from which they enter the main-flue leading to the chimney. The air necessary for combustion is preheated by causing it to flow through a pipe extending through the bottom flue and thence to a flue above the combustion chamber where it is further heated by radiation from the latter. The top and sides of the muffle are protected against the intense heat by plates of fire-clay, but the metal bottom of the muffle is exposed directly to the gases which have already given up the greater part of their heat to the top and sides of the muffle.—W. H. C.

Treating coal ; An improved substance or mixture for ——. J. Jowett, Bolton-le-Sands. Eng. Pat. 8578, April 18, 1908. Addition to Eng. Pat. 14,893 of 1907 (this J., 1908, 495).

The claim is for the use in gas manufacture of a mixture of potassium and sodium chlorides, saltpetre, and potassium permanganate, in a powdered or solid form, which is thrown into the retort after the coal has been charged, rather than as a solution which is sprinkled over the coal before charging. By its use an increased yield of gas and a reduction in the quantity of sulphuretted hydrogen formed, are claimed.—W. H. C.

Gas [carburetted air] ; Production of —— from volatile hydrocarbons. T. Parker, London. Eng. Pat. 15,871, July 10, 1907.

The supply of hydrocarbon to the carburettor is controlled, in proportion to the consumption of gas, by the movements of a cylindrical weight, which is connected to the bell of the gas-holder and slides within a perforated or slotted vertical outflow pipe in a supply tank arranged over the carburettor. A second weight, suspended within the bell, slides in a perforated or slotted outlet pipe closed at the upper end, and controls the supply of gas to the burner of a hot-air engine for driving the fan or blower which supplies air to the carburettor. When the bell rises to a certain height, this burner is extinguished, but when the bell falls, an automatic igniter is brought into operation to relight the burner. The exhaust of the hot-air engine is passed through a jacket around the carburettor.—A. T. L.

Gas ; Process of manufacturing ——. H. W. Benner, Chambersburg, Pa., Assignor to Internat. Gas Development Co., New York. U.S. Pat. 896,795, Aug. 25, 1908.

Steam is forced into contact with coal which is passing through a distilling chamber. The gas produced is drawn off and enriched by mixing it with oil-enriched water-gas produced by passing steam and oil vapour through a heated bed of iron.—W. H. C.

Gas-producer. F. Powell, Portland, Oregon. U.S. Pat. 897,009, Aug. 25, 1908.

The generator-chamber is divided into two parts by a perforated baffle-wall and has two valved air inlets above the level of the grate, one at each side of the chamber. A valved gas outlet is arranged on each side of the chamber, near the centre, at a level above that of the air inlets. The air- and gas-ports are alternately opened and closed by mechanism, so that the air enters by the inlet on one side, passes in a generally horizontal direction through the bed of fuel, then through the perforations of the baffle-wall, and through the fuel on the other side, where the gas is "fixed," and escapes through the gas outlet which is farthest from the inlet. The direction of flow is reversed from time to time. Provision is made for withdrawing the products of distillation from the upper portion of the generator-chamber and for discharging them into the lower portion of the fuel-bed.—W. H. C.

Ammonia; Production of —— from wash-heaps [*of collieries*]. N. Caro. Ger. Pat. 198,295, Aug. 26, 1905.

It is found that if the material forming the wash-heaps of collieries be treated in a Mond gas producer, the whole of the nitrogen is recovered in the form of ammonia. Care must be taken that sufficient steam is introduced to allow of an excess being present in all parts of the producer. —A. S.

Gases; Process of purifying [*dehydrating*] ——. J. Babin and Soc. L'Air Liquide (Soc. Anon. pour l'Étude et l'Éxploit. d. Procédés G. Claude). First Addition, dated May 25, 1907, to Fr. Pat. 375,887, May 26, 1906 (this J., 1907, 919).

To obtain a large surface in contact with the gases, the dehydrating agent is exposed in thin layers on plain or perforated metal plates or on metal gauze. The plates or gauze are coated by dipping into the molten substance. The gas may be passed through a number of gauze discs coated in this way, or through a spiral passage formed by a coil of the coated metal plate.—A. T. L.

Incandescent gas mantles. A. Simonini, Salzburg, Austria. Eng. Pat. 10,233, May 11, 1908.

MANTLES of great strength and durability are made by washing and, if necessary, bleaching the webbing of artificial silk, then treating it with dilute hydrochloric acid and neutralising it with ammonia. The webbing is then dried and saturated with a strong solution containing thorium nitrate and cerium nitrate in the proportion of about 99 to 1. After drying the webbing, it is either dipped in a mixture of ammonia and hydrogen peroxide, or first immersed in strong ammonia for about 5 minutes, then rinsed, and subsequently immersed in hydrogen peroxide. After rinsing again and drying, the mantles are incinerated in a Bunsen flame. The formation of higher oxides by the combined action of hydrogen peroxide and ammonia is said to cause the incinerated mantle to be of a denser structure.—R. L.

Filament for electric incandescent lamps. H. Kuzel, Baden, Austria-Hungary. U.S. Pat. 896,060, Aug. 11, 1908.

THIN tungsten filaments are made by forming threads from a plastic mass containing tungsten and colloidal oxynitride of tungsten, drying the threads, and gradually heating them to white heat in a non-oxidising atmosphere. —A. T. L.

Coke ovens with continuous heat recovery. Solvay et Cie. Fr. Pat. 388,610, March 7, 1908. Under Int. Conv., July 22, 1907.

SEE Eng. Pat. 16,786 of 1907; this J., 1908, 14.—T. F. B.

Retort and chamber furnaces and the like for the treatment of coal, ore, and other materials. H. Ries, Munich, Germany. Eng. Pat. 1673, Jan. 24, 1908. Under Int. Conv., Jan. 26, 1907.

SEE Fr. Pat. 386,554 of 1908; this J., 1908, 742.—T F. B.

Gasification of raw combustible materials; Method for the ——. P. Hoering, Berlin, and W. Wielandt, Zwischenahn, Germany. U.S. Pat. 896,912, Aug. 25, 1908.

SEE Eng. Pat. 2245 of 1906; this J., 1906, 974.—T. F. B.

Suction gas generating plant. E. Baudot, Paris. Eng. Pat. 19,009, Aug. 23, 1907. Under Int. Conv., Sept. 7, 1906.

SEE Fr. Pat. 369,540 of 1906; this J., 1907, 85.—T. F. B.

Gas for heating and lighting; Process and apparatus for the production of ——. C. B. Tully. Fr. Pat. 388,703, March 30, 1908. Under Int. Conv., May 3, 1907.

SEE Eng. Pat. 10,346 of 1907; this J., 1908, 553.—T. F. B.

Packing material for gas purifiers or washers, condensers, reaction chambers, hot-blast stoves or the like. H. Petersen, Wilmersdorf, Germany. Eng. Pat. 21,346, Sept. 26, 1907. Under Int. Conv., Sept. 27, 1906.

SEE Fr. Pat. 382,262 of 1907; this J., 1908, 151.—T. F. B.

Filament for incandescent lamps. W. R. Whitney, Schenectady, Assignor to General Electric Co., New York. U.S. Pat. 896,341, Aug. 18, 1908.

SEE Eng. Pat. 929 of 1906; this J., 1907, 144.—T. F. B.

Carbonic acid, etc., in gas mixtures; Recording the percentage of ——. Eng. Pat. 22,896. *See* XXIII.

Gas-analysis apparatus; Device for discharging gases from ——. Ger. Pat. 197,594. *See* XXIII.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

Petroleum; Formation of ——. C. Engler. Z. angew. Chem., 1908, 21, 1585—1597.

THE author reviews the different theories of the formation of petroleum. He concludes that the hypothesis according to which petroleum is of inorganic origin must be rejected, except possibly in the case of small quantities of petroleum formed under exceptional conditions. The available evidence is shown to be in accord with the view that petroleum is of organic origin (animal and vegetable), the process of formation comprising two phases: first, the decomposition (putrefaction) of nitrogenous and other non-fatty substances, and secondly the conversion of the fatty residues (including fats, oils, waxes, resins, cholesterols, etc.) into petroleum. With respect to the optical activity of petroleum, the author is of the opinion that this is, in most cases, mainly caused by the presence of an individual substance, probably a product of the destructive distillation of cholesterol or a cholesterol-like substance. The maximum optical activity is almost invariably found in a high-boiling fraction of the petroleum, of about the same boiling point as the dextro-rotatory product obtained by the destructive distillation of cholesterol. The distillation of cholesterol can be so carried out that first a lævo-rotatory, then an inactive, and finally a strongly dextro-rotatory distillate are obtained. In an analogous manner, Java petroleum, on distillation, yields lævo-rotatory, inactive, and dextro-rotatory distillates. Moreover the lævo-rotatory fractions from both cholesterol and Java petroleum can be converted into dextro-rotatory products by heating under pressure at 350°—360° C.—A. S.

Petroleum ; Optical properties of —— from the Sjesnowodsk district. M. A. Rakusin. Petroleum. 1908. **3**, 1203—1205.

This oil is a thick, dark brown oil, of sp. gr. 0·9887 at 15° C., with latent dichroism, rich in asphaltic bodies, though not to the same extent as Fergana oil or that from Irtysch. The distillates exhibited a slight dextro-rotation, and all appeared, from the disagreeable smell, to be contaminated with sulphur compounds, probably derived from the gypsum deposits and sulphur springs in the vicinity of the source of the oil. Owing to the low yield (scarcely 10 per cent.) of crude lamp oil (kerosene) and the contamination of the distillates with dark-coloured sulphur compounds of disagreeable odour, the technical utilisation of the oil would not be remunerative. No paraffin could be isolated. The residue, amounting to 54·75 per cent. of the crude oil, had the high sp. gr. of 1·0234, and was nearly solid, with a pitchy gloss, at the ordinary temperature.—C. S.

Petroleum lamp oils ; Valuation of ——. R. Kissling. Chem. Rev. Fett- u. Harz-Ind., 1908, **15**, 212—214.

Tabular results are given in support of the author's view that neither fractionation nor photometric tests can be relied upon as certain criteria of the value of a lamp oil. Only in exceptional cases is this possible in the case of fractionation, whilst with the photometric test it is essential to repeat the determinations from 3 to 5 times with a lamp "standardised" upon a known oil. The main cause of the errors in the photometric method is the variation in the different wicks. For the examination of known varieties of petroleum lamp oils, a good method is to measure the height of the flame at fixed intervals during a burning of 8 to 9 hours' duration. This is effected by means of a cylinder graduated in tenths of a cm., the form of a regular flame being estimated from the usual irregular shape. Where an unknown type of oil is in question, Prössdorf's tedious photometric method (Petroleum, 1908, **3**, 231) may be recommended. For determining the value of a known type of oil with a lamp of given construction, the use of Weber's photometer with Lummer-Brodhun's prism combination is the most suitable method.—C. A. M.

Petroleum industry ; The Californian ——. P. M. Martell. Petroleum, 1908, **3**, 1199—1203.

The total production of crude oil in California in 1907 is estimated at 35 million barrels, of which only 10 million barrels would be refined, leaving 25 million barrels for use as fuel. This is largely consumed by the railways, on which some 1800 locomotives are now fired with crude oil, the annual consumption being about 15 million barrels. In addition, nearly 90 per cent. of the industrial establishments in the country employ this fuel, as well as 44 per cent. of the steamships. The American naval authorities have compared the heating value of Californian crude oil with best Cardiff coal, and find their relative calorific powers to be 20,503 B.T.U. and 14,885 B.T.U. respectively, so that the 25 million barrels aforesaid are capable of replacing 8 million tons of coal. Last year the production of the chief oil centres was :—Kern river, 9 million barrels ; Coalinga, 9½ million ; Santa Maria, 9 million ; Los Angeles, 1·7 million ; Fullerton, 2 million ; Mc.Kittrick, 1 million ; Whittier, 650,000 ; and Sunset, 500,000 barrels. In 1906, California headed the list of the oil-producing States in point of output, but only occupied fifth place in respect of the total value, the difference being due to the greater accessibility and lower cost of transport enjoyed by the eastern oil centres. The exports of fuel oil for the present year are estimated at 14½ million barrels, the chief markets being Japan, Central America, Mexico, British Columbia, Alaska, and Hawaii.—C. S.

Petroleum production of the United States. U.S. Geol. Survey. [T.R.]

The production of petroleum increased from 126,493,936 barrels, or 16,868,599 metric tons, in 1906, to 166,095,335 barrels, or 22,149,862 metric tons, in 1907. The increase shown for 1907 over 1906 is 39,601,399 barrels, or more than the total product of petroleum in any year up to 1889. The total value increased from $92,444,735 in 1906 to $120,106,749 in 1907. The average price decreased only slightly from $0·731 per barrel in 1906 to $0·723 in 1907. The Californian fields produced 39,748,375 barrels, against 33,098,598 barrels in 1906. The combined output of Kansas and Oklahama increased from 21,718,648 barrels to 45,933,649 barrels, whilst that of Illinois rose from 4,397,050 barrels in 1906, to 24,281,983 barrels in 1907.

During 1907 a total of 18,855,691 barrels of oil was consumed as fuel by the railroads of the United States, as against 15,577,677 barrels in 1906. The estimated length of line operated by the use of fuel oil in 1907 was 13,593 miles, and the total length of line covered by oil-burning engines is estimated at 74,197,144 miles, an average of 3·935 miles per barrel of oil consumed. Most of the oil consumed was crude oil, the remainder being residuum from the refineries.

Wood distillation in the United States. U.S. Census Bulletin. [T.R.]

Hardwood :—There were 100 active plants reported for 1907, an increase of 14 over 1906. The total consumption of wood—chiefly birch, beech and maple—in 1907 was 1,219,771 cords, as against 1,144,896 cords in 1906. The production of charcoal increased from 45,657,721 bushels, valued at $2,965,940, to 50,772,233 bushels, valued at $3,838,392 ; that of gray acetate from 96,376,497 pounds, valued at $2,017,331, to 133,374,941 pounds, valued at $2,565,938 ; and that of brown acetate from 6,960,933 pounds, valued at $85,777, to 8,152,848 pounds, valued at $94,446. The reported yield of crude wood spirit, on the other hand, decreased from 7,871,494 gallons, with a value of $2,676,191, to 7,741,645 gallons, with a value of $1,153,307, a loss of 1·6 per cent. in quantity, and of 56·9 per cent. in value.

Softwood :—Longleaf pine supplies the bulk of the raw material, though other species of pine, as well as other conifers, are used. While the inquiry disclosed only 31 plants in operation in 1907, as against 32 in 1906, the quantity of wood consumed increased from 50,234 cords to 61,149 cords. This increase was accompanied by an advance in the average cost per cord from $2·58 to $3·44. The total yield in 1907 of turpentine, the leading product, was 654,711 gallons, against 503,427 gallons in 1906, while the average value per gallon remained substantially the same—about 47 cents. The production of tar and oils increased from 773,128 gallons, valued at $81,797, to 1,152,752 gallons, valued at $127,531. The production of charcoal also showed marked increase, from 791,887 bushels, with a value of $44,381, to 1,158,364 bushels, with a value of $102,411. (See also this J., 1908, 216.)

Patents.

Hydrocarbons ; Method for treating naphtha and carburetting water-gas to obtain aromatic ——. A. Nikiforoff, Moscow. Eng. Pat. 17,450, July 30, 1907.

Hydrocarbons of a boiling point not exceeding 200° C. obtained by the destructive distillation of naphtha are pulverised by directing a current of water-gas issuing from a suitable nozzle against a jet of the oil, previously heated to 200° C., and the mixture is caused to pass through a retort. The water-gas is previously heated in a coil to a temperature of 800°—1000° C. and to keep up the requisite temperature, more water-gas of the same temperature is introduced into the retort at both ends. By this means aromatic hydrocarbons are said to be formed, which collect, together with soot, in a catch-box provided with a stirring arrangement, whilst the gases and uncondensed hydrocarbons escape. The condensed hydrocarbons are drawn off through an overflow, and when working at 800°—850° C., the products are stated to be: 15 per cent. of commercial benzene, 4 per cent. of naphthalene, 0·5 per cent. of anthracene, 10 to 12 per cent. of coke, 9 per cent. of coked material and soot, and 50 per cent. of gas of 14 candles illuminating power.—R. L.

Alkaline effluents: Treatment of certain ——. J. Radcliffe, East Barnet, Herts. Eng. Pat. 18,135, Aug. 10, 1907.

THE process relates to the treatment of liquids from which it is not necessary to remove or recover thiocyanates as in the method described in Eng. Pat. 10,075 of 1905 (this J., 1906, 584). The treatment is effected by passing the effluent and a suitable neutralising agent through holes in agate or other resistant material. The size of the holes is adjusted so as to pass the correct proportion of effluent to neutralising agent. Pumps working on the same shaft at fixed rates may also be employed. The neutralising agent consists, preferably, of sulphur dioxide or sulphurous acid, obtained as a by-product in the same operation as that which produced the alkaline effluent.
—W. P. S.

Wood; Process for distilling ——. T. B. Gautier, Annapolis, Md., Assignor to C. C. Burger, New York. U.S. Pat. 896,292, Aug. 18, 1908.

TURPENTINE-BEARING wood in its natural state, is placed in a retort "under an exhaust," and heated to a temperature not exceeding 380° F., but sufficient to disengage the turpentine and similar oils and the rosin. Excessive temperature is prevented by injecting a cooling medium into the heating medium in a direction opposed to the flow of the latter. The turpentine is led away from the retort, and the retort is discharged.—A. T. L.

Distillation apparatus and process. H. O. Chute, Cleveland, Ohio. U.S. Pats. 896,434 and 896,435, Aug. 18, 1908.

THE process, which is particularly applicable to the separation of wood-alcohol and pyroligneous acid from pyroligneous liquor, consists in passing the crude liquor down a column-still. A settling chamber at the bottom of the still is connected by an automatic level-regulating apparatus to a heater. A portion of the settled exhausted liquor passes into the heater, and, is there converted into steam, which passes back through a pipe from the top of the heater to the settling chamber and serves to effect the distillation.—W. H. C

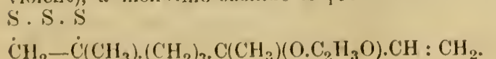
Oils: Apparatus for determining the degree of viscosity and lubricating power of ——. Fr. Pat. 388,671. *See* XXIII.

Liquid combustibles, especially petroleum: Conversion of —— *into the solid state.* Ger. Pat. 199,169. *See* II.

IV.—COLOURING MATTERS AND DYESTUFFS.

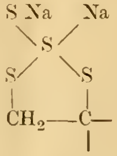
Thio-ozonides, and the constitution of certain sulphur compounds. H. Erdmann. Annalen, 1908, **362**, 133—173.

WHEN melted sulphur is cooled to 160° C., two distinct layers of liquid may be seen, of different specific gravity and colour. The deep yellowish-brown coloured layer contains a highly reactive, unstable form of sulphur (thio-ozone, $S : S : S$) which corresponds to ozone. It yields addition compounds with certain organic substances, especially those which contain the group, $R_1R_2C : CH_2$. Linalool, $CH_2:C(CH_3).(CH_2)_3.C(CH_3)(OH).CH:CH_2$, which contains this methylene group twice, reacts with sulphur yielding a dithio-ozonide, but in its acetyl derivative, $CH_2 : C(CH_3).(CH_2)_3.C(CH_3)(O.C_2H_3O).CH : CH_2$, the presence of the acetyl radical appears to protect one methylene group and by heating with sulphur to 160° C. (at which temperature the reaction tends to become violent), a monothio-ozonide is produced.

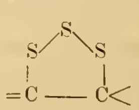


$$\begin{array}{l} S\,.\,S\,.\,S \\ \dot{C}H_2—\dot{C}(CH_3).(CH_2)_3.C(CH_3)(O.C_2H_3O).CH : CH_2. \end{array}$$

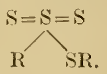
The nature of this compound is peculiar in that it is amphoteric, capable of reacting as a thio-acid with alkali sulphides, and also as a thio-base. The compound with sodium sulphide probably contains the grouping,



Regarding the class of "sulphide" dyestuffs, the author is of the opinion that the first stage in their formation is the addition of thio-ozone to the organic base and the production of thio-ozonides, as all products of the sulphur melt show the characteristic properties of thio-ozonides. They are insoluble in ordinary solvents, but dissolve easily in solutions of alkali sulphides and are readily oxidised by the oxygen of the air at ordinary temperatures. By such gentle oxidation the characteristic ring,



(which apparently possesses chromophoric and substantive properties) would remain intact, the middle sulphur atom becoming quadri- or sexavalent and capable of fixing the oxygen. It is remarkable, that whilst the basis of almost every sulphide dyestuff is an amino compound, these dyestuffs by air oxidation produce free sulphuric acid (a fact which has often been observed in the case of dyeings upon cotton); from sulphides, or disulphides, aminosulphonic acids would result. Assuming, however, the thio-ozonide constitution, the sulphur atoms in direct union with carbon would, upon oxidation, remain combined, whereas the middle one would be split off in the form of sulphuric acid. This would explain the destructive action of bleaching powder upon the sulphide dyestuffs, as also the ease with which sulphuretted hydrogen is produced by warming them with a reducing agent such as stannous chloride and hydrochloric acid. Reliable analytical data upon free sulphide dyestuffs are apparently non-existent, but the bisulphite compound of a blue dyestuff of this class, purified by re-crystallisation, gave upon analysis, figures which corresponded to a formula, $C_{14}H_{12}N_2S_3O_4$, for the dyestuff. The molecule therefore contains just three atoms of sulphur, and there is nothing in opposition to the assumption that the dyestuff has been produced by the addition of thio-ozone, and subsequent oxidation. Further conclusions drawn by the author are:—(1) All, or nearly all well defined simple polysulphides are thio-ozonates of the general formula,



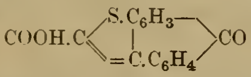
(2) Ultramarines are not thio-ozonates but thio-ozonides. (3) Melted sulphur, at about 160° C., contains besides thio-ozone, S_3, an amorphous, viscous polymeride $[(S_8)x]$ of octatomic sulphur. (4) An octatomic form of oxygen, with ring configuration similar to that of sulphur probably exists. (5) Vulcanised indiarubber is mainly a "semi-solid" solution of polymerised octatomic sulphur, $(S_8)x$, in polymerised dimethylcyclooctadiëne $[C_8H_{10}(CH_3)_2]x$ and its thio-ozonide. Vulcanite is mainly a polythio-ozonide of indiarubber.—F. M.

Dyestuff obtained by melting the hydrochloride of Meldola's base with resorcinol; Improved method of preparing the ——. L. Paul. Z. angew. Chem., 1908, 21, 1844—1845.

TWENTY to 25 c.c. of glycerol, previously heated to 250° C. to remove water, are added to a mixture of 2·6 grms. of Meldola's base, 1·4 grms. of aniline salt, and 1·5 grms. of resorcinol, and the whole well agitated: the red product is dissolved in dilute hydrochloric acid, filtered, and the filtrate precipitated with salt solution. The hydrochloride is now dissolved in very dilute hydrochloric acid; on standing, "Rx$_2$" separates out, from which 0·3 grm. of a dyestuff was obtained by extraction with 30 to 50 per cent. acetic acid. The hydrochloric acid solution (base No. 2) is treated with a slight excess of ammonia, filtered, washed, and the solution heated. On adding 60 c.c. of salt solution, 1·25 grms. of base No. 2 crystallises out. Aqueous solutions of the base dye unmordanted cotton and silk bluish-red in the cold; wool is also dyed, but only feebly. The dyeings are fast to soaping, but not to light. Base No. 2 can be diazotised and combined to form azo dyestuffs. A base of a yellower shade is obtained in a similar manner from 1 grm. of the neutral hydrochloride of Meldola's base, 1·5 grms. of resorcinol, 4—6 drops of aniline, and 20 c.c. of glycerol. (See this J., 1904, 863.)—T. F. B.

Anthraquinone; Mercaptans of ——. L. Gattermann. Chem.-Zeit., 1908, 32, 810.

Thiocyanates of the anthraquinone series were prepared by the action of copper and alkali thiocyanate on diazo-derivatives obtained from aminoanthraquinones. These thiocyanates were readily converted by the action of alkali hydroxide into the corresponding mercaptans. The latter compounds are similar in character to the thiophenols and are distinguished by the characteristic colours of their alkali salts. They are readily oxidised to disulphides. 1-Thioanthraquinone, dithioquinizarin, and dithioanthrarufin were all obtained by the above-mentioned reactions. Thiopurpurin (OH : OH : SH = 1 : 2 : 4) was obtained from aminoalizarin, and yielded by oxidation, alizarin disulphide, which is a mordant dyestuff, giving dyeings which differ little in shade from those obtained with alizarin itself. 1-Thioanthraquinones yield anthraquinonylthioglycollic acids with chloracetic acid, and these readily lose a molecule of water forming compounds of the formula:—



$$\mathrm{COOH.C}\begin{cases}\mathrm{S.C_6H_3}—\\ \quad\ \ | \\ \mathrm{=C.C_6H_4}\end{cases}\!\!\!\mathrm{CO}$$

The thioanthraquinones are said to be useful as raw materials for the manufacture of vat-dyestuffs.—E. F.

Dyestuff solutions; Classification of ——. H. Freundlich and W. Neumann. Z. Chem. Ind. Kolloide, 1908, 3, 80—83.

Solutions of dyestuffs can be divided into three main classes, namely true solutions, semi-colloidal solutions, and colloidal solutions proper. A distinguishing characteristic of solutions of true colloidal character is non-diffusion through parchment-paper. The appearance under the ultramicroscope is also characteristic, for solutions which are resolvable by this means may with certainty be considered to be colloidal. The following classification has been arrived at mainly from the above criteria. True solutions in water are formed by:—Chrysoidine, Bismarck Brown, Alizarin Red, Auramine, Pyronine, Eosine, Thionine, Methylene-Blue, Safranine, Magdala Red, Picric acid, and Rhodamine. Semi-colloidal solutions (showing marked anomalies) are formed with water by:—Methyl Violet, Crystal Violet, Fuchsin (Magenta), New Fuchsin, Diamond Fuchsin, Capri Blue, Nile Blue, and Neutral Red. True colloidal solutions are formed in water by:—Congo Red, Congo Fast Blue, Benzopurpurin, Azo Blue, Benzoazurin, Diamine Pure Blue, Aniline Blue, Alkali Blue, Induline, and Night Blue. The true colloidal solutions can again be divided into two sub-groups. Those of the first class, typified by a colloidal solution of arsenious sulphide, have comparatively little effect on the physical properties of the solvent, the freezing point and surface tension of which, for instance, remain unaltered. Such solutions also show the peculiarity that they are precipitated by the addition of salts at small concentrations, which are influenced greatly by considerations of valency. Colloidal solutions of this class are known as "suspension colloids" or "suspensoids." They may also be called "lyophobic colloids." In the second sub-group, the "emulsion-colloids" or "lyophilic colloids," the properties of the solvent are considerably influenced. The internal friction, surface tension, and other properties of the liquid show great changes even when only a small proportion of matter is in colloidal solution. Colloids of this class are only precipitated by considerable amounts of salts. Solutions of gelatin or albumin are typical of this class, which is much more closely related to that of the true solutions than are the suspension-colloids. By utilising the fact that suspension-colloids have practically the same surface tension in solution as the pure solvent, whilst solutions of emulsion-colloids often show a lower surface tension, the authors have determined to which sub-group the aqueous solutions of a number of dyestuffs belong, as the result of comparative measurements of the surface tension in each case, by the rise of the solutions in capillary glass tubes. They thus arrive at the conclusion that aqueous solutions of Night Blue contain that substance as an emulsion-colloid, the surface tension being considerably lowered, whilst Congo Red acts as a suspension-colloid with water and scarcely alters the surface tension when in solution. Alcoholic solutions of various dyestuffs were examined in the same manner; in no case was a depression of the surface tension observed.—E. F.

Sulphoricinoleic acid; Decomposition of —— *by dilute acids.* P. Wagner. *See* XII.

Patents.

Sulphurised dyestuffs. J. Hirschberger, D. Maron, and Levinstein, Ltd., Manchester. Eng. Pat. 17,749, Aug. 3, 1907.

Hydroxylated azines or their alkyl, aryl, carboxylic, sulphonic or sulphurised derivatives, or oxy-derivatives of substances containing an azine group, are heated with alkali polysulphides in the presence of nickel or cobalt or a compound of either or of mixtures of nickel and cobalt or their compounds, whereby dyestuffs are obtained which dye cotton from a sulphide bath in red shades. *Example.*—50 parts of sulphur are dissolved with 110 parts of crystallised sodium sulphide and 66 parts of water; then 20 parts of aminohydroxyphenazine are introduced and finally 8 parts of crystallised cobalt sulphate dissolved in 16 parts of water. The mass is heated to 120° C. for about 15 hours. In a similar example, ethylsafraninone and nickel sulphate are used.—J. C. C.

Anthracene series; Production of compounds and colouring matters of the ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 19,172, Aug. 26, 1907.

When a 4-halogenated anthrapyridone compound containing a methyl, halogen or other group in position 2, is condensed with an aromatic amine of the benzene or naphthalene series in the presence of sodium acetate, 4-arylaminoanthrapyridone compounds are produced. Examples are given of the condensation of 4-chloro-2-methyl- and 2 : 4-dichloroanthrapyridone with *p*-toluidine. On sulphonation these compounds furnish dyestuffs giving fast red shades on wool.—J. C. C.

Indigo; Reduction of —— *and similar colouring matters.* J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 11,141, May 22, 1908.

The difficulty of preparing pure Indigo-white is overcome by reducing indigo in the presence of alcohol by means of zinc dust and sulphurous acid or by means of a bisulphide or a hydrosulphite with or without the addition of sulphurous acid, the alcohol used being in sufficient strength and amount to dissolve the Indigo-white. In this way the solution of Indigo-white can be separated by filtration from the undissolved solids and, by evaporation in a vacuum, a practically pure Indigo-white is obtained. The process can be applied to the reduction of Tolylindigo, Bromo-indigo, and Thioindigo. —J. C. C.

Leuco derivatives and dyestuffs therefrom ; New series of ——. P. Lemoult. Fr. Pat. 388.187, May 23, 1907.

NEW dyestuffs are obtained by the action of oxidising agents and of nitrites on certain leuco derivatives possessing an ethylenic double linkage between two of their carbon atoms. All such leuco compounds are claimed "when they can be obtained directly or indirectly by classical or well known reactions employed in the chemistry or technology of dyestuffs." When magnesium-halogen-derivatives of organic radicals, containing a CH_2 group adjacent to the magnesium atom, of the formula, $R.CH_2.MgX$ (where R represents an organic residue and X a halogen atom), act on a ketone or aldehyde in solution in ether, dimethylaniline or other solvent, the final product of the reaction is a hydrocarbon of the general formula, $R.CH : CR_1R_2$. These compounds are leuco-derivatives of the character claimed in this patent. Thus if the magnesium-halogen-derivatives of methyl, ethyl, or benzyl, respectively are condensed with Michler's ketone, the three following compounds are obtained: $CH_2{:}CD_2$, $CH_3{:}CH{:}CD_2$, and $C_6H_5.CH{:}CD_2$, where D represents the residue, $C_6H_5.N(CH_3)_2$. These compounds are of very basic character, being soluble in dilute acetic acid of more than a certain strength, Their solutions in acids, such as hydrochloric, sulphuric, or acetic acid, are strongly coloured by oxidising agents, becoming pure green in the first case, bright blue in the second, and greenish-blue in the third. The products of oxidation so obtained dye tannin-mordanted cotton in very even shades, yielding dyeings of similar intensity to those obtained with the same quantities of ordinary basic dyestuffs, such as Malachite Green or Methylene Blue. *Example.*—One mol. proportion of ethyl iodide diluted with dry ether is treated with one atomic proportion of pure magnesium ribbon to convert it into the magnesium derivative. One mol. proportion of Michler's ketone, carefully dried, is then placed in an extraction apparatus under a reflux condenser connected with the flask containing the ethereal preparation of the magnesium compound, and this latter is then heated. The ketone is gradually dissolved by the condensed ether and carried down to the magnesium compound below. The reaction commences at once, as can be seen by the formation of yellow drops which dissolve in the ether and are gradually deposited as a yellowish-brown paste. After all the ketone has disappeared, the heating is continued for some hours and the ether distilled off. The intermediate organo-metallic compound which is left is then carefully acted on with water, an abundant precipitate being formed. The whole is dissolved in hydrochloric acid, and ammonium chloride and ammonia added; the magnesium salts remain in solution and a crystalline precipitate of the required leuco-base, mixed with an excess of Michler's ketone, is obtained. These are separated by fractional precipitation, the basic properties of the leuco-base being much more marked than those of the ketone. The dried leuco-base is purified by one or two recrystallisations from alcohol. To form the dyestuff, it is dissolved in a mineral or organic acid, diluted with cold water, and an oxidising solution, such as bichromate or permanganate, or an oxidising paste of a peroxide, such as lead or manganese peroxide, is added in the ordinary manner. The best oxidising agent for leuco compounds of this series, however, appears to be sodium nitrite or other nitrites. As the nitrite solution is added, the colour of the acid liquid gradually becomes an extremely bright blue. As other oxidising agents produce the same coloration, the action of the nitrite is presumably of an oxidising nature, although nitrites do not convert solutions of Leucomalachite Green into the dyestuff. Other methods of obtaining leuco-compounds of the type claimed in the patent are, for example, by the action of bromacetaldehyde on two molecules of dimethylaniline and subsequent elimination of a molecule of hydrobromic acid:—$CH_2Br.CHD_2 \rightarrow CH_2 : CD_2$; or again an aldehyde in which the aldehyde group is attached to an aliphatic chain, such as phenylacetaldehyde, is condensed with two mols. of a tertiary cyclic amine, such as dimethylaniline, yielding the compound, $C_6H_5.CH_2.CH[C_6H_4N(C_2H_5)_2]_2$, which is not in itself a leuco-compound, but loses to atoms of hydrogen on suitable oxidation, giving a compound containing an ethylenic bond adjoining the central carbon atom.—E. F.

Dyestuffs of the triphenylmethane series ; Process for preparing blue, chrome ——. J. R. Geigy. Ger. Pats. 199,943, June 15, 1907, and 199,944, May 28, 1907. Additions to Ger. Pat. 189,938, Sept. 29, 1906. (See this J., 1908, 801.)

IN place of the monosubstituted benzaldehydes, mentioned in the original patent, the following may be employed:—2.6-Dichlorobenzaldehyde or its 3-nitro- or 3-sulpho-derivative; 2.3.6- or 2.4.6-trichlorobenzaldehyde; 2-sulpho-6-chlorobenzaldehyde, 2.6-disulphobenzaldehyde, 2.4-disulpho-6-chlorobenzaldehyde, 2.4.6-trichloro-3-hydroxybenzaldehyde, 2.4.6-tribromo-3-hydroxybenzaldehyde, tetrabromodihydro-*m*-hydroxybenzaldehyde, 2.4.5.6-tetrachloro-3-hydroxybenzaldehyde, aldehydotrichloroquinonedichloride. The oxidation of the leuco-compounds can be carried out by means of nitric acid or aromatic nitro-compounds (*e.g.*, nitrohydrocarbons or their sulphonic acids, or nitrophenols) in place of nitrosylsulphuric acid.—T. F. B.

Vat dyestuffs of the anthracene series ; Process for preparing ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 200,014, June 12, 1907. Addition to Ger. Pat. 194,253, Nov. 13, 1906.

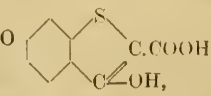
AMINOBENZANTHRONES are condensed with halogenated anthraquinones or halogenated benzanthrones with aminoanthraquinones. The dyestuffs dye cotton yellow to brown shades.—T. F. B.

[*Azo*] *Dyestuffs for cotton ; Process for preparing blue* ——. Chem. Fabr. Griesheim-Elektron. Ger. Pat. 200,054, Feb. 24, 1907. Addition to Ger. Pat. 196,924, Oct. 20, 1906.

THE naphtholdisulphonic acids mentioned in the principal patent (see U.S. Pat. 860,221; this J., 1907, 960), are replaced by the following naphtholdisulphonic acids:—$OH : SO_3H : SO_3H = 1.4.6$, 1.4.7, 1.4.8, 1.5.7, 2.3.6, 2.3.7, and 2.5.7.—T. F. B.

Dihydroxynaphthenecarboxylic acid ; Preparation of a ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 200,202, June 26, 1907.

BY heating 5-sulphophenyl-1-thioglycol-2-carboxylic acid with alkali hydroxides, a dihydroxythionaphthenecarboxylic acid,



is obtained.—T. F. B.

Vat [*thioindigo*] *dyestuff ; Preparation of a red* ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 200,351, July 20, 1907.

BY treating dihydroxythionaphthenecarboxylic acid (see preceding abstract) with oxidising agents, yellowish-red vat dyestuffs are obtained, the dyeings from which are highly sensitive to acids. By acting on the solutions of these dyestuffs in concentrated sulphuric acid with formaldehyde, dyestuffs are obtained which give yellowish-red dyeings on cotton and wool, very fast to acids and alkalis.—T. F. B.

Wool [azo] dyestuffs; Preparation of blue ——. Kalle und Co. Ger. Pat. 200,601, May 9, 1907.

Benzoazoles, which are not substituted on a nitrogen atom, are nitrated in sulphuric acid, and reduced, and the amino-compounds diazotised and combined with chromotrope acid in neutral or slightly alkaline solution. The resulting dyestuffs give blue shades on wool from acid baths.—T. F. B.

Vat [thioindigo] dyestuffs and intermediate products; Manufacture of ——. O. Imray, London. From Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. Eng. Pat. 16,584, July 19, 1907.

See U.S. Pats. 872,085 and 872,086 of 1907; this J., 1908, 116.—T. F. B.

Vat [thioindigo] dyestuffs; Manufacture of red ——. O. Imray, London. From Soc. of Chem. Ind. in Basle, Switzerland. Eng. Pat. 19,158, Aug. 26, 1907.

See U.S. Pat. 887,609 of 1908; this J., 1908, 622.—T.F.B.

Gallocyanine dyestuff. C. Heidenreich and E. Martz, Vohwinkel, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 895,635, Aug. 11, 1908.

See Fr. Pat. 383,190 of 1907; this J., 1908, 329.—T. F. B.

Sulphur [sulphide] dyestuff; Yellowish-brown ——. B. Jaeckel, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 896,916, Aug. 25, 1908.

See Fr. Pat. 388,539 of 1908; this J., 1908, 895.—T. F. B.

Azo dyestuffs and intermediate products therefor; Manufacture of ——. Farbenfabr. vorm. F. Bayer und Co. First Addition, dated March 26, 1908, to Fr. Pat. 380,540, Aug. 3, 1907. Under Int. Conv., June 29, 1907.

See Eng. Pat. 14,248 of 1907; this J., 1908, 800.—T. F. B.

Dyestuff derived from quinoline: Production of a new ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 389,035, April 8, 1908. Under Int. Conv., April 17, 1907.

See U.S. Pat. 890,588 of 1908; this J., 1908, 744.—T.F.B

Indophenol-like condensation products; Process of making ——. W. Schlenk, Munich, Assignor to Chem. Fabr. vorm. Weiler-ter Meer, Uerdingen, Germany. U.S. Pat. 895,689, Aug. 11, 1908.

See Fr. Pat. 378,655 of 1907; this J., 1907, 1135.—T. F. B.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

Cotton in presence of kapok; Detection and determination of ——. M. Greshoff. Pharm. Weekblad, 1908, 45, 867—874. Chem. Zentr., 1908, 2, 642.

Kapok, a fibre from the fruits of *Eriodendron anfractuosum*, is used extensively as a filling material for cushions, mattresses, and especially for life-belts. Adulteration of kapok with cotton may be detected by microscopical examination and by the behaviour of the fibre to chemical reagents. With Schultze's solution of zinc chloride and iodine, cotton gives a reddish-blue, and kapok a yellow coloration. If the fibre be left for 1 hour in contact with a dilute alcoholic solution of Magenta (0·01 part of Magenta, 30 of alcohol, and 30 of water) at the ordinary temperature, and then washed with water, cotton is scarcely coloured, but kapok is dyed a vivid red shade. For the determination of cotton in presence of kapok, Tollens' method is recommended. The material is distilled with dilute hydrochloric acid, and the furfural in the distillate precipitated with phloroglucinol, in order to ascertain the amount of pentosans in the fibre. Kapok contains 23—25 per cent. and cotton at the most 3 per cent. of pentosans, so that from the amount of pentosans found, the approximate relative proportions of kapok and cotton in the material may be easily calculated. (See also this J., 1893, 923; 1894, 147.)—A. S.

Acetylcellulose. E. Knoevenagel. Chem.-Zeit., 1908, **32**, 810.

When cellulose is acetylated in presence of sulphuric acid, solutions of acetylcellulose are obtained which, after days or weeks, according to the quantities of reagents employed, undergo a considerable change, characterised externally by the fact that the solutions which are first viscous become mobile. If, on the other hand, the acetylation is conducted in presence of inorganic salts, especially of sulphites and sulphates, for instance of ferrous sulphate, viscous solutions of very great stability, which can be spun into threads, are obtained. The fibres of acetylcellulose can be dyed in the usual manner, after suitable preliminary treatment, such as softening with alcohol. —E. F.

Aniline Black; Application of the newer oxidising agents in the production of ——. F. Erban. Chem.-Zeit., 1908, 32, 829—830.

The oxidising agents of comparatively recent introduction, *viz.*, peroxides, persulphates, percarbonates, and perborates of the alkali metals, being free from halogen constituents, might be expected to give useful results in the production of Aniline Black on the fibre. The behaviour of the *peroxides* in this respect has been described by Beltzer (Färber-Zeit., 1903, 51), who pointed out that their action is too rapid, and the blacks produced are therefore bare in appearance and rub off badly. This is also true, though in a less degree, of the *persulphates*; an aniline salt solution on the addition of a persulphate turns dark green and precipitation takes place. Persulphates might, however, in certain cases advantageously replace bichromates where a treatment with the latter after ageing or steaming is involved. The *percarbonates* decompose too readily and are too strongly alkaline to be of use. The author therefore confined his experiments to the *perborates*. Although excellent results were obtained, especially as regards the stability of the padding solutions, it was not found possible to produce a satisfactory black on the fibre: neither by ageing in air nor by steaming, could the oxidation be completed, and an increase of the amount of perborate in the padding mixture acted merely as an increase of alkali, and retarded the formation of the black. It is probable that the above oxidising agents might be usefully employed in the oxidation of aromatic bases other than aniline, and the persulphates might serve as a substitute for hydrogen peroxide in the production of blacks and browns on skins and furs by the oxidation of paraphenylenediamine, etc.—R. B. B.

Sulphoricinoleic acid; Decomposition of —— by dilute acids. P. Wagner. *See* XII.

Patents.

Nitrocellulose; Process for the manufacture of artificial silk and of explosives from a special form of ——. E. Berl. Ger. Pat. 199,885, April 5, 1907.

In the manufacture of threads of nitrocellulose, it is important to use relatively mobile solutions rich in nitrocellulose, in order to be able to force the solution through fine openings with the smallest possible pressure and to obtain uniform filaments. It is stated that highly concentrated solutions of nitrocellulose, of relatively low viscosity, can be prepared, if the dried cellulose, before nitration, be heated to a high temperature, for a long time, in presence of inert gases free from oxygen (carbon dioxide, nitrogen, water-gas, cooled fire gases, superheated steam). Under these circumstances, the cellulose is depolymerised to a degree varying with the temperature and duration of heating. It is stated that with cellulose treated in this manner, the cost of manufacture of smokeless powder is lessened, owing to the increased yield of nitrated product, the possibility of repeated regeneration of the nitrating mixture, and smaller consumption of solvents.—A. S.

Bleaching textile materials ; Process for ——. C. Jaloux. First Addition, dated Mar. 9, 1908, to Fr. Pat. 382,144, Sept. 23, 1907 (this J., 1908, 221).

THE bleaching bath mentioned in the original patent contains sodium silicate, barium peroxide, hydrogen peroxide, and glycerin. The present addition states that the glycerin is unnecessary and that the hydrogen peroxide may be very much reduced in quantity or even omitted altogether. Instead of hydrochloric acid, sulphuric, oxalic, or other acid may be used in the second bath, and "blueing" may be carried out in either the first or second bath.—F. M.

Dyeing apparatus. L. Mascelli. First Addition, dated Feb. 26, 1908, to Fr. Pat. 384,798, Dec. 6, 1907 (this J., 1908, 499).

THE addition describes means for circulating the dye-liquor by means of steam or compressed air. The plant consists of three kiers, connected by a system of pipes (with valves) with each other, and with a reservoir in which the dye-liquor is prepared. Piece goods are wound upon a perforated cylinder which fits into a false bottom in the dyeing kier, and cops, cheeses, loose wool, etc., are supported between suitable perforated plates. The other two kiers serve as montejus, the dye-liquor being forced from one, through the material to be dyed, into the other and back again, until the dyeing is completed.—F. M.

Animal tissue ; Method of treating —— *for the production of fibres.* F. Baum, Potsdam, Germany. Eng. Pat. 16,994, Jan. 24, 1908.

SEE Addition to Fr. Pat. 380,302 of 1907 ; this J., 1908, 459.—T. F. B.

Silk ; Consolidated natural —— *and process of making the same.* P. Schmid, Basle, Switzerland. U.S. Pat. 897,159, Aug. 25, 1908.

SEE Fr. Pat. 370,809 of 1905 ; this J., 1907, 252.—T. F. B.

Finish for cloth and other materials ; Manufacture of a ——. C. A. Day, London. From Erste Triester Reisschäl-Fabriks A.-G., Trieste, Austria. Eng. Pat. 4719, March 2, 1908.

SEE Fr. Pat. 387,736 of 1908 ; this J., 1908, 854.—T. F. B.

Drying apparatus for fabrics and the like ; Suction ——. J. Wülfing und Sohn, and A. Specht, Lennep, Germany. Eng. Pat. 28,726, Dec. 31, 1907.

SEE Fr. Pat. 385,860 of 1907 ; this J., 1908, 625.—T. F. B.

Lyes containing organic matter ; Regenerating ——. Fr. Pat. 388,555. *See* VII.

ERRATA.

This J., 1908, page 852, col. 2, line 37 from bottom, *for* "moulded" *read* "mounted."

This J., 1908, page 853, col. 2, line 22 from bottom, *for* "falls" *read* "fills."

This J., 1908, page 854, col. 1, line 11 from bottom, *for* "Ersk" *read* "Erste."

VII.—ACIDS, ALKALIS, AND SALTS, AND NON-METALLIC ELEMENTS.

Colloidal-amorphous formations of readily crystallisable and soluble salts of the alkaline-earth metals ; Preparation of so-called ——. P. P. von Weimarn. Z. Chem. Ind. Kolloide, 1908, **3**, 89—91.

BY reason of his previously published theoretical views on the nature and formation of colloidal systems, the author arrives at the conclusion that these are most readily formed and also most stable, when produced in a medium in which the resulting product is insoluble ; under such conditions he considers that the preparation of colloidal precipitates should be practicable over a wide range of concentration. These views are borne out by the experimental data presented in the paper. Thiocyanates of the alkali and alkaline-earth metals were dissolved in propyl-, butyl-, and amyl-alcohols in which liquids the mineral salts of the metals in question are practically insoluble, as shown by the data given. To still further reduce the solubility, benzene, toluene, and xylene were added to the propyl and butyl alcohol and ethyl-ether to the amyl alcohol. The best results were obtained by the use of a mixture of 50 to 75 c.c. of ether and 50 to 25 c.c. of amyl alcohol. These thiocyanate solutions were acted upon by aqueous or alcoholic solutions of the mineral acids, alcoholic solutions by preference. The following salts were thus obtained in a whole series of conditions ranging from a plainly micro-crystalline magma to a gelatinous mass :—potassium, sodium, ammonium, barium, strontium, and calcium chlorides, potassium, sodium, ammonium, barium, strontium, and calcium bromides, potassium, sodium, ammonium, barium, strontium, and calcium nitrates, and potassium, sodium, and ammonium sulphates. Barium, strontium, and calcium sulphates are obtainable as gelatinous precipitates from all alcohols, including methyl alcohol, and the same remark applies to the corresponding phosphates and to all other salts which are only very slightly soluble in water and still less soluble in alcohol. The gelatinous chlorides, and bromides of potassium, sodium, and ammonium, the preparation of which is described in this paper, are said to be very similar to the precipitates of silver chloride and bromide obtained from aqueous solutions in the ordinary manner.—E. F.

Air ; Combustion of —— *in the electric flame arc.* A. Grau and F. Russ. *See* XIA.

Moist nitrogen and moist nitric oxide ; Action of the silent electric discharge upon ——. W. Löb. *See* XIA.

Salt and bromine production of the United States. U.S. Geol. Survey. [T.R.]

IN 1907 the quantity of salt produced in the United States was 29,704,128 barrels of 280 pounds, valued at $7,439,551 ; in 1906 the production reported was 28,172,380 barrels, valued at $6,658,350. These quantities represent an output of 3,944,133 short tons in 1906, and 4,158,578 short tons in 1907. The following figures show the salt production of the United States by grades during 1907 :—Table and dairy, 3,537,157 barrels ; common fine, 7,684,638 ; common coarse, 2,053,054 ; packers, 422,324 ; solar, 862,929 ; rock, 5,809,328 ; other grades, 110,227 ; brine, 9,222,471.

The bromine industry in the United States is centred in Michigan, Ohio, Pennsylvania and West Virginia, named according to their relative importance, and the production from these four States during the past five years is given in the following table :—

	Pounds.	
1903	598,500	$167,580
1904	897,100	269,130
1905	1,192,758	178,914
1906	1,283,250	165,204
1907	1,379,496	195,281

Michigan furnished the greater part of the output of bromine in 1907. The brines in that State containing bromine in commercial quantities come from the Marshall sandstone, in the "Upper" Carboniferous, and contain from 0·1 to 0·3 per cent. of bromine. At Midland and Mount Pleasant, where large quantities of bromine and bromide are made, the bromine is liberated by means of the electric current; it is then blown out of the solution by air and absorbed by caustic soda.

Sulphur and pyrites industry of the United States. U.S. Geol. Survey. [T.R.]

The production of sulphur in the United States during the past four years is shown in the following table :—

	Long tons.	Value.
1904	127,292	$2,663,760
1905	181,677	3,706,560
1906	294,153	5,096,678
1907	293,106	5,142,850

The decrease is due to decreased output in Utah, Nevada, and Wyoming. The production in Louisiana increased over that of 1906, whilst Colorado again became a producer of sulphur.

The imports of sulphur in 1907 were valued at 420,175 dollars, against 1,333,580 dollars in 1906. Most of the sulphur was imported from Japan. The exports of sulphur amounted to 35,925 tons, value 734,749 dollars, an increase of 13,688 tons over 1906; most of the sulphur went to France.

Pyrites.—The production of pyrites in the United States in 1907 was 247,387 tons, valued at 794,949 dollars; these figures are less than those of 1906. Over one half of the pyrites was produced in Virginia.

Bauxite production of the United States. U.S. Geol. Survey. [T.R.]

The production of bauxite in the United States in 1907 amounted to 97,776 long tons, valued at $480,330. This is an increase of 22,444 tons, and $112,019 over the production of the year before. The average price of the material at the mines was about $4.91 per long ton, an advance of but 2 cents over the returns for 1906.

The consumption in the United States in 1907 was 122,842 long tons, valued at $573,538, of which 25,066 tons, $93,208, were imported. In 1906 the consumption was 93,141 tons, valued at $431,532, of which imports represented 17,809 tons, $63,221.

The world's production of bauxite amounted to 197,912 long tons, valued at $611,537 in 1906, of which the United States supplied 75,332 tons, $368,311; France, 115,926 tons, $229,952; and Great Britain, 6,654 tons, $13,274.

Patents.

Sulphuric anhydride and sulphuric acid; Manufacture of —— by means of alkaline-earth or alkali sulphates, with the simultaneous production of glass. H. Hilbert. Fr. Pat. 389,032, April 8, 1908.

Instead of using lime or calcium carbonate in the manufacture of glass, it is proposed to employ calcium or barium sulphates, and to condense the sulphuric anhydride liberated during the process of fusion. A mixture of gypsum, sand, and alkali sulphate is completely decomposed in this manner, all the sulphur present being evolved as sulphuric anhydride; about 1400° C. is a suitable temperature to employ. Many waste sulphates may be thus utilised, and glass obtained as a valuable by-product.—F. Sodn.

Sulphuric acid; Manufacture of —— by the chamber process by use of small chambers and towers. O. Niedenführ. Ger. Pat. 200,820, Dec. 13, 1906.

The system proposed comprises a number of small chambers around which are grouped the Glover-, absorption-, or reaction-towers. The burner gases may be passed either through several towers in succession, or simultaneously through a number of towers, before being led into the chambers. It is claimed that by this arrangement the velocity of the gases towards the centre of the system is lessened and thereby intimate admixture of the components is effected; loss of heat by radiation from the chambers is lessened; excessive rise of temperature in the chambers is prevented.—A. S.

Oxalic acid; Manufacture of ——. J. and F. L. McDougall, Greenwich. Eng. Pat. 17,971, Aug. 7, 1907.

For the manufacture of oxalic acid, the potassium salt is first obtained, and this is treated with sulphuric acid and a suitable sulphate, such as aluminium sulphate, so as to produce an alum which is then separated by crystallisation from the liberated oxalic acid, alcohol being added if necessary. Oxalates of the other alkali metals or ammonium may replace the potassium salt in the process.—F. Sodn.

Tungstic acid; Preparation of —— from minerals, by treatment with caustic alkalis, under pressure. A. Hempel. Fr. Pat. 389,040, April 8, 1908. Under Int. Conv., June 11, 1907.

Wolfram, or other mineral containing tungsten, is decomposed by heating, under pressure, with a concentrated solution of potassium hydroxide, lime or baryta being added to form insoluble compounds with the impurities present. The solution of alkali tungstate is then fractionally precipitated by acid, in order to separate the impurities remaining, before throwing down the tungstic acid. Or, the tungstic acid and impurities may be precipitated together, and the crude acid fractionally re-dissolved by caustic alkali. The process is stated to be economical and to furnish a very pure acid. Moreover, there is no necessity to powder the mineral before treatment, and its decomposition and solution are effected in one operation.—F. Sodn.

[*Sodium hydroxide and sodium carbonate*] *Lyes containing organic matter; Process for regenerating ——.* E. F. G. E. Locoge. Fr. Pat. 388,555, Mar. 27, 1908.

The patent is for the regeneration of sodium hydroxide or sodium carbonate lyes, such as are used in the manufacture of paper, artificial silk, mercerised cotton, etc., and which become contaminated with various organic impurities. Separation of these impurities is effected by dialysis, preferably carried out at about 90° C., the lyes being previously concentrated to about 25° B.—F. Sodn.

Bauxite or aluminous material; Treatment of ——. W. Pochin and J. H. Richardson, Manchester. Eng. Pat. 25,228, Nov. 14, 1907.

Bauxite or other aluminous material is mixed with sulphuric acid or nitre-cake (sodium bisulphate), and the mass is dried by heating in a suitable furnace, and then formed into cakes or slabs (containing a high percentage of alumina) by means of a briquetting machine.—A. S.

Oxides of nitrogen; Process for concentrating —— when mixed with much air. Elektrochem. Werke G.m.b.H. Fr. Pat. 388,305, Mar. 19, 1908. Under Int. Conv., April 19, 1907.

Air, mixed with small proportions of the oxides of nitrogen, is submitted to the action of feebly basic oxides of such metals as zinc, copper, magnesium, or lead, which furnish nitrates and nitrites readily decomposed by heat. The salts, thus obtained, are heated in iron retorts at 500° C., or, under reduced pressure, at a lower temperature, so that the oxides of nitrogen are evolved in a concentrated form. Absorption, in this process, is said to be rapid and nearly complete, with apparatus of comparatively small dimensions.—F. Sodn.

Oxides of nitrogen ; Process for the preparation of —— from gases containing nitrogen and oxygen. M. Platsch. Ger. Pat. 200,138, March 8, 1906.

In the electrical preparation of oxides of nitrogen from gases containing nitrogen and oxygen, with cooling of the reaction-products, solid substances, preferably those capable of evolving oxygen, *e.g.*, peroxides, are introduced, in the form of dust, into the gases, as these leave the electric arc. These substances are capable of absorbing a large quantity of heat, and thus strongly cool the gases, whilst the oxygen evolved from them increases the yield of oxides of nitrogen.—A. S.

Nitrites ; Preparation of —— from nitrates, by means of formates. A. Hempel. Fr. Pat. 388,563, Mar. 27, 1908. Under Int. Conv., Sept. 10, 1907.

A mixture of nitrate and formate is heated, *in vacuo*, at about 300° C. The nitrate is thus converted quantitatively into nitrite and the formate oxidised to carbonate. It is preferable to employ the formate of such a metal as calcium, of which the carbonate is insoluble.—F. Sodn.

Barium and strontium nitrates ; Process for the manufacture of ——. K. Puls, K. Krug, and Norddeutsche chem. Fabr. Ger. Pat. 198,861, Aug. 11,

Finely-powdered barium carbonate (witherite) or strontium carbonate (strontianite) is heated with an aqueous solution of calcium nitrate under steam pressure and with agitation, the calcium carbonate produced is filtered off, and the solution of barium or strontium nitrate is evaporated.—A. S.

Salt solutions ; Apparatus for the continuous evaporation of ——. E. Cantenot. Ger. Pat. 200,199, May 7, 1907.

The apparatus consists essentially of a number of annular evaporating chambers, with double bottoms, arranged directly one above the other. Each chamber is provided with a group of annular heating tubes, the tubes in the lowest chamber being fed with fresh steam, whilst those in the other chambers communicate with the respective hollow spaces of the double bottoms, and are supplied from these with steam from the next lower chamber. In this way the fall of temperature between adjacent chambers is diminished.—A. S.

Potassium-sodium sulphate and potassium-magnesium sulphate ; Process for obtaining ——. Dr. Wolters Phosphat, G. m. b. H. Ger. Pat. 200,333, Aug. 26, 1905.

The object of the process is the preparation of potassium-sodium sulphate of the composition, $3K_2SO_4.Na_2SO_4$, together with small quantities of potassium-magnesium sulphate, from crude potassium salts. The solution of the crude salts is treated with the calculated quantity of the constituents necessary for the formation of the potassium-sodium sulphate, and with at the most 4·3 equivalents of sulphuric acid for every 3 equivalents of potassium present, and evaporated to the point of crystallisation, the crystals being separated whilst the solution is still hot.—A. S.

Sulphuric acid and sulphuric anhydride ; Manufacture of —— by the contact process. A. C. Matignon, R. E. M. Trannoy, E. Urbain, A. Feige, and A. Verley, Paris. Eng. Pat. 8102, April 11, 1908. Under Int. Conv., April 12, 1907.

See Fr. Pat. 376,629 of 1907 ; this J., 1907, 1008.—T. F. B.

Aluminic-sodic chloride, ferric chloride, and phosphatic fertilisers from aluminic-ferric and calcic-aluminic-ferric phosphates ; Process of manufacturing ——. H. Schröder, Hedwigsburg, Germany. Eng. Pat. 23,634, Oct. 25, 1907.

See Ger. Pat. 192,591 of 1906 ; this J., 1908, 282.—T. F. B.

Phosphates ; Process of and apparatus for decomposing ground ——. F. Krupp Akt.-Ges. Grusonwerk, Magdeburg-Buckau, Germany. Eng. Pat. 6259, March 20, 1908. Under Int. Conv., May 4, 1907.

See Fr. Pat. 387,739 of 1908 ; this J., 1908, 867.—T. F. B.

Nitrogen peroxide ; Process for extracting —— from mixtures of air with small quantities of nitric oxide. Allgem. Elektricitäts Ges., Berlin. Eng. Pat. 9233, April 28, 1908. Under Int. Conv., May 13, 1907.

See Ger. Pat. 199,561 ; this J., 1908, 856.—F. Sodn.

Ammonia into oxides of nitrogen ; Catalytic apparatus for converting ——. W. Ostwald. Fr. Pat. 389,059, April 9, 1908.

See Eng. Pat. 7909 of 1908 ; this J., 1908, 898.—T. F. B.

Zinc hydrosulphite ; Process of making stable ——. M. Bazlen and T. Wohlfahrt, Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 896,610, Aug. 18, 1908.

See Eng. Pat. 3811 of 1907 ; this J., 1907, 823.—T. F. B.

Hydrogen peroxide solutions ; Process for preserving ——. J. Arndts. Fr. Pat. 388,875, March 28, 1908.

See Ger. Pat. 196,370 of 1907 ; this J., 1908, 448.—T. F. B.

Solid substances [graphite, etc.] ; Transferring suspended —— from aqueous media to non-aqueous media. E. G. Acheson, Niagara Falls, U.S.A. Eng. Pat. 27,312, Dec. 10, 1907. Under Int. Conv., Oct. 28, 1907.

See Fr. Pat. 384,698 of 1907 ; this J., 1908, 494.—T. F. B.

Ammonia ; Recovery of —— by fermentation. Addition to Fr. Pat. 382,689. *See* XVII.

Phosphatic manure and a nitrate. Fr. Pat. 388,460. *See* XV.

Ammonia ; Production of —— from wash-heaps [of collieries]. Ger. Pat. 198,295. *See* II.

Hydrogen and oxygen ; Preparation of ——. Ger. Pat. 198,626. *See* XIA.

VIII.—GLASS, POTTERY, AND ENAMELS.

Dissociation in the solid state [Glass]. C. Doelter. Z. Elektrochem., 1908, **14**, 552—555.

An examination of their electrical conductivities at high temperatures shows an essential difference between glasses and crystalline silicates. The conductivity of glass diminishes gradually, without any sudden break, as it cools from the state of isotropic liquid to the solid isotrope ; it must, therefore, be regarded as a fluid, and not a true solid. The crystalline silicates, on the other hand, when quite free from glass, exhibit two distinct conductivity curves for the solid and liquid states, which meet at the melting point, and no conductivity is observed below about 600° C. The author assigns as the principal cause of the small or negligible conductivity of solids (crystals), as compared with that of fluids (liquids or glasses), the greater immobility of the ions in the former, rather than a diminished degree of dissociation. Thus a crystal may be considerably dissociated and yet a non-conductor, but at high temperatures the ions become more mobile and the crystal conducts.—F. Sodn.

Patents.

Ceramic masses and articles containing aluminium oxide; Process for the manufacture of ——. F. Engelhorn, Mannheim-Waldhof, Germany. Eng. Pat. 11,175, May 13, 1907.

See Fr. Pat. 377,964 of 1906; this J., 1907, 1049.—T. F. B.

Sulphuric anhydride and sulphuric acid; Manufacture of —— *with simultaneous production of glass.* Fr. Pat. 389,032. *See* VII.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Patents.

Refractory materials; Process for diminishing the porosity of ——. H. Koppers. Ger. Pat. 200,241. Nov. 30, 1907.

The process consists essentially in burning within the pores of the material a gas, *e.g.*, hydrogen silicide, which on combustion yields a solid, incombustible deposit. In carrying out the process, the refractory material is strongly heated, and the combustible gas is forced into it from one side, and air or oxygen from the other side. —A. S.

Wood and other fibrous or cellular materials; Impregnation of ——. L. H. Baekeland, Yonkers, N.Y., U.S.A. Eng. Pat. 1922, Jan. 28, 1908.

See Fr. Pat. 386,628 of 1908; this J., 1908, 686.—T. F. B.

X.—METALS AND METALLURGY.

Rusting of iron. W. A. Tilden. Chem. Soc. Trans., 1908, **93**, 1356—1364.

The results of the author's experiments confirm those of Walker and others (this J., 1907, 1051; see also 1903, 799). In one experiment a piece of iron contained in a silica boat (to prevent contact with the glass) was enclosed in a tube, containing some crystallised baryta, and provided with a side tube ending in a sealed capillary. The tube was heated to expel air adhering to the walls, exhausted by means of a mercury pump, and sealed. The sealed capillary end of the side tube was introduced into a flask filled with a 20 per cent. solution of sodium hydroxide. Pure oxygen was introduced into the flask, displacing the alkali, and after standing for three days, the end of the capillary was broken, and the oxygen allowed to enter the tube containing the iron. Water was then condensed on the iron by heating the baryta and cooling the tube near the iron. Rusting of the iron began in about 10 minutes and proceeded rapidly. With the same apparatus it was shown that wetting the iron with strong sodium hydroxide solution or treating it with 1 per cent. chromic acid and then washing, prevented or retarded the rusting. Contact with water, in absence of oxygen, resulted in the gradual formation of a deep blue film (probably ferrous hydroxide) on the surface of the iron, whilst ferrous hydroxide also passed into solution. Rusting is accelerated if the iron is in contact with a less positive metal. With respect to the composition of rust, a specimen taken from a piece of iron from an old iron working, and which had been exposed to air and rain for about 250 years, still contained more than 9 per cent. of ferrous iron. The author's conclusions are:—(1) Commercial iron, liquid water, and oxygen are alone sufficient for the production of rust. Carbonic acid is not necessary, but when present hastens the action. (2) Commercial iron is attacked by pure water in the absence of oxygen and carbon dioxide, ferrous hydroxide being produced. (3) Iron rust always contains ferrous oxide. (4) The process of rusting is due initially to electrolytic action resulting in the production of ferrous hydroxide or carbonate. This may be explained by the presence in all ordinary iron of various components which afford surfaces at different potential in the presence of water, aqueous carbonic acid or other electrolyte.—A. S.

Iron; Corrosion of —— *from the electrochemical standpoint.* C. F. Burgess. Trans. Amer. Electrochem. Soc., 1908, **13**, 17—54.

The author passes in review many of the various electrochemical investigations that have been made on the subject of iron corrosion, dealing at considerable length with the effects of strain and inequalities of temperature. He calls attention to the fact that underground iron pipes, which usually corrode very slowly, have been seriously affected by the advent of electric tramways and railways. When an electric current flows from iron pipes to earth, corrosion of the pipes takes place, but when the flow is towards the pipes, they are not affected. It is suggested that the substitution of alternating currents would probably prevent the excessive corrosion. Another cause of corrosion is galvanic action. When iron is in contact with a conductive material, electro-negative to itself, the iron is subject to corrosion. A bronze propeller on a steel shaft would constitute an electrochemical system, unless means of protection were taken. "Carbon cinder," imbedded in an iron surface, induces local corrosion from galvanic action. Iron sulphide being also electro-negative to iron, has a similar effect. The author describes experiments to show the effect of strain on corrosion. Bars of mild steel were locally deformed, either by tension or torsion, and afterwards turned down to a uniform diameter and artificially corroded. In each case, the rate of corrosion was greater at the strained portion, which had become electro-positive to the unstrained part. On annealing one of the bars before corroding, it was found to be acted on uniformly, the effect of the strain having been quite removed. Tests made on punched boiler plate clearly showed, by excessive local corrosion, the zones of deformation round the punched holes, as well as lines of strain extending for a considerable distance. Experiments were made to investigate the cause of the unequal corrosion of boiler tubes. It was found that heated iron tends to become more electro-positive, and as the tubes are unequally heated, a difference of potential is set up. A special apparatus was constructed, to reproduce the conditions found in locomotive boilers, and a number of tests were made, using different waters, and varying the conditions. In each case the current, indicating the amount of corrosion, gradually increased at first, and then decreased, in spite of the heating conditions remaining constant. It was noticed that corrosion was accelerated on the addition of a fresh supply of water. It is possible that the removal of oxygen from the water, may be the chief explanation, as oxygen acts as a depolariser, but the formation of scale would also retard the electrolytic action.—F. R.

Steel conduit; Electrochemical corrosion of the Rochester ——. R. H. Gains. Trans. Amer. Electrochem. Soc., 1908, **13**, 55—96.

Two conduits have been laid to Rochester from the water supply at Hemlock lake, 29 miles distant. The first, consisting half of wrought iron and half of cast iron pipe, has been in service for thirty-two years, without developing any rust holes. The second was constructed of plates of soft open-hearth steel. After six years, the pipe began to develop serious rust leaks, and as the conduit runs through open country, the cause could not be attributed to external electric currents. The leaks were mainly situated where the pipe passed through wet ground, and where the waterproof protective coating had become damaged, and were evidently caused by the soil water coming in contact with the metal. In spite of the high quality of the steel, small local differences of potential occur, and if the exit of the current is concentrated in a small area, owing to breaks in the protective covering, or irregularities in the metal, local corrosion will be intensified and "pitting" take place.—F. R.

Ferrosilicon; Use of high-percentage —— in iron-founding. Westhoff. Stahl u. Eisen, 1908, **28**, 1246—1249.

Ferrosilicon containing up to 90 per cent. of silicon, obtained in the electric furnace, is now available as a commercial material, and can be used for obtaining castings containing any desired proportion of silicon. The calculated quantity of finely-powdered ferrosilicon is placed in a ladle and brought to red heat, and the iron is then poured on; the silicon is practically all taken up in about 1 minute, when the metal is stirred and poured into the moulds. The time required for taking up the silicon is less if 0·03 per cent. of aluminium borings be added.—A. T. L.

Metals; Cutting —— by means of oxygen. L. Guillet. Le Génie Civil, Paris, **51**, 241—244. Proc. Inst. Civil Eng., 1908, **171**, 54.

When a jet of oxygen is allowed to impinge upon iron previously raised to a high temperature, the iron oxide formed, being more readily fusible than the iron itself, passes away as it is formed, thus exposing fresh surface to the action of the jet. In the earlier experiments with this process, the metal was first heated by the oxy-hydrogen jet; on the required temperature being obtained, the heating was stopped and the jet of oxygen brought into play, but more recently the heating has been carried on simultaneously with the oxidising, the result being a much cleaner cut. In one of the latest forms of the apparatus, the heating is effected by an oxy-acetylene jet issuing from an annular space, in the centre of which is the jet of oxygen. The extreme rapidity with which iron or steel can be cut by this method is illustrated by the following facts:—(1) An armour plate 6·29 inches in thickness was cut in two for a length of 3·28 feet in 10 minutes; (2) the cutting of manholes in plates 0·78 to 1·17 inch in thickness occupied 4 to 5 minutes each; (3) in 7 minutes a groove 3·28 feet in length by 1·56 to 2·34 inches deep was cut in a slab 11·7 inches in thickness, while in the same piece of metal, by the use of a pneumatic chisel, the cutting of a groove of only one quarter the depth and 3·77 feet in length occupied no less than an hour. The process has also been found very efficient in removing the heads of rivets when a seam is to be undone, the head of a $\frac{7}{8}$-inch rivet being burnt off in 12 seconds. Carefully conducted experiments have shown that the metal contiguous to the cut is only slightly depreciated.

Iron; Alloying of calcium and ——. A. Hirsch and J. Aston. Trans. Amer. Electrochem. Soc., 1908, **13**, 143—150.

Calcium and iron were heated together in a crucible until the iron melted; the residual metal, however, contained no calcium. It was found that the vaporising temperature of calcium was 200° C. lower than the melting point of iron, so that, under ordinary conditions, the whole of the calcium volatilised. By heating the metals together under pressure, various homogeneous alloys were produced, but these are of little value, owing to their instability. Alloys containing over 4 per cent. of calcium rapidly oxidise when exposed to the air.—F. R.

Refractory oxides; Reduction of —— by carbon. H. C. Greenwood. Chem. Soc. Trans., 1908, **93**, 1483—1496.

The author describes in detail, a method for determining the temperatures (within about 10°, up to 2000° C.) at which refractory oxides are reduced by carbon. The furnace consists of a perforated graphite tube holding the mixture and attached to water-cooled brass tubes, which are fitted into the side arms of a glass globe, means being provided for exhausting the globe and recording alterations in the pressure. The mixed oxide and carbon is inserted in the graphite tube, the globe exhausted, and the temperature raised step by step, by passing a direct current, up to 300 ampères, through leads attached to the brass tubes. A constant temperature is maintained, at each step, for five minutes, and the increase of pressure noted. The globe is re-exhausted before raising the temperature to the next step. Owing to the amount of gas occluded by the carbon and graphite tube, a small rise of pressure occurs before reduction of the oxide commences, but as this seldom exceeds 2 mm. in the five minutes, there is no difficulty in determining the commencement of reduction. This is indicated by a sudden large rise of pressure, owing to the formation of carbon monoxide. The following determinations have been made, using retort carbon for reduction:—Tungsten dioxide, 1020° C.; manganous oxide, 1105°; chromium sesquioxide, 1185°; zirconia, 1400°; silica, 1460°; uranium dioxide, 1490°; thoria, 1600°. The reduction commences very sharply, but its rate and completeness depend on the degree of intimate contact between the oxide and the carbon. The reduction temperature alters on using different varieties of carbon. When acetylene black was substituted for retort carbon, in the case of chromium sesquioxide, reduction commenced at 1105° instead of 1185° C. The physical condition of the oxide also appears to affect the result. The reduced metal was, more or less, completely converted into carbide, the products in each case being in an unfused condition. Details are given of experiments made to show that reduction was due to the carbon and not to dissociation, and in each case, the temperature of dissociation, both in a vacuum and in air, was considerably higher than in the presence of carbon.—F. R.

Ferro-alloys; Production of ——. H. C. Greenwood. Chem. Soc. Trans., 1908, **93**, 1496—1500.

The following experiments were made to investigate the cause of the lowering of the temperatures of reduction of refractory oxides by carbon, through the presence of iron oxide. The mixtures to be tested were placed in a graphite tube, enclosed in a glass globe which was then exhausted. The temperature was raised step by step, by passing an electric current through the tube, the reduction temperature being indicated by the evolution of carbon monoxide. Silica was reduced when heated with retort carbon, at 1460° C., but on the addition of finely divided iron, the reduction temperature was lowered to 1050°, iron silicide being formed. Metallic manganese had a similar effect to iron, the reduction temperature being lowered from 1460° to 1100°. Iron silicide was also present in the product. A direct affinity between silicon and the metal appears to be the main cause of the action. Ferric oxide was tried in place of metallic iron, but apparently had no effect until it had itself become reduced. Similar tests were made using chromium sesquioxide in place of silica. The reduction temperature was unaffected by the addition of iron, but metallic manganese caused the temperature to fall from 1185° to 1120° C. The reduction temperature of manganous oxide was lowered by the presence of iron, from 1105° to 1030° C.—F. R.

Nitrogen compounds of metals and their magnetic properties. I. Shukow. J. Russ. Phys.-Chem. Ges., 1908, **40**, 457—459. Chem. Zentr., 1908, **2**, 484.

Up to a temperature of 1250° C., nitrogen is not absorbed by vanadium, iron, copper, and tungsten, and only very slightly by molybdenum. It is readily absorbed, on the other hand, by magnesium, calcium, aluminium, titanium, chromium, and manganese even at temperatures ranging from 780° to 875° C. The first three of these metals form definite chemical compounds with nitrogen, *viz.*, Mg_3N_2, Ca_3N_2, and AlN, but with the last three, only solid solutions are obtained, containing respectively 21, 8, and 12 per cent. of nitrogen. These absorption-compounds possess magnetic properties, the manganese-nitrogen compound standing next to metallic iron in this respect.—A. S.

Cobalt; Action of arsenic trichloride and of arsenic on ——. F. Ducelliez. Compt. rend., 1908, **147**, 424—426.

By the action of arsenic trichloride on cobalt or an alloy of cobalt and arsenic, at 800°—1400° C., the compound, Co_3As_2, is obtained; at 600°—800° C., the compound, CoAs, and at 400°—600° C., the compound, Co_2As_3, which below 400° C. is slowly transformed into the compound, $CoAs_2$. Mixtures of arsenic and cobalt, heated in presence of hydrogen until of constant weight, give the same series of arsenides, within the same temperature limits, and these compounds are further obtained by passing the vapour of arsenic, mixed with hydrogen, over heated cobalt. The arsenide, Co_3As_2, is also produced by reducing cobalt arsenite or arsenate by hydrogen at 900° C. These compounds are not attracted by a magnet, and their densities indicate that their formation is accompanied by a marked contraction. They readily react with chlorine, oxygen, or sulphur, and are easily dissolved by nitric acid, but hydrochloric or sulphuric acid has little action on them. They are slowly attacked by alkalis and alkali carbonates.—F. Sodn.

Nickel and arsenionickels; Action of arsenic trichloride on ——. E. Vigouroux. Compt. rend., 1908, **147**, 426—428.

By the action of arsenic trichloride vapour on nickel or its arsenides, at 400°—800° C., the compound, NiAs, is formed, and at 800°—1400° C. the compound, Ni_3As_2. At temperatures below 400° C. these arsenides are able to absorb more arsenic to form the compound, $NiAs_2$. All three products are readily attacked, when heated, by chlorine, oxygen, and sulphur, and are dissolved by nitric acid. They are almost indifferent towards hydrochloric or sulphuric acid, and are but slowly attacked by alkalis or alkali carbonates, though readily decomposed by fusion with potassium chlorate or potassium nitrate.—F. Sodn.

Pyrophoric alloys. B. Weiss. Z. Elektrochem., 1908, **14**, 549—551.

The author summarises Welsbach's work on pyrophoric alloys (see also this J., 1904, 484). The pure metals of the cerium group emit no sparks when scratched by a file, the pyrophoric property of commercial samples depending on the presence of iron. The alloys are hard, brittle, and almost unaffected by air, whereas the pure metals are fairly soft and oxidise readily. Sparks are obtained most readily from the cerium-iron alloys, but those of lanthanum emit the most brilliant light. Among the technical uses to which they are put is the manufacture of self-lighting gas burners and lamps, especially miners' safety lamps, and they may also be applied to the construction of intermittent signals for lighthouses. A gram of alloy is capable of making many thousand ignitions.—F. Sodn.

Power production from waste gases. C. Dantin. *See* II.

Aluminium; Behaviour of —— in contact with milk, wine, and some saline solutions. F. v. Fillinger. *See* XVIIIA.

Tin, arsenic, and antimony: Separation [and determination] of ——. Application to the analysis of bronzes. M. Dinan. *See* XXIII.

Mineral production of New South Wales. Board of Tr. J., Sept. 3, 1908. [T.R.]

The following statistics of the mineral production of the State of New South Wales during the years 1906 and 1907 are taken from the annual report for 1907 of the Department of Mines of that State:—

Minerals.	1906.		1907.	
	Quantity.	Value.	Quantity.	Value.
		£		£
Alunite .. Tons	1,856	4,637	2,088	5,115
Antimony (metal and ore) .. ,,	2,451	52,645	1,752	46,278
Bismuth (metal and ore) ,,	25	5,700	16	5,268
Chrome .. ,,	15	15	30	105
Coal .. ,,	7,626,362	2,337,227	8,657,924	2,922,419
Coke .. ,,	186,060	110,607	254,609	159,316
Copper (ingots, matte and ore) (*a*) .. ,,	9,755	789,527	10,098	727,774
Diamonds Cts.	2,827	2,120	2,539	2,056
Gold .. Oz. fine	253,987	1,078,866	247,363	1,050,730
Iron (*b*) .. Tons	8,000	112,848	29,902	178,632
Iron, "oxide" ,,	584	336	1,595	1,961
Ironstone flux ,,	935	723	10,659	7,707
Lead (pig, &c.) (*c*) ,,	59	1,084	19,768	374,182
Lime .. ,,	21,126	15,573	23,587	19,458
Limestone flux (*d*) .. ,,	12,788	7,463	41,667	16,162
Marble (*e*)	—	1,518	—	2,200
Molybdenite Tons	33	4,798	22	3,564
Noble opal ..	—	56,500	—	79,000
Platinum .. Oz.	205	623	276	1,014
Portland cement ..	—	128,487	—	144,548
Silver (ingots and matte) (*f*) Oz.	284,994	36,431	2,043,887	257,314
Silver-lead, ore, concentrates, &c. .. Tons	371,939	2,826,542	434,079	3,658,632
Shale (oil) .. ,,	32,446	28,470	47,331	32,055
Scheelite .. ,,	109	7,647	196	23,781
Stone (building, &c.) (*g*)	—	610	—	119
Stone (grindstones) (*g*)	—	130	—	194
Tin (ingots and ore) (*h*) .. Tons	1,671	255,744	1,914	293,305
Wolfram .. ,,	132	9,057	207	26,235
Zinc (spelter and concentrates) .. ,,	103,666	292,806	237,219	536,620
Sundry minerals and ores	—	890	—	1,634
Total value ..	—	8,169,624	—	10,577,378

(*a*) Exclusive of the copper produced in the State during the year from ore imported for treatment from other States of the Commonwealth. (*b*) Made chiefly from scrap, ore being smelted in 1907 only. (*c*) See silver-lead. (*d*) Value at smelting works. (*e*) Value at quarries of quantity disposed of. (*f*) The bulk of the silver is contained in the concentrates, &c., despatched from the Broken Hill Field and treated outside the State. (*g*) Quantity exported only. (*h*) Exclusive of tin refined in the State from imported ores.

N.B.—The "tons" are tons of 2240 lb.

Patents.

Briquettes for metallurgical and other purposes. W. F. Collins, Mong-tse, China. Eng. Pat. 17,546, July 31, 1907.

Finely-divided ore, or a mixture of ore, fuel, and lime, etc., is made into briquettes by adding 3—6 per cent. of solid water-glass, passing the mixture through a heated chamber into which steam is injected, and moulding under pressure. A metallic oxide or a calcium compound may also be added to the mass.—A. G. L.

Iron or steel; Manufacture of —— by the open hearth process or in electrical furnaces. J. Flohr, Dudelange, Luxembourg. Eng. Pat. 19,348, Aug. 28, 1907.

Briquettes, of high specific gravity, composed of iron oxide, rolling mill scale, iron scrap, etc., with lime, and made under high pressure, are added to the partially refined molten bath of metal. The briquette sinks through the slag and accelerates the refining.—F. R.

Malleable iron and steel and other alloys of iron; Process for the manufacture of ——, and apparatus relating thereto. E. C. R. Marks, London. From Rombacher Hüttenwerke, W. Schemann, and J. Bronn, Rombach, Germany. Eng. Pat. 25,400, Nov. 15, 1907.

Ferro-manganese is separately melted in a special three-phase electric tilting furnace, consisting of a number of intercommunicating channels, heated by direct resistance. The required amount of ferro-manganese is then added, in the molten state, to the iron or steel. The molten alloy may be added to the steel in the casting ladle, thus preventing reduction of phosphorus or sulphur from the slag in the converter.—F. R.

Armour plates, projectiles and other bodies; Steel suitable for the manufacture of ——. Comp. des Forges et Aciéries de la Marine et D'Homécourt. St. Chamond, France. Eng. Pat. 25,742, Nov. 20. 1907. Under Int. Conv., Sept. 7, 1907.

Armour plates, etc., are made of steel containing 0·65—0·80 per cent. of carbon, 3—4 of chromium, and about 2·5 of nickel. After being rolled, the plate is annealed twice, first at 850—900° C., and then. for a shorter period, at about 775° C. At this stage the steel possesses a fine texture, and can be cut easily. The plate is next heated to 775° C., quenched in oil, annealed at 775° C., reheated to 650—675° C., and quenched in water. The steel now possesses a fibrous texture and becomes very resilient. The body of the plate is finally heated to 675° C., whilst one face is heated to 800°—850° C., and this face is then sprinkled with water, whereby it becomes glass-hard, whilst the body of the plate retains its fibrous structure. —A. G. L.

Copper and copper alloys [containing iron]; Process for making dense and uniform castings from ——. W. P. Thompson, London. From Laboratorium für chem. Feuerschutz und Löschmittel C. Gautsch, G.m.b.H., Munich, Germany. Eng. Pat. 419, Jan. 7, 1908.

In order to obtain sound castings of copper and especially of copper-iron alloys, without the use of zinc, aluminium, nickel, or other "iron-carrier," 80 grms. of sodium bicarbonate, potassium bicarbonate, or a mixture of the two, are added to 50 kilos. of the material to be melted. Just before casting the metal, a further addition of 10 grms. of the fixed alkali bicarbonate and 50 grms. of ammonium carbonate is made, with vigorous stirring. Phosphorus may also be added as usual.—A. G. L.

Copper; Process of hardening ——. H. V. Draper, Assignor to G. A. Hancock, Springfield, Mo. U.S. Pat. 896,632, Aug. 18, 1908.

An intimate mixture of powdered alum and arsenic is added to molten copper, which is then further heated and the whole agitated before cooling.—F. R.

Concentrates and slimes; Process of saving the values of ——. S. M. Smith, Boise, Idaho. U.S. Pat. 895,509, Aug. 11, 1908.

The crushed ore or gangue is subjected to the action of water in such a way that the outflowing liquid carries the separated slimes over the edge of the receptacle into another vessel, where the mixture is carefully heated without boiling or agitation. Any arsenic, antimony, or sulphur compounds which may be present rise to the surface. After removal of these, the liquid is decanted from the settled slimes.—C. A. W.

Furnace; Rotary-retort ——. J. R. Moffitt, Denver, Colo. U.S. Pat. 895,656, Aug. 11, 1908.

A horizontal cylindrical retort is mounted so that it can be rotated within, but has no communication with, a combustion chamber. Within the retort a number of longitudinal "rabble-troughs" are arranged in a ring and are rotated with the retort. Each "rabble-trough" has an air-chamber through which compressed air can be delivered to the troughs but from which the air is cut off during the time that they are moving downwards. Each trough is also provided with an ore receptacle into which the material to be treated is charged.—W. H. C.

Ores; Method of treating ——. R. Baggaley, Pittsburg, Pa. U.S. Pat. 895,939, Aug. 11, 1908.

The ore, containing oxidisable compounds and therefore of some calorific value, is previously dried and heated to a point below the fusion point of the natural fuel elements contained therein, by means of the waste gases from the furnace. While still hot, it is thrown on to a molten bath of matte, low in grade but rich in oxidisable elements, and the reaction is assisted by means of a blast.—C. A. W.

Ores; Volumetric classifier for ——. J. C. Démaret. Fr. Pat. 388,753, June 7, 1907.

The apparatus consists of a slightly inclined screen of which one extremity is immersed in water contained in a bath of pyramidal form. The water charged with the material is caused to fall on the screen at its lowest extremity until the level in the bath has reached a certain point, when, by the automatic opening of a valve, it is allowed to flow away. By a series of oscillatory motions the material is made to ascend the plane, and in this way is subjected to a sifting action while on the surface of the water. The portion going through the screen passes away with the outflowing liquid at the bottom of the bath, the residue being collected at the top of the screen. —C. A. W.

Aluminium ores; Treatment of ——. Soc. de Electro-Metallurgie du Sud-Est. Fr. Pat. 389,008, June 15, 1907.

The invention relates to the method of extracting aluminium from its ores by fusion with sodium carbonate and extraction of the resulting aluminate with water. It is found that the practice of adding a certain quantity of chalk or lime to the ore does not completely prevent the solution of the silica. By the use of barium carbonate a more complete elimination is obtained, but the alumina only partially goes into solution. It is therefore proposed to employ a mixture of chalk or lime with the carbonate of barium or any other alkaline-earth metal.—C. A. W.

Muffle furnaces. F. Söllner and H. Köppel, Oberredwitz, Germany. Eng. Pat. 17,216, July 27, 1907.

See Fr. Pat. 379,420 of 1907; this J., 1907, 1283.—T. F. B.

Copper; Process for the removal of —— from copper, tin, antimony, and lead alloys. W. Richter, Emmerich on Rhine, Germany. Eng. Pat. 19,106, Aug. 23, 1907.

See Ger. Pat. 195,792; this J., 1908, 574.—T. F. B.

Steel; Impts. in, and means for use in, the manufacture of ——. Felten und Guilleaume Lahmeyerwerke Act.-Ges., Frankfort on Maine, Germany. Eng. Pat. 24,213, Nov. 1, 1907. Under Int. Conv., Nov. 1, 1906.

See Fr. Pat. 383,461 of 1907; this J., 1908, 344.—T. F. B.

Metallurgical process and apparatus especially suitable for the production of steel. S. Z. de Ferranti. Fr. Pat. 388,822, April 3, 1908. Under Int. Conv., April 9, 1907.

See Eng. Pat. 8255 of 1907; this J., 1908, 631.—T. F. B.

Iron-blast furnace gases ; Apparatus for washing ——. B. H. Thwaite. London. U.S. Pat. 896.175. Aug. 18, 1908.

See Eng. Pat. 14.757 of 1904 ; this J.. 1905. 836.—T. F. B.

Metals ; Manufacture of molten ——. B. H. Thwaite and W. Defries, London. U.S. Pat. 895.513. Aug. 11. 1908.

See Eng. Pat. 28.573 of 1906 ; this J.. 1907. 1282.—T. F. B.

Metals ; Method of manufacturing ——. H. Goldschmidt and O. Weil, Assignors to Th. Goldschmidt, Essen on Ruhr, Germany. U.S. Pat. 895.628, Aug. 11. 1908.

See Fr. Pat. 358,071 of 1905 ; this J., 1906. 185.—T. F. B.

Tantalum ; Process of hardening ——. W. von Bolton, Charlottenburg, Assignor to Siemens und Halske A.-G. U.S. Pat. 896,705, Aug. 25, 1908.

See Addition to Fr. Pat. 321,412 of 1902 ; this J., 1906, 213.—T. F. B.

Tantalum ; Process for hardening soft metallic ——. Siemens und Halske A.-G. First Addition, dated March 18. 1908, to Fr. Pat. 357.714. Sept. 14, 1905. Under Int. Conv., March 26, 1907.

See Eng. Pat. 6051 of 1908 ; this J., 1908, 904.—T. F. B.

Tantalum ; Process for hardening soft metallic ——. Siemens und Halske A.-G. Second Addition, dated March 18, 1908, to Fr. Pat. 357,714, Sept. 14, 1905. Under Int. Conv., March 26, 1907.

See Eng. Pat. 6050 of 1908 ; this J., 1908, 756.—T. F. B.

Silicides of calcium, barium, and strontium ; Process for preparing the ——. Th. Goldschmidt. Fr. Pat. 388,638, March 19, 1908.

See Ger. Pat. 199,193 of 1907 ; page 948.—T. F. B.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(A.)—ELECTRO-CHEMISTRY.

Air ; Combustion of —— in the electric flame arc. II. and III. Behaviour of the electric flame arc in oxygen. IV. Behaviour of the electric flame arc in nitrogen. A. Grau and F. Russ. Sitzungsber. K. Akad. Wiss., Wien, **117**, Abth. IIA., 321—371. Chem. Zentr., 1908, **2**, 667—668. (See this J., 1907, 619.)

The experiments were made with a vertical arc between platinum electrodes, the arc being surrounded by a cooled quartz tube. The gases from the interior of the electric flame were withdrawn by suction through the upper electrode, which was hollow. The ratio of the number of watts actually consumed to the number obtained by calculation (watts : volt-ampères) was found to be constant for arcs of different lengths, but was greater in oxygen than in air and in nitrogen. With rising content of oxygen in the gas mixture, the potential of the arc and the consumption of energy in the arc at constant strength of current increases, being at a maximum in pure oxygen, and greater in air than in nitrogen. The potential of the arc in oxygen, air, or nitrogen is a linear function of the velocity of the gas. Variations of pressure influence the potential of the arc only in the case of oxygen, in which case the potential is a linear function of the pressure, between 700 and 800 mm. of mercury. The concentration of nitric oxide in the reaction-products depends upon the strength of current, but attains a maximum at a relatively low current strength (about 0·1 ampère). The nitric oxide equilibrium is independent of the length of the arc (from 3 to 7 cm.) and of the consumption of energy (above 136 watts, corresponding to 0·1 ampère); in air, equilibrium is attained with 5·5 per cent. of nitric oxide by volume ; and in a mixture of equal volumes of oxygen and nitrogen, with 6·6 per cent. of nitric oxide. With the authors' apparatus, using an arc 5 cm. long, a yield of 500 kilos. of nitric acid per kilo.-watt year could be attained, the concentration of nitric oxide in the gaseous reaction-product being about 3 per cent. by volume.

The authors also examined the methods for the quantitative analysis of nitrous gases, and found that trustworthy results could be obtained by measuring the oxygen-content of the gases after absorption of nitrogen peroxide by sulphuric acid or $N/_1$ sodium hydroxide solution. For absorbing nitrogen peroxide from gases in motion, concentrated sulphuric acid gives better results than alkali.—A. S.

Moist nitrogen and moist nitric oxide ; Action of the silent electric discharge upon ——. W. Löb. Z. Elektrochem., 1908, **14**, 556—558.

The effect of the silent electric discharge on moist nitrogen is the production of small quantities of ammonia and nitrous acid, the latter in slight excess ; no nitric acid is formed. The excess of nitrous acid over ammonia, combined with the fact that free hydrogen is found with the residual nitrogen, makes it probable that two reactions occur :

(*a*). $N_2+4H_2O=2HNO_2+3H_2$: (*b*), $N_2+3H_2=2NH_3$. Moist nitric oxide at once turns deep brown in colour under the influence of the silent discharge, and there is a rapid contraction in volume ; finally the colour disappears and nitrogen only remains. The contraction corresponds to the reaction : $5NO=2N_2+NO_2+3O$, the nitrogen peroxide, here indicated, reacting with water to form nitric and nitrous acids, and the latter becoming oxidised to nitric acid by the excess of oxygen, as shown by the results of titration. Small quantities of ammonia are also formed during the discharge.—F. Sodn.

Accumulator of light weight. R. Goldschmidt. Bull. Soc. Chim. Belg., 1908, **22**. 317—327.

The zinc-nickel couple is used. The plates are of iron gauze, 12 by 10 cm. The anode plate is coated electrolytically with spongy nickel, using a solution of nickel fluosilicate containing a trace of cobalt fluosilicate as electrolyte. The cathodes, of iron gauze, are coated with zinc also from a fluosilicate solution. The zinc thus deposited readily oxidises in the air, even when moist, with rise of temperature. The electrolyte used in the cell is a solution of carbonate of sodium or potassium. The E.M.F. of the nickel-zinc cell is 50 per cent. greater than that of the nickel-iron cell.—R. L. S.

Aluminium ; Nature of the surface film formed on ——, *and the aluminium-magnesium cell.* H. T. Barnes and G. W. Shearer. Trans. Amer. Electrochem. Soc., 1908, **13**, 169—170.

The electromotive force developed between aluminium and magnesium, has been shown to be due to the action of oxygen in the electrolyte, on the surface of the aluminium. The probable chemical effect is the oxidation of the aluminium to hydroxide, with the production of hydrogen peroxide (see this J., 1908, 452). When aluminium is immersed in pure water, charged with oxygen, measurable quantities of hydrogen peroxide are produced, which indicates that the film formed on the surface of aluminium when exposed to moisture, consists of aluminium hydroxide.—F. R.

Metals ; Rapid electroanalytical separation of ——. H. J. S. Sand. *See* XXIII.

Patents.

Ozonising air [*electrically*]. Siemens Bros. and Co., Ltd. From Siemens und Halske A.-G., Berlin. Eng. Pat. 6105, March 19, 1908.

Plain metal rods or plates, alternating with metal rods or plates covered with a dielectric, are fixed in a suitable frame, thus forming a grid across the air passage or conduit. In an alternative form, each set of rods is intertwined into the form of a net, thus forming two opposed gratings through which the air must pass. Efficient generation of ozone may be obtained, with either slowly or quickly moving air currents, without water cooling.—B. N.

Ozoniser. G. Erlwein. Ger. Pat. 200,302, Nov. 18, 1906.

THE claim is for the use of electrodes composed of lead peroxide, manganese peroxide, iron oxides, or lead oxide, or of suitable supports coated with these substances. —A. S.

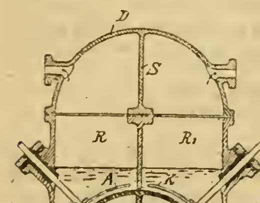
Furnace; Electric —— with blowpipe. B. H. Berruet. Fr. Pat. 388,236, March 17, 1908.

ONE or more of the electrodes may be made in the form of a blowpipe, for projecting on to the material to be treated a blast flame, which heats the material and renders it conductive, thus inducing the formation of an electric arc between the blowpipe electrode and the charge. The blowpipes may be made movable, so as to direct the combined flame to any required point. The material may be introduced, either wholly or partially, through the blowpipes, so as to permit of a preliminary heating.—B. N.

Particles carried away by gaseous substances; [Electrical] process of separating ——. F. G. Cottrell. Fr. Pat. 388,238, March 17, 1908.

THE particles in suspension in a gaseous mass may be precipitated by means of electric discharges, which traverse the mass between two electrodes, one of which is smooth and the other provided with threads (of glass wool, etc.) or fine projections. The electrodes have an unchanging polarity, the discharges being produced by an alternating current, an interrupter establishing the current at intervals synchronous with the alternations. An appropriate current of air prevents the deposition of the particles on the electrodes.—B. N.

Hydrogen and oxygen; Preparation of —— simultaneously, by electrolysis. G. Aigner. Ger. Pat. 198,626, Nov. 13, 1906.



THE alkaline electrolyte is contained in an iron vessel, G, in which an iron drum, T, rotates, the outer surface of the latter being amalgamated. The upper part of G is divided into two compartments, R and R_1, by the partition, S, which extends downwards nearly to the drum, T. The oxygen and hydrogen are led off through separate outlets in the cover, D. The electrolyte is introduced and withdrawn through the opening, L. At the anode, A, hydroxyl ions are depolarised, with formation of water and gaseous oxygen, the latter escaping into the compartment, R, whilst an equivalent quantity of sodium ions is depolarised and combines chemically with the amalgam on the surface of the drum adjacent to the anode. When this portion of the drum comes below the cathode, K, hydroxyl ions are depolarised with formation of sodium hydroxide, the sodium being re-dissolved from the amalgam, whilst sodium ions are depolarised with formation of sodium hydroxide and gaseous hydrogen. —A. S.

Gases or mixtures of gases, e.g., air; Process for heating —— by electric flames. K. Hiehle. Ger. Pat. 200,006, Feb. 13, 1907.

THE air is led into the flame through a channel formed between the two electrodes. The claim is for the disposal of the electrodes in such a manner that the passage for the air is of an annular shape, diverging in the direction of flow of the air.—A. S.

Electricity; Thermochemical generation of ——. L. P. Basset, Assignor to M. B. de Labarthe, Paris. U.S. Pat. 895,715, Aug. 11, 1908.

SEE Fr. Pat. 356,442 of 1905; this J., 1905, 1312.—T. F. B.

Chromic acid from chromic sulphate; Process of electrolytically producing ——. G. Adolph, Ammendorf, and A. Pietzsch, Assignors to Chem. Fabr. Buckau, Magdeburg, Germany. U.S. Pat. 895,930, Aug. 11, 1908.

SEE Fr. Pat. 377,027 of 1907; this J., 1907, 1054.—T. F. B.

Electrolysis of fluids; Apparatus for the ——. E. Weichert, Augsburg, Germany. U.S. Pat. 896,184, Aug. 18, 1908.

SEE Fr. Pat. 370,718 of 1906; this J., 1907, 261.—T. F. B.

Battery; Secondary ——. L. Fiedler, London. U.S. Pat. 896,981, Aug. 25, 1908.

SEE Eng. Pat. 5493 of 1906; this J., 1907, 326.—T. F. B.

Electric furnace. J. Härdén, Assignor to The Gröndal Kjellin Co., London. U.S. Pat. 897,203, Aug. 25, 1908.

SEE Eng. Pat. 8445 of 1907; this J., 1908, 816.—T. F. B.

Electric currents of high frequency; Production of ——. Badische Anilin und Soda Fabrik. Fr. Pat. 388,473, March 28, 1908. Under Int. Conv., March 27, 1907.

SEE Eng. Pat. 12,220 of 1907; this J., 1908, 816.—T. F. B.

Ozone from oxygen or atmospheric air; Apparatus for producing ——. J. R. Craig, jun. Fr. Pat. 388,982, April 6, 1908. Under Int. Conv., April 6, 1907.

SEE Eng. Pat. 8036 of 1907; this J., 1908, 453.—T. F. B.

Electrolytic apparatus for purifying liquids. U.S. Pat. 894,435. *See* XVIII*B*.

Filament for electric lamps. U.S. Pat. 896,060. *See* II.

Oxides of nitrogen; Preparation of ——. Ger. Pat. 200,138. *See* VII.

(*B.*)—ELECTRO-METALLURGY.

Iron; Electrical testing of —— during annealing. E. E. F. Creighton. Trans. Amer. Electrochem. Soc., 1908, **13**, 127—131.

IN order to determine the proper method of annealing iron for commercial electrical use, a special furnace was designed, which permitted the measurements of the hysteresis and eddy currents, for all values of temperature, up to, and down from, the temperature at which the iron becomes non-magnetic. The whole apparatus was enclosed in an air-tight case in order that different gases might be substituted for air. Certain gases had a marked effect on the iron at temperatures above that at which magnetism disappears. Ammonia gas rendered the metal completely unfit for electrical work, probably owing to the occlusion of nitrogen by the iron.—F. R.

Brasses; Additional experiments on the electrolytic corrosion of ——. A. T. Lincoln and G. C. Bartells. Trans. Amer. Electrochem. Soc., 1908, **13**, 331—336.

IN continuation of the experiments on the electrolytic corrosion of brasses, in solutions of various salts (see this J., 1908, 167), similar experiments were made, using synthetic sea water and solutions of commercial bath salt. Thirteen anodes, composed of alloys ranging from 3 to 93·5 per cent. of copper, were corroded simultaneously, using a current of about 0·03 ampère. The relative amount of corrosion was determined, together with the percentage of copper in the corrosion product, and the current efficiency. The total amount of corrosion decreased with the decrease of the copper content of the alloy, until brasses containing about 53 per cent. of copper were reached, when it remained constant. The corrosion products of brasses of over 53 per cent. of copper were of similar composition to the original alloy, but of those containing less copper, and in which γ-crystals were present, the corrosion product consisted of zinc compounds practically free from copper.—F. R.

Iron: Corrosion of —— from the electrochemical standpoint. C. F. Burgess. *See* X.

Steel conduit: Electrochemical corrosion of the Rochester ——. R. H. Gains. *See* X.

Patents.

Metallic deposits: Production of —— [electrolytically]. H. Schmidt, Cologne-on-the-Rhine. Eng. Pat. 18,043, Aug. 8, 1907.

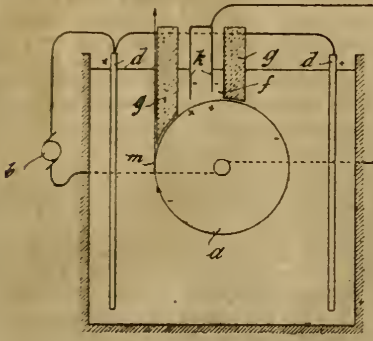


Fig. 1.

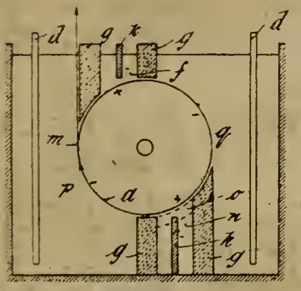


Fig. 2.

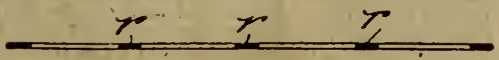


Fig. 3.

Electro-deposits, which can be readily removed from the cathode or base, are obtained by employing the cathode also as anode, at an electromotive force at which no visible alteration takes place. The rotary cylinder, *a*, is used as cathode, the current passing from the source, *b*, to the anodes, *d*, through the electrolyte to *a*, and back to *b*. Metal is deposited on the cylinder, and as the latter rotates, the metal passes into the space, *f*, isolated from the bath by the partitions, *g*. A current from the battery, *h*, passes to the cylinder, *a*, as anode, thence to the cathode, *k*, and back to the battery, *h*. In passing through the space, *f*, the surface of the cathode is "anodically polarised," and the metal subsequently deposited thereon will not adhere, and may be readily withdrawn at the point, *m*, as "an endless strip of metal foil." The electromotive force required for the "anodic polarisation" varies with the thickness of deposit required; for thin foil to be ground into bronze it is about 3 volts, but for thicker deposits of nickel, "of the thickness of tin foil," it is about 1·3 volts. In producing "an endless hollow pipe" of metal, a second isolating space, *n* (see Fig. 2), is provided, and templates, *o*, cover the deposited metal along certain lines. At the latter, the surface of the cathode will not be "anodically polarised," and the metal deposited when the cylinder passes through *p*, will adhere to that deposited when passing through *q*, as shown at *r* (Fig. 3), whilst both deposits will be separate where the first deposit has been polarised in passing through *n*. The strip will have the section shown in Fig. 3, and by cutting the strip longitudinally at the points, *r*, separate thin pipes of foil may be obtained.
—B. N.

Covering silver-plated surfaces of glasses or mirrors with a protective metal layer; Electrolytic processes for —— and apparatus therefor. J. H. Monge, St. Gilles-lez-Bruxelles, Belgium, and C. Arzano, La Madeleine-lez-Lille, France. Eng. Pats. 16,538, 16,539, and 18,210, Aug. 12, 1907.

(1). Silver-plated surfaces of glasses or mirrors are coated with a protective layer, such as copper, by treating the mirror as cathode in a neutral electrolytic bath, the neutral state being maintained by the combined action of a non-soluble and a soluble anode. For this purpose, a compensating bath is connected to a working electrolytic bath, and a circulation of the liquids in the two is maintained by a suitable pump. The anode in the compensating bath is soluble, and that in the working bath is insoluble, so that whilst an alkaline liquid is generated in one bath, that in the other becomes acid, or *vice versa*, thus maintaining a neutral condition of the electrolyte. (2). The cathode support has a surface twice as large as that of the anode, so that while one or more mirrors are undergoing treatment opposite the anode, other mirrors may be removed from or introduced into the electrolytic bath, and be given a preliminary treatment. In the latter case, owing to the distance of the anode from the cathode, the mirrors receive only a thin film of copper, which assists the subsequent copper plating proper. The cathode consists of two openwork horizontal frames, covered with a series or network of copper blades forming the cathode support, and the mirrors are placed, with their glass surfaces downwards on these, the silvered surfaces being connected electrically with the copper blades, as described in Pat. 18,210 (see below). The frames are provided with cables, guided by rollers, so that they may be lifted out of or lowered into the bath, whilst remaining connected to the source of current, the conductors attached to the copper blades being brought outside the bath, and introduced into conductor tubes containing mercury. The anodes consist of horizontal rods, carried by a carriage provided with conductor rollers attached to the anodes, and rolling on one or more conductor rails connected to the source of current. The carriage is movable longitudinally, and the anodes, whilst remaining attached to the source of current, may be brought in turn over each half of the cathode, after the preliminary treatment is completed. The bath is provided with inlet and outlet tubes for the electrolyte, the orifices being arranged substantially at the same level above the mirrors, and arrangements are provided for the agitation of the electrolyte in a horizontal direction. (3). The glass surface of the mirror bears on the surface of the cathode blades, so that, whatever the area of the silvered surface, a cathode surface of substantially constant area is obtained, the increased area of the cathode, due to the covering of the open spaces of the network by the mirror, being practically balanced by the silver-plated surface being brought nearer to the anode, due to the thickness of the glass. In order to distribute the current uniformly over the silvered surface of the mirror, contact pieces are threaded and pivoted on insulating rods, with interposed spacing pieces of insulating material. The whole is freely movable on the cathode support, so that it may be adapted to mirrors of any size. The pivoted contact pieces are covered on the outer side, facing the anode, with an insulating material, and their conductor faces rest in contact with both the surface of the supporting cathode and the edges of the silver-plating of the mirrors. A uniform distribution of current over the silvered surface, starting from the edges of the mirror, is thus obtained.
—B. N.

Metals; Process for the electro-deposition of —— by wet processes, dispensing with the preliminary scouring of the objects. A. Levy. First Addition, dated March 11, 1908, to Fr. Pat. 385,058, Feb. 25, 1907 (this J., 1908, 818).

In addition to the substances mentioned in the main patent, any inorganic or organic salt of the alkali metals or of the metal to be deposited, dissolved in an appropriate solvent, such as an alkali hyposulphite, sulphite, or bisulphite may be added to the electrolyte.—B. N.

Copper; Process for obtaining electrolytic —— from oxide ores or intermediate products containing copper oxide. Siemens und Halske A.-G. Ger. Pat. 199,258, May 30, 1907.

The claim is for an electrolytic process, using anodes smelted from the raw material containing copper oxide, and rotating cathodes in an electrolyte consisting of a copper solution obtained by lixiviating poorer ores and to which sulphurous acid has been added.—A. S.

Electrolytic colouring of objects having a metallic conducting surface. F. Fischer. Ger. Pat. 199,309, Oct. 13, 1907.

The objects are first coated electrolytically with lead, and then used as anodes in a suitable electrolyte, for example a hot solution of the phosphates of sodium, potassium, or ammonium. According to the temperature, current-density, and duration of treatment, yellow, greenish, brown, or red oxide coatings are produced on the lead, and these may be subsequently subjected to suitable chemical or mechanical treatment.—A. S.

Ores; Process of, and apparatus for extracting [volatile] metals from ——. J. H. Reid, Newark, N.J., Assignor to Electric Smelters, Ltd., Ottawa, Canada. U.S. Pats. 896,245 and 896,413, Aug. 18, 1908.

(1). The ore is passed through a series of communicating vacuum chambers, each heated to a temperature suited to the independent sublimation of one of the metals contained in the ore. Each chamber is provided with a separate condensing chamber. The ore may be heated to successive temperatures in one chamber, the sublimed metals being condensed successively and separately. (2). The apparatus consists of a series of chambers communicating vertically and heated to different temperatures, by electric arcs. The ore passes down through each chamber, whereby the metals are volatilised, separate condensing tanks being connected with each chamber. The complete furnace is enclosed in an outer casing. Means are provided for creating a vacuum in the chambers, tanks, and outer casing.—F. R.

Electric furnace. Westdeutsche Thomasphosphat-Werke. Fr. Pat. 388,668, March 28, 1908.

A number of electrodes of alternating polarity are arranged on the circumference of the fusion bed in such a way that the electric current is obliged to circulate across and around the metal therein. To the same end the furnace may have a T-shaped section with electrodes of opposite polarity contained in cavities in the hearth. Electrodes of carbon or steel are provided above the hearth corresponding to those below, which are always of steel and preferably cooled. It is also arranged that the circumferential electrodes may be connected pair by pair to different sources of electricity, so that various portions of the melt are put into different circuits, with the result that a more perfect admixture of the components is obtained.—C. A. W.

Metallic silicides [calcium silicide]; Preparation of ——, and their industrial application. Comp. Générale d'Electro-Chimie de Bozel. Fr. Pat. 388,730, Mar. 31, 1908.

The preparation of a metallic silicide (that of calcium, for instance), by the reduction of a mixture of oxide and silica by carbon, in the electric furnace, is attended with the formation of silicates which are only reduced with difficulty. According to the present invention, calcium carbide is used, instead of lime, in this process, or metallic silicon in the place of silica. The formation of silicate is thus prevented. Calcium silicide finds an application in steel works, replacing, with advantage, the more expensive aluminium, for preventing the formation of vesicles in the ingots. Steels made in this way are claimed as new products.—F. Sodn.

Calcium, barium, and strontium silicides; Manufacture of ——. T. Goldschmidt. Ger. Pat. 199,193, May 19, 1907.

An alloy of calcium and silicon, free from carbon, and suitable for technical purposes can be prepared by melting together lime and silicon in a crucible, muffle, reverberatory furnace, wind furnace, or Martin furnace. For example, a mixture of 2 parts of lime and 1 part of silicon is heated in a crucible at the temperature of molten cast iron. The silicon is partially oxidised, and the lime is partly reduced and partly converted into slag. A fluid calcium silicate slag is produced, the composition of which can be so regulated, that the slag falls to powder on cooling, thus allowing of the separation, by sifting, of the grains of calcium silicide distributed throughout the mass. The composition of the slag is controlled by addition of fluorspar and calcium chloride. The reaction proceeds according to the equation:

$$5CaO+5Si=2CaSi_2+3CaO.SiO_2.$$

Silicides of barium and strontium can be prepared in a similar manner.—A. S.

Electric furnace for the continuous extraction of zinc from its ores. E. F. Cote and P. R. Pierron, Lyons, France. Eng. Pat. 22,283, Oct. 9, 1907.

See Addition of Sept. 25, 1907, to Fr. Pat. 385,018 of 1907; this J., 1908, 632.—T. F. B.

[Electric] furnace for effecting fusion or refining. E. A. O. Viel, Paris. U.S. Pat. 895,519, Aug. 11, 1908.

See Fr. Pat. 380,119 of 1907; this J., 1907, 1285.—T. F. B.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

Cottonseed oil; Halphen's test for ——. H. Wagner and J. Clement. Z. Untersuch. Nahr. Genussm., 1908, **16**, 145—159.

The authors' experiments, described in detail, show that the reaction is more sensitive when the test is made in closed flasks capable of resisting pressure than in the usual way. The proportion of carbon bisulphide solution and amyl alcohol may be reduced to 3 c.c. for 5 grms. of fat without interfering with the intensity of the coloration, and even when the test is made in a test tube closed with a cork and tube to act as a condenser, a further addition of the reagents does not promote the reaction. If no coloration occurs after the flask has been immersed in boiling water for 15 minutes, the time may be increased to 30 minutes. Under these conditions an unmistakable red coloration will be obtained in the presence of at least 1 per cent. of cottonseed oil. The failure of the appearance of the reaction in the case of old oils must be attributed to the conditions under which they have been kept (exposure to light and air) rather than to the length of time.—C. A. M.

Japanese tea-seed oil. M. Tsujimoto. Chem. Rev. Fett- u. Harz-Ind., 1908, **15**, 224.

Two specimens of the decorticated seeds of *Thea sinensis* yielded 23·9 and 26·23 per cent. of oil respectively. The oil obtained by expression from Tokyo seed was an orange-yellow liquid with a somewhat unpleasant odour and bitter taste. It was readily soluble in the ordinary solvents for oils. In the elaidin test it yielded a butter-like mass after 24 hours. The following analytical values were obtained:—Sp. gr. at 15° C., 0·9178; acid value, 0·74; saponification value, 191·91; iodine value (Hübl), 90·42; Hehner value, 95·6; Reichert-Meissl value, 0·66; refractometer reading at 20° C., 1·4707. *Fatty acids:*—Sp. gr. at 98° C., 0·8445; m. pt., 33·5° C.; neutralisation value, 197·6; mean molecular weight, 283·91; and iodine value, 92·86. Tea-seed oil resembles tsubaki and sasanqua oils (this J., 1908, 454) in many characteristics, but differs from them in containing a greater amount of fatty acids more unsaturated than oleic acid and a larger proportion of solid fatty acids. It could be used for the same purposes as those oils, but if intended for food would require careful refining to eliminate substances of the nature of saponin. So far it has not been prepared as a commercial oil product.—C. A. M.

Oleic acid; Spectral reaction of ——. J. Lifschütz. Z. physiol. Chem., 1908, **56**, 446—452.

Oleic acid gives coloured products when treated with various oxidising agents under certain conditions, the best results being obtained with chromic acid in presence of glacial acetic and sulphuric acids. The test is carried out in the following manner: 1 drop of oleic acid is dissolved in 3—4 c.c. of glacial acetic acid, 1 drop of a 10 per cent. solution of anhydrous chromic acid in glacial acetic acid is added and finally 10—12 drops of concentrated sulphuric acid. The mixture is allowed to stand, whereupon the green colour fades rapidly, giving place to a violet to cherry-red, which increases in intensity. The coloured solution, diluted if necessary with acetic acid, shows a strong, broad absorption band in the green portion of the spectrum, near the blue, and two weaker, narrower bands, one in the green, near the yellow, and one between the orange and yellow. In the case of glycerides the solution is liable to become cloudy after the addition of the sulphuric acid, but may be cleared by the cautious addition of a few drops of chloroform. For the detection of oleic acid in presence of stearic or palmitic acids, the separation of the solid acids may be obviated by warming the reaction-mixture to 70°—80° C. and examining the warm solution spectroscopically. The spectroscopic examination may be made quantitative by diluting the warm solution with glacial acetic acid and examining the intensity of the bands side by side with known standards. Another means of separating the oleic acid product from the stearic acid consists in adding to the warm reaction-mixture sufficient chloroform to cause the separation of two layers on cooling. The oleic acid product remains in the lower layer, which may be diluted for examination by the addition of concentrated sulphuric acid. The degree of sensitiveness of the spectral reaction is about 1 : 15,000. Wool fat does not give this reaction, nor does oxidised oleic acid. Fused trichloracetic acid gives the same spectral reactions with oleic acid direct, and since this reaction is very similar to Tschugajew's trichloracetic acid test for cholesterol, care must be taken to remove all traces of oleic acid from the cholesterol before applying the test.—J. F. B.

Sulphoricinoleic acid; Decomposition of —— by dilute acids. P. Wagner. Z. Farben-Ind., 1908, **7**, 284—285.

It is usually accepted that sulphoricinoleic acid is decomposed by dilute acids into ricinoleic acid and sulphuric acid. The author shows, however, that the fatty acid formed in the decomposition differs materially from ricinoleic acid. Thus it does not solidify at − 18° C., and forms gelatinous alkali salts and an amorphous lead salt which is insoluble in ether; whereas ricinoleic acid solidifies completely at − 6° to − 10° C., forms crystalline alkali salts and a crystalline lead salt which dissolves in ether. In the author's opinion the new acid is a dihydroxy fatty acid formed in accordance with the equation—

$$C_{18}H_{33}.O_2.OSO_3H + H_2O = C_{18}H_{33}O_2O.OH + SO_2 + H_2O,$$

the decomposition thus being analogous to that of sulphobenzoic acid by alkali hydroxide. The new acid and its gelatinous alkali salts have been used with success in the preparation of aniline dyestuffs and in the textile industry. —C. A. M.

Lard and other fats; Determination of water in ——. K. Fischer and W. Schellens. *See* XVIII*A*.

Drying oils; Radiation phenomena of ——. Werner Schmidt. *See* XXIV.

Patents.

Grease; Still for treating recovered ——. C. Ellis, Boston, Mass., Assignor to Ellis-Foster Co., New Jersey. U.S. Pat. 896,093, Aug. 18, 1908.

The still consists of an elongated retort situated above a heating chamber. A steam superheater is fitted in the heating chamber and a perforated pipe in connection with the superheater extends into the retort. The neck of the retort is provided with a trap in which is a vertical baffle-plate; means are also provided for drawing off the liquid from the upper and lower portions of the trap. This trap is surrounded by a preliminary drying chamber for the wet grease, a vertical valved pipe connecting the drying chamber with the retort.—W. P. S.

Oleic acid; Apparatus for the conversion of —— into stearic acid by the contact process. P. Schwoerer. Ger. Pat. 199,909, Dec. 29, 1906.

The apparatus consists of a jacketed chamber in which is mounted a screw, the blades of which have upturned edges. The oleic acid flows down over the upper faces of the blades of the screw, whilst the catalytic agent (asbestos impregnated with nickel) is distributed on the under sides of the blades. By this arrangement the temperature of the reaction chamber can be easily regulated, and the catalytic substance comes in contact only with oleic acid vapour, thus avoiding the formation of tar, etc., which takes place when it comes in contact with liquid oleic acid.—A. S.

Soap; Liquid —— and process of producing the same. K. Lendrich, Hamburg, Assignor to H. Lieber, New York. U.S. Pat. 895,477, Aug. 11, 1908.

A liquid soap, in which benzene is readily soluble, is prepared from a mixture consisting of 100 parts by weight of a vegetable oil rich in compounds of unsaturated fatty acids; 62 parts of "spirits"; and 37 parts of potash lye. The potash lye should contain 55 per cent. of potassium hydroxide and be practically free from chlorides and carbonates.—W. P. S.

Soap; Method of cooling ——. F. Jürgens, Sangerhausen, Germany. U.S. Pat. 896,551, Aug. 18, 1908.

See Eng. Pat. 18,666 of 1905; this J., 1906, 486.—T. F. B.

Oils; Apparatus for determining the degree of viscosity and lubricating power of ——. Fr. Pat. 388,671. *See* XXIII.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(*A.*)—PIGMENTS, PAINTS.

Patents.

Pyrites, pyrites cinder, and the like; Process for utilising liquor obtained from ——. [*Preparation of zinc sulphide pigments.*] J. H. Thwaites, Peterborough. Eng. Pat. 27,426, Dec. 12, 1907.

This invention relates to the recovery of compounds, and especially of zinc sulphide pigments, from liquors obtained from pyrites, pyrites cinder, and the like. To the heated liquor, from which copper may have been already removed, zinc carbonate, oxycarbonate, or oxide is added in sufficient quantity to precipitate all the iron present, ferrous being oxidised to ferric iron by air or other oxidising agent. Any copper, lead, arsenic, antimony, and cadmium are then removed from the liquor by adding a sufficient amount of a suitable sulphide, and nearly all the zinc is next precipitated with a soluble sulphide, barium sulphide being preferably used, if a sulphate be present, so as to produce the pigment known as lithopone. The rest of the zinc, together with manganese, cobalt, and nickel, is precipitated from the remaining liquor by a further addition of a soluble sulphide, and the final liquor may be worked up for compounds of the alkalis or alkaline-earths. It is stated that the oxides of iron and aluminium precipitated in this process, which are suitable for the preparation of oxide paints, etc., are much more easily handled and washed, than when alkalis or alkaline-earths are used as precipitants.—F. Sodn.

Zinc liquors for the manufacture of lithopone; Purification of —— by electrolysis. Chem. Fabr. Marienhütte Gebr. Alberti. Ger. Pat. 199,493, June 11, 1907.

In the usual method of purifying crude zinc liquors by boiling with zinc dust, it is very difficult to remove the whole of the cadmium, which when present imparts a yellow colour to lithopone. According to the present process the crude liquor is purified by electrolysis in a lead-lined vessel, which serves as cathode, the anode being a plate or bar of metallic zinc suspended in the liquid. The zinc dissolves at the anode and foreign metals are deposited in a spongy condition on the lead lining of the containing vessel. The electrolysis is continued until a test-sample of the electrolyte is found to be free from cadmium.—A. S.

Painting; Manufacture of compounds for ——. W. N. Blakeman. Fr. Pat. 388,736, March 31, 1908.

See U.S. Pats. 883,513, 883,514, 883,515, and 883,516 of 1908; this J., 1908, 456.—T. F. B.

Painting; Manufacture of compounds for ——. W. N. Blakeman. Fr. Pat. 388,737, March 31, 1908.

See U.S. Pats. 883,517, 883,518, 883,519, and 883,520 of 1908; this J., 1908, 456.—T. F. B.

(C.)—INDIA-RUBBER, &c.

Elastic substance (caoutchouc) occurring on the shoots and young leaves of Eucalyptus corymbosa and some species of Angophora. H. G. Smith. Abs. Proc. Royal Soc. N. S. Wales, 1908, July 1st, vii.—viii.

The elastic substance, which is stated to be a very good form of caoutchouc, is produced at the time the shoots are developed, forming a protective coating over them, which stretches and expands as the buds expand and the individual leaves are formed. It then becomes oxidised to a white powdery substance, which, although it is not visible in the case of *E. corymbosa* and the other *Eucalypts* of the same group, remains on the leaves and can be removed from them by means of ether. This white substance is accompanied by small quantities of a vegetable wax, soluble in boiling petroleum ether and boiling alcohol. In species of *Eucalyptus* having white pulverulent growth, such as *E. cinerea*, *E. pulverulenta*, *E. globulus*, etc., the proportion of wax is high, and where the wax predominates, the elastic substance is absent, the protective functions of the latter being performed by the wax. The amount of material removed from the fresh, young leaves of *E. corymbosa*, by means of ether, was 0·84 per cent., of which 0·224 per cent. was wax; in the case of *E. cinerea* the amounts were 1 per cent. and 0·355 per cent. respectively. The elastic substance dissolves well in chloroform, and from the solution a highly elastic sheet of rubber is obtained on evaporation. The other usual rubber solvents have very little action upon it. The rubber did not melt when heated to 250° C., and recovered its elasticity on cooling; it vulcanised well when heated in molten sulphur. The commercial preparation of Eucalyptus rubber does not appear to be practicable on account of the high cost of collection, and the rapid alteration undergone by the rubber on the leaf. From 500 grms. of buds and young leaves, 0·785 grm. of rubber was obtained. The author suggests that the possibility of polymerising some of the Eucalyptus terpenes is a question worthy of consideration; he wishes to reserve to himself the chemical investigation of the white powdery substance and of the vegetable wax.—E. W. L.

Thio-ozonides and the constitution of certain sulphur compounds. H. Erdmann. *See* IV.

Indiarubber exports from Madagascar. Bd. of Tr. J., Sept. 10, 1908. [T.R.]

The export of indiarubber has decreased from 301,518*l.* in 1906 to 209,705*l.* in 1907. While this diminution is due principally to the fall of prices on the European markets, other causes have contributed to lessen the production. A duty of 2*d.* per lb. imposed since February on all qualities of rubber exported from Madagascar so affected the low class rubber found in the west of the island that the value of exports from the province of Tulear, in the south-west, fell from 46,213*l.* in 1906 to 24,754*l.* in 1907, while from Majunga, on the west coast, the respective values in 1906 and 1907 were 76,071*l.* and 43,984*l.* In the northern provinces of the island, plantations of from 700,000 to 800,000 trees have been almost entirely abandoned owing partly to the above-mentioned causes and also to the impossibility of any longer obtaining labour in consequence of the more remunerative employment offered to the natives in the recently formed mining camps.

Bahia rubber. Indiarubber J., Sept. 7, 1908. [T.R.]

The export of rubber from Bahia during 1907 was less by over 300 tons than the export during 1906. The diminished export during the past year was the result of the financial crisis in the United States, which country had been the principal customer for Bahia rubber. The rubber of Bahia is of two kinds, known respectively as Manicoba and Mangabeira, both of which are generally inferior in quality to Para rubber. The financial crisis in the United States led to heavy reduction in price of Para rubber, the figures touched during 1907 having been as low as 2s. 9d. per lb. for "fine hard" quality and 3s. 2d. per lb. for "plantation" quality. Under those circumstances, coupled with the fact that the stock of medium (non-Para) rubber accumulated during 1907 amounted to some 10,000 tons, manufacturers elected to purchase only Para rubber during the past year, and thus the demand for Bahia rubber was but small during the period in question.

Patents.

Caoutchouc and resin; Process and apparatus for the separation of —— from latex, or from resinous products containing caoutchouc. L. G. Worms and G. F. Flamant. First Addition, dated Feb. 24, 1908, to Fr. Pat. 382,571, Oct. 4, 1907 (this J., 1908, 235).

In the main patent the use of mixtures consisting of a liquid which dissolves both caoutchouc and resin, and a liquid which dissolves resin but precipitates caoutchouc from its solutions, is claimed for the purpose of extracting resins. In the present addition, two other solvents, belonging to the former category, are named as suitable for use, viz., ethyl ether and carbon bisulphide.—E. W. L.

Vulcanised gums; Process for the regeneration of ——. E. A. L. Rouxeville. First Addition, dated May 18, 1907, to Fr. Pat. 375,709, May 21, 1906 (this J., 1907, 935).

In order to remove the resins with which the vulcanised waste has been heated, the following substances, in addition to those already mentioned, may be used: sodium or potassium carbonate, ammonia or ammonium salts, and certain oxides which have the property of forming soaps. In addition to resins, pitch or tar may be used for dissolving the waste. The author explains the devulcanisation as being effected by the solution of the vulcanised rubber by terpenes (present in the resins), which also deprive it of its sulphur. By the addition of water to the mass obtained on treating the resin-solution of vulcanised rubber with alkalis, an emulsion is formed, and the loading materials are thus readily separated from the rubber. On subjecting caoutchouc itself to similar treatment, an emulsion is also obtained, from which the caoutchouc may be precipitated by the addition of alum or acid.—E. W. L.

Rubber; Regeneration and devulcanisation of old ——. G. Austerweil. Fr. Pat. 388,248, Mar. 17, 1908.

The vulcanised waste is dissolved in four to five times its weight of limonene at the boiling-point of the latter, the solution being decanted from insoluble impurities, and the rubber precipitated by the addition of a fatty alcohol or of acetone. The precipitated rubber is washed with hot water and dried at 100° C. (See also this J., 1907, 265.)—E. W. L.

Elastic compositions. L. Roland, Paris. Eng. Pat. 26,446, Nov. 29, 1907. Under Int Conv., May 22, 1907.

See Second Addition to Fr. Pat. 364,075 of 1906: this J., 1907, 1153.—T. F. B.

Errata.

This J., 1908, page 908, col. 2, line 30 from top, *after* "London," insert "From Rutgerswerke A.-G.".

This J., 1908, page 909, col. 2, line 8 from top, *for* "Weichmann" *read* "Wiechmann."

XIV.—TANNING, LEATHER, GLUE, SIZE.

Patents.

Leather, artificial; Manufacture of ——. Fiber Products Co. Fr. Pat. 388,735, March 30, 1908.

In the preparation of artificial leather from leather waste, etc., the plastic fibrous material contained in a permeable envelope, is introduced into the annular space between two concentric perforated drums mounted on a common shaft. The whole is then rapidly rotated; under the action of the centrifugal force, the inner drum approaches the outer one, and thus the fibrous material is subjected to the combined action of centrifugal force and mechanical pressure. In order to increase the effect, tangential bars are fixed on the one hand to a nave on the central shaft, and on the other, to the periphery of the inner drum. The latter is constructed in separate sections, in order to allow of the drum expanding or contracting without changing its position relative to that of the outer drum.—A. S.

Artificial leather and other materials made from fibres; Manufacture of ——. H. W. Lake, London. From Fiber Products Co., New York. Eng. Pat. 6131, March 19, 1908.

See Fr. Pat. 388,735 of 1908; preceding.—T. F. B.

Quebracho extracts; Process for treating ——. A. Redlich and L. Pollak. Fr. Pat. 388,855, March 10, 1908.

See Eng. Pat. 4358 of 1908; this J., 1908, 696.—T. F. B.

XV.—MANURES, &c.

Patents.

Peat; Industrial treatment of —— to increase its content of nitrogen, in view of its application as a manure. E. V. H. Bazin. Second Addition, dated Mar. 17, 1908, to Fr. Pat. 360,484, Dec. 14, 1905 (this J., 1906, 488, 1227).

Sewage, which has been subjected to anaerobic fermentation in a tank containing peat, is conducted to a tank where it is submitted to the action of aerobic organisms. The liquid is then delivered on to beds composed of nitrate-producing ground as described in the original specification, and the solution of nitrate thus obtained is allowed to evaporate in large shallow basins. The residue of nitrate and peat-dust obtained by the evaporation is used as a manure.—W. P. S.

Phosphatic manure and a nitrate; Process of manufacturing a ——. C. N. Riiber. Fr. Pat. 388,460, Mar. 23, 1908.

A mineral phosphate, such as apatite or phosphorite, or powdered bones, is dissolved in the dilute nitric acid obtained by subjecting air to the action of an electric arc, and the solution is then neutralised by the addition of powdered lime, milk of lime, or calcium carbonate. The precipitated phosphate is separated and constitutes the manure claimed, whilst the nitrate remaining in solution is recovered in the usual manner.—W. P. S.

XVI.—SUGAR, STARCH, GUM, &c.

Sugar factories; Formation of jelly and mucilage in raw —— by micro-organisms. A. Schöne. Deutsche Zuckerind., 1908, 33, 699—702. (See also this J., 1901, 733; 1904, 1037.)

After giving a brief historical account of the subject, the author describes his own recent researches in four cases of jelly or mucilage formation:—(1). An examination of the greyish-white, transparent, pasty mass which formed on the plate under the filter-press, showed that it consisted chiefly of a network of rodlet bacteria and threads embedded in mucilage. By means of sugar-gelatin plate cultures, motile and non-motile rodlets, 0·6—0·8 μ broad and 1·6—1·8 μ long, were obtained; when, however, the jelly was heated in sugar solution for 5 minutes to 100° C. before cultivating the organisms, the length of the rodlets subsequently obtained, was much greater. The author considers that these bacteria and the jelly-forming organisms described by Maassen (this J., 1905, 1076) and others, all belong to the *Semiclostridium* group. The pasty mass containing the *Semiclostridium* was also found to contain harder lumps of a jelly-like substance; these lumps consisted of *Leuconostoc cocci* and chains of cocci, surrounded by a tough jelly. The connection, if any, between the presence of *Leuconostoc* and that of *Semiclostridium* requires further study. (2). A sample of jelly obtained from another factory, was much tougher than that discussed in the preceding case, and consisted chiefly of *Leuconostoc* embedded in jelly; it was also found to contain *coli*-like rodlets and thermophilic yeast. It may be that the yeast co-operates with the *Leuconostoc* in the production of jelly. According to the nature of the organisms accompanying it, or of the medium surrounding it, *Leuconostoc* appears to be capable of altering the consistency of the jelly which it forms. (3). A sample of raw juice from a third factory consisted chiefly of a mucilaginous, ropy gum: this gum was soluble in water, differing in this respect from the jellies described above. The organism responsible for the production of the gum was found to be a motile rodlet, 0·8—1·0 μ broad and 4·0—10·0 μ long; on sporulation, the rodlets acquired a *Clostridium* form. (4). In this case, a flocculent gum was formed in the diffusion juice; the organism which produced the gum was isolated by heating the latter to 75° C. (whereby yeasts and *Leuconostoc* were destroyed), and then making plate cultures; it was found to be a typical *Cladothrix* variety. Grown in diffusion juice, this organism forms a surface film which gradually sinks to the bottom, a succession of new films being subsequently formed, so that finally, a number of films accumulate at the bottom of the vessel. These films present a structure quite similar to that of the above-mentioned flocks. The samples of juice containing the flocculent gum examined by the author, were in a state of vigorous fermentation, owing, very probably, to the yeast present in them. It is worthy of notice, that this yeast, like that observed in case (2), was thermophilic, not being affected when heated to 70° C. for 10 minutes.—L. E.

Pentoses ; Detection of —— with orcinol and hydrochloric acid. J. Pieraerts. Bull. Assoc. Chim. Sucr. et Dist., 1908, **26**, 46—62.

In examining some solutions containing pentose and hexose sugars, the author found that though they yielded furfural on distillation with hydrochloric acid and also gave Ihl's pentose reaction with phloroglucinol and hydrochloric acid, they gave a negative result when tested for pentoses with orcinol and hydrochloric acid, the colour obtained being bronze-brown instead of greenish-blue. The substances in these solutions were found to consist practically entirely of pentose and hexose sugars, and further tests showed the presence of xylose, lævulose, galactose, and dextrose. The author therefore made experiments to determine the influence of the three hexoses on the reaction between xylose and orcinol-hydrochloric acid. His method for carrying out the test is as follows :—Five c.c. of the solution, containing 1—5 per cent. of sugar, is treated with 3 drops of a fresh, alcoholic solution of orcinol (prepared by dissolving 1 grm. of purest orcinol in 200 c.c. of 94 per cent. alcohol) and then with 5 c.c. of concentrated hydrochloric acid. The mixture is shaken and then heated on a boiling water-bath for half an hour. The presence of pentoses is indicated by the appearance of a greenish-blue colour after a shorter or longer time ; blue flocks (dissolving in amyl alcohol to an azure-blue colour) are often formed as well. The author also employed the orcinol tests recommended by Tollens and by Bial. The chief conclusions drawn from the experiments were as follows :—The ketonic group prevents the detection of pentoses by orcinol-hydrochloric acid owing to the production of brownish colours ; hence this method is not applicable in presence of lævulose or compounds which yield lævulose on hydrolysis ; if such compounds are present in the substance to be tested, they must be decomposed by fermentation. Tollens' reagent (prepared by dissolving 0·5 grm. of orcinol in 30 c.c. of concentrated hydrochloric acid and then adding 30 c.c. of water) is only suitable for detecting pentoses in solid substances ; in testing solutions for pentoses, the acidity of the mixture (5 c.c. of solution and 5 c.c. of Tollens' reagent) must be increased by addition of 5 c.c. of concentrated hydrochloric acid. The disturbing influence of dextrose on the orcinol test for pentoses is only a slight one, especially if alcoholic orcinol be used ; other naturally occurring aldose sugars have practically no effect on the characteristic orcinol-pentose coloration. Small quantities of pentoses may be detected by the alcoholic orcinol reagent and by that employed by Bial.—L. E.

Sugars ; Precipitation of —— by cupric hydroxide. S. Yoshimoto. Z. physiol. Chem., 1908, **56**, 425—445.

In 1872, E. Salkowski observed that dextrose could be practically completely precipitated from solutions, in combination with cupric hydroxide, when the reagents were mixed in the proportions of 1 mol. of dextrose, 5 mols. of copper sulphate, and 11 mols. of sodium hydroxide. The author has repeated these experiments and has extended his investigations to other sugars. The solutions employed were of such a strength that the above molecular proportions were obtained when 10 c.c. of a solution containing 4·5 grms. of dextrose per 100 c.c. (or an equivalent weight of another sugar) were mixed with 25 c.c. of copper sulphate solution (124·7 grms. per litre) and treated with 27·5 c.c. of $N/_1$ sodium hydroxide solution. Then, keeping the quantities of sugar and copper sulphate solutions constant, the author studied the effect of varying the quantity of sodium hydroxide solution on the precipitation of the sugars. The precipitates were allowed to stand for half-an-hour and then collected on dry filters, and the sugar remaining unprecipitated was determined in the filtrates. In all cases a point of maximum precipitation of sugar, lying between the limits of 20·5 and 30·5 c.c. of $N/_1$ sodium hydroxide, was found, but the actual quantity of sodium hydroxide required and the proportion of sugar precipitated at the maximum point varied with each sugar. These quantities are summarised in the following table :—

Sugar.	c.c. of $N/_1$ sodium hydroxide required to effect maximum precipitation.	Percentage of total sugar remaining unprecipitated.
Dextrose	27·5	1·66
Lævulose	23·5	10·53
Galactose	30·5	9·17
Sucrose	25·5	40·34
Maltose	23·5	38·42
Lactose	24·5	17·98
Raffinose	27·5	4·07
Arabinose	23·5	22·16
Xylose	24·5	7·93

In certain cases this reaction may be of use for the isolation of sugars, *e.g.*, from urine, but it is not available for the separation of different sugars.—J. F. B.

PATENTS.

Sugar solutions ; Apparatus for separating pulp from ——. Eberhardt Maschinen und Armaturen-Fabrik. First Addition, dated Mar. 27, 1908, to Fr. Pat. 383,522, Oct. 25, 1907.

The apparatus, which may be used for separating the pulp from beet-root juice, etc., consists of a vertical cylindrical sieve surrounded by an outer jacket. The juice is introduced into the top of the sieve, and the liquid portion passing through the sieve is conducted away from the outer jacket, whilst the pulp is removed from the inner surface of the sieve by means of revolving brushes fixed to a central shaft. Screw blades fitted to the lower end of the shaft force the pulp to the bottom of the sieve and thence into a screw compressor.—W. P. S.

Heating device for vacuum evaporators, especially for the sugar industry. A. Gräntzdörffer. Ger. Pat. 199,264, Feb. 13, 1907.

Fig1.

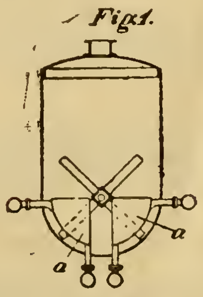


Fig2.

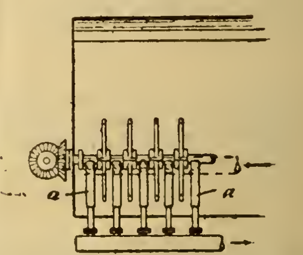


Fig3.

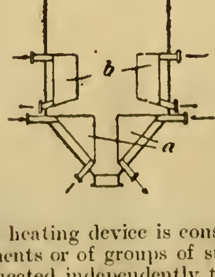


Fig4

The heating device is constructed of a number of similar elements or of groups of such elements. Each element si connected independently to the steam supply and to the outlet pipe for condensed water, and is constructed so as to possess a horizontal surface as small, and a vertical surface as large as possible, *e.g.*, in the form of a hollow disc or plate. In the case of rectangular evaporators with semi-cylindrical bottoms, the elements, *a*, have the form of quadrants and are arranged parallel to one another as shown in Figs. 1 and 2. In the case of cylindrical evaporators with conical bottoms, on the other hand, the heating elements, *a*, *b*, are of triangular or trapezoidal form, and are disposed radially as shown in Figs. 3 and 4. —A. S.

Evaporating solutions to the point of crystallisation, in a vacuum; Process for —— especially in the manufacture of sugar. A. Geiger. Ger. Pat. 199,936, May 7, 1907.

In vacuum evaporators of the common type, the use of a liquid as heating agent in place of steam is claimed. The liquid, heated to a suitable temperature, is caused to circulate through the tubes or other heating device. It is claimed that by this method it is possible to avoid local overheating, and the formation of "false crystals," *i.e.*, fresh crystals independent of those already formed. The evaporation proceeds gradually throughout the whole mass of the solution, and a slow and uniform growth of crystals is ensured.—A. S.

Starch, dextrin, and amylaceous products; Manufacture of ——. R. Goldschmidt and J. Hasek. First Addition, dated Feb. 29, 1908, to Fr. Pat. 331,061, Apr. 9, 1903 (this J., 1903, 1142).

The starch, after the pulp has been removed as described in the original specification, is diluted with water in the centrifugal drum, sifted, and washed.—W. P. S.

XVII.—BREWING, WINES, SPIRITS, &c.

Saponin [in lemonade and beer]; Detection of ——. J. Rühle. *See* XVIII*A*.

Aluminium; Behaviour of —— in contact with milk, wine, and some saline solutions. F. v. Fillinger. *See* XVIII*A*.

Patents.

Saccharine juices; Process for sulphitating and desulphitating —— and its applications to various fermentation industries. E. A. Barbet. Fifth Addition, dated June 6, 1907, to Fr. Pat. 361,869, Oct. 27, 1905 (this J., 1907, 29, 109, 708, 1250; 1908, 826).

The desulphitating process is carried out under reduced pressure so that the liquid boils at a temperature of from 70° to 72° C. A concentrated juice is thus obtained, containing from 320 to 325 grms. of sugar per litre, which, when fermented, produces a "liqueur" wine. The process enables the latter class of wine to be obtained from any kind of grape juice.—W. P. S.

Ammonia; Recovery of —— by the fermentation of organic nitrogenous substances [residues from sugar refineries and distilleries]. J. Effront. First Addition, dated April 1, 1908, to Fr. Pat. 382,689, Oct. 8, 1907 (this J., 1908, 241).

Ammoniacal fermentation of nitrogenous organic substances, produced by the butyric ferment, as described in the principal patent, is due to a diastase (amidase) which is also found in brewers' yeast, in a state of autophagy, and in soil ferments. Claim is now made for the employment, in the process, of yeast or garden soil, or preferably a mixture of the two. The time required for fermentation is thereby reduced and the yield of ammonia considerably augmented. To prevent the growth of moulds and the action of nitrifying ferments, partial sterilisation of the soil at 90° C. is recommended. —F. Sodn.

Still [for spirit, etc.]; Automatic ——. L. Grimaud. Fr. Pat. 388,843, Feb. 18, 1908.

The claim is for a self-contained still, rectifying column, and condenser, consisting of a furnace, above which is mounted a boiler for generating steam from the residual waste liquid. A column formed of a number of trays is arranged above the boiler and is surmounted by several superposed rectifying chambers surrounded by cooling casings. An outer annular vessel which surrounds the latter contains the cooling coil. The liquid to be distilled enters through a strainer and an automatic regulating valve, passing first around an auxiliary condenser where the objectionable volatile ethers escaping from the chief condenser are condensed. It then flows through the annular tank containing the condensing coil, becomes heated and passes to a small chamber at the top of the apparatus. In this chamber a thin metallic vessel, filled with pure alcohol and connected to the automatic valve is placed. In this way the feed of liquid to the still is controlled by the temperature of the same liquid as it leaves the condensing tank. The warm liquid flows through the tanks surrounding the rectifying chambers, enters the top tray of the column and flows down to the boiler at the bottom, from which the exhausted liquid is discharged. Steam passes upward from the boiler and carries with it the alcohol into the rectifying chambers; the steam is partially condensed and alcohol vapour mixed with more or less steam as desired, passes on to the coil in the annular tank, where it is condensed. —W. H. C.

Spirit; Separation of first runnings and after runnings from ——. M. Strauch. Ger. Pat. 198,804, Jan. 29, 1907.

The spirit, in a relatively thin layer, is exposed to the action of a heated bath of liquid, and whilst it is in contact with the heating surface is kept in a nearly still condition. —A. S.

Beer worts; Clarification of ——. V. Lapp. Ger. Pat. 197,711, March 27, 1907.

The wort, previously freed from the coarser insoluble particles, is led into a filter and heated. At 85°—95° C., the finely-divided particles forming the turbidity, coagulate, and the wort flows through the filter clear.—A. S.

Beer; Addition of "Kräusen" to ——. O. Kirchner. Ger. Pat. 199,344, Oct. 31, 1907.

The strong "head" produced in Pilsener beer is stated to be due to the presence of hop-resin constituents. The present patent relates to a process for producing a strong "head" in ordinary beers, and at the same time increasing the palate-fulness of such beers. This is attained by adding "Kräusen" to the beer in the storage cask, where it is under pressure owing to the evolution of carbon dioxide. In this way not only carbon dioxide, but also hop-resin constituents, peptones, and dextrins are introduced into the beer.—A. S.

Acetifiers; Charging —— alternately with wort and return vinegar. W. Martin. Ger. Pat. 199,616, Nov. 15, 1906.

The vinegar which is to be passed again through the acetifier, flows from the latter into a small receptacle and is then raised by means of a pump into a second small vessel, fixed above the acetifier, and connected with the device for controlling the alternate supply of wort and return-vinegar to the acetifier. The pump is alternately thrown into and out of gear by means of a float in the first receptacle.—A. S.

Brewers' pitch; Process for the manufacture of ——. L. Schmied, Prague, Austria-Hungary. U.S. Pat. 895,800, Aug. 11, 1908.

See Fr. Pat. 374,611 of 1907; this J., 1907, 886.—T. F. B.

Malting process. A. Oertel, Godesberg, Assignor to Deichmann und Co., Cologne, Germany. U.S. Pat. 896,752, Aug. 25, 1908.

See Fr. Pat. 349,478 of 1904; this J., 1905, 746.—T. F. B.

Mash; Apparatus for stirring and filtering ——. A. Hellwig, Belchatow, Russia. U.S. Pat. 897,205, Aug. 25, 1908.

SEE Eng. Pat. 4174 of 1907; this J., 1907, 984.—T. F. B.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

(A.)—FOODS.

Egg-yolk; The proteins of ——. R. H. Aders Plimmers. Chem. Soc. Trans., 1908, 1500—1506.

EGG-YOLK contains two proteins, fairly closely related to one another, the one, vitellin, containing 1 per cent., and the other, livetin, containing 0·1 per cent. of phosphorus. (See also this J., 1900, 840.) Since it is impossible to decide upon the identity or non-identity of two proteins from the figures obtained by ultimate analysis, etc., recourse was had to the determination of the various forms in which the nitrogen is contained in the proteins. This method, first carried out by Hausmann, was used effectively by Osborne and Harris in their study of the vegetable proteins, showing distinct differences (see this J., 1903, 655—656), and finally, it has again been used with regard to the two proteins of egg-yolk, as above stated.

Proteins; Detection of —— *by means of formaldehyde.* L. v. Liebermann. Z. Unters. Nahr. Genussm., 1908, **16**, 231.

THE test proposed is the converse of the well-known test for formaldehyde in milk, etc. Five c.c. of the solution to be tested for proteins are mixed with a few drops of formaldehyde solution, a trace of a dilute ferric chloride solution is added, and the mixture is allowed to flow over the surface of a quantity of concentrated sulphuric acid contained in a test-tube. If proteins be present in the solution, a violet ring appears at the junction of the two liquids. The test will detect the presence of 1 part of protein in 50,000 parts.—W. P. S.

Dry milks; Determination of fat in ——. B. G. McLellan. Analyst, 1908, **33**, 353—356.

THE determination of fat in condensed milk in a dry form, such as that produced by the Just-Hatmaker process, presents some difficulty, owing to the fact that the globules of fat are encased by a coating of substance which is not permeable by the solvent used to extract the fat. The Werner-Schmidt process, in which the milk is brought into complete solution before the fat is extracted, gives satisfactory results, but the ordinary methods of direct extraction give low results unless attention is paid to the manner of extraction and to the solvent used. The fat may be completely extracted by means of ethylic ether of sp. gr. 0·720, if 5 grms. of the sample be placed in a cartridge in a Soxhlet apparatus, allowed to soak overnight in the solvent, extracted during the whole of the next day, again soaked in the solvent over the following night, and extracted an hour or two the next day. Slightly low results are obtained when either methylated ether of sp. gr. 0·720, pure dry ethylic ether, or petroleum spirit is used for the extraction under similar conditions. It appears that the small amount of alcohol or moisture which is present in the ethylic ether of sp. gr. 0·720 exerts a disintegrating action on the coatings which surround the fat globules, allowing the fat to be extracted completely.—W. P. S.

Aluminium; Behaviour of —— *when in contact with milk, wine, and some saline solutions.* F. v. Fillinger. Z. Unters. Nahr. Genussm., 1908, **16**, 232—234.

THE results are recorded of a number of experiments which were carried out with the view of ascertaining whether metallic aluminium is attacked or dissolved by such liquids as milk, wines, table waters, etc. In each experiment strips of aluminium were immersed in the boiling liquid for 30 minutes. It was proved that fresh milk and red and white wines do not dissolve any trace of the metal; in one experiment a very acid sample of milk dissolved a mere trace of aluminium (0·0002 grm.). $N/10$ solutions of sodium chloride, potassium iodide, sodium silicate, potassium sulphate, magnesium chloride, and calcium silicate are without action on the metal; $N/10$ solution of sodium bicarbonate however, dissolves considerable quantities of the metal, as was to be expected, whilst similar solution of magnesium sulphate, calcium chloride, and calcium sulphate cause the metal to increase in weight. This is probably due to the formation of silicates, the aluminium used in the experiments containing an appreciable quantity of silica. Mineral waters which contain alkali carbonates should not, therefore, be kept in aluminium flasks, but the latter can be safely used in the case of milk, wine, etc.—W. P. S.

Butter; Limits of error in the determination of water in ——. A. Schoojans. Bull. Soc. Chim. Belg., 1908, **22**, 342—360.

SAMPLES of butter (10 grms.) were dried with and without addition of sand, in flat capsules and in glass beakers, and, also, imbibed in filter paper in a beaker. The dryings were carried out in a water oven and in an air oven at 115° C. The samples were weighed hourly to within 0·1 mgrm. In no case were consecutive weighings within a mgrm. The author concludes that:—(1) Discordant results are obtained by varying in any way the method employed. (2) Assuming that an increase in weight follows the removal of the last traces of water, this stage is reached, for one and the same butter, sometimes by one and sometimes by another method and after various times of heating. (3) Heating in a beaker is not likely to yield true figures. (4) The use of a paper spiral to absorb the butter leads to a low result being obtained. (5) The variations found are such as to preclude any exact value being obtained for the amount of water present in a butter.—R. L. S.

Benzoic acid; Detection of —— *in butter.* G. Halphen. J. Pharm. Chim., 1908, **28**, 201—203.

THE reaction proposed for the detection of benzoic acid is based on the formation of ammonium diaminobenzoate which gives a brownish-red coloration in alkaline solution. In the case of butter, a portion of the sample is melted over a quantity of lime-water, the mixture is well stirred, and allowed to settle; sufficient lime-water must be used to render the aqueous portion distinctly alkaline. After cooling, the aqueous layer is separated, rendered acid with phosphoric acid, and shaken out with ether. The ethereal extract is allowed to evaporate spontaneously and the residue is dried at the ordinary temperature. Two c.c. of sulphuric acid are then added to the residue, the mixture is carefully heated to a temperature not exceeding 110° C., and then cooled; 0·2 c.c. of fuming nitric acid is next added, the solution is transferred to a test-tube and heated over a small flame until fumes of sulphuric acid just commence to appear in the tube. After cooling, about 5 c.c. of water are added, and then a saturated solution of sodium sulphite, which is added drop by drop with constant shaking until all yellow vapours in the tube have disappeared. When cold, ammonia is allowed to flow over the surface of the solution in the test-tube; an orange-red coloration is produced if benzoic acid were present in the butter, the intensity of the coloration being proportional to the quantity of the preservative. The above conditions must be adhered to or the test may fail. (See Wiley, this J., 1908, 914.)—W. P. S.

Saponin [in lemonade and beer]; Detection of ——. J. Rühle. Z. Untersuch. Nahr. Genussm., 1908, **16**, 165—171.

THE following modification of Brunner's method (Z. Untersuch. Nahr. Genussm., 1902, **5**, 1197) is stated to enable 0·02 grm. of saponin in 100 c.c. of liquid to be detected with certainty in lemonade and to indicate its probable presence in the case of beer:—The contents of the bottle are neutralised with magnesium carbonate, concentrated to 100 c.c., treated with 20 grms. of ammonium sulphate, and vigorously shaken for some time with 9 c.c. of phenol. After standing till the liquid separates into two layers, the phenol solution, containing the saponin, is shaken with about 50 c.c. of water, and 100 c.c. of ether, an addition of 4 c.c. of alcohol being made, if necessary, to prevent the formation of an emulsion. After standing for 12 to 24 hours for the liquids to separate, the aqueous layer is drawn off and evaporated, and the residue dried in an exsiccator and tested for saponin either immediately or after purification with acetone. In the case of liquids containing dextrins, the latter should be removed, before the extraction of the saponin, by concentration of the fluid to about 20 c.c., and precipitation with 150 c.c. of 96 per cent. alcohol. After standing for 30 minutes, the mixture is heated to the boiling point on the water bath, and immediately filtered, and the clear filtrate freed from alcohol, diluted to 100 c.c., and treated as described above. Residues thus obtained from mineral waters and from dark Munich beer were purified by two digestions of 24 hours each with acetone, and then gave the reactions for saponin with concentrated sulphuric acid and with Fröhde's reagent, and frothed strongly in aqueous solution.—C. A. M.

Patents.

Milk; Apparatus for testing the acidity of ——. W. Richmond, Castle Douglas. Eng. Pat. 26,200, Nov. 27, 1907.

A graduated glass or aluminium vessel having a capacity of 6 ounces to a given mark, is provided with an orifice at the bottom delivering 2½ ounces of milk per minute. On the addition of rennet and water, coagulation sets in the more rapidly the greater the acidity of the milk. The volume of liquid flowing from the orifice, before coagulation sets in and stops the flow, is a measure of the acidity.—G. W. McD.

Milk and cream; Process for preserving ——. J. Herz. Fr. Pat. 388,418, Mar. 21, 1908. Under Int. Conv., April 3, 1907.

The milk or cream is treated with a preservative solution prepared by mixing together 100 parts of water, 75 parts of formalin, 10 parts of a solution of sodium salicylate, and 1 part of theobromine. This mixture is boiled for about 8 minutes, cooled, and a further 30 parts of water are added. About 4 grms. of the solution are used for every 20 litres of milk.—W. P. S.

Cream or milk rich in fat; Method of taking samples of —— for the determination of the fat. P. Funke und Co. Ger. Pat. 199,384, April 5, 1907.

The sample is taken by means of an instrument similar to a syringe, but with a bent tip, and is then forced into the butyrometer, in such a manner that it does not mix with the contents of the latter.—A. S.

Nutritive and aseptic product [beverage, etc.]. F. Guelpa. Fr. Pat. 388,514, Mar. 25, 1908.

Malt extract is added to milk whey which may have been subjected previously to restricted fermentation. The fermentation is stopped by heating the mixture when the desired quantity of lactic acid has been produced. Slight fermentation yields a liquid suitable for use as a beverage, or the fermentation may be carried to completion so as to furnish a kind of vinegar. When concentrated, the liquid may be used in bread-making, etc. —W. P. S.

Cow-milk and other kind of milk; Process for homogeneously emulsifying ——, as well as preparing homogeneous milk from milk powder. M. Erfurt, Straupitz, Silesia. Eng. Pat. 24,375, Nov. 4, 1907.

See Fr. Pat. 383,535 of 1907; this J., 1908, 351.—T. F. B.

(*B.*)—SANITATION; WATER PURIFICATION.

Patents.

Sewage; Method and means for treating, purifying, and distributing ——. A. Beall, Stamford. Eng. Pat. 3542, Feb. 17, 1908.

The sewage, after being twice treated with "liquid lime" in two successive series of tanks, in which the precipitate formed is allowed to settle, is conducted through pipes fitted with spraying devices which deliver the liquid over the surface of land. Drain pipes buried below the surface of the land collect the filtered sewage and deliver it into a river or other water-course. The precipitate formed by the lime treatment is removed from the tanks, mixed with quicklime, and disposed of.—W. P. S.

Electrolytic apparatus for purifying liquids [water]. J. T. Harris, New York. U.S. Pat. 894,435, July 28, 1908.

An apparatus for carrying out the process described in U.S. Pat. 857,277 of 1907 (this J., 1907, 829) is claimed. Groups of electrodes are fitted in a vessel, the anodes consisting of metals capable of yielding colloidal hydroxides. Baffle plates are arranged in the lower part of the vessel between the groups of electrodes, and an inlet pipe, connected with the water main, extends beneath and parallel with the electrodes.—W. P. S.

Liquids [water] and liquid-containers; Method of treating —— [for preventing incrustation]. F. B. Camors, New Orleans. U.S. Pat. 896,272, Aug. 18, 1906.

The liquid is treated with sufficient quantities of barium aluminate and sodium aluminate in order to prevent the formation of incrustation in, and to eliminate incrustations from, liquid-containers.—W. P. S.

Water; Apparatus for purifying [softening] ——. G. J. Dehn. Fr. Pat. 388,306, Mar. 19, 1908. Under Int. Conv., Mar. 28, 1907.

The apparatus consists of a section of pipe provided with screw ends so that it may be interposed in the water supply pipe. On this section of pipe is mounted a cylindrical vessel containing an inner perforated vessel in which is placed the reagent with which the water is to be treated. Side pipes connect the cylinder on either side with the water supply pipe; these side pipes are provided with screw taps so that a regulated portion of the water may be caused to pass through the cylinder containing the reagent and thence back again into the main pipe. The apparatus may be inserted in the supply pipe of a boiler. The cylinder is provided with a removable cover for the purpose of recharging the inner vessel.—W. P. S.

Water; Method of and apparatus for sterilising potable —— by ozone. A. de Bouillanne, Paris. Eng. Pat. 2307, Feb. 1, 1908. Under Int. Conv., Feb. 2, 1907.

See Fr. Pat. 374,152 of 1907; this J., 1907, 775.—T. F. B.

Purifying and filtering water; Process for ——. A. Vogelsang, Dresden, Germany. U.S. Pat. 897,039, Aug. 25, 1908.

See Fr. Pat. 383,947 of 1907; this J., 1908, 417.—T. F. B.

Peat; Treatment of —— to increase its content of nitrogen. Addition to Fr. Pat. 360,484. *See* XV.

(*C.*)—DISINFECTANTS.

Patent.

Formaldehyde disinfecting gas; Process for producing ——. G. Carteret. Fr. Pat. 388,808, Apr. 3, 1908.

A mixture consisting of 1 part of paraformaldehyde and 2 parts of bleaching powder is treated with 3 parts of water; a reaction takes place, and formaldehyde is evolved mixed with steam and traces of chlorine. Aqueous solutions of formaldehyde, or trioxymethylene, may be employed in place of the paraformaldehyde. (See also this J., 1908, 465.)—W. P. S.

XIX.—PAPER, PASTEBOARD, &c.

Acetylcellulose. E. Knoevenagel. *See* V.

Patents.

Paper pulp; Rotary strainer for ——. P. Reinicke. Fr. Pat. 388.748, Apr. 1, 1908. Under Int. Conv., Apr. 6 and July 25, 1907.

In a rotary drum strainer, in which the pulp passes from the inside to the outside, the collars at the ends of the drum are supported, with very little play, by curved vibrating levers. These levers are extended, concentrically with the collars, on the side nearest to the point of oscillation, to a height beyond the horizontal diameter of the drum. In this way the simultaneous vibration and rotation of the drum are made more steady by the support given by the extended curvature of the levers. The strained pulp passes into a curved trough beneath the drum and is allowed to flow away through a channel arranged along one side of the trough. In order to reach this channel it has to pass under a partition extending nearly to the bottom of the trough, so as to prevent the sedimentation of the heavier particles of the pulp at the bottom of the trough. —J. F. B.

Cellulose xanthogenate; Preparation of —— in the form of a dry powder. H. Lyncke. Fr. Pat. 388,915, Apr. 4, 1908. Under Int. Conv., Sept. 21, 1907.

Cellulose xanthogenate, prepared by treating alkali-cellulose with carbon bisulphide, is mixed with strong alcohol instead of with water. The mass is treated with alcohol (about three times the weight of the cellulose), in a kneading machine, until the alkali cellulose xanthogenate is dehydrated and converted into small granules. These may be treated again with alcohol for further purification, or they may be dried direct. Drying is effected rapidly at a temperature not exceeding 70°—80° C., and the dried product may be ground to a fine powder. This powder remains soluble in water or dilute alkali for a fairly long time. If desired, a little acetic or other feeble acid may be added to the alcohol used for purification.—J. F. B.

Evaporating apparatus; Paddle-wheel —— for the waste lyes from the manufacture of cellulose. C. P. Carlson. Ger. Pat. 199,218, June 2, 1907.

The apparatus is intended specially for the concentration of the alkaline waste liquors from the soda cellulose process. Revolving paddle-wheels dip partly into the liquid, raising it and bringing it into contact with a current of hot furnace gases above the level of the liquid. The blades of the wheel are fixed obliquely to the axis of rotation, in order to effect a circulation of the liquid and to bring the latter into intimate contact with the fire gases.—A. S.

Plastic product [from celluloid] for the manufacture of combs, moulded objects of any kind, and like applications and process for the manufacture thereof. L. Desvaux and H. Allaire, Paris. Eng. Pat. 9313, April 29, 1908.

See Fr. Pat. 388,097 of 1908; this J., 1908, 873.—T. F. B.

Lyes containing organic matter; Regenerating ——. Fr. Pat. 388,555. *See* VII.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, & EXTRACTS.

Opium; Manufacture of —— in Persia. A. F. Stahl. Chem.-Zeit., 1908, **32**, 804—805.

The greatly increased consumption of opium in Persia has led to the extension of the cultivation of the poppy over the whole country. The seed is sown in November and the opium is collected in May. Since the lightest coloured opium commands the best price in the market, the incisions in the poppy-heads are made at sunset, and the exuded sap is collected before sunrise, as sunlight discolours the product. The juice, or *Schire-Teriak* (schire = milk, Pers.), is collected in copper pots which are closed with goatskin. Its price, which in 1890 was 13s., is now from 17s. to 20s. per lb. *Teriak-i-Tschune*, or opium for export, which is sold in lumps, is prepared from *Schire opium* by evaporating it to about three-fourths of its bulk and adding from 50 to 70 per cent. of grape juice and other unknown ingredients. Opium for home consumption is obtained by adding about 20 per cent. of foreign matter to the *Schire-opium* after its volume has been reduced by one-sixth through evaporation. The added material is in the main, "sarcocolla," the resin of *Penaea mucronata*, but sometimes a boiled extract of dried poppy-heads, the seed of wild rue (*Ruta sylvestris*), and an extract obtained by steeping fresh poppy leaves in water are added, and the mixture slowly boiled for 3 hours with constant stirring. The paste thus obtained is kneaded and rolled into small sticks which are put on the market wrapped in paper. This opium, known as *Teriak-i-lule*, is worth about 36s. per lb. The opium left in the pipes after smoking is prepared for further consumption by being mixed with about 10 per cent. of *Schire-opium* and is then smoked as *Teriak-suchte* (burnt opium) or is eaten in the form of pills. It is impossible to determine the opium production of Persia, as no statistics are kept, but in the season 1905–1906, opium to the value of £4700 was imported from Afghanistan, whilst the value of that exported to different parts of the world was over £173,000.—J. A.

Methylmorphimethines; Pharmacological action of the ——. H. Kionka. Z. angew. Chem., 1908, **21**, 1744—1745.

The methylmorphimethines are tertiary bases obtained from the codeine-methyl-iodides by boiling with sodium hydroxide solution. Six isomerides are now known and these can be divided into three pairs of stereoisomerides. The strength and character of the action of these methine bases is independent of their isomeric differences. The bases are said to affect the respiration and action of the heart of warm-blooded animals without having any narcotic action. The respiration is always first affected and the action of the heart later. Whereas other morphine derivatives are said to increase the volume of each respiration and at the same time strongly diminish the frequency of breathing, whilst the total amount of respiration is only slightly diminished, the bases here discussed do not, it is said, greatly influence the frequency, but increase the volume of each breath, and therefore also the total amount of respiration.—E. F.

Terpenes and essential oils. 94th communication. (Fenchone derivatives.) O. Wallach. Annalen, 1908, **362**, 174—200.

The author continues the work on the hydrocarbons obtained from fenchyl alcohol, and his results throw some doubt on the constitution of fenchone as accepted at present. Fenchylamine, prepared from *d*-fenchone, was shaken with dilute acetic acid and sodium nitrite, when two hydrocarbons boiling at 155°—158° C., and 175°—178° C. respectively, were obtained by fractionation. The former hydrocarbon was identified as *d-l*-fenchene, with the sp. gr. 0·869 at 19° C., and $n_D = 1{\cdot}4724$, and a fraction obtained from it boiling at 156°—157° C. had $a_D = -32° 12'$ in a 100 mm. tube. It gave a dibromide, $C_{10}H_{16}Br_2$, crystallising in rhombic tablets melting at 87°—88° C., and with $[a]_D = +42{\cdot}83°$ in ethyl acetate. When oxidised with alkaline permanganate, this hydrocarbon yields *d-l*-hydroxyfenchenic acid (m. pt. 153°—154° C., and $[a]_D = -62{\cdot}98°$), and a small quantity of apocamphoric acid (m. pt., 205°—206° C.). In the decomposition of fenchylamine by means of nitrous acid, *d*-limonene and cineol were also found amongst the products. *d-l*-Fenchene was warmed with acetic acid and dilute sulphuric acid, when *iso*-fenchyl alcohol was produced, which boiled at 201°—202° C., and formed a urethane melting at 106°—107° C. From this alcohol a hydrocarbon was obtained by the action of zinc chloride, which when oxidised by alkaline permanganate, gave *d-d*-hydroxyfenchenic acid, m. pt. 138° C. When *iso*-fenchyl alcohol is oxidised by chromic acid, *iso*fenchone, $C_{10}H_{16}O$, is produced. This was purified by means of the semicarbazone, m. pt. 221°—222° C. The free ketone boils at 201° C., has the sp. gr. 0·943 at 18·5° C., $n_D = 1{\cdot}4621$ at 18·5° C., and $\alpha_D = +9° 35'$ in a 100 mm. tube. It forms a mono-bromo substitution product, which, when crystallised from methyl alcohol, melts at 56°—57° C., and has $[\alpha]_D = -164{\cdot}1°$ in alcohol. When *iso*fenchone is oxidised with alkaline permanganate, *iso*fenchocamphoric acid, $C_{10}H_{16}O_4$, is formed. This acid melts at 158°—159° C., and has $[\alpha]_D = -12{\cdot}75°$ in ether. Starting from *l*-fenchone, *l*-fenchone oxime was made, reduced to the amine, and decomposed with nitrous acid. On fractionation, *l-d*-fenchene separated, which boiled at 155°—156° C., and had $\alpha_D = +29°$ in a 100 mm. tube at 14° C. This gave a dibromide, m. pt. 87°—88° C., which when crystallised with the dibromide from *d-l*-fenchene gave a racemic compound melting at 62° C. *l-d*-Fenchene was hydrated, and from the alcohol, an *iso*fenchocamphoric acid was prepared, which had $[\alpha]_D = +12{\cdot}32°$ in ether, and melted at 158°—159° C. When crystallised with its optical isomeride, it formed a racemic compound melting at 174°—175° C.—F. Shdn.

Sesquiterpene from cade oil. J. Schindelmeiser. J. Russ. Phys.-Chem. Ges., 1908, **40**, 181—184. Chem. Zentr., 1908, 2, 598.

The sesquiterpene described by Lepeschkin (this J., 1908, 766), which occurs together with cadinene in cade oil, is identical with that previously described by Tröger and Feldmann (Arch. Pharm., **236**, 692), and by the author (Sitzungsber. Naturf.-Ges. Dorpat, **14**, 31). The liquid dihydrochloride of this sesquiterpene, $C_{15}H_{24},2HCl$, boils at 160°—164° C. at 12 mm., has the sp. gr. 1·114 at 20° C., and is optically inactive. The sesquiterpene itself boils at 263°—265° C., has the sp. gr. 0·908 at 20° C., $n_D = 1{\cdot}5006$, and is optically inactive. Lepeschkin's hydrocarbon was impure and contained considerable quantities of cadinene. His statement that the new sesquiterpene when heated with hydrochloric acid yields an isomeride resembling humulene is erroneous. What Lepeschkin obtained was probably a mixture of tetrahydrocadinene, cadinene, and the new sesquiterpene. Pure cadinene readily absorbs oxygen, with diminution of its optical rotatory power, yielding a syrupy mass heavier than water, which readily decomposes potassium iodide or hydriodic acid solution and oxidises arsenic trioxide to the pentoxide.—A. S.

Ethyl, propyl, iso-butyl, and amyl alcohols; Catalytic oxidation of ——. E. Orlow. J. Russ. Phys.-Chem. Ges., 1908, **40**, 203—217. Chem. Zentr., 1908, 2, 581.

The author has extended his work on the catalytic oxidation of methyl alcohol (this J., 1908, 139, 419), to other alcohols. A current of dry air was drawn through the alcohol, suitably warmed, and the mixture of air and alcohol vapour led over heated, freshly reduced copper gauze in a combustion tube. The gaseous products of the reaction consisted chiefly of carbon monoxide and dioxide, and saturated and unsaturated hydrocarbons. The aldehydes, which were the principal reaction-products, were collected in a water condenser. There was also obtained, floating on the aqueous layer in the condenser, a light oil consisting chiefly of unoxidised alcohol, aldehyde, and ketones (acetone from propyl and *iso*butyl alcohols, methylethylketone from amyl alcohols). A yield of aldehyde as high as 66 per cent. was obtained from ethyl alcohol. The quantity of air required in order to keep the contact material in a state of incandescence by the heat of the reaction is much greater than the theoretical amount in the case of ethyl-, *iso*butyl-, and amyl alcohols. This is due to the fact that besides the exothermic oxidation of the alcohol, an endothermic decomposition into water and unsaturated hydrocarbons takes place, and excess of air is required to further oxidise the latter to carbon monoxide and dioxide, and thus furnish the heat required to keep the contact material in a state of incandescence. It is stated that the preparation of acetaldehyde from ethyl alcohol by the contact process is quite practicable. Yields of 50 per cent. of aldehyde can also be obtained from *iso*butyl and amyl alcohols. In the latter case the oxidation products of the alcohol have an acrid odour and are suitable for use as disinfectants and for denaturing alcohol.—A. S.

Monomethylamine; Preparation of ——. M. Francois. Compt. rend., 1908, **147**, 428—430.

The author's method of separating amines from ammonia, by means of yellow mercuric oxide (this J., 1907, 432, 721), can be applied to the preparation of pure monomethylamine, only when the crude product contains no other nitrogenous base, except ammonia. It is, therefore, useless in conjunction with the method of preparation from formaldehyde and ammonium chloride (Brochet and Cambier), but the product obtained by Hofmann's method from acetamide and bromine, treated with mercuric oxide, gives perfectly pure methylamine, 35 per cent. of the calculated yield being obtained. Purification by alcohol does not furnish a pure product, much of the ammonium chloride present being dissolved.—F. Sodn.

Thio-ozonides, and the constitution of certain sulphur compounds. H. Erdmann. *See* IV.

Citrate and lemon juice exports from Messina. Chem. and Drug., Sept. 5, 1908. [T. R.]

The total exports of citrate of lime from Messina during 1907 amounted to 4,737 tons, as compared with 4,349 tons in 1906, 3,043 tons in 1905, 3,649 tons in 1904, and 2,246 tons in 1903. Of the total exportation in 1907, 1,628 tons was sent to France, 1,485 tons to the United States, and 771 tons to the United Kingdom. More than half the total exportation of concentrated lemon-juice from Messina was sent to the United Kingdom—*viz.*, 575 tons out of a total of 984 tons. In 1906, 888 tons was exported, 1,107 tons in 1905, 2,059 tons in 1904, and 1,419 tons in 1903.

Bengal Government cinchona plantation and quinine factory. Chem. and Drug., Sept. 12, 1908. [T. R.]

The annual report of the Bengal Government cinchona plantation and factory, British Sikkim, for 1907-8 states that the total number of cinchona trees of all kinds on March 31, 1908, was 3,471,216, a decrease of 227,561 since last year. The use of bonemeal was discontinued, the result not being sufficient to justify a continuation of expenditure. Mortality continues very high among the Ledger trees, and the current season will show a further and marked decrease. The bark-harvest for the year amounted to 445,638 lb., an increase of 16,081 lb. Of this total 419,388 lb. were Ledgeriana, 407 lb. succirubra, and 25,000 lb. hybrid. The total quantity of bark worked up in the factory was 945,900 lb., of which 764,954 lb. was Ledgeriana. The output of quinine sulphate was 27,564 lb., being an increase of 11,499 lb. over last year's output. Only 3,370 lb. of cinchona febrifuge was produced. No cinchonidine sulphate was manufactured during the year, there being an ample quantity in stock to meet the limited demand. The average yield of quinine sulphate from the bark used in the factory was 2·90 per cent. These low figures will not occur in future years, for the whole of the accumulation of old and poor bark has now been worked up, and only the bark now being produced or bought will be available. The yield at the end of the year had risen to 3·34 per cent. The profit on the year's working is Rs. 52,967, or, deducting non-recurrent charges, Rs. 44,127.

Patents.

Phenylglycine and its homologues; Manufacture of ——. M. Friswell, Bexley, Executrix of R. J. Friswell. Eng. Pat. 18,149, Aug. 10, 1907.

Phenylglycine or a homologue thereof is obtained in good yield by heating aniline (or a homologue) with the monochloroacetate of an alkali or alkaline-earth metal or a metal of the iron or aluminium group in the presence of water. Example :—107 grms. of *o*-toluidine are heated in a flask under a reflux condenser with 116·5 grms. of sodium monochloroacetate and 150 c.c. of water for 3 to 4 hours. On cooling, *o*-tolylglycine separates out. —J. C. C.

Diamino- and alkylated diaminobenzoylalkamines ; Manufacture of ——. O. Imray, London. From Farbwerke vorm. Meister, Lucius, und Brüning, Höchst a/Main, Germany. Eng. Pat. 18,942, Aug. 22, 1907.

Alkamine esters of *m* : *p*-diaminobenzoic acid and of the alkylated *m* : *p*-diaminobenzoic acids are obtained : (1), by esterifying the above acids with alkamines ; (2), by reducing *m* : *p*-dinitro-, *m* : *p*- (or *p* : *m*-) aminonitro- or *m* : *p*- (or *p* : *m*-) alkylaminonitro-benzoic acid alkamine esters : (3), by the reduction of *m* : *p*-diamino- or alkylated *m* : *p*-diamino-benzoic acid halogen alkyl esters with secondary amines ; (4), by heating *m* : *p*-diamino- or alkylated *m* : *p*-diamino-benzoic acid esters with alkamines. *Example* :—15 grms. of *m* : *p*-diaminobenzoic acid or its methyl ester and 30 grms. of diethylaminoethanol are mixed with 150 grms. of cold concentrated sulphuric acid and heated for 5—6 hours on the water-bath. The mass is then poured on to ice, made alkaline with ammonia, saturated with potash and extracted with ether. After washing with water and evaporating the ethereal extract, the *m* : *p*-diaminobenzoyldiethylaminoethanol remains as an oil which, with the calculated amount of hydrochloric acid, yields a monohydrochloride crystallising from alcohol in needles, m. pt. 163° C. Other examples illustrate the method of preparation of this substance (and of *m*-amino-*p*-dimethylaminobenzoyldiethylaminoethanol) by the alternative processes detailed above. The compounds are strong local anæsthetics of little toxicity.—J. C. C.

Therapeutic compounds [*phenylarsonic acids*] ; *Manufacture of new* ——. H. S. Wellcome, London, and F. L. Pyman, Dartford. Eng. Pat. 855, Jan. 14, 1908.

Equimolecular parts of *o*-toluidine and arsenic acid are mixed with hot water ; the *o*-toluidine arsenate is heated with twice its weight of *o*-toluidine for one hour at 180°—185° C. The product is extracted with sodium carbonate solution and the solution concentrated. The sodium salt of 3-methyl-4-aminophenylarsonic acid, $CH_3.C_6H_3(NH_2)AsO(OH)_2$, separates out on cooling and is purified by recrystallisation from water. The free acid, obtained by treatment with acetic acid, is almost insoluble in cold water, soluble to the extent of 3 per cent. in hot water, and readily soluble in methyl alcohol. It melts with decomposition at 198°—200° C., combines with bases to form salts, and can be converted into an acetyl derivative by treatment with acetic anhydride.—T. F. B.

Diphtheria antitoxin ; Process for the preparation of ——. Farbwerke vorm. Meister, Lucius, und Brüning, Höchst a/Main, Germany. Eng. Pat. 15,768, July 24, 1908. Under Int. Conv., July 31, 1907.

The disadvantages hitherto encountered in the preparation of diphtheria antitoxin from horses and other animals are overcome or at least diminished by immunising mules or hinnies with diphtheria toxins. A higher percentage of these animals may be immunised than in the case of horses, and they show no hypersensitiveness to the toxin.—J. C. C.

Radium preparation. H. Lieber, New York. U.S. Pat. 895,478, Aug. 11, 1908.

Gelatin is impregnated with a radium salt in order to form a preparation which "is capable of being taken up by the liquids and tissues of the body, and thereby, by degrees, liberating the radium salt."—W. P. S.

Formates and oxalates ; Preparation of ——. A. Hempel. Fr. Pat. 389,039, April 8, 1908.

Caustic alkalis, alkaline-earths, or analogous substances, or the corresponding carbonates, are heated with carbon monoxide, under pressure. At 200° to 360° C. formates are thus produced, and oxalates by employing higher temperatures, up to 420° C. Oxalates are also obtained by heating formates, with or without the addition of indifferent substances, at 200° to 420° C., under pressure. —F. Sodn.

Chloral ; Preparation of compounds of —— *with acid amides.* N. Sulzberger. Ger. Pat. 198,715, April 24, 1907.

By dissolving amides of fatty acids containing more than 12 atoms of carbon, or their substitution derivatives, in rather more than the calculated quantity of chloral, there are obtained odourless and tasteless, non-volatile, non-hygroscopic compounds of great stability, which are easily soluble in fats, oils, and paraffin hydrocarbons. The products have the general formula : $CCl_3·CH(OH)·NXY$, where X is a fatty acid residue or its substitution derivative, and Y is a hydrogen atom or an alkyl or aryl group. *Example.*—The amide of palmitic acid is warmed with rather more than the calculated quantity of chloral, the temperature being finally raised to 100° C. The warm liquid is then poured into water, when the reaction-product separates in white hard lumps. When crystallised from alcohol, the new compound forms a white powder, which melts at 190° C.—A. S.

Amyl ether and higher ethers from the corresponding alcohols ; Preparation of ——. G. Schroeter and W. Sondag. Ger. Pat. 200,150, Oct. 3, 1907.

Ethers are prepared from amyl alcohol and higher fatty alcohols by heating them with less than the calculated quantity of sulphuric acid or a sulphonic acid.—T. F. B.

Acetyl nitrate or mixtures containing acetyl nitrate ; Preparation of ——. A. Pictet. Ger. Pat. 200,201, Jan. 19, 1907.

Acetyl nitrate, $CH_3.CO.ONO_2$, a colourless liquid of b. pt. 22° C. (70 mm.) is obtained (*a*) by the action of nitric anhydride on acetic anhydride, preferably in presence of dehydrating agents, or (*b*) by the interaction of nitric acid and acetic anhydride in presence of sulphuric anhydride or phosphoric anhydride. It forms a convenient and energetic nitrating agent, no water being split off in the reaction ; fatty acids, chloroform, etc., can be nitrated by its aid. In the nitration of aromatic compounds, the nitro-group generally enters the *o*-position to the existing substituents.—T. F. B.

Vanillin, heliotropine, and camphor ; Process for the production of ——. A. J. Boult, London. From F. Fritzsche und Co., Hamburg, and The Verona Chemical Co., Newark, U.S.A. Eng. Pat. 27,927, Dec. 18, 1907.

See Fr. Pat. 385,700 of 1907 ; this J., 1908, 644.—T. F. B.

Polyglycerines ; Process for manufacturing ——. C. Claessen, Berlin. Eng. Pat. 9572, May 2, 1908.

See Ger. Pat. 198,768 of 1907 ; this J., 1908, 833.—T. F. B.

Nicotine from tobacco material ; Process of recovering ——. G. B. Lindenberger and R. B. Arnold, Richmond, Va., Assignors to The Kentucky Tobacco Products Co., Louisville, Ky. U.S. Pat. 896,124, Aug. 18, 1908.

See Fr. Pat. 385,837 of 1907 ; this J., 1908, 644.—T. F. B.

Camphene ; Process of making ——. C. Weizmann, Assignor to The Clayton Aniline Co., Ltd., Manchester. U.S. Pat. 896,962, Aug. 25, 1908.

See Eng. Pat. 5032 of 1906 ; this J., 1907, 32.—T. F. B.

Camphor ; Manufacture of ——. The Clayton Aniline Co., Ltd. Fr. Pat. 389,071, April 10, 1908. Under Int. Conv., Oct. 4, 1907.

See Eng. Pat. 21,946 of 1907 ; this J., 1908, 917.—T. F. B.

Glucoside, soluble in water, from the bark of Cascara sagrada (Rhamnus Purshiana) ; Process for preparing a ——. Soc. pour l'Ind. Chimique a Bâle. Fr. Pat. 388,951, April 6, 1908. Under Int. Conv., Aug. 23, 1907.

See Eng. Pat. 1617 of 1908 ; this J., 1908, 644.—T. F. B.

Alkali formates ; Process for preparing ——. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 389,065, April 9, 1908. Under Int. Conv., April 10, 1907.

See Eng. Pat. 8012 of 1908 ; this J., 1908, 769.—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Resins and allied bodies : Action of —— *on a photographic plate in the dark.* W. J. Russell. Roy. Soc. Proc., 1908, B., **80**, 376—387.

Rosin and "amber resin" produce images on photographic plates in the dark, at the ordinary temperatures, after two or three days of contact : at 40° C. the action is very much more rapid. A current of air which has passed over powdered rosin is also active. The presence of oxygen appears to be necessary for the action, which is also shown by abietic acid. Thin sheets of glass or mica interposed between the plate and rosin prevent the action taking place. The activity of resins is decreased slightly by heating, and is increased by exposure to blue rays of light, but this increase slowly disappears on keeping in the dark or in red light. Amber has no action on a photographic plate, but alcohol extracts a small quantity of a highly active substance from it. Of five samples of lignite examined, two were found to be slightly active : no instance of activity in jet or graphite has been discovered. Coal generally has a slight action on photographic plates, which is increased by drying, in some cases ; the effect of heating coals is variable, in some instances an increase and in others a decrease of activity being found. Sunlight has no effect on the activity of coals, and the alcoholic extracts are inactive.—T. F. B.

Silver-gel in photographic films. Lüppo-Cramer. Z. Chem. und Ind. der Kolloide, 1908, **3**, 33—36.

Liesegang (Photochem. Studien, 1895, 28, and Phot. Archiv, 1895, 177) has shown that whereas pyrogallol and sodium carbonate precipitate from silver nitrate solutions a pure, black form of silver ("A") which takes a long time to settle, pyrogallol alone yields an almost white form of silver ("B"), which settles rapidly. "A" is bleached, but "B" is darkened by mercuric chloride solutions, and by subsequent treatment with ammonia, "A" becomes black, whilst "B" remains unaltered. The "A" form is generally produced by reduction of silver solutions with alkaline developers, and the "B" form by the use of ferrous sulphate, quinol, and metol, without alkali. On the other hand, the "A" form is obtained by reduction with gallic acid or *o*-aminophenol without alkali. When dissolved in nitric acid, only the "A" form is deeply coloured by the oxidation products of developing substances. Sulphites have a great influence on the form of silver produced, a normal ferrous oxalate developer forming the dark silver, whereas if sulphite is added, a grey variety is produced : normal metol-soda developers, containing sulphite, also produce the grey form, whilst the black form is produced when the sulphite is omitted. Other organic developers act similarly. The most finely-divided form of silver is produced by pyrogallol or catechol in presence of alkali carbonates, without sulphite ; the precipitates are very dark, and pass through ordinary filter papers. A variety intermediate between "A" and "B" may be obtained by reduction with alkaline developers in presence of the normal quantity of sulphite. Mercuric chloride converts the "A" form, and also the "gel" obtained from it by coagulation with sulphuric acid, into white silver chloride. Similar differences are shown by the forms of silver obtained from silver bromide, with and without sulphite ; the addition of a solvent for silver bromide produces analogous results to the addition of sulphite. Reduction of solutions of silver bromide in thiosulphate, thiocyanate, etc., in presence of gelatin, gives a precipitate of similar appearance to that of dichroic fog : in absence of gelatin, grey, finely-divided silver results. The silver image, obtained by "physical development" of negatives, is analogous to "B," as regards its behaviour with mercuric chloride ; the silver in negatives on collodio-bromide plates is also analogous to "B." Suspensions of silver bromide in collodion and gelatin are reduced, under similar conditions, to very light coloured and grey-black silver respectively.—T. F. B.

Patents.

Photographic paper ; Method of treating ——. E. A. Cunningham, Ambridge, Pa. U.S. Pat. 895,970, Aug. 11, 1908.

Photographic prints are treated with solutions of metallic salts (*e.g.*, of copper salts) and then with solutions which will form a sulphide (*e.g.*, a solution of sodium sulphide).—T. F. B.

Films [for photography, etc.] ; Continuous production of —— *by coagulation.* Soc. Gen. des Films and C. Gonon. Fr. Pat. 388,755, June 8, 1908.

A collodion of 20—25 per cent. concentration, prepared by dissolving a very soluble, hot-nitrated pyroxylin in methyl alcohol containing 15—18 per cent. of ether, is delivered through a slit on to an endless band travelling beneath the surface of a coagulating liquid. This liquid must be miscible with methyl alcohol but must not dissolve the pyroxylin ; for instance, 80 per cent. alcohol, or benzene, or petroleum hydrocarbons, may be used. The film is carried on the endless band through the coagulating bath and is then still sufficiently plastic to be smoothed or further flattened by pressure between rollers ; it is finally dried in a current of air.—J. F. B.

XXII.—EXPLOSIVES, MATCHES, &c.

Explosives ; Thirty-second annual report of H.M. Inspectors of —— *for* 1907.

Licensed Factories.—The number of factories under continuing certificate was 34 (being one less than in the previous year). The number of factories under licence was 108 (being four less than in 1906). Application was made for 55 amending licences during the year.

Accidents.—The number of accidents by fire or explosion of which the Department had cognisance during the year was 414, causing 63 deaths and injuring 422 persons. The number of deaths (6), from accidents by fire or explosion in the manufacture of explosives was below the average for the decade (6·9).

The following table gives the details under the above heading :—

	Total Accidents.	Causing no injury.	Causing injury.	Persons.	
				Killed.	Injured.
Manufacture ..	44	23	21	6	22
Keeping ..	10	4	6	2	6
Conveyance ..	—	—	—	—	—
Use and Miscellaneous ..	360	1	359	55	394
	414	28	386	63	422

Storage.—The total number of magazines under continuing certificate and licence was 437, being 5 more than in 1906. There were no accidents by fire or explosion in connection with magazines during the year.

Importation.—The number of importation licences granted during 1907 was 142. The following table gives the quantity and nature of blasting explosives imported:—

		1907. lb.	1906. lb.
Containing nitroglycerine	..	1,341,900	3,558,662
Not containing ,,	..	109,400	41,714

Of the above explosives some 769,500 lb. were known to have been transhipped to other countries. The number of detonators imported was some 18 millions, being about 5½ millions less than in 1906. Some 4 millions were transhipped for other countries. The quantity of fireworks imported was some 301 tons.

Report of Chemical Advisers.—Messrs. Dupré point out that the total number of samples examined during the year amounted to 559, a number considerably in excess of those examined in any previous year. In addition to these there were carried out 155 tests for the presence of volatile mercury salts, and 72 special heat tests for the investigation of the effect produced by mercury in the heat test.

Manufacture of heat-test papers.—An addition has been made to the processes specified for the preparation of heat-test papers. Several batches of paper were found to contain some material which, though insoluble in water, liberates iodine from potassium iodide in the presence of acetic acid and thus makes the acetic acid test for the good quality of the papers of no value. It has therefore been decided to wash all the paper used for the preparation of heat-test papers twice, for about half an hour each time, in a 10 per cent. solution of acetic acid, and then wash thoroughly in tap water. After two rinsings in distilled water and subsequent drying, the paper is ready for dipping.

Mercury in explosives.—During the year the presence of mercury in explosives was a subject which occupied the attention of, not only the whole of the explosives industry, but also the law courts. It is of interest therefore to quote the Chemical Advisers of the Explosives Department in full on this question. "In our annual report for 1906 we stated that methods for testing various kinds of explosives for mercury, or volatile mercury salts, were being worked out, and that details of those methods finally adopted would appear in this year's report. Various methods had to be worked out, as different classes of explosives require quite different treatment, and in some cases specially delicate methods had to be employed when the quantity of mercury present was extremely small, although still enough materially to affect the heat test. In all cases a special form of spectrum tube was employed. The apparatus consisted of two stoppered tubes of about 20 c.c. capacity, joined by a capillary tube. To one stopper was attached a tube fitted with a good tap. All the grinding had to be done very perfectly, so as to keep a vacuum for some hours even at a slightly raised temperature. About the centre of each tube the electrodes, contained in tubulures slanted up so as to prevent the entrance of the explosive material, are attached. The parts of the tubes below these tubulures are filled with the substance to be examined, the stoppers replaced, and the tube exhausted by means of a good pump (not a mercury pump). The parts of the tube containing the explosive are then immersed in hot water (about 90° C.), and a discharge from a powerful induction coil (we use a 6-in. coil) passed through it. The capillary tube is then examined, end on, the use of a condenser greatly intensifying the brilliance of the spectrum.

"If mercury, or a volatile mercury salt, is present, even in very minute quantities, the characteristic lines of the mercury spectrum are seen in addition to those of any other gases that may be present, *e.g.*, nitrogen, oxygen, hydrogen, etc. The spectrum of the nitrogen may be eliminated by passing a stream of hydrogen through the cold tube before exhaustion, when, after exhaustion, practically only the spectra of mercury (should this be present), hydrogen, and oxygen, will be seen. The hydrogen and oxygen spectra can never be eliminated, as it is impossible to get rid of the last traces of moisture; but this does not in any way interfere with the mercury spectrum.

"The lines we rely on for proving the presence of mercury are the two yellow, the green, and the violet of the following wave lengths:—The yellow, 5790 and 5769; the green, 5461; and the violet, 4359. At present we never certify the presence of mercury unless all these lines are seen. All the apparatus used, tube, connections, etc., etc., must be carefully tested to prove the absence of mercury before each test is carried out.

Tests at present in use.

"*For ungelatinised guncotton.*—About 2 grams of the nitro-cotton are carefully dried, at a temperature not exceeding 120° F., introduced into the special vacuum tube, and the test carried out as described above.

"*For blasting gelatine, gelignite, etc.*—About 4 grams of the explosive are ground up with French chalk, introduced into the vacuum tube, and tested as above. If the explosive contains a considerable amount of moisture, the introduction of a piece of calcium chloride above the explosive in each limb may be of considerable advantage.

"Blank experiments must be made with the chalk used, before the test is carried out.

"*For cordite.*—Fifteen grams of the cordite are ground so as to pass through the finest sieve of the heat test set, and extracted with ether for two hours. The flask is then removed, and a carefully cleaned flask substituted; fresh ether is introduced, and the extraction continued for a further 10 hours. The ether is then distilled off, and the flask carefully dried at a low temperature. The flask is washed out with several quantities of boiling distilled water, a little hydrochloric acid being added to the first boiling. The washings are put into a previously ignited platinum dish, and the solution electrolysed over night, using the dish as anode and a coil of platinum or gold wire as cathode (we use two Leclanché cells in series for the electrolysis). The wire is then washed with water and acetone, dried at a low temperature, dropped into a clean narrow test tube (3 ins. by ⅜ in.) and the part of the tube containing the wire strongly ignited. The bottom of the tube is cut off, after removing the wire, the remainder dropped into the vacuum tube and tested for mercury as already described.

"*Hard gelatinised nitro-cotton preparations.*—These are treated exactly as cordite, unless the explosive contains nothing which is soluble in ether, other than a mercury salt, when the initial two hours' extraction with ether is omitted.

"*Specially delicate tests.*—If an ungelatinised nitro-cotton has to be tested for very minute traces of soluble mercury salts, any desired quantity can be extracted with ether and treated as above for hard gelatinised nitro-cotton explosives.

"All the above tests in which extraction by ether is employed are, of course, only tests for soluble mercury salts, not for metallic mercury. The following test which we employ as a very delicate test for use with blasting gelatine and similar explosives, may also be used for any class of explosive when only metallic mercury is to be tested for, and by using appropriate quantities, a test of any desired delicacy can be obtained.

"*Delicate test for blasting gelatine, etc.*—Fifteen grams (or any other desired quantity) are ground up with French chalk and introduced into a stoppered glass bottle. A piece of previously ignited silver foil,* contained in a glass spoon, is placed on top of the explosive, the bottle tightly stoppered and kept at a temperature of from 90 to 100° C. for from 10 to 15 hours. The silver foil is then treated in the same way as the coil in the cordite test.

"Considerable difficulty has been experienced by firms who have been using mercury in their explosives in the past in getting their plant free from all traces of the salt used. Even six months after the last addition of mercury the explosive contains enough very seriously to affect the heat test. In this connection it may be of service to point out the extremely minute amount of mercury that may influence the result.

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* This ignition is carried out in a combustion tube through which a slow current of hydrogen is passed.

"From quantitative experiments we have made, we have found that even so small a quantity of mercury as 1,000th milligram can combine with as much iodine as would be liberated by an average sample of blasting gelatine in the five minutes after the standard tint on the test paper had been reached, or, in other words, is capable of masking the heat test by five minutes. Extreme care is therefore necessary in cleaning the plant after the mercury has once been used, and the alternate use of the same plant for explosives containing mercury, and for those intended to be free, is probably out of the question.

"With reference to the rejection of explosives on account of their containing mercury, it was suggested that the main objection to its use, *viz.*, its affect on the heat test, might be overcome by introducing a piece of silver foil into the tube during the test. It was alleged that the mercury was thus completely retained by the silver, and that the true test of the explosive was obtained. This point was therefore investigated, but it was found that, although the effect of the mercury on the test paper was undoubtedly counteracted, and a test which had been much prolonged by the presence of mercury was considerably shortened, yet the silver itself had a considerable masking effect, probably due to the absorption of the acid vapours by the silver. It was, therefore, concluded that, although the above test might be useful as a supplementary test for the presence of mercury, it could not be considered to remove the objections to the use of mercury in explosives. The use of gold foil was also suggested, but although preferable to silver for use with nitro-cotton in that its masking effect is decidedly less, yet, since it has a strong decomposing effect on nitro-glycerine vapour, its use with nitroglycerine explosives is quite inadmissible."

Woolwich Testing Station.—Captain Desborough's report states that a series of experiments was carried out with coal dust at the Home Office Testing Station. The object was to ascertain whether all coal dusts are to be regarded as being dangerous, whether there are degrees of danger, and whether any relation can be established between the constituents of a coal dust and its sensitiveness. The dust to be tested was strewn along the floor of the official test gallery at Woolwich. This gallery consists of an iron tube 2 feet 6 inches in diameter and 28 feet in length; there are seven safety valve orifices at equal intervals along the top of the tube. The dust was inserted through these orifices, the quantity being such as to ensure a surplus of dust being present should an ignition take place. To obtain the desired comparison, varying charges of a specially prepared fine grain powder, stemmed with a plug of plaster of Paris, 2 inches in length, and fitting the bore fairly closely, were fired from a cannon into the gallery, and the experiments were continued until the maximum charge which failed to cause an ignition was determined. This limiting charge was confirmed by twice repeating the experiment.

Screen dust.—The limiting charges which failed to ignite these dusts varied between 50 and 100 grams of gunpowder, and all screen dusts must be regarded as being readily ignitible. It was not found to be possible to deduce from the analyses of the dusts any relationship between the proportion of the constituents and their varying degrees of sensitiveness. From the fact that freshly-ground dust appears to have always been found more sensitive than that kept for some time, there can be little doubt that there must be some connection between the two. In addition to the chemical composition, the physical characteristics probably play an important part. To test this point weighed quantities of the most and least sensitive dusts which had previously been sifted through an 80-mesh sieve, were allowed to fall in a glass tube, and note taken of the time which elapsed before the dust had settled from one standard tint to another of a lesser intensity. The results indicated that the more sensitive dust settled at a slower rate. *Road and timber dusts.*—There was only a comparatively slight difference of sensitiveness between the dust collected from the timbers and from the roadways, and both were not much less sensitive than the screen dusts and would hence appear to be dangerous. The experiments were carried out in air free from gas and as in a colliery there is always the possibility of from 1 to 2 per cent. of firedamp being present, this would probably have the effect of increasing the sensitiveness up to that of the screen dusts.—G. W. McD.

Patents.

Explosives. B. E. D. Kilburn, London. From W. Rickmers, Baden, Germany. Eng. Pat. 10,510, May 6, 1907.

Organic substances containing tannin are said to possess advantages when mixed with oxidising bodies for producing an explosive. The following is given as an example of such a composition:—Powdered myrabolans (36), saltpetre (29) and ammonium perchlorate (35 parts).
—G. W. McD.

Dynamite or other explosives; Heater for ——. B. F. Kelly, Salt Lake City, U.S.A. U.S. Pat. 895,028, Aug. 4, 1908.

The heater consists of a casing with an opening on the upper side. A cover provided with a chamber on the under side fits into this opening. The chamber contains the explosive and is provided with a rack for supporting the cartridges, so arranged that they cannot come in contact with each other. A hot water pan for warming the air rests on the bottom of the outer casing.—G. W. McD.

Explosive. C. Girard, Paris. U.S. Pat. 895,254, Aug. 4, 1908.

A process for making explosives consisting in incorporating trinitrocresol and picric acid in molecular proportions, heating the mixture until liquefied, and while the product is in a molten condition and at a temperature below the melting point of either constituent, incorporating an oxidising agent such as a metallic chlorate.—G. W. McD.

Explosive; Stable ——. F. B. Holmes, Woodbury, N.J., Assignor to the E.I. du Pont de Nemours Powder Co., Wilmington, Del. U.S. Pat. 895,639, Aug. 11, 1908.

The explosive consists of a mixture of nitrated starch (98—95 parts) and ammonium carbonate (2—5 parts). The latter is said to render the nitrated starch stable.
—G. W. McD.

Explosives; Method of shipping and storing ——. F. L. Chamberlin, Cleveland, Ohio. U.S. Pat. 896,622, Aug. 18, 1908.

The explosive is kept submerged in a hydrocarbon oil in which it is insoluble.—W. H. C.

Nitro explosives; Indicator of the spontaneous decomposition of ——. J. C. E. Bouchaud-Praceiq. Fr. Pat. 388,142, May 22, 1907.

The metallic cases containing the explosive have a small hole bored in them. A metallic tube of very fine bore is screwed into the hole and the free end is adapted to a glass tube containing paper or other material impregnated with an indicator for nitrous acid. Any disengagement of this latter body from the explosive is indicated on the test paper.—G. W. McD.

Guncotton and the like; Process for the recovery of the nitrating acid in the manufacture of ——. C. Claessen. Ger. Pat. 200,292, May 22, 1906.

After the nitration is finished, and the acid has been separated, sulphuric acid is injected into the rotation drum of a centrifugal machine containing the nitrated material, and the sulphuric acid is subsequently displaced by water.—A. S.

Matches ; Process for the manufacture of ——. G. Heyden. Ger. Pat. 195,400, Feb. 10, 1906.

The igniting composition is prepared by mixing 1 kilo. of amorphous phosphorus, about 550 grms. of potassium chlorate, 800 grms. of lead peroxide or other suitable lead compound, and 600 grms. of a filling material (chalk, powdered glass, or the like) with gum arabic, dextrin, or gum tragacanth dissolved in water. The ribbon of matchwood is tipped with this paste in the usual manner, and after drying, is impregnated with a suitable lac and then with paraffin wax.—A. S.

Igniting composition suitable for "match ribbons" ; Process for the manufacture of an ——. Bochum-Lindener Zündwaren-und Wetterlampenfabı. C. Koch. Ger. Pat. 198,710, March 15, 1907.

The greater part of the phosphorus in the ordinary mixtures of phosphorus and oxygen-yielding substances, is replaced by nitrocellulose containing a low percentage of nitrogen.—A. S.

Explosive. W. Rickmers, London. U.S. Pat. 896,325, Aug. 18, 1908.

See Eng. Pat. 10,510 of 1907 ; preceding.—T. F. B.

Explosive. C. E. Bichel, Hamburg, Germany. U.S. Pat. 896,887, Aug. 25, 1908.

See Fr. Pat. 369,661 of 1906 ; this J., 1907, 224.—T. F. B.

Nitrocellulose ; Manufacture of artificial silk and explosives from a special form of ——. Ger. Pat. 199,885. *See* V.

XXIII.—ANALYTICAL CHEMISTRY.

APPARATUS.

Patents.

Carbonic acid and other gases in gas mixtures ; Apparatus for recording the percentage of ——. T. Thorp, Manchester. Eng. Pat. 22,896, Oct. 17, 1907.

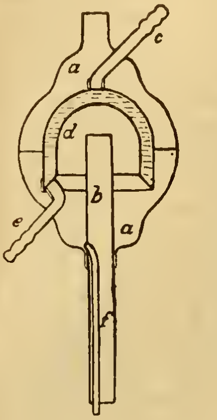
The apparatus consists of the combination of a tank partly filled with a liquid capable of absorbing the carbonic acid or other gas, two rotary pumps of the same size and capacity, driven at the same speed from one shaft, one of the pumps drawing in the gas mixture and delivering it below the level of the liquid in the absorption tank, the other drawing the mixture from the top and delivering it into the atmosphere or source of supply. A branch pipe leads from the suction pipe of the second pump into a gas-holder with a floating bell or equivalent pressure recorder. A rod connected to the bell or indicator has a pencil attached and records the variation of pressure and consequently of carbon dioxide on a rotating band. —G. W. McD.

Oils ; Apparatus for determining the degree of viscosity and lubricating power of ——. W. H. Houston. Fr. Pat. 388,671, March 28, 1908.

The oil to be tested is contained in a reservoir of narrow rectangular section. The lower half of the reservoir is placed in a heating bath, and a thermometer immersed in the oil, with its bulb close to the outlet tap, records the temperature. The upper part of the reservoir projects above the heating bath and is provided with an upper and a lower index mark. Owing to the shape of the reservoir, a thin layer of oil is exposed to the heat of the outer bath, and thus readily takes up, and is maintained at, the requisite temperature. The time taken by different oils in falling, when the outlet tap is opened, from the upper to the lower index mark is a measure of the relative viscosities.—G. W. McD.

Gas-analysis apparatus ; Device for discharging gases from ——. J. Weber. Ger. Pat. 197,594, Jan. 11, 1907.

A device provided with a sealing liquid, is set in operation by liquid from a reservoir, by means of an intermittent siphon, and alternately opens and closes the gas-outlet tube.—A. S.



Reflux condenser ; Open ——. E. A. Lentz. Ger. Pat. 199,144, Jan. 23, 1907.

The condenser is of the form shown in the diagram. The cooling water enters through *e*, fills the space between the double walls of the hood, *d*, and flows away through *c*. The vapour from the distillation flask enters the condenser through the tube, *b*, and the condensed liquid flows back through the tube, *f*.—A. S.

Gas analysis ; Automatic apparatus for ——. E. Schatz, Frankfort on Maine, Germany. U.S. Pat. 895,798, Aug. 11, 1908.

See Second Addition to Fr. Pat. 359,352 of 1905 ; this J., 1906, 778.—T. F. B.

Gas analysis ; Apparatus for automatic and continuous ——. W. S. Hubbard, Leicester. U.S. Pat. 896,544, Aug. 18, 1908.

See Eng. Pat. 26,924 of 1907 ; this J., 1908, 645.—T. F. B.

INORGANIC—QUALITATIVE.

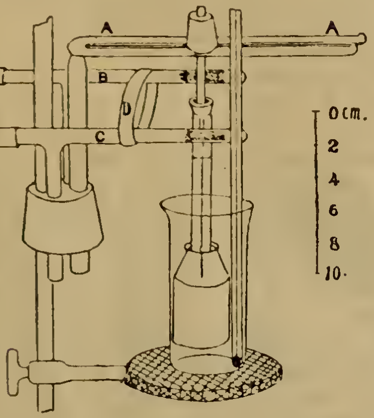
Metallic bases ; A new method of qualitative and quantitative separation of the ——. E. E. Pozzi Escot. Bull. Soc. Chim. Belg., 1908, **22**, 327—338.

To avoid the inconveniences which arise in the ordinary methods of qualitative analysis from the occasional presence of phosphoric acid, this acid is always added, as sodium phosphate, to the solution under examination. The metallic elements are separated into six groups. Group I., precipitated by hydrochloric acid, contains lead, thorium, mercury, silver and thallium. The filtrate is saturated with hydrogen sulphide and the precipitate separated into Group II., antimony, tin, arsenic, molybdenum, gold, platinum, and iridium, sulphides soluble in ammonium sulphide, and Group III., lead, bismuth, copper, cadmium, zinc, mercury, osmium, rhodium, palladium, and ruthenium, with insoluble sulphides. To the boiling solution, containing the metals not precipitated by hydrogen sulphide in acid solution, an excess of sodium phosphate, hydroxide, and hypobromite is added. The filtrate contains Group IV., thallium, vanadium, aluminium, glucinum (beryllium), chromium, zinc, potassium, cæsium, sodium, rubidium, tantalum and niobium. The precipitate is dried and fused with sodium carbonate, taken up in water, washed, and dissolved in hydrochloric acid,

boiled to remove carbon dioxide, and Group V., manganese, iron, uranium, indium, gallium, zirconium, cerium, thorium, lanthanum, didymium, titanium, erbium, gadolinium, and germanium, precipitated by ammonia solution. The solution contains Group VI., cobalt, nickel, calcium, strontium, barium, magnesium and lithium. Tables are given for the identification of the metals contained in the various groups, and the author claims that the separations are quantitative and that the method may be used as a basis for the estimation of the various metals.
—R. L. S.

INORGANIC—QUANTITATIVE.

Metals; Rapid electroanalytical deposition and separation of ——. *II. Antimony and tin. Employment of a diaphragm.* H. J. S. Sand. Chem. Soc. Trans., 1908, **93**, 1572—1592.



A continuation of the author's previous work (this J., 1907, 490) with a slightly modified apparatus. The difficulty in obtaining coherent deposits of antimony from acid solutions is due to the intermediate formation of antimony hydride. It can be overcome, as in the case of bismuth, by employing a high temperature and keeping the cathode potential low. In the presence of hydrazine sulphate, antimony can readily be completely deposited from its solution in sulphuric acid (1 : 1) at temperatures above 100° C., at an auxiliary potential (*loc. cit.*) of 0·65 volt, whereas under similar conditions tin does not begin to separate below 0·8 volt. In devising a method for the separation of antimony and tin, it was sought to start with a solvent capable of dissolving the common alloys containing these metals and also of dissolving a precipitate of antimony and tin sulphides on a filter-paper. The solvent adopted was a mixture of 40 c.c. of concentrated sulphuric acid, 5 c.c. of water, and 2 c.c. of concentrated nitric acid. The nitrosulphonic acid formed in such a solution interferes with the separation of antimony, but it can be destroyed by addition of hydrazine sulphate, which also reduces any antimony pentoxide. The apparatus used is shown in the figure. The electrodes are suspended in the beaker (42 mm. diam., 10 cm. high) about 1 cm. from the bottom. The stem of the inner electrode is held in position by means of a rubber cork and by the glass fork, A, as shown. Contact is made through the leads, B and C, which consist of glass T-pieces, into the ends of which strips of platinum gauze have been fused; these are filled with mercury and closed at the ends by rubber caps, through which copper wires pass. The pieces, B and C, are held against the stem of the inner, and the collar of the outer electrode, respectively, by the rubber band, D. With the solvent mentioned above, at 180° C., the metal dissolves fairly rapidly. The solution is heated to about 220° C., and a current of 5 ampères passed. When the temperature rises to 250°—270° C., vigorous effervescence and rapid reduction of the nitrosulphonic acid take place. After about 5—10 mins. at this temperature, the current is stopped, and the liquid allowed to cool (by about 100° C.) for at least 10 mins. A quantity of hydrazine sulphate equal in weight to the total amount of metal present, or at least 0·5 grm., is now added, and the liquid, which may be stirred by rotating the inner electrode, is again heated, the temperature being raised finally to 300° C. After the temperature has been allowed to fall again to about 100° C., the beaker is placed first in warm and then in cold water, and when cooled to about 30° C., 40 c.c. of water and a quantity of hydrazine sulphate equal to that of the antimony present, or at least 0·5 grm., are added. The temperature rises to about 120° C., and the separation of the antimony may then be commenced, with the auxiliary electrode at a potential of 0·53—0·65 volt. After the complete deposition of the antimony, the solution is washed into a tall 400 c.c. beaker, and oxalic acid added (in quantity sufficient to leave 1—3 grms. per 80 c.c. of solution at the end of the analysis). The inner electrode is now placed in the beaker, and the latter covered with a clock-glass provided with a hole just large enough for the stem of the inner electrode to move in it freely. The beaker is placed in cold water, 100 c.c. of strong ammonia solution are poured gradually on to the clock-glass, and the contents of the beaker are stirred with the electrode. After the whole of the ammonia has run through into the beaker, the clock-glass is removed and washed, the solution is made neutral to methyl orange, and an excess of sulphuric acid added, corresponding with 0·5—0·75 c.c. per grm. of oxalic acid previously added. A current of 4 ampères is now passed, at 70° C., until most of the oxalic acid is destroyed and most of the tin is deposited. It is then stopped, 15 c.c. of concentrated hydrochloric acid and 3 grms. of hydroxylamine hydrochloride are added, and the temperature is raised rapidly nearly to 100° C. Electrolysis is now continued with a current of 3 ampères, falling later to 2, the potential of the auxiliary electrode being 1·5 volts at the beginning of the separation and falling to 1·3 or even 1·15 volts at the end.

The author also gives a brief account of the use of a diaphragm, cut from a Schleicher and Schüll parchment paper diffusion shell, in rapid electroanalysis.—A. S.

Tin, arsenic, and antimony; Separation [*and determination*] *of* ——. *Application to the analysis of bronzes.* M. Dinan. Monit. Scient., 1908, **22**, 600—602.

The author has elaborated a method of determining tin, arsenic, and antimony in alloys. For the analysis of a bronze, 3 grms. are treated with 30 c.c. of nitric acid (sp. gr. 1·4), and, after the action has ceased, the liquid is boiled; zinc, lead, and nearly all the copper go into solution and the residue contains the tin, antimony, a little copper and lead, and the arsenic, as arsenate of tin. After washing the residue, as far as possible, by decantation, it is dissolved, by boiling for half an hour or more, with a solution containing 10 grms. of oxalic acid and 4—5 grms. of normal ammonium oxalate; 1 c.c. of hydrochloric acid is then added, the whole diluted to about 400 c.c., and a rapid stream of hydrogen sulphide passed through the nearly boiling liquid for 2 hours; the sulphides of antimony, arsenic, copper, and lead are thus precipitated and are filtered off and washed with boiling water; the filtrate is concentrated, and the tin determined by electrolysis, in the presence of 5—6 grms. of oxalic acid, with a current density of 1 amp. per sq. dm., the liquid being kept hot. The sulphide precipitate is treated with boiling potassium hydroxide solution, to dissolve the sulphides of antimony and arsenic, and the solution is separated from the insoluble copper and lead sulphides, reduced to 40 c.c. by evaporation, and the heating continued, after adding 60 c.c. of hydrochloric acid, until all hydrogen sulphide is expelled; this precipitates the arsenic as sulphide, which is filtered off when cold, and washed with dilute hydrochloric acid; potassium chlorate is added to the filtrate, so as to convert the antimony trichloride into pentachloride, excess of chlorine is boiled off the solution cooled, and 3 grms. of potassium iodide, in concentrated solution are added; the antimony is then determined in the usual manner, by titrating the liberated iodine, after diluting to 500—600 c.c. The residue of arsenic sulphide is dissolved in potassium hydroxide solution, 60 c.c. of hydrochloric acid and some potassium chlorate are added, and the arsenic similarly determined with potassium iodide and thiosulphate. The antimony may also be deposited electrolytically by dissolving the precipitate of sulphide in sodium sulphide, adding potassium or sodium hydroxide and potassium cyanide, and then electrolysing, in the cold, with a current of feeble density. The copper and lead sulphides are dissolved in nitric acid (sp. gr. 1·2), the solution added to the liquid containing the main portion of the copper, and the whole evaporated to about 15 c.c.; then 3 c.c. of a saturated solution of sodium acetate are added, and the solution is electrolysed, in the cold, at 4 volts, with a current density of 0·5 amp. per sq. dm.; the copper is thus deposited on the cathode and the lead, as peroxide, on the anode, which, as usual, is roughened by a sand-blast; the peroxide is dried at 180°—200° C. and its weight multiplied by the factor 0·853 to give the weight of lead. The liquid, after electrolysis, is evaporated to dryness, the residue heated, to drive off the ammonium salts produced, and then dissolved in 2—3 c.c. of hydrochloric acid, and the zinc determined in the solution with sodium carbonate in the ordinary way. In the case of a phosphor-bronze, the phosphorus may be determined by a known method in the liquid from which the tin has been deposited by electrolysis, in which liquid it is present as phosphate. When iron is present, it is found to contaminate many of the deposits, and its exact determination is complicated.—F. Sodn.

ORGANIC—QUALITATIVE.

Cotton in presence of kapok; Detection and determination of ——. M. Greshoff. *See* V.

Cottonseed oil; Halphen's test for ——. H. Wagner and J. Clement. *See* XII.

Oleic acid; Spectral reaction of ——. J. Lifschütz. *See* XII.

Pentoses; Detection of —— with orcinol and hydrochloric acid. J. Pieraerts. *See* XVI.

Proteins; Detection of —— by means of formaldehyde. L. v. Liebermann. *See* XVIII*A*.

Benzoic acid; Detection of —— in butter. G. Halphen. *See* XVIII*A*.

Saponin [in lemonade and beer]; Detection of ——. J. Rühle. *See* XVIII*A*.

ORGANIC—QUANTITATIVE.

Coke; Yield of ——. F. W. Hinrichsen and S. Taczak. *See* II.

Sugar: Determination of —— in sugar products and chiefly in "queues de betteraves" and dried pulps. J. Robart. *See* XVI.

Dry milks; Determination of fat in ——. B. G. McLellan. *See* XVIII*A*.

Butter; Limits of error in the determination of water in ——. A. Schoojans. *See* XVIII*A*.

Lard and other fats; Determination of water in ——. K. Fischer and W. Schnellens. *See* XVIII*A*.

Patent.

Cream or milk rich in fat; Method of taking samples of ——. Ger. Pat. 199,384. *See* XVIII*A*.

XXIV.—SCIENTIFIC & TECHNICAL NOTES.

High temperatures and pressures; Apparatus for experiments at ——, and its application to the study of carbon. R. Threlfall. Chem. Soc. Trans., 1908, **93**, 1333—1356.

Preliminary experiments, suggested by Spring's researches on the flow of solids, showed that graphite readily flows under high pressure, whereas silica, magnesia, and alumina practically do not flow at all. There are thus available on the one hand, graphite which is an electrically conductive fluid at high pressures, and on the other hand, non-conducting, more or less infusible substances (silica, alumina, magnesia), which can be consolidated by pressure, in which state they are practically incapable of flowing, and thus are especially suitable as material for vessels capable of withstanding pressure. By utilising these two sets of properties, apparatus can be constructed in which substances may be electrically heated and at the same time submitted to high pressures, the latter being transmitted from a hydraulic lifting jack by means of graphite. Full details of the construction of such an apparatus are given, as also its application to the study of the effect of high temperatures and pressures on carbon. The results of this latter work were substantially the same as those obtained by Parsons by a different method (this J., 1907, 1069), no formation of diamond being observed. The author discusses previous work on the formation of diamond, and concludes that the necessary conditions are the presence of a mixture from which a pure carbon phase can separate at a temperature which is not high enough, at the pressure in question, for the velocity of transformation to graphite to have any appreciable value. As the limits of the temperature interval over which diamond can crystallise without conversion into graphite are probably very near together, the most promising line of research would appear to be to keep a solvent containing carbon under a considerable pressure for considerable periods, at the lowest temperature at which carbon could separate.—A. S.

Fluid crystals and their mixtures; Character of melting point and clearing point curves of ——. A. Bogojawlensky and N. Winogradow. Z. physik. Chem., 1908, **64**, 229—242.

The authors find that azoxy- and azo-compounds exhibit a tendency to form isomorphous mixtures: of ten cases which were investigated, the following combinations form mixed crystals:—(1), Azoxyphenetol and azophenetol; (2), azoanisolphenetol and azophenetol; (3), methylpropylazophenol and ethylpropylazophenol. From the shape of the melting point curves the most complete miscibility is to be expected in the case of (1) and then from (2) and (3). The clearing point curves in all cases examined show the complete miscibility of the fluid-crystalline phase. The direction of the clearing point curve in the binary mixtures is connected only with the position of the clearing point curves of the two components and does not depend on the melting point curves. The clearing points of the azo-compounds examined are below the melting points, that is, the substances are monotropic; the azoxy-compounds are enantiotropic. Two monotropic substances can form enantiotropic fluid-crystal mixtures. The method of extrapolation of the clearing point curves can be used for the investigation of the fluid-crystalline modifications.—J. C. C.

Drying oils; Radiation phenomena of ——. Werner Schmidt. Z. physik. Chem., 1908, **64**, 243—250.

In envelopes which had been printed on the inside to render them opaque, it was noticed that the gum arabic used for gumming, when moistened, became rough, and the adhesiveness was completely destroyed. The orginally colourless gum also became brownish-yellow. This destructive action was found to be due to the fact that the linseed oil varnish used for making the printing ink has the property of emitting rays. Experiments with photographic plates showed that these rays resemble those of light in their action, but whilst they are not transmitted by glass or mica, they readily pass through gold-leaf, celluloid, paper, gutta-percha, gelatin, etc. The rays can be reflected from a brass surface, but do not discharge an electroscope and are not diverted in a magnetic field. Comparative experiments on gum arabic paper in sunlight and exposed to dry varnish in the dark, showed very similar results: in both cases the conversion into an insoluble substance was hastened by the addition of ferrous sulphate or electrolytically separated iron to the gum arabic solution, and in the presence of potassium bichromate the conversion was instantaneous in the case of sunlight and complete in 8 days under the action of the varnish.—J. C. C.

New Book.

Proceedings under the Sale of Food and Drugs Act, The Merchandise Marks Acts, The Fertilisers and Feeding Stuffs Act, and The Board of Agriculture Act for the year 1907. [Cd. 4274.] Wyman and Sons, Fetter Lane, London, E.C. Price 5d.

This constitutes Part I. of the Report of the Intelligence Division of the Board of Agriculture and Fisheries to the Secretary of the Board.

Patent List.

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised. Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

Applications.

18,544. Dooley. Plant for the manufacture of chemical products. Sept. 4.

18,730. Parvillée. Ovens or furnaces. [Fr. Appl., Sept. 9, 1907.]* Sept. 7.

18,813. Crossley and Rigby. Evaporation and concentration of liquids or mixtures of solids and liquids. Sept. 8.

18,831. Peyton. Packing pieces for chemical absorption, condensing, and like towers. Sept. 8.

18,956. Bromham. Centrifugal drying machines.* Sept. 9.

Complete Specifications Accepted.

20,177 (1907). Macfarlane and Macfarlane. Centrifugal drying machines. Sept. 16.

25,436 (1907). Mills (Hendricks). Desiccating process and apparatus. Sept. 9.

2528 (1908). Von Radlowski. Burning process employed in rotary furnaces. Sept. 9.

3467 (1908). Tiemann. *See under* XVI.

4053 (1908). Bock. Method of crystallisation. Sept. 9.

7479 (1908). Royston. *See under* XVII.

7836 (1908). Sauerstoff-Fabrik Berlin Ges. Removal of boiler-scale. Sept. 16.

9207 (1908). Boult (Goldman and Co.). Filters. Sept. 16.

II.—FUEL, GAS, AND LIGHT.

Applications.

18,444. Müller. Burner tube coke ovens, etc.* Sept. 2.

18,829. Rodhe. *See under* XXIII.

19,188. Potter. Mantles for gas and electric lighting and heating. Sept. 12.

Complete Specifications Accepted.

17,841 (1907). Durupt. *See under* XVII.

19,672 (1907). Ges. f. Verwertung Chem. Produkte. Metallic filaments for electric glow lamps. Sept. 9.

20,139 (1907). Feld. Obtaining tar constituents, ammonia, etc., from coal gas and analogous gases. Sept. 16.

20,227 (1907). British Thomson-Houston Co. (General Electric Co.). Manufacture of refractory bodies. Sept. 9.

21,593 (1907). Fabry. Coke ovens. Sept. 9.

23,679 (1907). Whitfield. Power gas producing plant. Sept. 16.

2550 (1908). Richter. Regenerative coking ovens. Sept. 9.

2609 (1908). Kelly and Lowry-Corry. Manufacture of fuel. Sept. 9.

4461 (1908). Michaud and Delasson. Manufacture of filaments for illuminating and heating. Sept. 16.

5188 (1908). Schmatolla. Gas producers. Sept. 16.

8397 (1908). Chavanne. Gas generators. Sept. 9.

8421 (1908). Wolfram-Lampen A.-G. Incandescent filaments for electric lamps. Sept. 16.

12,968 (1908). Kuzel. Manufacture of filaments for electric glow lamps. Sept. 9.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

Application.

19,225. Kittle. Vaporisation and decomposition of mineral oils, tar oils, oil residuals, etc. Sept. 12.

Complete Specification Accepted.

20,139 (1907). Feld. *See under* II.

IV.—COLOURING MATTERS AND DYESTUFFS.

Applications.

18,729. Newton (Bayer und Co.). Manufacture of dyestuffs of the azine series. Sept. 7.

18,736. Lauch. Manufacture of an orange lake-dyestuff. [Ger. Appl., Oct. 8, 1907.]* Sept. 7.

Complete Specifications Accepted.

19,807 (1907). Ransford (Cassella und Co.). Manufacture of dyestuffs. Sept. 9.

23,026 (1907). Newton (Bayer und Co.). Manufacture of azo dyestuffs. Sept. 16.

25,507 (1907). Newton (Bayer und Co.). Manufacture of dyestuffs of the anthracene series. Sept. 9.

26,538 (1907). Imray (Meister, Lucius, und Brüning). Manufacture of chlorinated dibromindigos. Sept. 9.

28,266 (1907). Newton (Bayer und Co.). Manufacture of a yellow colouring matter. Sept. 16.

7583 (1908). Imray (Soc. Chem. Ind. in Basle). Manufacture of vat dyestuffs containing sulphur. Sept. 16.

16,011 (1908). Newton (Bayer und Co.). Manufacture of azo dyestuffs. Sept. 16.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

Applications.

18,872. Castle. Material for use in textile and other manufacture. Sept. 8.

19,064. Orr and Raw. Treatment of plants and other fibrous substances. Sept. 10.

19,065 and 19,066. Hollins and Taylor. Preparation of fibre. Sept. 10.

19,157 and 19,158. Tetley and Clayton. Apparatus for the manufacture of artificial silk and like threads. Sept. 11.

19,216. Siefert-Schwab. Printing fabrics. Sept. 12.

Complete Specifications Accepted.

23,624 (1907). Higginson and Arundel. Gassing or singeing machines for yarn or thread. Sept. 9.

28,060 (1907). Pugh, Ltd., and Read. Dyeing cotton and the like. Sept. 9.

993 (1908). Venter. Purifying and clarifying the soda-lye rendered impure by the mercerisation process. Sept. 16.

8876 (1908). Düring. Producing embossing effects on fabrics. Sept. 16.

VII.—ACIDS, ALKALIS, AND SALTS.

Applications.

18,245. McTear. Manufacture of salt. Aug. 31.

18,356. Keogh and Douglas. *See under* X.

18,434. Gibbs. Process of making chromates. [U.S. Appl., Sept. 20, 1907.]* Sept. 2.

19,148. Pipereaut and Vila. Preparation of metallic sulphides and alkaline hyposulphites from ores and other metallic compounds. [Belg. Appl., Sept. 19, 1907.]* Sept. 11.

Complete Specifications Accepted.

20,139 (1907). Feld. *See under* II.

20,509 (1907). Crowther, Leach, and Gidden. Purification of sulphuric acid from arsenic and selenium. Sept. 16.

25,311 (1907). Fousset. Apparatus for treating solutions containing ammonia and production of ammonium salts. Sept. 16.

993 (1908). Venter. *See under* V.

9772 (1908). Weyer. Obtaining the nitrates of barium and strontium. Sept. 9.

11,415 (1908). Norsk Hydro-Elektrisk Kvaelstofaktieselskab. Production of pure sodium nitrite. Sept. 16.

11,732 (1908). Gaillard. Lead chambers for the manufacture of sulphuric acid. Sept. 16.

VIII.—GLASS, POTTERY, AND ENAMELS.

Application.

18,482. Solon and Campbell. Purifying the slip, etc., used in the manufacture of china, earthenware, and like goods. Sept. 3.

Complete Specifications Accepted.

19,695 (1907). Woolley. Gas-fired potters' ovens or kilns. Sept. 9.

12,570 (1908). Rogerson. Production of mica powder. Sept. 16.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Applications.

18,738. Allan. Manufacture of clinker for making Portland cement. [Appl. in New Zealand, July 1, 1908.]* Sept. 7.

19,070. Lessing. Manufacture of cement from blast-furnace slag and the like. [Ger. Appl., Sept. 10, 1907.]* Sept. 10.

Complete Specification Accepted.

1854 (1908). Boucherie. Injection of woods. Sept. 16.

X.—METALS AND METALLURGY.

Applications.

18,356. Keogh and Douglas. Manufacture of fusible compounds of aluminium and recovering aluminium therefrom. Sept. 1.

18,523. Schmelzer. Furnaces for metallurgical purposes. [Ger. Appl., Nov. 4, 1907.]* Sept. 3.

18,534. Gutensohn. Briquetting metal oxide and metal sulphide material. Sept. 3.

18,584 and 18,585. Incandescent Heat Co., and Smallwood. Furnaces for annealing or heating metals. Sept. 4.

18,596. Chalas. Recovery of nickel from silicious ores. [U.S. Appl., Sept. 6, 1907.]* Sept. 4.

18,653. Côte and Pierron. *See under* XI.

18,680. Lessing. Briquetting ore with blast furnace slag.* Sept. 5.

18,726. Cowper-Coles. Desulphurising and dephosphorising iron. Sept. 7.

18,768. Cowper-Coles. Extraction of iron from its ores. Sept. 7.

18,842. Reynolds. Production of fused slags particularly applicable to the manufacture of steel, etc. Sept. 8.

18,946. Heinrich. Manufacture of filaments of refractory metals or mixtures thereof. Sept. 9.

19,035. McCarty. Treatment of iron and steel.* Sept. 10.

Complete Specifications Accepted.

23,627 (1907). Zenzes. Production of pig iron for the manufacture of steel in the converter. Sept. 16.

25,985 (1907). Dwight and Lloyd. Apparatus for roasting and sintering ores. Sept. 9.

28,637 (1907). Johnson (Fellner und Ziegler). Preparation of weathered ores for smelting. Sept. 9.

2528 (1908). Von Radlowski. *See under* I.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

Applications.

18,246. Hutton and Hutton. Electroplating and like processes. Aug. 31.

18,513. Röchling'sche Eisen- und Stahl-Werke, and Rodenhauser. Electric induction furnaces. [Ger. Appl., Feb. 26, 1908.]* Sept. 3.

18,653. Côte and Pierron. Electric furnace for the continuous extraction of zinc from its ores. [Fr. Appl., Feb. 12, 1908. Addition to No. 5100 of 1907.]* Sept. 5.

18,767. Cowper-Coles. Electrodeposition of iron. Sept. 7.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

Applications.

18,692. Hoffmann and Middleton. Treatment of the bran of rice under oil extraction. Sept. 7.

19,140. Common, and The Hull Oil Manufacturing Co. Process for thickening castor oil. Sept. 11.

Complete Specifications Accepted.

20,916 and 26,540 (1907). Schou. Manufacture of soap. Sept. 9.

27,500 (1907). Hill. Substitute for fullers' earth. Sept. 16.

7103 (1908). Lake (Blakeman). Oils. Sept. 16.

7110 (1908). Lake (Blakeman). Oils. Sept. 9.

16,823 (1908). Wolffenstein. Manufacture of soaps containing peroxides. Sept. 16.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc.

(*A.*)—Pigments, Paints.

Application.

18,616. Johnson (Badische Anilin und Soda Fabrik). Manufacture of pigments or lakes. Sept. 4.

Complete Specifications Accepted.

17,675 (1907). Ulrichs. Manufacture of lakes. Sept. 9.

19,427 (1907). Evans (Minimax Consolidated). Agitating and mixing colours, paints, and dyestuffs. Sept. 9.

7090 (1908). Lake (Blakeman). Manufacture of paint compounds. Sept. 16.

7100 (1908). Lake (Blakeman). Manufacture of paint compounds. Sept. 9.

(*B.*)—Resins, Varnishes.

Application.

18,349. Reif. Manufacture of a linoleum-like substance.* Sept. 1.

(*C.*)—India-Rubber.

Applications

18,269. Wildermann. Manufacture of ebonite capable of resisting the action of chlorine.* Aug. 31.

18,538. Drury and Grimston. Vulcanising. Sept. 3.

XIV.—TANNING, LEATHER, GLUE, SIZE, Etc.

Complete Specification Accepted.

6247 (1908). Baechler. *See under* XVIIIA.

XVI.—SUGAR, STARCH, GUM, Etc.

Application.

18,237. McMullen. Manufacture of sugar.* Aug. 31.

Complete Specifications Accepted.

24,503 (1907). Hafner and Krist. Manufacture of fermentable sugar from materials containing starch or cellulose. Sept. 16.

3467 (1908). Tiemann. Apparatus for producing a uniform circulation of the crystallised material or massecuite in boiling pans and vacuum apparatus. Sept. 16.

XVII.—BREWING, WINES, SPIRITS, Etc.

Application.

19,212. Schwensen and Lazarus. Process of saccharifying malt. Sept. 12.

Complete Specifications Accepted.

17,841 (1907). Durupt. Combined denaturalisation and carburation of alcohol. Sept. 9.

7479 (1908). Royston (Victoria Distillery Co.). Apparatus for distilling alcohol, low wines, spirits, etc. Sept. 9.

14,515 (1908). Kummle. Manufacture of beer. Sept. 9.

XVIII.—FOODS; SANITATION, WATER PURIFICATION; AND DISINFECTANTS.

(*A.*)—Foods.

Applications.

18,692. Hoffmann and Middleton. *See under* XII.

18,839. Heslop. Alimentary product. Sept. 8.

18,959. Westgate. Apparatus for generating gases for bleaching flour. Sept. 9.

18,985. Kemp. Increasing the strength of wheaten flour. Sept. 10.

19,038. Best. Germ flour for making bread, etc. Sept. 10.

Complete Specifications Accepted.

20,205 (1907). Polowinsky. Preservation of meat and fish. Sept. 9.

6247 (1908). Baechler. Manufacture of casein. Sept. 9.

6573 (1908). Wiechmann. Treatment of vegetable albumen and products therefrom. Sept. 16.

(*B.*)—Sanitation; Water Purification.

Applications.

18,199. Purcell, Ryan, and Polglase. Sewage constituents recovery. Aug. 31.

18,355. Reisert. Removing iron from water by means of air.* Sept. 1.

Complete Specifications Accepted.

23,706 (1907). Digby and Biggs. Detection and estimation of impurities and dissolved matter in water and other fluids. Sept. 16.

7072 (1908). Clark and Proctor. Purification of sewage or water. Sept. 9.

(*C.*)—Disinfectants.

Application.

19,058. Ongley. Production of chlorine disinfectants. Sept. 10.

Complete Specification Accepted.

20,387 (1907). Howorth (Chem. Fabrikswerke. Disinfectant and insecticide. Sept. 16.

XIX.—PAPER, PASTEBOARD, Etc.

Applications.

18,600. Gestetner. Preparation and treatment of stencil paper. Sept. 4.

18,890. Armitage and Ibbetson, Ltd., Woodburn, and Sully. Gelatining or glazing paper, cardboard, etc. Sept. 9.

19,067. Hollins and Taylor. Manufacture of cellulose. Sept. 10.

Complete Specifications Accepted.

22,532 (1907). Davidson. Manufacture of paper. Sept. 16.

8023 (1908). Lyncke. Preparation of powdered soluble alkali-cellulose xanthate. Sept. 9.

8727 (1908). Johnson (Knoll und Co.). Manufacture of cellulose derivatives and their solutions. Sept. 9.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

Applications.

18,374. Freund. Producing pure solutions of the effective principle of the suprarenal gland. Sept. 1.

18,493. Mertens und Co., and Jerosch. Making insoluble in water the root substance of various kinds of amorphopallus.* Sept. 3.

18,759. Wellcome and Barrowcliff. Manufacture of therapeutic compounds. Sept. 7.

Complete Specifications Accepted.

20,050 (1907). Zimmermann (Schering). *See under* XXI.

22,627 (1907). Newton (Bayer und Co.). Manufacture of pharmaceutical compounds. Sept. 9.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Complete Specification Accepted.

20,050 (1907). Zimmermann (Chem. Fabr. auf Actien, vorm. E. Schering). Manufacture of arylalkyl-*p*-aminophenols and their use as photographic developers. Sept. 16.

XXIII.—GENERAL ANALYTICAL CHEMISTRY.

Application.

18,829. Rodhe. Apparatus for analysing gas.* Sept. 8.

Complete Specifications Accepted.

16,670 (1908). Sefton-Jones (Hartmann und Braun A.-G., and Della Santa). Apparatus for detecting the presence of combustible gases. Sept. 9.

23,706 (1907). Digby and Biggs. *See under* XVIII*B*.

Journal of the Society of Chemical Industry.

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Journal and Patent Literature.

Patent Specifications may be obtained by post by remitting as follows :—
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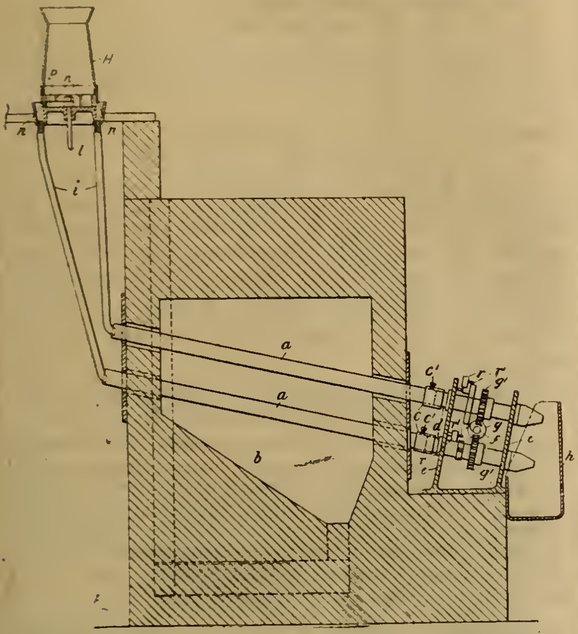
I.—PLANT, APPARATUS, AND MACHINERY.

Patents.

Powdered material in thin layers; Apparatus for rapidly exposing —— to the action of heat. G. T. and H. N. Beilby, Glasgow. Eng. Pat. 18,750A, Aug. 20, 1907.



The material to be treated is charged into the hopper, H, and is forced by the wipers, *p*, driven by the shaft, *l*, through the openings, *n*. It then falls down the feed tubes, *i*, into the inclined tubes, *a*, which pass through and are heated to the desired temperature in the furnace, *b*. The lower ends of the tubes, *a*, projecting beyond the furnace, are coupled by the collars, *c*, and the screws, *c'*, to the tubes, *d*, which are supported by the frame, *e*, and rotated by the gearing, *f*, *g*, *g'*. The material is discharged into the receiving trough, *h*. To facilitate the passage of the material through the tubes, *a*, the lower tubes, *d*, are tapped from time to time by the hammers, *r*, *r'*.—W. H. C.

Furnaces. J. D. F. Andrews, East Sheen. Eng. Pat. 18,760, Aug. 20, 1907.

The claim relates to improvements in furnaces described in Eng. Pats. 9952 of 1905 and 2525 of 1907 (this J., 1906, 580), and consists in the provision of an inclined grate to support the fuel, in combination with the combustion-chamber or "retort," therein described.—W. H. C.

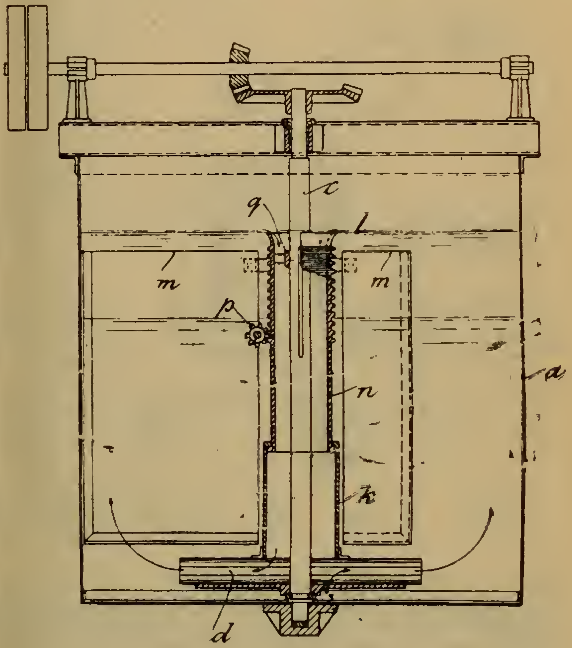
Cleaning and husking grain, disintegrating ores, for cooling, drying or evaporating, and for aerating and de-aerating liquids; Machines for ——. F. Müller, Esslingen-on-Neckar, Germany. Eng. Pat. 2421, Feb. 3, 1908. Under Int. Conv., Feb. 4, 1907.

The claim is for the provision of separate concentric draw-off passages for each tray in the case of centrifugal machines in which materials are treated on superposed rotating trays with a current of air or vapour, which passes over them from apertures in a central hollow shaft.—W. H. C.

Frame filter-presses. E. Feix, Tüppelsgrün, Austria. Eng. Pat. 5943, March 17, 1908.

The rod or bar which transmits to the plates the pressure of the screw rod, telescopes into the latter, made hollow for the purpose, so that its length can be adjusted to suit the number of plates and frames in use. After adjustment, the two rods are clamped by a nut operated by a lever, and the press is then tightened by a few turns of the screw wheel.—W. H. C.

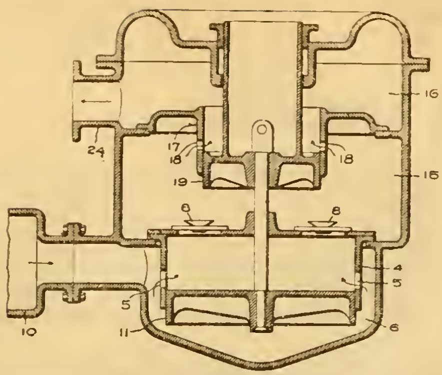
Mixing apparatus; Centrifugal ——. A. Furowicz, Kiew, Russia. Eng. Pat. 12,252, June 5, 1908.



A vane-wheel, *d*, is rotated by a shaft, *c*, in a tank, *a*. The interior of the vane-wheel communicates with the cylinder, *k*, which is also rotated and has its upper part, *n*, telescopic, in order that its height may be adjusted by the rack and pinion, *p*, so that the top, *q*, is just below the level, *l*, of the liquid in the vessel. Baffle-plates, *m*, *m*, are arranged within the vessel, and the circulation of the liquid takes place as indicated by the arrows.—W. H. C.

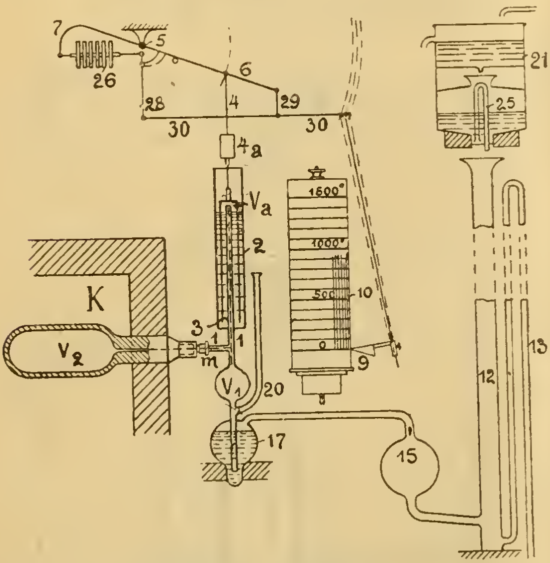
Pump for producing a vacuum or compressing gases; Multistage ——. A. Siegel, Berlin, Germany, Assignor to General Electric Co., New York. U.S. Pat. 897,498, Sept. 1, 1908.

Two cylinders, 4, and 17, are arranged as shown in the figure. Air is drawn through the inlet port, 10, into the lower casing, 6, and enters the cylinder, 4, through the ports, 5, being compressed during the upward stroke of the piston, 11, which first closes the ports, 5. When



the compression is sufficient to overcome the pressure in the intermediate chamber, 15, the valves, 8, lift, and the air enters the chamber, 15. It is here further compressed during the downward stroke of the upper piston, 19, and passes through the ports, 18, in the cylinder, 17, into the upper chamber, 16, from which it escapes through the outlet passage, 24.—W. H. C.

Air-pyrometer. M. Arndt. Fr. Pat. 388,992, April 7, 1908.



The pyrometer vessel, V_2, is exposed in the flue, K, to the temperature which it is desired to measure, and is connected by the narrow tube, 1, with the float-vessel, 2. Water flows from the constant-level cistern, 21, by the intermittent siphon, 25, into the tube, 12. The water rises in the bulb, 15, drives the air before it into the bulb, 17, and forces the mercury from the latter into the bulb, V_1, which is in communication with the atmosphere, by the tube, 20. As the mercury rises, it cuts off the communication with the atmosphere and imprisons a definite quantity of air in the bulb, V_1. The mercury continues to rise until it reaches the level, *m*. The air is driven into the bell, V_a, floating in the mercury, 3, in the tube, 2. The tension of the air in V_2, varies with the temperature, and a smaller or greater quantity of the air driven upwards by the mercury finds its way into the vessel, V_2, as the temperature being measured is higher or lower than that of the atmosphere, the remainder going to the float. Consequently the height to which the float, V_a, rises, depends upon the temperature which is being measured. The float, V_a, is connected by the rod, 4, and the adjusting weight, 4_a, to the compound lever, 5, 6, 7, 28, 29, 30, carrying the pen, 9, which registers the temperature on the drum, 10. Compensation for variations in the atmospheric pressure is obtained by the aneroid-barometer discs, 26, carried by the lever. When the tube, 12, is filled to the level of the top of the siphon, 13, the latter acts, the tube, 12, is emptied and the mercury in V_1, sinks into the bulb, 17, until the siphon, 25, again commences to act, when the measurement is repeated.—W. H. C.

Dissolving apparatus. Sieg-Rheinische Hütten-A.-G. Ger. Pat. 198,010, Nov. 30, 1906.

The substance to be dissolved is placed in a funnel which rests in the funnel-shaped upper end of a long vertical tube. The solvent is forced up through the long tube and overflows between the upper end of the latter and the funnel. It then falls, and by the injector action of the rising liquid, is again drawn up into the long vertical tube, a continuous circulation being thus obtained. When the solution has attained the desired concentration, it is drawn off through a separate outlet.—A. S.

Dissolving solids in liquids ; Device for ——. E. Gminder. Ger. Pat. 199,283, June 29, 1907.

The vessel in which the solution is effected has a funnel-shaped bottom, provided with a slit, in which a circular saw rotates.—A. S.

Evaporation of lyes and other liquids. G. Zschocke. Ger. Pat. 198,044, Feb. 8, 1907.

A series of iron discs, spaced apart, is mounted on a rotating shaft in a casing. The liquid is atomised and fed on to the discs, the edges of which are turned over, in order to prevent liquid falling between the discs without coming into contact with them. The edges are also corrugated. Displaceable elastic scrapers, with their lower edges extending down into a trough, are disposed between the discs, in order to remove the separated solids.—A. S.

Distilling and rectifying apparatus ; Regulating device for ——. H. Illgen. Ger. Pat. 199,623, May 2, 1907.

The distillate from the condenser or cooler flows through a chamber containing a float, the latter being connected to a balanced lever, which by means of suitable connecting rods and valves, can simultaneously increase the supply of steam and reduce that of cooling water, or *vice versa*. The float may also be connected, by means of levers, with the three-way valve used for diverting the different distillates into separate receivers.—A. S.

Crystallisation ; Method of ——. J. Bock, Radebeul, Germany. Eng. Pat. 4053, Feb. 22, 1908. Under Int. Conv., Jan. 30, 1908.

See Fr. Pat. 387,194 of 1908 ; this J., 1908, 795.—T. F. B.

Filtering apparatus. B. M. Jäger, Birkenhead. U.S. Pat. 897,745, Sept. 1, 1908.

See Eng. Pat. 20,677 of 1907 ; this J., 1908, 437.—T. F. B.

II.—FUEL, GAS, AND LIGHT.

Volatile matter of coal ; Nature of —— *as evolved under different conditions.* H. C. Porter and F. K. Ovitz. J. Amer. Chem. Soc., 1908, 30, 1486—1507.

During storage, some coals evolve gas of a composition similar to that of "natural gas" (chiefly methane); in some cases, oxygen is rapidly absorbed from the air, and no carbon dioxide formed. When dried in the air at 115° C., some coals lose appreciable amounts of carbon dioxide, and most coals take up oxygen to a considerable extent, but in none of the cases examined was there any considerable formation of combustible gases. In the destructive distillation of different coals, the nature of the volatile products evolved at low temperatures, during the early stages of heating, varies considerably, according to the smoke-producing tendencies of the coals. During combustion, the oxygen of the coal is evolved partly in the form of oxides of carbon and partly as water vapour, whereas in Dulong's formula for the calculation of the calorific value from the composition of the coal, it is assumed that the whole of the oxygen combines with hydrogen.—A. S.

Coal dust experiments. "Times," Sept. 25, 1908. [T.R.]

The experimental gallery at Altofts Colliery for the investigation of coal dust explosions (see this J., 1908, 888), has now been extended to a length of 1083 feet. It was found that, until the coal dust zone exceeded about 180 ft. in length, inflammability only was obtained, no explosive force having been manifested. The tube is fitted with an intake return airway fan for producing a ventilation current, and timber sets are erected and rails laid throughout the intake carrying 10 cwt. tubs. The coal dust and stone dust as required are distributed over the surface of narrow wooden ledges, running horizontally along the sides of the tube. The dust is raised and mixed with air by firing, by means of a fuse, a small cannon placed inside the tube, charged with 4 oz. of blasting powder. This is followed by the explosion of a larger cannon placed further in, charged with 16 oz. of blasting powder, which represents a blown-out shot in blasting. The coal dust was at first taken from the pit screens, but is now, for the sake of uniformity, obtained by grinding lump coal in a disintegrator. Seventy-nine per cent. of the coal thus ground will pass the meshes of a screen 40,000 to the square inch. Twenty-six experiments were conducted between May 6 and August 14 of the present year with only one failure and no personal injuries. The results obtained in this gallery are in no way dissimilar to those actually exhibited after a colliery disaster. In the case of the experimental explosion, the report has been heard seven miles away. The combination necessary to set up an explosion in such a medium, to develop its full force, must be first of all investigated from a fundamental standpoint before any conclusion can be formed as to the real nature of the problem confronting the mining engineer ensuring the safety of the mine. For this part of the inquiry the committee in charge of the investigation have secured the services of Dr. R. V. Wheeler, who will collaborate with Professor W. A. Bone.

The experiment on Sept. 24th was intended to demonstrate whether an explosion can be confined to a coal dust area by sandwiching it between two lengths spread with stone dust. With this end in view the conditions of the test were arranged in the following manner, namely :—A zone of 367 ft. of coal dust was sandwiched between two stone dust zones of 210 ft. each, and the cannons fired in the usual manner. The experiment was entirely satisfactory, no flame issuing from the end of the tube.

Coal output of India in 1907. Board of Trade J., Sept. 24, 1908. [T.R.]

The output of coal in 1907 amounted to 10,526,468 tons, as compared with 9,112,663 in 1906. Of this, 9,993,348 tons were raised in Bengal, exceeding the output of the preceding year by 1,375,528 tons. The principal increases come from the Jherria coal-field, where the output has gone up over one million tons, and from that of Burdwan, over 200,000 tons. Pench Valley in the Central Provinces has more than doubled its output, while Burma has ceased to produce any coal. The coal trade of Bengal continued extremely active during the year, and high prices were maintained.

Production of coke in United States. E. W. Parker. "Min. Resources" for 1907. [T.R.]

From 1893, when the first plant of 12 by-product ovens was completed by the Semet Solvay Co. of Syracuse, N.Y., to the close of 1904, there was a steady increase in the construction of by-product ovens in the United States. During the last three years there has been a falling off. In Dec. 1903, there were 1335 by-product ovens in course of construction; in 1904 there were 832; in Dec., 1905, 417; in 1906, 112; in Dec. 1907, 330. The value of the gas, tar, and ammonia obtained from 7,506,174 tons of coal in 1907 was $7,548,071. In 1907, 54,485,522 tons of coal were coked in bee-hive ovens, showing, on the ratio of the above figures, a waste of by-products amounting to $55,000,000.

Including the output from by-product ovens, the total production of coke in 1907 was 40,779,564 short tons (2000 lb.) valued at $111,539,126, against 36,401,217 short tons, valued at $91,608,034, in 1906. The average price per ton at the ovens rose from $2·52 in 1906 to $2·74 in 1907—the price for 28 years. Of the total production in 1907, 35,171,665 tons or 86·25 per cent. were beehive, as against 5,607,899 tons of by-product coke, or 13·75 per cent. The production of beehive coke increased 10·45 per cent. while retort oven coke increased 23·03 per cent. The total production of coke in 1907 was double that of 1900 and more than three times that of 1897.

The coal coked in by-product ovens in 1907 yielded 75 per cent. of coke, as against 73·6 per cent. in 1906, and 74·8 per cent. in 1905, a much larger yield than is possible in beehive ovens. The total value of by-products was made up as follows :—

	Quantity.	Value.
		$
Gas............Thousand cubic feet	20,516,731	3,130,839
Tar .... gallons	53,995,795	1,242,530
Ammonia, sulphate or reduced to equivalent in sulphate .... pounds	125,372,360	3,174,702
Total	—	7,548,071

The gas is the "surplus" not consumed in the coking process which is either sold or used.

The following table gives the quantity and value of coke imported and entered for consumption in the United States from 1902 to 1907, inclusive, reduced to short tons :—

1902...	140,489	$423,775	1905.....	203,142	$796,545
1903....	142,776	437,625	1906.....	147,819	570,150
1904....	180,855	648,521	1907.....	135,968	596,366

The quantity of coke exported from the United States has increased each year since 1900. The exports for the last six years are shown in the following table, the quantities in this case also being reduced to short tons :—

1902...	439,590	$1,785,188	1905....	670,939	$2,243,010
1903...	466,351	2,091,875	1906....	857,013	2,753,551
1904...	585,861	2,311,401	1907....	979,652	3,206,793

The following table shows the value of the coal-tar products imported into the United States in each year since 1896, inclusive :—

Year.	Salicylic acid.	Alizarin and colours or dyes, natural and artificial.	Aniline salts.	Coal-tar colours or dyes, not specially provided for.
	Value.	Value.	Value.	Value.
	$	$	$	$
1896*..	138,013	994,395	662,459	2,918,333
1897*..	201,980	1,023,425	812,884	3,163,182
1898*..	28,688	886,349	1,087,704	3,723,288
1899*..	57,192	700,786	743,130	3,900,099
1900*..	89,175	771,336	537,812	4,792,103
1901...	76,786	713,392	589,535	4,034,171
1902...	57,852	1,028,327	631,467	4,911,668
1903...	19,012	660,464	789,553	5,252,611
1904...	7,305	636,418	686,184	4,903,077
1905...	2,214	625,491	789,052	5,673,242
1906...	2,772	661,155	806,901	5,717,932
1907...	1,240	782,368	667,758	5,830,651

Year.	Coal-tar, all preparations, not colours or dyes.	Coal-tar products not medicinal, not dyes, known as benzol, toluol, &c.	Total.
	Value.	Value.	Value.
	$	$	$
1896*....	—	—	4,713,200
1897*....	—	—	5,201,471
1898*....	134,416	228,037	6,088,482
1899*....	221,101	393,602	6,015,910
1900*....	274,946	397,780	6,863,152
1901.....	342,116	383,559	6,139,559
1902.....	496,928	368,098	7,494,340
1903.....	544,176	425,069	7,690,885
1904.....	522,242	391,645	7,146,871
1905.....	768,556	486,439	8,344,994
1906.....	864,067	483,416	8,536,243
1907.....	911,096	653,288	8,846,401

* Fiscal years.

PATENTS.

Gaseous fuels; Process and apparatus to retard the combustion of ——. R. Fabry, Chesterfield. Eng. Pat. 5801, Mar. 16, 1908.

IN gas-fired apparatus, such as coke ovens, retorts, muffle furnaces, steam superheaters, etc., either the gas or the air for combustion is admitted intermittently, in a series of puffs, in order to obtain a more uniform distribution of temperature in the flue. The burner creates zones which contain alternately an excess of fuel and an excess of air, and combustion is not complete until the gases in successive zones, mix during their passage through the flue. Baffles may be provided towards the end of the flue to complete the mixing. The rate of combustion along the flue can be decreased by making the zones longer. A suitable device for producing the pulsations comprises a rectangular valve-plate arranged in a cylindrical casing, and rotating about the axis of the cylinder at any desired speed, so as to interrupt the flow of air or gas through the casing twice during each revolution.—A. T. L.

Naphthalene and similar substances; Utilising —— *as the motor medium for internal-combustion engines.* Rutgerswerke-A.-G., Berlin. Eng. Pat. 7594, April 6, 1908. Under Int. Conv., May 15, 1907.

THE naphthalene is dissolved in any of the usual liquid fuels in a chamber heated by the exhaust gases of the engine or by the hot water from the cylinder jackets. The naphthalene is contained in a cylindrical chamber, perforated around its lower end, and this chamber works through a stuffing-box in the upper end of a heating chamber for the liquid fuel, arranged near the fuel valve of the engine. The naphthalene chamber is normally held above the level of the liquid fuel by a spring, and the engine is started with the liquid fuel only. When the heating chamber reaches the desired temperature, the naphthalene chamber is forced down into the liquid fuel. Before stopping the engine, the naphthalene chamber is released, and the engine works for a short time with the liquid fuel alone, so that the fuel-supply pipe shall not become choked with naphthalene when cold.—A. T. L.

Coke ovens. A. O. Jones, Whitley Bay. Eng. Pat. 25,262, Nov. 14, 1907.

THE invention relates to an arrangement of gas-supply piping for gas-fired horizontal coke ovens of the type described in Eng. Pat. 17,137 of 1907 (this J., 1908, 113), in which a number of vertical heating flues are formed in each dividing wall of a battery of ovens, the flues being supplied with heated air and combustible gas from separate apertures at the base. A gas-supply main is located in a tunnel beneath the oven, running transversely to the dividing walls, and a vertical branch pipe rises beneath each wall nearly to the base of the ovens. Removable horizontal pipes extend laterally to right and left from the top of each vertical pipe, and are provided with vertical nozzles which pass through apertures in a base plate closing the lower ends of the heating flues. The tunnel is suitably recessed beneath each wall to facilitate removal of the horizontal pipes. Two tunnels and sets of piping may be used, each supplying one half of the flues in each dividing wall.—A. T. L.

Retort furnaces. H. Ries, Munich. Eng. Pat. 8370, April 15, 1908.

HEATING-conduits in the walls and roof of inclined retort chambers are arranged in separate groups, communicating through damper-controlled openings with a discharge flue leading to the regenerator, so that the heating gases can be circulated more rapidly at the lower part, or at any other desired part, of the retorts. As applied to the furnace described in Eng. Pat. 14,341 of 1907 (this J., 1908, 798), the vertical flues in the partitions between the retort chambers are arranged in four groups, each group leading to a separate damper-controlled opening in the main discharge flue; and each group of heating flues is connected at the top with the corresponding group of flues in the adjacent partition.—A. T. L.

Suction gas-producers. F. I. Bennett, Macclesfield, and W. Tapley, Southampton. Eng. Pat. 20,233, Sept. 11, 1907.

THE apparatus comprises a producer, a coke-scrubber, an oil-scrubber for removing tar from the gas, a starting fan, and an arrangement of connecting pipes and valves. The producer consists of a cylindrical base, on which is mounted the usual producer chamber, lined with firebrick, and surrounded by an outer casing which forms an annular jacket. The upper part of the producer contains a vaporiser in the form of an annular trough, of which the outer wall is attached to the inner shell of the producer jacket, whilst the inner wall extends upwards and outwards in the shape of an inverted cone and is connected to the outer shell of the jacket. The top plate of the producer is provided with a gas-outlet passage, and the usual feeding hopper and valve. The firebars are carried by a rotatable stand in the base of the producer. The vaporiser is fed with water from a constant-level reservoir, and the flow of water through it, is regulated by a cock on a drain pipe; an overflow pipe just above the normal water level, leads a small quantity of water to the ash-pit, for the production of additional steam, each time that the surface of the water is agitated by the suction of the engine. Air-inlet pipes terminate just above the surface of the water in the vaporiser, and the mixed air and steam pass downwards through the producer jacket and thence through openings, which may be provided with gauze screens or with non-return valves, into the base of the producer. The coke-scrubber consists of an outer casing and an inner cylindrical coke chamber open at the bottom and provided with a water-spray at the top. The gas enters near the top of the outer casing, which forms a cooling chamber, and leaves by a pipe at the top of the coke chamber. The oil-scrubber consists of a chamber partly filled with machine oil, and containing a number of wicks, or a porous screen, suspended by a cord from a pulley, so that they can be periodically dipped in the oil. A valve is arranged in the pipe connecting the two scrubbers, at a point between two branch pipes which are connected to the intake and delivery of a starting fan. At starting, the valve is closed and the fan draws the combustion products from the producer through the coke-scrubber, and discharges them through another branch pipe and a three-way cock to the chimney; when the producer has been started, the valve is open and the fan is inoperative; and when the producer is idle, the three-way cock connects the cooling chamber of the coke scrubber, directly with the chimney.—A. T. L.

Water-gas and producer-gas; Manufacturing —— H. Pettibone, New Rochelle, N.Y. Eng. Pat. 8715, April 21, 1908.

THE patent relates to improvements in the inventions described in Eng. Pats. 5912 and 6302 of 1904 (this J.,

1904, 602). A pair of generators are connected, at the top, by an inlet pipe for air and steam, and have a horizontal gas outlet pipe connection at the bottom, provided with valves, one on either side of a vertical branch leading to a wet scrubber. This vertical branch is water-jacketed, and forms one limb of a long inverted U-bend, the lower end of the other limb leading to the base of the scrubber. A water-box is arranged to contain the horizontal gas-outlet connections from the generators, and has an upward extension which encloses the U-bend and forms a vaporising and air-heating chamber. By passing the heated air and vapour through the generators, a mixed water-gas and producer-gas is formed. The gas passes through the wet scrubber and then through a dry scrubber or direct to an exhauster, which delivers to a holder or to a waste-pipe. To loosen the fuel in the generator when it has become clogged with ash and cinder, sudden puffs of compressed water-gas or air are admitted, through the gas-outlet connection, to the base of one generator, while the products pass off from the base of the other generator.
—A. T. L.

Producer-gas and carburetting system; Combined ——. W. F. Steele, New York. U.S. Pat. 897,799, Sept. 1, 1908.

The fuel in the generator is maintained in a state of incandescence by a blast of air introduced beneath the grate. Steam is blown into the incandescent mass, and liquid fuel is introduced into the centre of the glowing fuel, so that in one and the same generator, producer-gas and water-gas are formed, and the mixture is carburetted by the gas resulting from the decomposition of the liquid fuel.—W. H. C.

Water-gas; Continuous production of —— from carbonised combustible materials. Gewerkschaft Messel. Ger. Pat. 200,602, May 23, 1906.

The water-gas is produced in the lower part of vertical retorts or shafts, heated on the outside, whilst the carbonisation of the fuel is effected in the middle portion of the retorts. The steam required is generated by evaporation of water in the upper part of the retorts by the heat of the fire-gases, after these have been utilised for the production of the water-gas and the carbonisation of the fuel. The steam is blown into the base of the retort. The heating chamber between the retorts is divided into separate superposed compartments, one for each working zone of the retort.—A. S.

Scrubber and cooler; Combined —— for treatment of producer gas. E. Hall-Brown, Glasgow. Eng. Pat. 23,078, Oct. 19, 1907.

The apparatus comprises a box divided by removable partitions into a number of compartments communicating with one another at the top, the lower ends of the compartments being sealed in water. A hollow metal shell, through which air can be circulated, is arranged in each compartment, and the upper edge of each shell is extended to meet the cover of the box, so that the gas in passing through the box from one end to the other is led up and down through the narrow spaces between the hollow shells and the partitions. The surfaces of the shells and partitions are wetted by water sprayed from perforated pipes arranged across the box above each partition plate.
—A. T. L.

Electrodes for arc lamps. Allgem. Elektricitäts-Ges., Berlin. Eng. Pat. 4762, March 2, 1908. Under Int. Conv., March 1, 1907.

A metallic oxide cathode, which itself yields a non-conducting tip or cup, is used in conjunction with a metallic anode. When the current is switched off and the electrodes come together, a fusible compound is formed at the zone of contact; when the current is re-established, this compound is fused, so that the electrodes can be easily separated for striking the arc. A suitable combination is a cathode of titanium oxide with an iron anode.—A. T. L.

Filament for incandescence electric lamps. Wolfram-Lampen Akt.-Ges. Fr. Pat. 389,363, March 30, 1908. Under Int. Conv., April 26, 1907.

A core of osmium, vanadium, thorium, zirconium, titanium, niobium, or an alloy of any or all of these metals is coated with tungsten. In order to obtain the metal forming the core in a porous condition, the powdered metal or alloy is mixed with carbon and placed in an envelope of tungsten, the whole being subsequently submitted to the same treatment as filaments composed entirely of metal.—W. H. C.

Gas from hydrocarbon oils or other materials; Apparatus for making ——. W. P. Thompson, Liverpool. From International Amet Co., Phoenix, Arizona, U.S.A. Eng. Pat. 8408, April 15, 1908.

See U.S. Pat. 885,904 of 1908; this J., 1908, 554.—T. F. B.

Gas; Apparatus for producing ——. International Amet Co. Fr. Pat. 389,194, April 14, 1908.

See U.S. Pats. 885,903 and 885,904 of 1908; this J., 1908, 554.—T. F. B.

Gas under pressure; Generator of ——. G. F. Jaubert. Fr. Pat. 389,257, June 19, 1907.

See Eng. Pat. 17,252 of 1907; this J., 1908, 797.—T. F. B.

Gas for illuminating and heating; Apparatus for the manufacture of ——. C. B. Tully. Fr. Pat. 389,361, March 28, 1908. Under Int. Conv., April 9, 1907.

See Eng. Pat. 8293 of 1907; this J., 1908, 326.—T. F. B.

Metallic filaments or the like for electric glow lamps and method of making same. Ges. f. Verwerthung Chem. Produkte m.b.H., Berlin. Eng. Pat. 19,672, Sept. 3, 1907. Under Int. Conv., Aug. 2, 1907.

See Fr. Pat. 380,802 of 1907; this J., 1908, 68. Reference is directed in pursuance of Sect. 7, Sub-sect. 4, of the Patents and Designs Act, 1907, to Eng. Pats. 18,814 of 1905; 3213, 11,409, 15,021, 18,745 and 18,749 of 1906; and 17,360 of 1907.—T. F. B.

Arc-light electrode and method of making the same. C. F. Lindsay, Schenectady, Assignor to General Electric Co., New York. U.S. Pat. 897,548, Sept. 1, 1908.

See Eng. Pat. 26,920 of 1904; this J., 1905, 190.—T. F. B.

Gases; Apparatus for the automatic analysis of ——. Fr. Pat. 389,498. *See* XXIII.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

Petroleum, benzine, and benzol; New means of purifying ——. A. Gawalowski. Allgem. Oesterr. Chem.-Techn. Zeit., 1908, **26**, 87.

The fibrous or spongy aluminium hydroxide recommended by Wislicenus (this J., 1904, 765; 1905, 294) for the determination of tannin, has been found by the author to be a very effective agent for the purification of petroleum and benzol. It neutralises any free acid present and exerts a clarifying and deodorising action. This fibrous aluminium hydroxide has a much looser structure than the ordinary kind, the relative weights of 1 cubic metre being 393 and 643 kilos. respectively. The petroleum or the like is treated with the necessary quantity (as determined by a preliminary test) of the fibrous aluminium hydroxide, the mixture is agitated until the maximum effect is produced (4—6 hours), and is then passed through a filter-press.—A. S.

PATENTS.

Tar and resins and products containing the same; Hardening of ——. H. Trillich. Ger. Pat. 200,524, March 26, 1907.

THE spent material from gas purification (Laming's mixture), is dried, sifted, and stirred into the hot tar, which has been previously dehydrated, in the proportion of 12 parts per 100 of tar. An asphaltum-like pitch, easily soluble in crude benzol, is thus obtained. The cyanogen- and ammonium compounds may be extracted from the spent gas-purifying material, before the latter is dried. Tar products, resins, and resinous products can be hardened in a similar manner.—A. S.

Lubricating and cooling media. A. Duckham, Blackheath, Kent. Eng. Pat. 8387, April 15, 1908.

THE lubricant claimed is prepared by dissolving 1 part of lanoline in 3 parts of mineral oil of sp. gr. about 0·900, the oil being slightly warmed to aid solution; to this mixture is added 1 part of ammonium oleate dissolved in 3 parts of water, the temperature of mixing being preferably not higher than 40° C. The product is particularly applicable to internal combustion engines. —W. P. S.

Crude petroleum, or petroleum products, or distillates; Purifying ——. L. Edeleanu, Bucharest. Eng. Pat. 11,140, May 22, 1908.

THE oil is cooled below 0° C. and mixed with liquid sulphur dioxide in an agitator. The sulphur dioxide dissolves the injurious substances which cause colour and odour, and forms a separate layer which can be drawn off. The process can also be carried out by introducing gaseous sulphur dioxide under pressure into the oil and cooling the mixture, so that a layer of liquid sulphur dioxide separates. The sulphur dioxide is recovered quantitatively by evaporation, assisted by an exhausting pump. The impurities extracted from the oil are washed with water or alkali, and may then be used for obtaining aromatic substances, or as solvents.—A. T. L.

Waste waters containing cyanides and sulphocyanides; Process of freeing —— *from poison.* U.S. Pat. 897,735. *See* XVIII*B*.

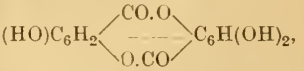
IV.—COLOURING MATTERS AND DYESTUFFS.

Triphenylmethane dyestuffs; Influence of methyl groups on the dyeing properties of basic ——. J. Bielecki and A. Koleniew. Anzeiger Akad. Wiss. Krakau, 1908, 296—318. Chem. Zentr., 1908, 2, 876—878.

DIFFERENT triphenylmethane dyestuffs were prepared by condensing tetramethyldiaminodiphenylcarbinol with *o*-toluidine, the dimethyl derivatives of *o*-, *m*-, and *p*-toluidine, and 1.3.4-, 1.4.5-, and 1.2.4-dimethylxylidine, respectively, in presence of dilute hydrochloric acid on the one hand, and of strong sulphuric acid on the other, and oxidising the resulting leuco-compounds. The methylated amines were prepared by the action of dimethyl sulphate on the amino-compounds. It was found that the methyl group behaves as a negative substituent, influencing the shade of the dyestuff when in the ortho or para position, but not when in the meta position to the methane carbon atom. A methyl group in the ortho position increases the fastness of the dyestuff to alkali, having a similar action, in this respect, to the substituents, SO_3H, Cl, Br, NO_2, OH, CO_2H.—A. S.

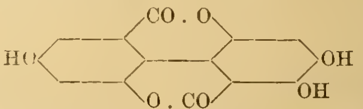
Resoflavin. J. Herzig and S. Epstein. Monatsh. Chem., 1908, 29, 661—675. (See also this J., 1907, 193).

HERZIG and Tscherne have shown (this J., 1908, 680) that resoflavin has the constitution,

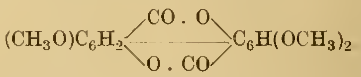


$$(HO)C_6H_2\left\langle\begin{matrix}CO.O\\ O.CO\end{matrix}\right\rangle C_6H(OH)_2,$$

the position of one hydroxyl group being undetermined. The authors now find that when fused with caustic potash, resoflavin gives 3:5-dihydroxybenzoic acid, and as ellagic acid, containing two pyrogallol rings, under the same conditions yields a hexahydroxydiphenyl, the conclusion is drawn that if resoflavin contained a pyrogallol- and a resorcinol ring (the latter ring being more stable than the former) it should yield, on fusion, a pentahydroxydiphenyl. Not doing this however, it is considered probable that the trihydroxy-ring of resoflavin is not a pyrogallol- but a hydroxyquinol ring and the constitution accordingly is



When the ether-ester of resoflavin, $(CH_3O)_2C_6H_2(CO_2CH_3).(CO_2CH_3)C_6H(OCH_3)_3$, is heated with concentrated sulphuric acid in alcoholic solution, it yields a substance which when treated with diazomethane, gives methylresoflavin,

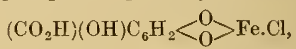


$$(CH_3O)C_6H_2\left\langle\begin{matrix}CO\ .\ O\\ O\ .\ CO\end{matrix}\right\rangle C_6H(OCH_3)_2$$

and is consequently a product of hydrolysis of the latter, which must be formed in the reaction. An analogous product is also obtained when the ether-ester of ellagic acid is similarly treated with sulphuric acid.—J. C. C.

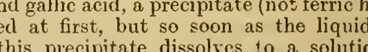
Iron-gall inks. Capacity of gallic acid and allied substances of forming complex salts. T. Silbermann and H. Ozorovitz. Bulet. Soc. de Stiinte din Bucuresti, 1908, 17, 43—57. Chem. Zentr., 1908, 2, 1024—1025.

GALLIC acid and ferric chloride, in aqueous solution, give a blue precipitate, probably *chloroferrigallic acid*,



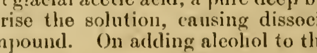
$$(CO_2H)(OH)C_6H_2<\begin{matrix}O\\ O\end{matrix}>Fe.Cl,$$

slightly soluble in water, but less soluble in alcohol. On addition of acid, on heating, or even on long standing, this compound dissociates, yielding gallic acid and ferric chloride. A dissociated phenolate of this character is present in ordinary iron-gall inks. On addition of ammonia (or alkali) to the solution containing ferric chloride and gallic acid, a precipitate (not ferric hydroxide) is produced at first, but so soon as the liquid becomes alkaline, this precipitate dissolves to a solution having an intense colour varying from blood red to brownish-yellow. The soluble compound formed by the treatment with ammonia, namely *ammonium ammoniumoxyferrigallate*,



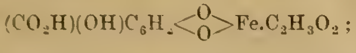
$$(CO_2NH_4)(OH)C_6H_2<\begin{matrix}O\\ O\end{matrix}>Fe.O.NH_4,$$

can be isolated by precipitation with alcohol. It forms a black, shining, brittle mass, containing 4 mols. of water, and is readily soluble in cold water, giving a deep bluish-violet solution. On addition of ammonia the solution becomes reddish-violet; with alkali it becomes brownish-red, and with glacial acetic acid, a pure deep blue; mineral acids decolorise the solution, causing dissociation of the coloured compound. On adding alcohol to the dissociated yellowish-brown to yellow solution of chloroferrigallic acid, blue flocks of *hydroxyferrigallic acid*,



$$(CO_2H)(OH)C_6H_2<\begin{matrix}O\\ O\end{matrix}>Fe.OH,$$

separate. This compound is insoluble in water, but easily soluble in ammonia, giving a bluish-violet solution. It can also be obtained by shaking freshly-precipitated ferric hydroxide with a solution of gallic acid. The blue solution obtained by adding glacial acetic acid to the solution of ammonium ammoniumoxyferrigallate, contains *acetylferrigallic acid*,



$$(CO_2H)(OH)C_6H_2<^{O}_{O}>Fe.C_2H_3O_2\ ;$$

on heating it, hydroxyferrigallic acid is precipitated, but can be redissolved by cautious addition of hydrochloric or acetic acid, being converted into the soluble chloro- or acetyl-ferrigallic acid.

On shaking a neutral solution of ammonium gallate with ferric hydroxide, the deep red, slightly soluble ammonium salt of hydroxyferrigallic acid is produced; this is converted into hydroxyferrigallic acid by addition of hydrochloric acid, and into the easily soluble ammonium ammoniumoxyferrigallate on addition of ammonia. The latter salt can be prepared directly by shaking ammonium gallate solution with ferric hydroxide in presence of ammonia. It loses 4 mols. of water at 105° C., becoming insoluble in cold water, but becomes soluble again on heating with water or treating with steam. Besides gallic acid, other compounds which contain at least two OH groups, or one OH-group and one CO_2H-group in ortho position, yield similar complex salts. The iron-ammonium salts are all more or less soluble in water, with a bluish-red colour, and are precipitated from their solutions by alcohol. The salt derived from tannin is slightly soluble in water, but insoluble in water containing 10—15 per cent. of alcohol. The ammonia or alkali used in the preparation of these complex salts can be replaced by alkali carbonates or other alkaline salts, or by alkaline-earth hydroxides, or organic bases. Other multivalent metals may be substituted for the iron.

Ammonium ammoniumoxyferrigallate may be used for the preparation of inks. A 7—8 per cent. solution gives writing of a violet-black colour, which soon becomes gray-black, and after some hours, black. The deposit on the paper becomes insoluble in water after about ½ hour, owing to oxidation, but exclusion of water is necessary, as in its presence, oxidation does not take place. (See also this J., 1908, 327.)—A. S.

PATENTS.

Dyestuffs ; Manufacture of ——. R. B. Ransford, Upper Norwood. From L. Cassella und Co., Frankfort on Maine, Germany. Eng. Pat. 19,807, Sept. 4, 1907.

BY boiling a mixture of dinitrostilbenedisulphonic acid, (2 : 4 : 1) $(SO_3H)(NO_2)C_6H_3.CH : CH.C_6H_3(NO_2)(SO_3H)$ (1 : 4 : 2), or dinitrodibenzyldisulphonic acid, (2 : 4 : 1) $(SO_3H)(NO_2)C_6H_3.CH_2.CH_2.C_6H_3(NO_2)(SO_3H)$ (1 : 4 : 2), and the sulphonic acids of aminoazo-compounds with dilute caustic soda, fast dyestuffs are obtained which produce orange to brown shades on cotton. As aminoazo-sulphonic acids, are mentioned sulphanilic acid-azo-α-naphthylamine, metanilic acid-azo-α-naphthylamine, 2-naphthylamine-3 : 6-disulphonic acid-azo-α-naphthylamine, benzeneazo-α-naphthylaminesulphonic acid (Cleve) and metanilic acid-azo-*m*-amino-*p*-cresol ether.—J. C. C.

Dibromindigos ; Chlorinated ——. O. Imray, London. From Farbwerke vorm. Meister, Lucius, und Brüning, Hoechst on Maine, Germany. Eng. Pat. 26,538, Nov. 30, 1907.

MONO- or dichlorodibromo-indigos are produced by treating dibromo-indigo with sulphuryl chloride. Example: 10 parts of dibromo-indigo are treated with 20 parts of sulphuryl chloride in the presence or absence of a solvent or carrier, such as 180 parts of carbon bisulphide and 2 parts of camphor, and the mixture is allowed to remain for some time at the ordinary temperature. The product is isolated by means of carbon tetrachloride, and boiled with alcohol; it dyes cotton and wool in the vat a very clear fast blue. If 5 parts of sulphuryl chloride be used, dyestuffs containing less chlorine are obtained, giving redder shades than those produced by the more highly chlorinated products.—J. C. C.

Vat dyestuffs ; Manufacture of ——. Farbwerke vorm. Meister, Lucius, und Brüning. First Addition, dated June 22, 1907, to Fr. Pat. 386,317, April 8, 1907. (See Eng. Pat. 8162 of 1907 ; this J., 1908, 680.)

VAT dyestuffs are formed by the action of sulphuric acid chlorhydrin on chloro-*o*-anisidine, chloro-*m*-toluidine, and chloro-*m*-nitraniline or their thioglycollic acid derivatives.—P. F. C.

Vat [Thioindigo] dyestuff ; Process for preparing a greenish-black ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 198,645, Feb. 20, 1907. Addition to Ger. Pat. 198,644, Feb. 14, 1907.

GREENISH-BLACK dyestuffs, giving fast shades on cotton and wool, are obtained by treating 5-5′-diaminothio-indigo (see U.S. Pat. 872,086 ; this J., 1908, 116) with halogens. Better yields are obtained by the use of bromine than chlorine.—T. F. B.

Sulphide dyestuff and process of making same. E. T. Bundsman, Assignor to Point Loma Chemical Co., Point Loma, Cal. U.S. Pat. 897,873, Sept. 8, 1908.

GRAPE sugar (glucose) is heated with sulphur and sodium sulphide, thus yielding, it is stated, a non-hygroscopic, friable, dark brown dyestuff, soluble in cold water, cold sodium carbonate solution, alcohol, and caustic soda solution. The product dyes cotton in fast dark brown shades in an "alkaline salt bath" with or without addition of sodium sulphide. When heated with hydrochloric acid, it yields a product insoluble in cold water, cold sodium carbonate solution, alcohol, and concentrated sulphuric acid, but easily soluble in caustic soda solution and sodium sulphide solution. This dyestuff also gives, it is stated, fast dark brown shades on cotton from an "alkaline salt" bath.—A. S.

Vat dyestuffs ; Halogenated —— *dyeing like indigo.* Soc. pour l'Ind. Chim. à Bâle. Second Addition, dated June 29, 1907, to Fr. Pat. 372,627, Dec. 17, 1906 (this J., 1907, 1135).

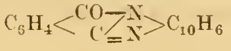
THE product of condensation of α-oxythionaphthene with α-isatinphenylhydrazone in the presence of nitrobenzene gives a yellow vat, dyeing cotton in bright violet shades of medium fastness to washing and chlorine. When, however, this substance is heated with bromine in the presence of nitrobenzene, a brominated dyestuff is obtained which dyes cotton from an alkaline vat in bright bluish-violet shades changing, after a brief soaping at 90° C., into a violet blue tint extremely fast to light, washing, and chlorine.—J. C. C.

Thiazine dyestuffs ; Manufacture of ——. Soc. pour l'Ind. Chim. à Bâle. Fr. Pat. 389,654, July 5, 1907.

WHEN dyestuffs of the thiazine series are oxidised in neutral or alkaline solution, they are transformed into new dyestuffs which are stronger and redder than the original ones and are faster to chlorine. Example: To a solution of 100 parts of Methylene Blue (free from zinc) in 5000—6000 parts of water, is added a solution of 32·5 parts of potassium permanganate in 100 parts of water. The mixture is heated for 1 hour, the manganese dioxide filtered off, and the filtrate precipitated by addition of zinc chloride. The green powder obtained, dyes tannin-mordanted cotton in pure blue shades. Other dyestuffs of the same series give similar results on oxidation.—J. C. C.

Condensation products derived from 1·8-*naphthylenediamine ; Preparation of new* ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 388,955, Apr. 6, 1908.

NEW products are formed by condensing 1·8-naphthylenediamine with such di- or polycarboxylic acids as are able to form intramolecular anhydrides. The esters, anhydrides, or imides of these acids may also be employed. The products are useful as raw materials for the manufacture of dyestuffs. *Example*—By heating together equimolecular proportions of 1·8-naphthylenediamine and phthalic anhydride to 160—200° C., water is liberated and the mixture becomes deep red in colour. On cooling, the condensation product separates in crystals. It has the constitution,



$$C_6H_4<\begin{matrix}CO-N\\C=N\end{matrix}>C_{10}H_6$$

—P. F. C.

Dichlorothioindigo derivatives; Process of preparing ——. Kalle und Co. Ger. Pat. 199,492, Aug. 3, 1906.

Dichlorothio-indigos are obtained by treating monochlorophenylthioglycollic acids with concentrated sulphuric acid, in presence of substances which assist the condensation and oxidation, *e.g.*, mercury salts, nitro-compounds, boric acid, etc. The resulting substances have tinctorial properties analogous to those of thio-indigo. —T. F. B.

Chloro-acylamino-anthraquinones; Process for preparing ——. Badische Anilin und Soda Fabrik. Ger. Pat. 199,758, July 23, 1907.

Acylamino-anthraquinones are treated with chlorine or substances which liberate chlorine. Acyl-1-amino-anthraquinone is chlorinated in the *p*-position, whilst 2-acylamino-anthraquinone is chlorinated in the *α*-position to the acylamino group. The acylation and chlorination can be performed in one operation, if desired.—T. F. B.

Dyestuffs of the anthracene series; Process for the production of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 25,507, Nov. 18, 1907.

See Addition of Nov. 18, 1907, to Fr. Pat. 380,176; this J., 1908, 441.—T. F. B.

Disazo dyestuff. O. Günther and L. Hesse, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 897,529, Sept. 1, 1908.

See Eng. Pat. 14,248 of 1907; this J., 1908, 800.—T. F. B.

Disazo dyestuff. O. Günther and L. Hesse, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 898,217, Sept. 8, 1908.

See Eng. Pat. 14,248 of 1907; this J., 1908, 800.—T. F. B.

Gallocyanines with amines; Process of condensing ——. C. de la Harpe, Assignor to Dye Works, formerly L. Durand, Huguenin, et Cie., Basle, Switzerland. U.S. Pat. 897,619, Sept. 1, 1908.

See Fr. Pat. 378,923 of 1907; this J., 1907, 1194.—T. F. B.

Gallocyanine dyestuff and process of making same. C. de la Harpe, R. Burckhardt, and E. Zehntner, Assignors to Dye Works, formerly L. Durand, Huguenin, et Cie., Basle, Switzerland. U.S. Pat. 898,039, Sept. 8, 1908.

See Eng. Pat. 19,002 of 1907; this J., 1907, 1194.—T. F. B.

Gallocyanine and process of making same. C. de la Harpe and R. Burckhardt, Assignors to Dye Works, formerly L. Durand, Huguenin, et Cie., Basle, Switzerland. U.S. Pat. 898,040, Sept. 8, 1908.

See Eng. Pat. 19,003 of 1907; this J., 1907, 1194.—T. F. B.

Gallocyanines; Condensation dyestuff from —— and process of making same. C de la Harpe, K. Oswald, and E. Zehntner, Assignors to Dye Works, formerly L. Durand, Huguenin, et Cie., Basle, Switzerland. U.S. Pat. 898,098, Sept. 8, 1908.

See Fr. Pat. 378,923 of 1907; this J., 1907, 1194.—T. F. B.

Orthohydroxyazo dyestuffs; Process for preparing ——. Chem. Fabr. Griesheim-Elektron. Fr. Pat. 389,368, March 31, 1908. Under Int. Conv., Sept. 9, 1907.

See U.S. Pat. 887,348 of 1908; this J., 1908, 622.—T. F. B.

Dyestuffs of the thioindigo series; Manufacture of ——. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 389,649, July 4, 1907.

See Eng. Pat. 14,846 of 1907; this J., 1908, 156.—T. F. B.

Copying ink; Sympathetic ——. L. Garzino. Fr. Pat. 389,660, April 27, 1908.

See Eng. Pat. 9108 of 1908; this J., 1908, 895.—T. F. B.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES YARNS, AND FIBRES.

"*Dead cotton.*" R. Haller. Chem.-Zeit., 1908, **32**, 838—839.

The occasional fibres which do not take the dyestuff in dyeing pieces with Indigo, and which are known to dyers as "dead cotton," are really unripe cotton fibres. These fibres have the following properties. Under the microscope the lumen is seen to contain a considerable quantity of matter, and the fibres do not appear to be twisted so much as the ripe fibres. When treated with an ammoniacal solution of copper oxide, the fibres swell up, but do not go into solution. On treating a mixture of ripe and unripe fibres with a solution of iodine in zinc chloride, the unripe fibres very quickly develop a blue colour, which only appears much more slowly with the ripe fibres. A solution of iodine in potassium iodide colours the ripe fibres a dark yellowish-brown, whilst the unripe fibres acquire only a light yellow colour. When treated with an 18 per cent. solution of sodium hydroxide, the unripe fibre retains what twist it has, and only becomes lighter and more transparent. The unripe and ripe fibres also exhibit marked differences in their behaviour towards polarised light. A mixture of the two varieties of fibres was boiled in a soda lye of 2° B. and then soured, washed, and dyed with Indigo. The ripe fibres took up the dyestuff readily, but the unripe fibres either not at all or only to a limited extent. The reverse was the case on dyeing the two sorts of fibres with direct dyeing colours, the unripe fibres acquiring the deeper colour. Ripe and unripe fibres were also treated with a tannin-antimony mordant and then dyed with a basic dyestuff. Both fibres took up the colour, but whereas the ripe fibre was dyed homogeneously, the unripe fibre was only dyed in the interior. —P. F. C.

Azo-developers. L. Lichtenstein. Z. Elektrochem., 1908, **14**, 586—591.

In the preparation of the diazo-solution for producing Para-red on the large scale, the best results were obtained by using an amount of sodium acetate equivalent to that of the hydrochloric acid. In order to ascertain if the sodium acetate can be replaced by a cheaper substance, the author has studied the influence of the hydrogen-ion concentration on the stability of the diazo-solution and on the blueness of the shade produced. Although the above quantity of sodium acetate is largely in excess of that required to neutralise the free hydrochloric acid, if an amount equivalent to the latter be used, a yellowish shade is obtained: this is not due to the formation of the diazonium acetate when excess of acetate is taken, for when the latter diazo-compound was used, the shade was rendered bluer by addition of sodium acetate. Experiments carried out with formic acid gave similar results. By titration with a *β*-naphthol solution it was found that a diazo-solution which had not been neutralised, was extremely stable (at 15° C.), but after excess of sodium acetate or sodium phosphate had been added or the solution partly neutralised with sodium carbonate and then excess of sodium acetate added, the solution was measurably decomposed. The conclusion is drawn, therefore, that the decomposition of the compound in diazo-solutions which is capable of producing the dyestuff, proceeds more quickly the smaller the hydrogen-ion concentration or the greater the hydroxyl-ion concentration. The influence of the hydrogen-ion concentration on the shade produced is known to be of importance, for a diazo-solution containing free hydrochloric acid gives an indifferent shade, and a full blue shade is only produced by complete neutralisation. In order therefore to obtain always the same shade during a long period of working, the hydrogen-ion concentration must be kept the same, and although two solutions prepared in accordance with this requirement, the one neutralised with sodium acetate and the other partly neutralised with sodium carbonate and completed with sodium acetate, gave the same shade, yet the hydrogen-ion concentration, varying as it does on the large scale by reason of variations in the hydrochloric acid content of the diazo-solutions, is much less influenced by the use of sodium acetate than when sodium carbonate and acetate are employed. The author's experiments confirm Goldschmidt's conclusions that the formation of the dyestuff is retarded by hydrogen ions, and the use of a diazo-solution containing free hydrochloric acid with naphthol containing an excess of alkali results in a weak yellowish shade and decomposition of the diazo-compound.—J. C. C.

Patents.

Fibres for spinning; Method of manufacturing —— from reed-mace. E. Némethy, Arad, Hungary. Eng. Pat. 17,096, July 25, 1907.

The stems of reed-mace are boiled for several hours in a solution of magnesium sulphite the free acid of which has been neutralised by soda. The addition of a very small quantity of ferric oxide to this solution is found to improve the quality of the product. After this treatment the fibres obtained are washed in water containing a small quantity of iron salts in solution.—P. F. C.

Spinning viscous liquids; Machine for ——. J. P. Bemberg, Akt.-Ges., Barmen-Rittershausen, Germany. Eng. Pat. 8711, April 21, 1908. Under Int. Conv., May 15, 1907.

The spinning vessel is provided with two inlet openings in addition to the spinning nozzle. The first is arranged near to the spinning head and admits a slow current of coagulating liquid adjacent to the nozzle. The second inlet which is placed at the other end of the spinning vessel admits a swifter current of coagulating liquid, which only comes in contact with the threads after they have acquired a certain solidity. In order to prevent the formation of eddies in the coagulating liquid near to the spinning nozzle, a packed ring is arranged inside the spinning vessel which directs the swift current away from the spinning nozzle and in the same direction as the threads travel.—P. F. C.

Spinning viscous liquids; Apparatus for ——. J. P. Bemberg, Akt.-Ges., Barmen-Rittershausen, Germany. Eng. Pat. 15,448, April 21, 1908. Under Int. Conv., May 15, 1907.

In order to prevent the breakage of newly spun artificial threads during their passage from the spinning nozzle to the winding spool, carrying devices are arranged along the path of the threads, so that the winding is not effected under considerable tension. These carrying devices consist of toothed wheels partly running in liquid, the threads being carried by the extremities of the teeth, whilst the excess of liquid runs down into the spaces between the teeth without coming in contact with the threads. The liquid collecting between the teeth of the carrying wheel, as well as any broken threads, may be removed by a second toothed wheel which engages with the first. In order to prevent damage to the threads, slides of some such substance as glass or porcelain may be arranged both in front of and behind the carrying wheel.—P. F. C.

Spinning viscous liquids; Apparatus for ——. J. P. Bemberg Akt.-Ges., Barmen-Rittershausen, Germany. Eng. Pat. 15,449, April 21, 1908. Under Int. Conv., May 15, 1907.

The spinning liquid is admitted through an inlet-pipe into the nozzle-head and thence passes through the spinning-nozzle into the coagulating liquid. This nozzle is pressed out of sheet metal in the form of a perforated rose and can be firmly attached to the nozzle-head by reason of its having a slightly conical wall which fits tightly upon a boss of similar shape on the nozzle-head. —P. F. C.

Viscose or similar viscous material; Forming filaments out of ——. C. A. Ernst, Lansdowne, Pa., Assignor to S. W. Pettit, Philadelphia, Pa. U.S. Pat. 896,715, Aug. 25, 1908.

Cellulose xanthate is dissolved in a 5 per cent. solution of sodium hydroxide, and acid is then gradually added until the greater part of the alkali is neutralised. The viscose solution thus obtained is forced through very fine apertures into a weak acid coagulating bath.—P. F. C.

Artificial hair and ribbons; Manufacture of very strong, elastic, and transparent ——. E. Crumière. First Addition, dated Mar. 17, 1908, to Fr. Pat. 377,118, April 23, 1907 (this J., 1907, 1045).

A cuprammonium solution of cellulose is forced through fine apertures into a coagulating bath consisting of a solution of sodium or potassium zincate, prepared by adding sodium or potassium hydroxide to a solution of zinc chloride or to metallic zinc.—P. F. C.

Viscose solutions free from sulphides; Preparation of —— by treatment with salts of aluminium or chromium. Verein Kunstseidefabr. A.-G. Fr. Pat. 389,284, April 16, 1908. Under Int. Conv., April 22, 1907.

Viscose solutions, free from sulphides and suitable for the manufacture of brilliant threads or films by direct coagulation in mineral acids, are prepared by treating the fresh, crude viscose in a highly dilute form (1 per cent. of cellulose) first with sufficient 0·1 per cent. sulphuric acid to neutralise the free sodium hydroxide present, and then with a quantity of aluminium sulphate, or equivalent salt of aluminium or chromium, sufficient to decompose the sulphides of the viscose. After standing for some time at the ordinary temperature, or after 3—6 hours at 40° C., the cellulose compound separates in a hydrated form and is drained off and pressed. This compound is insoluble in water, but readily soluble in dilute sodium hydroxide; the solutions are suitable for spinning threads or films, which when coagulated in baths containing mineral acids, yield products distinguished by special physical qualities.—J. F. B.

Flax yarn; Process of preparing ——. B. S. Summers, Port Huron, Mich., Assignor to Internat. Flax Twine Co., Minnesota. U.S. Pat. 895,123, Aug. 4, 1908.

The unretted flax yarn is treated with a solution of soap or glue or with a mixture of two such solutions and "balled" whilst it is in a moist condition.—P. F. C.

Retting of bast fibrous stalks or plants; Producing a solvent to be used in the artificial ——. M. H. Colahan, Chicago, Ill. U.S. Pat. 897,522, Sept. 1, 1908.

The unbroken bast fibrous stalks are subjected to the action of a solvent produced from the acid sludge discharge liquid known as "acid oil" to which a small quantity of soda has been added. Means are provided for injecting steam into the apparatus during the operation, to separate the fibre from the woody part of the stalk.—P. F. C.

Retting of plants or of fragments of vegetable growth by pectic aerobic ferments in a current of gas. G. Rossi. Fr. Pat. 388,651, Mar. 27, 1908. Under Int. Conv., April 17, 1907.

The material to be treated is washed and placed, together with sufficient pure water, inside a receiver through which a current of air or other gas can be forced. A sufficient quantity of a pure culture of some pectic ferment is then added, and the air or gas, which has been previously sterilised, is forced through the mixture, which is maintained at the temperature found experimentally to be most suitable for the particular pectic ferment employed. —P. F. C.

Silky textile fibre contained in the bark of the mulberry tree ; Process for extracting the ——. A. F. Camand. Fr. Pat. 388,874, Mar. 26, 1908.

The bark is retted in pure water until the woody part can be easily removed by scraping, either by hand or by mechanical means. The fibres which remain are then immersed for a time in boiling water and finally dried.—P. F. C.

Hawking machines employed in indigo dye vats. E. and W. Turner, Halifax. Eng. Pat. 8002, April 10, 1908.

In the stripping device described in Eng. Pat. 16,601 of 1900 (this J., 1901, 247), the piece is liable to adhere to the strippers. This is prevented by making the stripper of the back or loose roller of the machine deeper than the diameter of the roller and also by making its lower portion rectangular. If a piece should then display a tendency to adhere to the stripper, it can only do so along the short vertical section, after which it must detach itself and fall towards the bottom of the vat upon the delivery side.—P. F. C.

Dyeing machine. J. Hussong, Camden, N.J. U.S. Pat. 895,023, Aug. 4, 1908.

Above a dye-vat is arranged a frame work which supports a receiver in such a manner that the latter can be tilted. The top and bottom of the receiver are perforated. This receiver, into which the material to be dyed is put, can be lowered into the dye-vat, and the dye-liquor can then be circulated through the machine. After the dyeing operation is complete, the receiver is raised out of the dye-vat and then tilted, so as to discharge its contents. —P. F. C.

Dyeing or bleaching of fabrics ; Apparatus for ——. H. L. Gantt. Fr. Pat. 388,819, April 3, 1908.

This apparatus consists of a large U-tube having one arm very much longer than the other, and of smaller cross-section area than the rest of the apparatus. The bend of the tube is provided along its floor with a number of freely running rollers. The dye-liquor is contained in the bend of the tube and the material to be dyed is continuously led into the upper end of the long arm of the apparatus. It falls by its own weight until it comes in contact with the dye-liquor. It then travels through the dye-liquor, being propelled forward by pressure of the pieces behind, and by the action of the rollers on the floor of this part of the apparatus.—P. F. C.

Bleaching and dyeing yarn ; Process for —— under high torsion. A. Clavier. Fr. Pat. 388,977, April 6, 1908.

During the operations of bleaching or dyeing, the yarn is placed on frames by which it is tightly stretched. —P. F. C.

Silk dyeing ; Process for electrolysing sodium chloride for the manufacture of soap and stannic chloride, both to be used in ——. E. A. Sperry. Fr. Pat. 389,188, April 14, 1908.

Caustic soda and chlorine are obtained as usual by electrolysing an aqueous solution of sodium chloride. The greater part of the caustic soda obtained is converted into soap, the remainder being used to precipitate stannic hydroxide from spent liquors, the sodium chloride produced being again electrolysed. The chlorine is used for making stannic chloride in a cylindrical apparatus, the chlorine entering at one end, whilst tin or materials containing tin are supplied to the other end by means of a worm, and circulated through the cylinder by means of a rotating shaft carrying curved blades. The cylinder is heated until the reaction commences, after which it is cooled. The stannic chloride produced passes upwards through a condenser into a receiver, and thence into a separator, in which it is separated from stannic hydroxide, which collects on top of the liquid and overflows through a pipe. The excess of chlorine is absorbed in coke scrubbing towers. Both soap and stannic chloride are used for treating silk preliminary to dyeing.—A. G. L.

Effects on both sides of fabrics of cotton, raised or non-raised, wool or other textiles ; Producing ——. L. Caberti. Fr. Pat. 388,769, April 1, 1908. Under Int. Conv., April 2, 1907.

The principle of this invention consists in moistening the fabric, before it comes in contact with the printing rollers, with a solution of gum tragacanth of suitable thickness to which has been added some substance which has the property of rendering the fabric under treatment capable of being easily penetrated by the printing paste. Thus for woollen fabrics, this addition may consist of phenol ; for cotton fabrics, glycerin, glucose, or some other such substance may be employed. This preparatory mixture is applied to the cloth by one or more cylinders which are kept moistened with the preparation. The fabric is then passed through the printing machine and is finally run between two very smooth squeezing rollers, which cause the printing paste to pass completely through the cloth, so that the printed design shows up both on the face and the back of the material.—P. F. C.

Printing cotton with sulphide dyestuffs ; Process for ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 389,590, April 24, 1908. Under Int. Conv., Mar. 9, 1908.

Good results are obtained by printing with sulphide printing colours, thickened with starch which has been previously treated with alkali. Example :—80 grms. of Katigen Black T extra, free from sodium sulphide, are mixed with 200 c.c. of warm water, 40—50 grms. of glucose, and 150 c.c. of caustic soda lye (40° B.). The mixture is maintained at 55°—75° C. until solution is complete and then allowed to rest for 24 hours. To prepare the thickening, 40 grms. of wheat starch are heated with 600 c.c. of water and 10 c.c. of caustic soda lye (40° B.) until the mixture is quite clear. 400—500 grms. of this thickening are added to the solution of the colour which is heated to 50° C., and the mixture is kept thoroughly agitated at this temperature for 2 hours, and then allowed to rest for 24 hours. Finally 20—30 grms. of glucose and 50—100 c.c. of caustic soda lye (40° B.) are added to the mixture and the cotton is printed with the printing colour thus obtained.—P. F. C.

Discharges of azo dyestuffs on fabrics dyed with indigo on β-naphthol ground ; Production of pure white ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 199,843, Nov. 19, 1907.

If diazo compounds of arylaminosulphonic acids or other amines which form easily soluble dyestuffs, are printed on fabrics dyed with indigo on a β-naphthol ground, pure white discharges may be obtained on the fabrics by the chromate discharging method.—T. F. B.

Dyeing. A. Schlegel, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 893,384, July 14, 1908.

See Fr. Pat. 359,466 of 1905 ; this J., 1906, 373.—T. F. B.

VII.—ACIDS, ALKALIS, AND SALTS, AND NON-METALLIC ELEMENTS.

Ammonia ; Production of —— from atmospheric nitrogen by means of peat. H. C. Woltereck. Paper read before Brit. Assoc., Dublin, 1908.

It is stated that a mixture of nitrogen and hydrogen passed over reduced iron at a low red heat produces ammonia. Better yields are obtained by passing a mixture of air and coal gas over iron oxide; oxides of other metals, particularly those of bismuth and chromium, behave similarly. With freshly-reduced iron wire gauze, the most favourable temperature is 300—350° C. Further experiments showed the presence of oxygen and water to be of importance and finally led to the complete omission of the coal gas or hydrogen. As the oxidation of the iron proceeds, the formation of ammonia decreases, and it is necessary to reduce the iron from time to time by passing carbon monoxide or hydrogen over it at a higher temperature. Carbonaceous materials (coke, charcoal, peat), sufficiently cheap to admit of renewal when exhausted, were next substituted for iron, and thus the necessity of periodically reducing the contact material was avoided. Peat was found to give the most satisfactory and rapid results, and even when it contained up to 80 per cent. of water, it could be utilised advantageously. To prove the co-operation of atmospheric nitrogen in the change, sugar carbon absolutely free from nitrogen was treated by the process and produced an average of 1 per cent. of ammonia on the carbon consumed. In a plant consuming 1 ton of peat in 24 hours, the average yields of ammonium sulphate obtained were, it is stated, 7 per cent. A large plant has been constructed at Carnlough, Ireland.—E. F. A.

Calcium carbide; Absorption of nitrogen by ——. [*Potassium carbonate as a catalyst.*] G. Pollacci. Z. Elektrochem., 1908, **14**, 565—566.

Potassium carbonate exerts a catalytic action on the absorption of nitrogen by calcium carbide, lowering the temperature required. The best results are obtained with an addition of 4 per cent., and it thus compares very favourably with calcium chloride, hitherto employed, there being the further advantage that potassium itself has a positive manurial value. It is also found that absorption of nitrogen by the carbide is hastened by an increased pressure of the gas, the maximum effect being attained at 2 atmospheres. As an example: at 900°—950° C., 2·4 per cent. of added nitrogen were found, after an absorption of 1 hour at 2 atmos. pressure; under the same conditions with the addition of 4 per cent. of potassium carbonate, 23·0 per cent. were found.—F. Sodn.

Ammonia and carbon monoxide; Dissociation temperatures of ——. H. C. Woltereck. Compt. rend., 1908, **147**, 460—461.

A current of ammonia gas, was passed, at the rate of 1 litre (at 760 mm. and 15° C.) in 15 minutes, through a tube of Jena glass heated in an air-bath, the temperature being controlled by a Le Chatelier pyrometer. Dissociation of the ammonia was first observed at 620° C. Control experiments showed that whilst pure dry ammonia does not dissociate below 620° C., the temperature of dissociation is considerably reduced by the presence of traces of organic matter or of water vapour. In presence of metallic iron, ammonia begins to dissociate at 320° C., and in presence of iron oxide at 420° C.

Carbon monoxide begins to dissociate at 570°—580° C., but in presence of a trace of water vapour, dissociation does not take place even at very high temperatures.—A. S.

Basic copper carbonate; Solubility of precipitated —— *in solutions of carbon dioxide.* E. E. Free. J. Amer. Chem. Soc., 1908, **30**, 1366—1374.

The precipitates produced on adding a soluble carbonate to a solution of a copper salt, are unstable and of varying composition and solubility in solutions of carbon dioxide. On treatment with carbon dioxide solutions, they gradually pass into an apparently stable compound, possessing a definite solubility in solutions of carbon dioxide. In the author's experiments, a $N/_2$ solution of sodium carbonate was precipitated at 50° C. by an equivalent quantity of $N/_2$ copper sulphate solution, and the precipitate was washed, suspended in water, and treated with carbon dioxide under slight pressure for six days. The ratio of CuO to CO_2 in the precipitate was 1 : 0·411 before and 1 : 0·510 after treatment with carbon dioxide. The solubility of the precipitate (after treatment with carbon dioxide) in solutions of carbon dioxide increased with the concentration of the latter, ranging from 1·5 parts of metallic copper per million in pure water to 39·7 parts in water containing 1549 parts of free carbon dioxide per million, the temperature being 30° C. in all cases. The solubility was not appreciably affected by addition of small quantities of sodium chloride or sodium sulphate, but was increased by larger additions. Calcium sulphate had practically no influence on the solubility of the basic copper carbonate. Sodium carbonate and calcium carbonate caused a strong decrease of solubility. According to Skinner (this J., 1906, 384) saturated solutions of sodium bicarbonate and calcium bicarbonate, respectively hold in solution 953 and 207·1 parts of copper per million. It is pointed out that these high values are due to (1), insufficient time being allowed for the formation of a stable copper salt after precipitation; and (2), probable supersaturation of the solutions. On adding copper sulphate solution to a saturated solution of calcium carbonate and carbon dioxide, and allowing to stand, the copper content of the solution decreased from 67 parts per million to 14 parts after 5 days, and to less than 1 part after 20 days.—A. S.

Persulphates; Action of metals on aqueous solutions of ——. M. G. Levi, E. Migliorini, and G. Ercolini. Gaz. chim. ital., 1908, **38**, I., 583—602.

The authors have studied the decomposition of solutions of potassium and ammonium persulphates in presence of powdered metals at about 25° C. Except in the case of gold and platinum, the effect of the metals on the decomposition of the persulphates was more chemical than catalytic, and the reaction was rather slower with ammonium persulphate than with the potassium salt. The reaction was very vigorous with magnesium, this metal causing evolution of ammonia from ammonium persulphate. The metals (with the exception of gold and platinum) passed into solution; and in several cases, oxides or basic sulphates were precipitated. In the case of arsenic, both arsenious and arsenic acids were produced. (See also this J., 1907, 148.)—A. S.

Oxides of copper, cobalt, nickel, and antimony; Dissociation pressures of certain ——. H. W. Foote and E. K. Smith. J. Amer. Chem. Soc., 1908, **30**, 1344—1350.

The oxides, contained in a porcelain boat in a porcelain tube, were heated by means of a platinum electric resistance furnace, the temperature being measured by means of a platinum and platinum-rhodium thermo-couple. The porcelain tube was connected to a mercury manometer, and was exhausted by means of a vacuum pump before each experiment. With cupric oxide the pressure developed ranged from 15·8 mm. of mercury at 900° C. to 239 mm. at 1050° C., and was equal to that of the oxygen in the air (about 160 mm.) at about 1025° C. The residual mixtures of cuprous and cupric oxides melted at about 1070° C. Cobalto-cobaltic oxide, Co_3O_4, developed a pressure of 10 mm. at 800° C., 183 mm. at 910° C., and 765 mm. at 970° C. Cobaltous oxide showed no signs of dissociation at temperatures up to 1100° C (see also Richards and Baxter, Chem. News, 1900, **81**, 125). Nickelous oxide gave a pressure of 2 mm. at 1000° C., and 18 mm. at 1245° C. No satisfactory results could be obtained with antimony tetroxide, owing to sublimation of the trioxide formed: on heating a weighed quantity of the tetroxide in an open tube, loss of weight was first observed at about 950° C. The dissociation pressures of cupric oxide and nickelous oxide, as determined by the authors are much higher than those calculated by Stahl (Metallurgie, 1907, **4**, 682) by the aid of Nernst's formula connecting the dissociation pressure with the heat of reaction and absolute temperature.—A. S.

Ferric oxide; Dissociation pressures of ——. P. T. Walden. J. Amer. Chem. Soc., 1908, **30**, 1350—1355.

The author determined the dissociation pressures of ferric oxide by a method similar in principle to that described in the preceding abstract. The results obtained were as follows:—1100° C., 5 mm.; 1150° C., 7; 1200° C., 9; 1250° C., 20; 1300° C., 59·5; 1320° C., 90·5; 1340° C., 138·5; 1350° C., 166; 1360° C., 202; 1380° C., 297;

1390° C., 352·5; and 1400° C., 454 mm. of mercury. The dissociation pressure was equal to that of the oxygen in the air (160 mm.) at about 1350° C., up to which temperature, therefore, ferric oxide is stable when heated in the air. Magnetic oxide of iron showed no signs of dissociation at temperatures up to 1350° C. The values calculated by von Jüptner by means of Nernst's formula (see preceding abstract) for the dissociation pressure of ferric oxide are much higher than those obtained by the author.—A. S.

Ferrites: compounds of an iron acid. J. S. C. Wells. Eng. and Min. J., 1908, **86**, 420—422.

The author draws attention to the work of Pelouze and Ebelman in 1851, showing that under certain conditions ferric oxide acts as an acid. Ebelman prepared a zinc ferrite, ZnO,Fe_2O_3, in small black octahedral crystals, similar to franklinite, which were slightly magnetic, insoluble in cold dilute hydrochloric acid, and had the sp. gr. 5·13. The author's experiments show that when mixtures of the sulphides, sulphates, or oxides of iron and zinc are heated to redness together, part of the zinc is rendered insoluble in ammoniacal ammonium chloride solution, owing to the formation of zinc ferrite. Hence if a blende contain iron, zinc ferrite will be formed on roasting, and a portion of the zinc thus rendered insoluble. In processes in which the zinc is recovered by leaching, the best results will be obtained by roasting the ore in as coarse a condition as possible, as the production of zinc ferrite is greater the more intimate the mixture of the zinc and iron compounds.

The author also observed that on precipitating a mixture of ferrous and ferric sulphates with caustic alkali, a black precipitate is formed, probably ferrous ferrite or magnetic oxide of iron, Fe_3O_4. Freshly-precipitated ferrous sulphide when heated carefully to 200° C. is also converted largely into magnetic oxide of iron. The sulphide also becomes distinctly magnetic when exposed to the air for several days.—A. S.

Solubility [*of salts*]; *Influence* [*of non-electrolytes*] *on* ——. V. Rothmund. Z. Elektrochem., 1908, **14**, 532—534.

The lowering of the solubility of a salt in water by the addition of a non-electrolyte is not strictly proportional to the quantity added, but, for dilute solutions, is well in accordance with the logarithmic formula: $^1/_n$ (log. l_0/l) = const., where n = molecular concentration of the added substance, l_0 = solubility of the salt in water, and l = solubility in the solution. The numbers given in the table for $^{100}/_n$ (log. l_0/l) show approximately the percentage decrease of solubility of lithium carbonate through an addition, in the proportion of 1 grm.-mol. per litre, of the substances mentioned to the aqueous solution of the salt.

Methyl alcohol	19·8	Urea	4·6
Ethyl alcohol	33·7	Dimethylpyrone	54·6
Propyl alcohol	41·8	Ammonia	14·1
Amyl alcohol (tert.)	63·1	Diethylamine	56·1
Acetone	42·5	Pyridine	44·5
Formaldehyde	9·5	Piperidine	50·6
Ether	52·2	Urethane	41·0
Glycol	14·2	Acetamide	20·9
Mannitol	− 10·7	Antipyrine	69·7
Dextrose	−6·6	Thiourea	10·4
Sucrose	5·5	Acetonitrile	34·5
Glycerol	9·4	Mercuric cyanide	− 4·2

It will be noted that mannitol, dextrose, and mercuric cyanide cause an increase of solubility of the salt. Analogous results were obtained with silver sulphate and potassium bromate.—F. Sodn.

Graphite; Decacyclene as a solvent for ——. J. Ostromysslenski. Schweiz. Woch. Chem. Pharm., 1908, **46**, 507—508.

Decacyclene, $C_{36}H_{18}$, m. pt. 402° C., obtained by the action of sulphur on acenaphthene, has the property, when melted, of dissolving notable quantities of graphite. Thus on heating 6 grms. of decacyclene in a bath of molten tin and adding 0·2563 grm. of Ural graphite, the latter was completely dissolved in 90 minutes. In another experiment, 1·2316 grms. of Nertschink graphite were dissolved in 11 grms. of decacyclene in 5 hours, at 485° C. The solution is quite opaque and black. Decacyclene does not dissolve diamond.—J. O. B.

Selenic acid from lead selenate; Electrolytic formation of ——. F. C. Mathers. *See* XIA.

Alloys of nitride-forming metals; Preparation of ——. [*Fixation of atmospheric nitrogen.*] E. Beck. *See* XIB.

The Potash Syndicate. For. Off. Ann. Ser. No. 4084, Aug. 1908. [T.R.]

The board of the Potash Syndicate is presided over by a representative of the Prussian Treasury. An increase in the net price of sale over that fixed at the foundation of the syndicate cannot take place to the German agriculturist without the consent of the Prussian Secretary of State for Trade and Commerce.

Of natural potash salts Germany enjoys a monopoly, but internal competition constantly arises from newly discovered mines which clamour for admission to the Syndicate or threaten to fight. Since January, 1905, when the syndicate was last renewed, the works included have risen by thirteen to forty, and others will shortly be entitled to admission. The number of "claims" of potash fields have also risen. It is true that in Prussia the new mining law reserves to the Government the right of mining minerals and alkalis. But this new mining law was preceded for two years by a temporary law, during which grants amounted in the mining district of Clausthal alone to fifty-one, against fifteen granted during the two years preceding; in Halle to 390, against forty-one in 1905. Moreover, in the Hanoverian and Thuringian fields the new mining law does not apply, and here activity is likely to increase.

In March, 1908, the Prussian Secretary of State for Commerce insisted upon the necessity of the continued syndication of the potash industry, and the negotiations for a renewal of the Syndicate in 1909 are being actively pursued.

The following are the figures of participation in thousandth parts in force in 1907, and as they will be modified by the reception of new members in 1909, the numbers of votes in the syndicate (out of a total of 5,440) are also given:—

	Votes.	Participation in thousandth parts.	
		1907.	1909.
Prussian Government	512	93·99	89·69
Anhalt Government	231	42·36	40·31
Bernburg	206	37·88	36·26
Westergeln	202	37·07	35·39
Neustassfurt	202	37·07	35·39
Aschersleben	202	37·07	35·39
Wilhelmshall	179	32·79	32·50
Gluckauf	149	27·38	28·21

This table shows not only the more important producers, but also the extent to which the older works have to sacrifice their figures of participation in the interests of newcomers.

The mines scheduled in accordance with their geographical situation within the German States participate as follows:—

	Thousandth parts.	
	1907.	1909.
In Prussia	670·89	669·56
In Anhalt	80·24	76·57
In Mecklenburg	41·90	42·62
In Saxe Weimar	60·24	62·35
In Brunswick	63·33	64·13
In Saxe Meiningen	36·02	36·13
In Schwarzberg Sonderhausen	27·38	28·21
In Rudolstadt	20	20·35

So the future reduction will fall to Prussia (1·33 thousandth parts) and Anhalt (3·67).

The value of concentrated salts sold by the Potash Syndicate amounted to :—

	Net value of sales.
	M.
1898	43,889,386
1899	48,086,709
1900	56,550,758
1901	59,550,758
1902	57,214,525
1903	64,399,146
1904	74,391,031
1905	82,007,145
1906	*90,000,000

* About.

During the first six months of 1907 the sales showed a decrease, which amounted to 49,750 double centners pure potash, though in view of the increased production every effort was made to push the sales, more especially abroad. It was also suggested that the loss of profit should be made good by an advance in prices. The suggestion was negatived; it was claimed, however, that the time had come for abolishing the 5 per cent. bounty which the Syndicate has for years granted to German agriculture "in view of its distressed state!" German agriculture can no longer be called necessitous; it appears, moreover, capable of looking after its own interests, for early in 1908 an agricultural combination secured an interest in the Potash Syndicate.

As the sinking of new shafts would entail considerable expense, various neighbouring concerns have combined and are connecting their single shafts underground; up to certain distances the Government agreed that the requirements of the law may thus be fulfilled. There can be no doubt that this interpretation of an old law was applied to the potash mines at a most unfavourable period.

In view of increased activity in the future, which must lead to over-production, an understanding is being aimed at between the claim owners and the Syndicate on the basis that every shaft should pre-suppose a minimum area of potash deposits, and that for any deposits beyond, if the owner undertakes not to work the same, the respective member is to receive an additional negotiable quota of production—the value of this to represent a small interest upon the value of the deposits as ascertained by an expert commission, which would have to inquire into the extent, quality, facility of working and other chances of the deposits in question.

Another suggestion to secure, in view of the probable extension, a profitable working of the industry advocates the conversion of all potash deposits into a Government monopoly. It is not likely that this suggestion will find a majority in the Prussian Diet, for there can be no certainty that further alkali fields will not be discovered outside the German Empire. Moreover, new inventions may cause serious competition from chemically-produced substitutes. The suggestion, however, shows how syndication has prepared the German mind for the idea of monopolies of an industrial kind, the industrial Government monopolies thus recommended being the potash, alcohol, petroleum and electrical power industries.

Bauxite exports from Bordeaux. For. Off. Ann. Series No. 4019, 1908. [T.R.]

In 1907, there were exported 2,965,070 kilos. (2,912 tons) of bauxite. Bauxite comes from mines in the department of Ariège, where the output during 1908 is expected, owing to improved methods of exploitation, to reach at least 30,000 tons.

Patents.

Sulphuric acid; Increasing the efficiency of the reaction spaces in the lead chamber process of making ——. H. Petersen, Wilmersdorf, Germany. Eng. Pat. 27,738, Dec. 16, 1907. Under Int. Conv., Dec. 15, 1906.

The usual system of Glover and Gay-Lussac spaces, "rinsed" with ordinary nitrous vitriol of 60° B. and ordinary vitriol respectively, is combined with another system of Glover and Gay-Lussac spaces, rinsed with nitrous vitriol of 54° to 55° B. and weaker vitriol respectively. The weaker acid circulates in the second system only and readily absorbs the lower nitrogen oxides on the one hand, and liberates the same without the necessity of a high temperature or of undue dilution on the other. It is thus possible to admit a much greater amount of nitrogen oxides to the chambers, the resulting increased efficiency being attended by no loss of nitrous material. The arrangement recommended is as follows: (1), Glover tower rinsed with nitrous vitriol of 60° B. and with dilute acid; (2), denitrating tower rinsed with nitrous vitriol of 54° to 55° B. coming from the Gay-Lussac towers of the second system; (3), lead chambers; (4), Gay-Lussac towers of the second system rinsed with Glover acid of 54° to 55° B.; (5), Gay-Lussac towers of the first system rinsed with 60° B. Glover acid.—O. R.

Fluorine; Separation of —— *from minerals containing it.* G. Delplace. Ger. Pat. 200,747, Jan. 24, 1907.

Blendes containing fluorine present difficulties when used as raw material for the manufacture of sulphuric acid, as the fluorine compounds liberated during the roasting, attack the furnace and other parts of the plant. According to the present process, the mineral is finely ground and heated with sulphuric acid, for instance by waste gases or in the upper part of the furnace. If necessary, silica may be added to the mineral in the form of powdered glass, sand, quartz, or the like. The fluorine compounds are recovered and utilised.—A. S.

Sodium ferrite and aluminate; Process and apparatus for the manufacture of ——. G. T. Beilby and H. N. Beilby, Glasgow. Eng. Pat. 18,750, Aug. 20, 1907.

An intimate mixture of sodium carbonate and ferric or aluminium oxide, or of sodium carbonate and bauxite, is heated in thin layers to about the melting point of sodium carbonate, the carbon dioxide being removed, as it is formed, by a current of air or other indifferent gas. The apparatus is identical with that described in Eng. Pat. 18,750a (see page 969).—O. R.

Hydrocyanic acid; Preparation of ——. O. Dieffenbach and W. Moldenhauer. Fr. Pat. 389,469, April 21, 1908. Under Int. Conv., April 22, 1907.

The patent relates to the preparation of hydrocyanic acid by passing a mixture of nitrogen and hydrogen over strongly heated carbon. In place of the pure gases, however, a suitable mixture of these with the oxides of carbon, as obtained by any known industrial process, or combination of processes, is employed. Or, a mixture of air and steam may be used, so that the production of hydrogen from carbon and steam, and its combination with carbon and nitrogen to form hydrocyanic acid, may be successive stages of the same operation. The heating of the carbon is preferably carried out electrically.
—F. Sodn.

Hydrocyanic acid; Process for the conversion of —— *into oxides of nitrogen.* O. Dieffenbach and W. Moldenhauer. Fr. Pat. 389,500, April 22, 1908. Under Int. Conv., April 24, 1907.

Hydrocyanic acid is converted into oxides of nitrogen by passing it, mixed with oxygen or air, over suitable heated catalysts, such as platinum, palladium, iridium, or manganese dioxide, the presence of which makes it possible to effect the combustion at a temperature below that at which the oxides of nitrogen are decomposed.
—F. Sodn.

Cyanogen and cyanogen compounds; Process for preparing ——. G. Erlwein. Ger. Pat. 199,973, June 6, 1906.

Nitrogen, or a mixture of nitrogen and hydrogen, nitrogen and carbon monoxide, or nitrogen, carbon monoxide, and hydrogen, is passed through molten iron which is kept saturated with carbon, by covering it with a layer of coke or the like.—T. F. B.

Nitric acid ; Process of making ——. O. H. U. Brünler, Leipzig-Göhlis, Germany. U.S. Pat. 898,033, Sept. 8, 1908.

See Eng. Pat. 5901 of 1906 ; this J., 1906, 811.—T. F. B.

Hydrate of lime ; Apparatus for the production of ——. W. Schulthess, Paris. U.S. Pat. 897,495, Sept. 1, 1908.

See Eng. Pat. 3210 of 1907 ; this J., 1907, 1279.—T. F. B.

Peroxide of potassium ; Manufacture of ——. G. F. Jaubert, Paris. U.S. Pat. 897,980, Sept. 8, 1908.

See Eng. Pat. 7641 of 1907 ; this J., 1907, 1008.—T. F. B.

Sulphur, etc. ; Manufacture of ——. H. Köhler, Assignor to Rütgerswerke Akt.-Ges., Berlin. U.S. Pat. 898,378, Sept. 8, 1908.

See Fr. Pat. 379,559 of 1907 ; this J., 1907, 1252.—T. F. B.

Nitrosulphuric acid ; Concentrating waste —— [*electrolytically*]. U.S. Pat. 898,390. *See* XI*A*.

[*Nitrogen ; Fixation of atmospheric* ——.] *Electric discharges of high efficiency.* Fr. Pat. 389,112. *See* XI*A*.

VIII.—GLASS, POTTERY, AND ENAMELS.

Zinc glazes. L. Petrik. Die Tonwaren-Ind., 1908, 20, 68, 74—75. Chem.-Zeit., 1908, 32, Rep., 490.

Zinc enamel has a smaller coefficient of expansion than other glazes, and when melted on to pottery or stoneware, is less liable to show hair-like cracks than lead glaze. Crystalline zinc glazes are produced by separation of zinc silicate (willemite) on slow cooling. The author has found that a mixture of 6 parts of a frit of the composition, $2ZnO, K_2O, 6SiO_2$, with 10 parts of a frit,

$$2{\cdot}5ZnO, 0{\cdot}5K_2O, 6SiO_2,$$

yields the most satisfactory crystals, the requisite temperature being that of Seger cone 9. Boric acid imparts opalescence to zinc glazes, similar to that observed with tin glazes, this being due, as can be distinctly seen with a high content of boric acid, and under a magnifying glass, to the production of a dense aggregate of fine crystals. By addition of different oxides, characteristic colour effects can be obtained with zinc glazes. For instance, transparent glazes are coloured brown, and crystalline glazes, steel-blue, by addition of nickel oxide. Chromium oxide, which even in small quantities greatly accelerates the formation of crystals, produces an opalescence appearing greenish-grey in daylight, and red in "artificial light." Special mention is made of zinc glazes with red crystals on a green ground, obtained by re-firing a glaze already coloured green by means of copper, and then cooling in a reducing atmosphere, whereupon only the crystals become red, whilst the amorphous glaze forming the ground remains green. In zinc glazes between the limits :

$$\left.\begin{matrix} 2{\cdot}5ZnO \\ 1{\cdot}5K_2O, Na_2O \end{matrix}\right\} \begin{matrix} 9{\cdot}6\ SiO_2 \\ 2{\cdot}4B_2O_3 \end{matrix} \quad \text{and} \quad \left.\begin{matrix} 3{\cdot}5ZnO \\ 0{\cdot}5K_2O, Na_2O \end{matrix}\right\} \begin{matrix} 9{\cdot}6SiO_2 \\ 2{\cdot}4B_2O_3 \end{matrix}$$

the zinc oxide may be partially replaced by lead oxide, lime, or baryta, and it may also be partly replaced by alumina, viz., in glazes between the limits,

$$RO, 0{\cdot}5Al_2O_3, 4SiO_2, 0{\cdot}5B_2O_3 \quad \text{and}$$
$$RO, 0{\cdot}125Al_2O_3, 2{\cdot}4SiO_2, 0{\cdot}6B_2O_3$$

Zinc oxide may also be used in place of the dearer tin oxide for producing opalescent glazes.—A. S.

Patents.

Glass ; Apparatus for drawing ——. O. Imray, London. From Window Glass Machine Co., Pittsburg, U.S.A. Eng. Pat. 15,669, July 23, 1908.

In drawing cylinders for making window-glass, etc., the cylindrical bait used, and the lower part of the blowpipe to which it is attached, are surrounded by a conical shield, which prevents too rapid cooling of the glass. The shield is preferably made in two hinged sections held together by a spring. It fits tightly on the blowpipe, and is kept in place by clamping projections, so as to prevent it from touching the glass. The bait itself may be given such a form that the shield cannot slip low enough to touch the glass.—A. G. L.

Sheet-glass ; Apparatus for drawing ——. F. M. Oppermann. Fr. Pat. 388,457, Mar. 23, 1908.

The opening through which the glass is drawn upwards is prolonged vertically by lips, which may be simply two walls parallel to each other, or may be inclined towards each other, or may be parallel but be thickened in their upper portions. As the glass is drawn upwards between the lips, the cooled outer portions of the glass, which travel more slowly than the central hotter portion, overflow continuously from the lips, running into channels leading back to the bath. In this way, the central portion only is drawn upwards, free from lumps of semi-solid glass. —A. G. L.

Felspar flux [*for porcelain*] *; Process for making* ——. F. M. Locke, Victor, N.Y. U.S. Pat. 897,636, Sept. 1, 1908.

Felspar is fused, cooled, and finely ground. The product is used as a flux in the manufacture of porcelain insulators. —A. G. L.

Tunnel-furnace for the continuous burning by means of gas of porcelain, biscuit-ware, and other ceramic products. S. Vincart-Mouzin. Fr. Pat. 388,585, Feb. 12, 1908.

The furnace is of the tunnel kind in which two sets of trucks move continuously in opposite directions past the actual source of heat, in order that the burnt goods leaving the tunnel may impart some of their heat to the unburnt goods entering it. The furnace is made with a permanent outer wall of silica, and a thin inner lining, which is easily removed and replaced through suitable openings. The inner lining is kept tight by grounding all joints in sand, thus allowing the lining to expand and contract freely.—A. G. L.

Ceramic tiles ; Manufacture of ——. Soc. Français de Carrelage et de Ceramique. Fr. Pat. 388,657 Mar. 28, 1908.

Clay is powdered as usual and is then mixed with sufficient water to bring the water content up 5—9 per cent. This mixing is carried out in a special horizontal mixer, along which the clay is moved by a central shaft carrying helical arms. Water is supplied to the mixer from a number of jets, the water being atomised by jets of compressed air. The well-mixed clay is then moulded under pressure in special moulds designed to leave no mark on the upper face of the tile. For this purpose, the upper part of the mould, which alone is movable, is made in one piece, which is applied a number of times to the tile. Between each application, the surface of the tile is swept by mechanical brushes, and heated, either by steam or electrically. If desired, the surface of the tile may be made of finer clay than the body. For this purpose, a special mould is used, to which a hopper supplies the fine clay to the desired thickness.—A. G. L.

Enamelled metallic surfaces ; Process for producing a metallic lustre on ——. Act.-Ges. der Emaillirwerke und Metallwaarenfabriken "Austria." Fr. Pat. 388,761, April 1, 1908.

The enamelled surface is covered with a thin layer of an essential or fatty oil containing not more than 1 per cent. of a precious metal in suspension, or a similar quantity of a salt of a precious metal in solution. The oil is allowed to dry and the whole then burnt at a temperature approaching the melting-point of the enamel.—A. G. L.

White enamel of great covering power; Process of manufacture of ——. Landau et Cie. and C. Rosenzweig. Fr. Pat. 389,483, April 22, 1908.

The enamel is obtained by fusing silica with white metallic oxides, especially with beryllium and zirconium oxides. Natural silicates freed from iron, etc., may also be used. —A. G. L.

Kilns for bricks, pottery, and the like. Eng. Pat. 4722. *See* IX.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Cement; Micrographic examination of ——. E. Stern. Chem.-Zeit., 1908, 32, 877—879.

Portland cement, when examined by reflected light under the microscope, shows the presence of two constituents, of which one, A, probably represents the hard crystals of cement proper, whilst the other, B, which is present only in small quantity, consists of the soft decomposition products produced by the action of water on cement. On etching the cement by immersing the slide on which it is mounted for 1—3 seconds in 25 per cent. hydrofluoric acid, and then immediately washing with water, A is coloured dark brown, and B is completely removed. If slag-cement is present, this etching produces intense interference colours in the particles of slag-cement, by means of which as little as 1—2 per cent. can be detected. The scratch test of Martens is also useful for the detection of slag in cement, the hard particles of slag showing up well under the microscope.—A. G. L.

Puzzuolanas in marine construction; Behaviour of ——. H. Vetillart and R. Feret. Tonind. Zeit., 1908, 32, 1639—1641.

Addition of puzzuolana to cement-mortar appears to be advantageous, the destructive effect of sea-water being less than with ordinary cement mortar. The puzzuolana can replace one-third of the cement generally used; it should be finely ground, and intimately mixed with the cement, best in the cement factory. The mortar must not be allowed to dry before being immersed in the sea. The use as puzzuolana of roasted "gaize," a highly silicious French rock, is especially recommended. If slag-cements are employed, special tests should be made to ascertain the most favourable proportion to be used.—A. G. L.

Abrasives; Production of —— in United States. Board of Trade J., Sept. 24, 1908. [T.R.]

According to the Geological Survey, the value of abrasives produced in the United States in 1906 and 1907 was as follows:—

——	1906.	1907.
	dollars.	dollars.
Oilstones and scythestones	268,070	264,188
Grindstones and pulpstones	744,894	896,022
Buhrstones and millstones	48,590	31,741
Pumice	16,750	33,818
Infusorial earth and tripoli	72,108	104,406
Abrasive quartz and felspar	121,671	126,582
Garnet	157,000	211,686
Corundum and emery	44,310	12,294
Artificial abrasives	777,081	1,027,246
Totals	2,250,474	2,707,983

Patents.

Kilns for bricks, pottery, and the like. J. Bührer, Konstanz, Germany. Eng. Pat. 4722, Mar. 2, 1908.

A continuous gas-fired furnace of the ring type is supplied with a gas-distributing chamber placed below the furnace. From this chamber the gas is supplied as desired to vertical pipes leading to the burners, these pipes being placed in the walls of the kiln.—A. G. L.

Refractory products resisting the action of high temperatures and of fused substances. A. Parvillée. Fr. Pat. 388,906, April 4, 1908.

The refractory products consist of aluminium silicate (containing 46 per cent. or more of alumina), alumina, and magnesia or a mixture of magnesia and lime. They are obtained either by electrically fusing the material and casting it in moulds; or else, by casting the material into lumps, powdering these, moulding the powder with the addition of a small quantity of tannic acid, tar, etc., under a pressure of 500—1000 kilos. per sq. cm., and burning at 1300—1400° C. The aluminium silicate used is obtained by electrically fusing kaolin or clay, the uncombined silica rising to the top of the bath, and being removed; pure alumina may be added to the silicate. —A. G. L.

Refractory bodies; Manufacture of —— from ignited quartz and water-glass. A. Heimbach. Ger. Pat. 200,639, April 20, 1907.

Quartz sand, as pure as possible, is ignited, ground, and mixed with water-glass, to which up to 25 per cent. of water are added. The mass thus obtained sets in the air, yielding a refractory product as hard as stone, suitable for the construction of large furnaces for the production of steel by the acid process.—A. S.

Building materials; Process of manufacturing ——. Soc. Le Roc. Fr. Pat. 389,371, April 1, 1908.

An inert material, *e.g.*, sand, marble-chips, etc., (7—10 parts by weight) is first soaked in water, then allowed to drain, and mixed, in the order named, with magnesium oxide (1 part), magnesium chloride solution of 32° B. (1 part by volume), barium aluminate solution of 5° B. (1/8 part), and a saturated solution of potash alum (¼ part), to which may be added gypsum (¼—½ part). The mixture is moulded under pressure and dried. The material obtained may be impregnated with sodium fluosilicate, borax, paraffin, etc.—A. G. L.

Cement; Process for the manufacture of ——. W. E. Snyder, Nazareth, Pa. U.S. Pat. 897,938, Sept. 8, 1908.

The raw materials are intermittingly fed on to a movable hearth and are exposed to a series of electric arcs, and to a current of air moving in a direction opposed to that of the hearth.—A. G. L.

Binding stuffs for technical purposes; Method of producing ——. F. J. Seyfried, Cologne, Germany. Eng. Pat. 23,484, Oct. 24, 1907.

See Fr. Pat. 383,177 of 1907; this J., 1908, 282. Reference is directed in pursuance of Sect. 7, Sub-sect. 4, of the Patents and Designs Act, 1907, to Eng. Pats. 5938 of 1882 and 9241 of 1894.—T. F. B.

Refractory substances; Manufacture of ——. C. Caspar, Stuttgart, Germany. Eng. Pat. 69, Jan. 1, 1908. Under Int. Conv., Jan. 5, 1907.

See U.S. Pat. 886,111 of 1908; this J., 1908, 568.—T. F. B.

Timber and the like; Method of impregnating ——. E. Marmetschke, Assignor to H. Brüning, Schöpfurth, Germany. U.S. Pat. 898,246, Sept. 8, 1908.

See Fr. Pat. 376,798 of 1907; this J., 1907, 1049.—T. F. B.

X.—METALS AND METALLURGY.

Thomas process [basic converter]; Experimental investigation of the ——. F. Wüst and L. Laval. Metallurgie, 1908, 5, 431—462, 471—489.

The authors have studied in very great detail the conversion of two charges of about 10 tons each of pig-iron to steel in the basic Bessemer converter. They show

that, contrary to many text-book statements, about 25 per cent. of the phosphorus present is removed by the time that nearly all the carbon is burnt. The loss in iron consequent on the removal of 6·7 and 7·8 per cent. of impurities amounted to 8·2 and 10·7 per cent., of which 2·7 and 4·7 per cent. were burnt during the after-blow in order to remove the last 0·1 per cent. of phosphorus. This is due to the fact that the combustion of phosphorus produces a high temperature, and that the affinity of iron for oxygen increases more rapidly with an increase in temperature than that of phosphorus. The loss of iron can be diminished to some extent by lowering the temperature of the metal during the after-blow by addition of scrap, lime-ore briquettes, etc., but the authors believe that a more economical treatment is obtained by working iron rich in phosphorus in a basic Siemens-Martin furnace. About 90 per cent. of the phosphorus can in this way be obtained in the form of slag poor in iron, and as valuable as Thomas slag, and the rest of the phosphorus can be oxidised chiefly at the expense of the oxygen of the ore added. The use of dry air for the blast in the basic converter does not diminish the loss of iron, although it yields sound castings. The use of air enriched in oxygen, or of heated air, is not to be recommended except for the treatment of iron poor in silicon, as with ordinary silicious iron the final temperature attained is increased to such an extent that, although the time of blowing is shortened, relatively large quantities of iron must be oxidised in order to remove phosphorus completely.
—A. G. L.

Cast-iron rich in phosphorus ; Experimental investigation of the solidification and fusion of ——. N. Gutowsky. Metallurgie, 1908, **5**, 463—470.

The author constructed heating and cooling curves, and prepared microphotographs of small specimens of cast-iron subjected to different thermal treatment. The metal contained : total carbon, 3·57 ; graphite, 2·75 ; phosphorus, 1·32 ; manganese, 0·63 ; silicon, 2·05 ; and sulphur, 0·083 per cent. The conclusions drawn from the results are that in ordinary cast-iron the phosphorus is contained as a binary phosphide eutectic, not as a ternary eutectic, the carbon separating out in the form of graphite during the solidification of a binary eutectic of mixed crystals and cementite. This solidification is complete at about 1100° C., whilst the phosphide eutectic only solidifies at 944° C. On heating cast-iron, the phosphide eutectic melts at about 980° C. Above 1000° C., a large proportion of the graphite is absorbed, forming cementite.—A. G. L.

Gold smelting ; Battery and cyanide ——. A. Thomas. J. Chem., Met., and Min. Soc., S. Africa, 1908, **9**, 6—9.

The author describes in detail the present methods of amalgam retorting, gold smelting, etc., in use in S. Africa. The amalgam is charged on to whitewashed semicircular trays and placed in cast steel cylindrical retorts, each capable of holding 5000 oz. The usual water-cooled condensers for the mercury fumes are used, and the doors sealed with wet asbestos cord. The retorts are uniformly heated and the temperature maintained at the minimum for distillation for two hours ; they are then more strongly heated to remove the remaining mercury. The retorting of 5000 oz. of amalgam takes 4—4½ hours, with a coal consumption of 350 lb., the average loss of mercury being 0·14 per cent. The "sponge" gold is weighed up into 1000 oz. lots, smelted with a little borax in a No. 40 plumbago crucible, and skimmed before pouring ; the loss in weight averages 0·72 per cent. Zinc-gold slimes are calcined in iron trays on a hot plate, using a gradually increasing temperature, the time required being about 3 hours. The loss, amounting to about 43 per cent., consists mainly of moisture and a little carbonaceous matter. When cool, the slimes, without previous grinding, owing to the danger of loss by "dusting," are weighed, with the addition of 7·5—10 per cent. of manganese dioxide, into clay-lined plumbago crucibles. About 40—50 per cent. of a flux consisting of crushed clay liners and fused borax is added as a cover. The resulting gold buttons are usually of sufficiently high grade to be cast into bars, but the presence of much lead or copper would necessitate purification by cupellation. Pan reverberatory furnaces, of the Tavener type, are used for the treatment of by-products, which consist mainly of slag from the zinc-gold slimes, together with old crucible liners, calcining trays, and battery screens, etc. A few bars of lead are placed in the furnace to form a bath, and prevent corrosion of the furnace bottom by the slag, and the first charge, containing 5·5 per cent. of iron from battery screens, etc., and 9 per cent. of litharge is then added. Notice is taken of the behaviour of the first charge, so that modifications may be made in the succeeding charges, if found necessary. A liquid slag of low specific gravity is desired, the lead contained in the materials treated being reduced by the iron and assay slag added if the charge is too thick. Before withdrawing the slag, it is cleaned by the addition of a little litharge and coal dust, the last few pots being reserved for re-treatment. The lead is concentrated and purified by oxidation and the dross removed before the metal is tapped. The lead bullion is then cupelled.
—F. R.

Ferric oxide ; Chemically pure —— as standard substance for the volumetric determination of iron in hydrochloric acid solution. L. Brandt. *See* XXIII.

Ferrites : compounds of an iron acid. J. S. C. Wells. *See* VII.

Persulphates ; Action of metals on aqueous solutions of ——. M. G. Levi and others. *See* VII.

Manganese ore production of India in 1907. Board of Trade J., Sept. 24, 1908. [T.R.]

The production of manganese ore has risen from 436,442 tons in 1906 to 642,082 tons last year. Of this amount over 496,000 tons were produced in the Central Provinces, whose output has increased by 170,000 tons. The known manganese deposits of this part of India are found in an area comprising the districts of Chhindgara, Nagpur, Bhandara, and Balaghat, containing some 3,500 square miles. Although the area is surrounded on three sides, and will in the near future be completely surrounded by main railway lines, few of the mines are provided with direct access to these lines, and some of them are as much as 35 miles distant from them. One mining company has laid down two narrow gauge tram lines starting from different points on the main line to the south and penetrating to distances of 12 and 30 miles, respectively, within the mining area.

The manganese ore which is mined in the Central Provinces is grey in colour, of fine grain and usually very hard and tough. This latter property is a very valuable one as the mineral has to endure a lengthy transport and many changes of bulk before reaching its destination. Chemically the ore is one of the richest and purest mined in the world. The percentage of manganese varies from 50 to 55 whilst the phosphorus content is low.

Patents.

Steel ; Treatment of iron which is to be converted into ——. H. Röchling and J. Schoenaiva, Völklingen on Saar, Germany. Eng. Pat. 27,556, Dec. 13, 1907.

Before being treated as usual in a converter, the pig-iron is subjected to a preliminary refining process in a pig-iron mixer provided with an electrical heating device, fluxes, *e.g.*, iron scale, manganese ore, lime, being also added. A large part of the silicon, carbon, and sulphur present is thus eliminated.—A. G. L.

Iron ; Process of smelting ——. M. Ruthenburg, Philadelphia, Pa. U.S. Pat. 898,068, Sept. 8, 1908.

Equal parts by weight of ordinary pig-iron and iron oxide ore free from manganese are charged into a vertical stack (cupola) furnace on to a mass of fuel. The charge is subjected to a fusing temperature, agitation being prevented. The products obtained are iron containing less sulphur and phosphorus than the original pig-iron, and a ferruginous slag rich in sulphur and phosphorus. —A. G. L.

Iron and steel; Process and apparatus for preventing the oxidation and corrosion of ——. J. J. Bradley. Fr. Pat. 389,289, April 16, 1908.

The cleaned metal is submitted, at a high temperature, to the action of nascent hydrogen, or of hydrogen and vaporised copper. The hydrogen penetrates the surface of the metal, and eventually is said to form a kind of alloy furnishing a superficial layer, and preventing corrosion. By then cooling the metal in contact with a hydrocarbon, a certain quantity of carbon is said to penetrate into the layer of alloy.—F. R.

Cementation [of iron]; Process and apparatus for ——. A. W. Machlet. Fr. Pat. 389,547, March 12, 1908.

The iron is exposed, at a high temperature, to the action of a mixture of a carbon-free gas (*e.g.*, ammonia) with a definite proportion of a hydrocarbon. The apparatus consists of a rotating retort, to hold the iron, with means for introducing and withdrawing the carburising gas, and for mixing the gases in the required proportions. —F. R.

Steels; Process for obtaining metals or —— *of all qualities.* L. Baraduc-Muller. Fr. Pat. 389,577, July 2, 1907.

The required alloy or steel is produced by the addition, at the right moment, of briquettes, composed of certain metallic oxides and silica, or of metallic oxides and carborundum, to the molten metal in the fusion furnace. —F. R.

Converters. R. Cremer, Leeds. Eng. Pat. 10,835, May 19, 1908.

The object of the invention is to facilitate removal of the body of the converter for repair. For this purpose, the air-box is made easily removable from the converter, being bolted to a flange permanently secured to the latter. From the air-box the air passes to the tuyères either by means of a pipe having detachable connections, or else through the medium of a second box, which may be either bolted to the converter around the tuyères, or into which the tuyères are fitted through a lid with which the box is provided.—A. G. L.

Ores; Apparatus for treating ——. W. C. Tracy, Denver, Colo. U.S. Pat. 896,955, Aug. 25, 1908.

The apparatus consists of a tank having an impervious bottom of cement, in which is imbedded a coiled pipe having holes in its upper side, through which air is blown into the solution. The holes are arranged so that the currents of air cross each other. A second similar pipe supplying steam may also be provided.—A. G. L.

Blast-furnaces; Drying air for ——. D. T. Day, Washington, D.C. U.S. Pat. 897,356, Sept. 1, 1908.

The air is compressed to a pressure of 50—100 lb., cooled by the circulation of water round the pipes, and the water of condensation drawn off. The air is then further cooled and dried by expanding it to the required pressure of 15 lb. The cooled air, on its way to the furnace, is used to cool the circulating water.—F. R.

Alloy for bearing metals. E. A. Touceda, Albany, N.Y. U.S. Pat. 897,431, Sept. 1, 1908.

The alloys consist of lead, or lead and other metals, hardened and toughened by the presence of cadmium. —F. R.

Tin-plate scrap; Preparation of merchantable iron and tin compounds from ——. E. A. Sperry, Brooklyn, N.Y. U.S. Pat. 897,796, Sept. 1, 1908.

The tin scrap is compressed into laminated billets, which are packed in a retainer, so as to form a hollow cylinder with the laminations in a plane "normal to the axis." The retainer is rotated in a reaction-chamber, which is heated, and the gaseous or liquid de-tinning reagent is caused to flow, by the centrifugal action of the rotating retainer, from the central space outwards through the tin scrap. During the process the pressure in the reaction-vessel is varied from time to time, but is always kept below that of the atmosphere.—F. R.

Smelting. A. R. McKenzie, Great Falls, Mont. U.S. Pat. 897,993, Sept. 8, 1908.

Molten slag and matte are discharged downwards from a furnace into a receptacle, into which is also charged finely-divided ore or flue-dust, the latter being smelted by the heat contained in the slag and matte.—A. G. L.

Roasting-furnace [for ores]. A. R. Wilfley, Denver, Colo. U.S. Pat. 898,024, Sept. 8, 1908.

Hot gases from a hearth travel first upwards through a vertical flue, and then downwards through a second flue which is greater in cross-section at the bottom than at the top. Ore is introduced at the top of the second flue, and falls down through the latter on to the water-jacketed inclined bottom of the flue, whence it is discharged through an opening into a water-jacketed trough from which air is excluded. The trough is given a longitudinal vibratory motion to facilitate the discharge of the ore from the furnace.—A. G. L.

Metals; Process of refining ——. K. O. Kretschmer, Elizabeth, N.J., Assignor to C. J. and F. E. Canda, New York. U.S. Pat. 898,116, Sept. 8, 1908.

A previously dehydrated compound of boron, *e.g.*, a borate, is added to the molten metal, while the latter is being charged into the ladle.—A. G. L.

Spelter furnace; Recuperative ——. N. L. Heinz, La Salle, Ill. U.S. Pats. 898,409 and 898,410, Sept. 8, 1908.

The retort chamber, having gas inlet and outlet openings at opposite ends, is provided with a longitudinal dividing wall. A large horizontal flue runs throughout the length of the wall near the bottom, having ports at intervals, opening into the space at the bottom of the chamber on either side. A gas-supply flue, in combination with an air-heating chamber placed beneath the retort chamber, has common connection with the gas inlet and the horizontal flue.—F. R.

Nickel sulphide ores or metallurgical products, containing iron and copper; Treatment of ——. W. Borchers and F. Warlimont. Ger. Pat. 200,467, May 18, 1907.

The sulphide ore, or a crude matte, poor in copper, prepared from the same, is roasted in an oxidising atmosphere at a low temperature, whereby, it is stated, most of the copper and cobalt are obtained as sulphates, and most of the iron as ferric oxide, whilst the greater part of the nickel remains in the form of sulphide. On lixiviating with very dilute sulphuric acid, a solution is obtained containing copper and cobalt sulphates, together with small quantities of sulphates of iron and nickel, and also any silver that may have been present. The silver is recovered by passing the solution over granulated copper. The copper is separated electrolytically or by means of iron scrap, and the residual solution is treated with a quantity of an alkali- or alkaline-earth sulphide sufficient to precipitate the cobalt and nickel, but as little iron as possible. The sulphide precipitate is treated by one of the usual methods. The residue left from the first lixiviation, containing the greater part of the nickel and iron, is worked up by one of the known methods for treating nickel matte free from copper.—A. S.

Ores; Preparation of weathered —— *for smelting.* J. Y. Johnson, London. From Fellner und Ziegler, Frankfort on Maine, Germany. Eng. Pat. 28,637, Dec. 30, 1907.

See Fr. Pat. 385,632 of 1907; this J., 1908, 689.—T. F. B.

Metallurgical apparatus. W. A. Merralls, San Francisco. U.S. Pat. 898,415, Sept. 8, 1908.

See Eng. Pat. 1344 of 1907; this J., 1907, 929.—T. F. B.

Metallic alloy. E. Haynes. Fr. Pat. 389,424, April 18, 1908. Under Int. Conv., April 23, 1907.

See U.S. Pat. 873,745 of 1907; this J., 1908, 128.—T. F. B.

Steel; Process for decreasing the duration of the manufacture of open-hearth ——. Soc. Anon. des Hauts-Fourneaux et Forges de Dudelange. Fr. Pat. 389,652, July 5, 1907.

SEE Eng. Pat. 19,348 of 1907; this J., 1908, 943.—T. F. B.

Refractory bodies from ignited quartz and water-glass. Ger. Pat. 200,639. *See* IX.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(*A.*)—ELECTRO-CHEMISTRY.

Selenic acid from lead selenate; Electrolytic formation of ——. F. C. Mathers. J. Amer. Chem. Soc., 1908, **30**, 1374—1378.

WHEN lead selenate is placed on the bottom of a platinum dish and covered with water, selenic acid is produced on passing an electric current, using the dish as cathode, and a coil of platinum wire as anode. At 35° C., with a current density of 0·09—0·1 ampère per sq. dm. of cathode surface, 87·6 per cent. of the selenium was obtained as selenic acid. The current yield is increased by rise of temperature and increase of the thickness of the layer of lead selenate, but the percentage of selenium converted into selenic acid is reduced.—A. S.

Colloidal solutions; Coagulation of —— within an electric circuit. W. Biltz. Z. Elektrochem., 1908, **14**, 567—571.

FERRIC oxide, gold, and antimony sulphide, in colloidal aqueous solution, are slowly precipitated by the introduction of a metallic couple. Thus, in a zinc/gold-solution/copper element, scarcely any change occurs in 15 hours, if the circuit be left open, but, on closing the circuit, all the gold is precipitated, within a like period, as a purple deposit which is apparently an adsorption product of gold and zinc hydroxide. The minute quantity of electrolyte present is sufficient to account for the current produced, and precipitation of the colloid is regarded as due, partly to this current, partly to the presence of ions, and partly to adsorption of the colloid particles by the metallic oxide separating during action of the cell. Coagulation of milk and egg-albumin solutions by metallic couples has also been observed in a less marked degree.
—F. SODN.

PATENTS.

Liquids; Electrochemical concentration of ——. G. W. Nistle, North Muskegon, Mich., and R. L. Gifford, Chicago, Ill. U.S. Pat. 896,749, Aug. 25, 1908.

ACID "electrolytic liquids" are concentrated by placing them in electrical contact with a mass of iron (or other metal which can react with the acid) and another more electro-negative metal, connecting the iron and the other metal so as to form a battery, and simultaneously supplying heat by external means. When the electric current ceases to flow, an external current may be sent through the circuit in the same direction.—A. G. L.

Nitrosulphuric acid; Concentrating waste —— [electrolytically]. H. Pauling, Assignor to Salpetersäure Ind.-Ges. G.m.b.H., Gelsenkirchen, Germany. U.S. Pat. 898,390, Sept. 8, 1908.

THE anode compartment of an electrolyser is filled with the nitrosulphuric acid, the cathode compartment being filled with dilute nitric acid. The nitrogen oxides liberated at the cathode are conducted into the anode chamber.—F. R.

Storage battery electrodes; Metallic film for use with —— and process of preparing the same. T. A. Edison, Llewellyn Park, Orange, N.J., Assignor to Edison Storage Battery Co., West Orange, N.J. U.S. Pat. 896,811, Aug. 25, 1908.

"INSOLUBLE metallic films" of cobalt or nickel (see U.S. Pats. 865,687 and 865,688; this J., 1907, 1097, 1098) are mixed with the active material of secondary batteries. The films are given minutely roughened surfaces by first oxidising them superficially, then reducing by means of hydrogen, and finally removing metallic impurities from the surface.—A. G. L.

[Nitrogen; Fixation of atmospheric ——.] Electric discharges of high efficiency; Process of producing ——. Elektrochem. Werke G.m.b.H. Fr. Pat. 389,112, April 10, 1908.

AIR is circulated through the annular space formed between two concentric cylindrical electrodes, of which the outer forms the lining of a drum constituting the reaction chamber, and the inner is a short cylinder placed near the centre of the drum. The space between the two electrodes is 20—100 times as great as the length of the normal arc with the current used (5000—6000 volts.). A thin conducting rod therefore extends from the inner electrode to within 5—10 mm. of the outer, and establishes the arc. The air passed through the drum is given a circular movement mechanically, and carries the arc with it in helical fashion so as to fill the entire space between the two electrodes.—A. G. L.

Electrolyte in a solid, permanent form; Preparation of a double cyanide of an alkali and another metal for use as an ——. A. Barth. Ger. Pat. 200,142, Nov. 28, 1906.

DOUBLE cyanides prepared by dissolving the cyanide of a heavy metal in an alkali cyanide solution, and evaporating to the crystallising point, are used for the preparation of solid electrolytes. It is now found that powdered mixtures of the components can be used with advantage in place of the double salts.—A. S.

Voltaic high-current arcs; Apparatus for producing ——. H. Pauling, Assignor to Salpetersäure-Ind. Ges., Gelsenkirchen, Germany. U.S. Pat. 898,133, Sept. 8, 1908.

SEE Eng. Pat. 18,901 of 1907; this J., 1907, 1243.—T. F. B.

Gases; Apparatus [electric furnace] for the treatment of ——. S. Z. de Ferranti, London. U.S. Pat. 898,346, Sept. 8, 1908.

SEE Eng. Pat. 13,965 of 1906; this J., 1907, 1145.—T. F. B.

Ozonising apparatus. Siemens und Halske A.-G. Fr. Pat. 389,564, April 4, 1908.

SEE Eng. Pat. 6105 of 1908; this J., 1908, 945.—T. F. B.

Electrodes for arc lamps. Eng. Pat. 4762. *See* II.

Thermometers; Electric resistance ——. Eng. Pat. 27,569. *See* XXIII.

Filaments for incandescence electric lamps. Fr. Pat. 389,363. *See* II.

Silk dyeing; Electrolysing sodium chloride for the manufacture of soap and stannic chloride, both to be used in ——. Fr. Pat. 389,188. *See* V.

(*B*).—ELECTRO-METALLURGY.

[Nickel] Passivity in acid solution. O. Sackur. Z. Elektrochem., 1908, **14**, 607—613.

THE author has studied the anodic solution of nickel in sulphuric acid, the cathode consisting of copper in copper sulphate solution. Above a certain "critical strength" of current, under these conditions, nickel becomes completely passive. The more dilute the acid and the greater the current-density, the more readily does the metal acquire this property. The passivity is hindered by a rise of temperature and by the presence of sodium chloride or bromide. Passive nickel in sulphuric acid solution, especially at higher temperatures and in presence of halogen ions, dissolves to some extent. The author considers that the passive state is brought about through the slow reaction between the electrode and the discharged anions. Only when the depolarisation of the anions by the metal proceeds more quickly than their conveyance to it by the current, does the electrode dissolve according to Faraday's law. The "critical strength" varies with the nature of the electrolyte. At 1° C., it is 0·085 ampère in *N*/5 sulphuric acid, 0·01 amp. in 0·15 *N* sulphuric acid, 0·013 amp. in a solution of the concentration, 0·15–*N* sulphuric acid and 0·005–*N* sodium chloride, and 0·024 amp. in a solution of 0·15–*N* sulphuric acid and 0·015–*N* sodium chloride.—J. C. C.

Nickel; Electrodeposition of ——. E. F. Kern and F. G. Fabian. School of Mines Quart., 1908, **29**, 342—370.

The authors have studied the electrodeposition of nickel from solutions of the dithionate, chloride, fluosilicate, fluoborate, and sulphate. No satisfactory results could be obtained with the dithionate, decomposition occurring, with separation of sulphur. With acid solutions of nickel chloride, sulphate, and fluosilicate, only a very low cathode efficiency was attained, whereas the anode efficiency was in most cases over 95 per cent. By continued electrolysis the free acid was neutralised and the cathode efficiency increased. Very satisfactory deposits of nickel were obtained by the electrolysis of neutral chloride and fluosilicate solutions with current densities of 10 and 20 ampères per square foot, and the current efficiency was high. The current efficiency was increased and the E.M.F. reduced by heating, the most suitable temperature being about 40° C. Satisfactory deposits were also obtained from neutral solutions of nickel fluoborate at the ordinary temperature, with a current density of 10—15 ampères per sq. ft. In one experiment extending over 115 hours with a neutral fluosilicate solution containing about 7 per cent. of nickel, two cast anodes (3 ins. × 4 ins.), containing 92 per cent. of nickel, 5 per cent. of iron, some carbon, and a trace of copper, were used, whilst the cathode (3½ ins. × 4 ins.) was of sheet nickel, placed between the anodes, at a distance of about $\frac{3}{4}$ in. from them. The electrolysis was carried out at 40°—50° C., with a current density of about 15 ampères per sq. ft., the E.M.F. being 1·10—1·18 volts. The deposit of nickel was $\frac{3}{16}$ in. thick and weighed 214 grms. It was bright, perfectly smooth, flexible, and free from apparent crystallisation.—A. S.

Alloys of nitride-forming metals; Preparation of ——. [Fixation of atmospheric nitrogen.] E. Beck. Metallurgie, 1908, **5**, 504—521.

Magnesium forms a nitride readily, and the author has endeavoured to obtain the nitride from alloys containing magnesium. It is stated that the preparation of alloys of magnesium with metals such as lead and tin is more easily and cheaply carried out than the preparation of the pure metal. Experiments undertaken to prepare a nitride of magnesium by reducing oxides of magnesium and tin with carbon, and then blowing in nitrogen were not successful. It was found however that a suitable method of preparing an alloy of magnesium and tin was to electrolyse a solution of magnesium oxide in a bath of molten carnallite, using a cathode of molten tin and an anode of carbon. In this process it is best to keep the molten tin constantly stirred. A current of nitrogen is then blown in through an iron pipe well coated with fireclay. The magnesium forms a nitride, whilst the tin is unacted on. The nitride of magnesium is then treated with steam, when the nitrogen is given up as ammonia, whilst the magnesium forms the oxide, which is then used over again in the process. No experiments on the large scale have yet been made with this process, but a calculation of the cost shows that this should be slightly less than the cost of the Frank and Caro process (this J., 1905, 441) for the fixation of nitrogen as cyanamide.—C. E. F.

Patents.

Metallic foil or leaf; Apparatus for use in the electrolytic manufacture of ——. S. O. Cowper-Coles, London. Eng. Pat. 4273, Feb. 25, 1908.

The apparatus consists of an annular vat, in which revolves a cylindrical cathode formed of segments of sheet aluminium resting in grooves on skeleton frames carried by radial arms extending from a vertical shaft placed in the centre of the vat. Anodes of the metal to be deposited (silver, gold, etc.) are placed on both sides of the cathode, and the electrolyte is sprayed on to the cathode from a number of jets. A current density of 50 ampères or more per sq. ft. is used. The foil is readily removed from the aluminium by bending the latter. The whole cathode may be dipped in methylated spirits before immersing it in the electrolyte, in order to further facilitate removal of the foil, and to prevent the formation of holes due to air-bubbles.—A. G. L.

Ferro-alloys; Production of ——. F. M. Becket, Niagara Falls, N.Y., Assignor to Electro Metallurgical Co., Chicago, Ill. U.S. Pat. 898,173, Sept. 8, 1908.

Low-carbon ferro-alloys are produced by smelting iron and refractory oxide ores in an electric furnace, with sufficient carbide of an alkaline-earth metal to yield a metallic product low in carbon.—F. R.

Electroplating; Making articles [cans] by ——. T. A. Edison, Llewellyn Park, Orange, N.J., Assignor to Edison Storage Battery Co., West Orange, N.J. U.S. Pat. 898,404, Sept. 8, 1908.

Seamless storage battery cans are made by electrolytically depositing a coating of copper on a mould, then a coating of nickel on the copper, and a coating of iron on the nickel. The copper lining to the vessel may be removed, if desired, leaving a nickel-plated interior.—F. R.

Electro-deposition of metals. A. Lévy, Paris. Eng. Pat. 25,553, Nov. 18, 1907.

See Fr. Pat. 385,058 of 1907; this J., 1908, 818.—T. F. B.

Copper; Method of rendering electrolytic —— homogeneous. M. A. Jullien and E. L. Dessolle, Levallois-Perret, France. U.S. Pat. 897,291, Sept. 1, 1908.

See Fr. Pat. 369,746 of 1906; this J., 1907, 210.—T. F. B.

Alloys; Electrodeposition of ——. S. O. Cowper-Coles, London. U.S. Pat. 898,189, Sept. 8, 1908.

See Eng. Pat. 19,411 of 1906; this J., 1907, 972.—T. F. B.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

Laurel-seed oil and its unsaponifiable constituents. H. Matthes and H. Sander. Archiv Pharm., 1908, **246**, 165—177.

The specimen of laurel-seed oil examined by the authors had the following characters:—Acid value, 9·4; saponification value, 200·9; Reichert-Meissl value, 3·2; Polenske value, 2·8; Hehner value (of saponifiable portion), 85·8; iodine value (Hübl), 82·2 to 82·43; n_D, 40° = 1·4643; true acetyl value, 5·108, apparent acetyl value, 15·23. The unsaponifiable constituents (1 per cent. of the weight of the fat) consist of myricyl (melissyl) alcohol, $C_{30}H_{62}O$, m.pt. 88° C.; a hydrocarbon, laurane, $C_{20}H_{42}$, m. pt. 69° C.; a phytosterol, $C_{27}H_{44}O + H_2O$, m.pt. 132—133° C., and a yellowish-brown oily liquid with an aromatic odour, having the iodine value 191·95.

A table is given showing the colour reactions of the phytosterol with various reagents, compared with those given by the phytosterol of cacao butter and ergosterol. —J. O. B.

Artificial degras; Manufacture of ——. U. J. Thuau. *See* XIV.

Cocoanut oil [and palm-kernel oil in butter] and lard; Detection of ——. G. Fendler. *See* XVIIIA.

Lard and other fats; Determination of water in ——. K. Fischer and W. Schellens. *See* XVIIIA.

Rafia wax in Madagascar. For. Off. Ann. Ser. No. 4113. [T.R.]

When collecting and preparing rafia fibre the natives bring the leaves gathered in the vicinity into camps where, after extraction of the fibre, they are left lying about, often in considerable quantities. In 1905 it was found that these leaves, when shaken, yielded a flaky white substance which on boiling yielded a wax. About 100 lb. of this wax was offered in October, 1905, and was sold in small lots at 1s. per lb. Beyond these no shipments have been made, nor has the preparation of the wax been continued, the price being considered insufficient for its preparation, a very large number of leaves being required to produce even 1 lb. of wax.

Patents.

Chinese wood oil [tung oil]; Preparation of a solid product applicable as a loading material for rubber and for other purposes and of an oil not gelatinised on heating from ——. F. Steinitzer. Ger. Pat. 200,746, Nov. 28, 1907.

If Chinese wood oil be treated with sulphuric acid of sp. gr. between 1·597 and 1·759, preferably 1·688, there is stated to be no evolution of heat and no formation of sulphur dioxide, but a brownish solid mass is obtained, from which the sulphuric acid can be completely removed by washing with water, leaving a yellowish powder of faint odour and neutral reaction, and containing no sulphur. This product does not melt, but chars when heated. It is insoluble in water and the usual solvents for fat, but is capable of absorbing considerable quantities of liquids, and of withdrawing dyestuffs, salts, etc., from their solutions. It can be used as a loading material for rubber, as a vehicle for medicinal preparations, etc. It can be readily saponified with caustic alkalis or alkali carbonates, and from the resulting soap, on treatment with acid, there separates a thick, reddish-brown drying oil, miscible with alcohol in all proportions, which does not gelatinise on heating.—A. S.

Lubricating and cooling media. Eng. Pat. 8387. *See* III.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(*A.*)—PIGMENTS, PAINTS.

Substitutes for white lead in the Netherlands. Oil, Paint, and Drug Rep., Sept. 7, 1908. [T.R.]

The Minister of the Interior of the Netherlands, in 1903, appointed a Commission to investigate whether the climatic conditions of Holland would make it possible to substitute zinc oxide or other white pigments for painting in place of white lead. In the first preliminary report of October, 1906, the Commission arrives at the conclusion that zinc white is not deficient in covering power in comparison with white lead; if anything, it is superior, because there is a saving of eight per cent. in its favour. The second preliminary report of March, 1908, deals with the question of the best substitute for white lead in painting. By increasing the proportions of pigment to oil in the zinc white paint, the coating of zinc white equals that made by white lead in opacity. Repeated tests of the thickness of films of the coatings with white lead and with zinc white paint have proved that despite the stouter consistence of the zinc white paint, the thickness of the dried films of white lead paint is invariably greater than that of the zinc white.

Patents.

Oil-colours: Process of making —— containing boric acid or a borate as base. J. Meurant. Fr. Pat. 389,051, April 9, 1908. Under Int. Conv., May 6 and Aug. 9, 1907.

Boric acid, or a borate of lead, zinc, etc., is substituted for lead oxide, etc., as a base for oil-colours. The borate is obtained by fusing together boric acid and the corresponding metallic oxide.—A. G. L.

Lakes [from azo dyestuffs]; Manufacture of ——. E. Ulrichs, Charlottenburg, Germany. Eng. Pat. 17,675, Aug. 2, 1907. Under Int. Conv., Oct. 12, 1906.

See Fr. Pat. 381,206 of 1907; this J., 1908, 132.—T. F. B.

Paint compounds; Manufacture of ——. W. E. Lake, London. From W. N. Blakeman, New York. Eng. Pat. 7100, March 31, 1908.

See U.S. Pats. 883,517 and 883,520 of 1908; this J., 1908, 456.—T. F. B.

[Paint] oils. W. E. Lake, London. From W. N. Blakeman, New York. Eng. Pat. 7110, March 31, 1908.

See U.S. Pat. 883,522 of 1908; this J., 1908, 456.—T. F. B.

Oils used in painting. W. N. Blakeman. Fr. Pat. 389,369, March 31, 1908.

See U.S. Pat. 883,522 of 1908; this J., 1908, 456.—T. F. B.

Lampblack; Apparatus for making ——. G. Wegelin, Kalscheuren, Germany. U.S. Pat. 897,439, Sept. 1, 1908.

See Eng. Pat. 28,189 of 1907; this J., 1908, 579.—T. F. B.

Colouring matters [pigments]. J. C. Heckman. Fr. Pats. 389,412 and 389,413, April 18, 1908. Under Int. Conv., June 12 and Sept. 26, 1907.

See U.S. Pats. 887,042 and 887,043 of 1908; this J., 1908, 579.—T. F. B.

(*B.*)—RESINS, VARNISHES.

Gamboge from Garcinia cowa. D. Hooper. Annual Report Indian Museum, 1907-8, 13. Pharm. J., 1908, 81, 161.

The gum-resin of *Garcinia cowa*, from Chittagong, has similar constituents to those of ordinary gamboge, but contains more resin; it is paler in colour than the latter, and forms a beautiful permanent lacquer for metallic surfaces when dissolved in oil of turpentine. A sample examined contained: moisture, 6·5; resin, 84·3; gum, 5·6: residue, 2·5; ash 1·1 per cent.—J. O. B.

Patents.

Shellac; Process of preparing substitutes for ——. J. Meyer, Berlin. U.S. Pat. 898,382, Sept. 8, 1908.

Four hundred parts of a resin or mixture of resins, soluble in alcohol, are treated with a solution of 60 parts of anhydrous sodium carbonate in 1000 parts of water, the mixture is boiled, then allowed to cool, filtered, and the filtrate added to a hot liquid prepared by dissolving 8 parts of stearin in 8 parts of a 33 per cent. solution of potassium hydroxide, and adding 80 parts of water. The mixture is neutralised with a mineral acid at a low temperature, the whole is stirred for some time, then heated to about 70° C., filtered, and the precipitate washed and dried.—A. S.

Resin-casein lac; Preparation of a clear ——. M. Fehringer. Ger. Pat. 200,919, July 13, 1907.

If an alcoholic solution of a resin be mixed with an ammoniacal solution of casein, a lac is obtained, which gives brilliant coatings. The lac is, however, always slightly turbid when prepared from commercial casein, and the turbidity cannot be removed by allowing to stand, by filtration, or by addition of clarifying agents. According to the present patent, the lac can be readily separated into a transparent clear portion and a turbid portion, if it be cooled for some time below 0° C.—A. S.

Lincrusta or like material; Apparatus for embossing and colouring or printing ——. F. Walton, London. U.S. Pat. 898,292, Sept. 8, 1908.

See Fr. Pat. 345,848 of 1904; this J., 1905, 34.—T. F. B.

Resinous product and process of making same. R. Bohn, Mannheim, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 898,307, Sept. 8, 1908.

See Eng. Pat. 16,245 of 1907; this J., 1908, 457.—T. F. B.

(C.)—INDIA-RUBBER, &c.

Rubber goods; Direct determination of the mineral constituents in ——. F. Frank and E. Marckwald. Gummi-Zeit., 1908, 22, 1344—1346.

The method consists essentially in heating the rubber sample with a solvent, at such a temperature that the vulcanised caoutchouc present is depolymerised and passes into solution, and then filtering off and weighing the minerals which remain undissolved. 1 grm. of the sample, which has been previously extracted with acetone, is immersed in 30 c.c. of xylol (b. pt. 136°—140° C.), contained in a stoppered glass vessel. This vessel is placed in an autoclave containing xylol, and the temperature is slowly raised, during about an hour, until a pressure of 15 atmospheres is attained. The pressure is kept constant at 15 to 18 atmospheres for 3 to 4 hours, and the autoclave is then allowed to cool down before being opened. If the minerals have settled out well from the solution, the latter is diluted at once with its own volume of ether, but if the liquid is cloudy, about 1 to 3 c.c. of alcohol are first added. This causes the precipitation of a slight amount of rubber from the solution, and by this the suspended minerals are carried down. Ether is then added as above, and the liquid is allowed to stand overnight. The residue is filtered off on a weighed filter, washed with ether, dried, and weighed. Any rubber that may have been precipitated by the alcohol is re-dissolved by the ether. Any particles of rubber which remain undissolved, mixed with the minerals, may either be removed by treatment with a suitable solvent, or may be accounted for in the complete analysis of the minerals. Examples are given of a number of analyses by this process, the analytical results agreeing well with the calculated values.

Of the various substances ordinarily present in vulcanised rubber, it appears to be only the free sulphur which is liable to affect the accuracy of the method, and this is therefore removed by a preliminary extraction with acetone. —E. W. L.

Patents.

Resilient bodies; Production of ——. S. W. Wilkinson, London. Eng. Pat. 18,696, Aug. 19, 1907.

Formaldehyde is added to a solution of gelatin containing viscous extracts, such as are obtained from fish-offal, or to a solution containing gelatin, casein, and albumin. These solutions have the power of absorbing considerable quantities of formaldehyde, and they remain fluid when cold. The mixture is poured into moulds, tyres, balls, etc., and coagulated instantaneously by subjecting it to a heat not exceeding 100° C.—W. P. S.

Liquids similar to rubber latex; Process for the preparation of —— *from old rubber or rubber waste.* M. Fränkel and Runge. Ger. Pat. 197,154, July 24, 1906.

The old rubber or rubber waste is treated with a suitable solvent, and the rubber solution is heated under pressure with a strongly alkaline solution. The mass is then mixed with water, and the rubber solvent (*e.g.*, benzol) removed by distillation with steam. The residue is finally heated with water under pressure.—A. S.

Composition of matter [*rubber substitute*]. M. Bartels, Wiesbaden, Germany. Eng. Pat. 25,071, Nov. 12, 1907.

See Fr. Pat. 379,530 of 1907; this J., 1907, 1245. Reference is directed in pursuance of Sect. 7, Sub-sect. 4, of the Patents and Designs Act, 1907, to Eng. Pats. 109 of 1871; 19,163 of 1893; 15,534 and 23,056 of 1897; and 15,907 of 1906.—T. F. B.

Elastic material; Method of manufacturing ——. A. Adler, Assignor to R. Neufeld, Vienna. U.S. Pat. 897,334, Sept. 1, 1908.

See Eng. Pat. 22,382 of 1907; this J., 1908, 759.—T. F. B.

Vulcanised rubber; Machine for reducing —— *to powder.* T. Gare. Fr. Pat. 389,210, April 14, 1908. Under Int. Conv., April 18, 1907.

See Eng. Pat. 8976 of 1907; this J., 1908, 633.—T. F. B.

Rubber substitute. A. G. Inrig. Fr. Pat. 389,315, April 17, 1908. Under Int. Conv., April 19, 1907.

See Eng. Pat. 9094 of 1907; this J., 1908, 82.—T. F. B.

Colloidal substances; Process and apparatus for drying ——. Soc. Anonyme de Travaux Dyle and Bacalan. Fr. Pat. 389,227, April 15, 1908.

The articles to be dried are supported on or suspended from a travelling device situated at the top of a closed chamber. Openings, provided with covers, are provided at each end of the chamber, and a current of air is passed through the latter. The air current enters at the top and is delivered uniformly throughout the chamber by passing it through a perforated plate extending across the top of the chamber. A pipe at the bottom of the chamber conducts the air to a condenser where any volatile solvents are recovered. —W. P. S.

Chinese wood oil [*tung oil*]; *Preparation of a loading material for rubber from* ——. Ger. Pat. 200,746. *See* XII.

XIV.—TANNING, LEATHER, GLUE, SIZE.

Solubility of tanning extracts; Determination of ——. J. Paessler and T. Veit. Collegium, 1908, 295—304, 308—320, 322—331.

The authors draw attention to the fact that the differentiation of the soluble from the insoluble matters of a tanning extract, as shown in the report of the ordinary analysis, forms no criterion of the solubility of these extracts when stronger infusions are made, such as is usual in their practical employment in the tannery, and that some extracts, showing by analysis little insoluble matter, yield in practice a considerable sediment owing to the separation of the difficultly soluble tannins from solution. As the value of an extract depends upon the tannin which is available in practice, the authors have elaborated a method by which numerical expression can be given to the solubility of these extracts when made up into stronger liquors. The ordinary analysis is first performed, and on the basis of its results, four fresh infusions are prepared, taking such quantities of the extract as contain 5, 12½, 25, and 35½ grms. of "total solubles." These are named strengths (1), (2), (3), and (4), respectively. These quantities of extract are dissolved by water as far as possible, and the volume of each liquor made up to 250 c.c. Solution may be brought about in two ways: (*a*), by shaking the extract with water at ordinary temperature for 2 hours, and then making up to mark; and (*b*), by dissolving in water at 90°—100° C., cooling slowly, and then making up to 250 c.c. The infusions are well mixed and filtered through thick filter paper until clear filtrates are obtained. The "total soluble matter" is ascertained in each case by the evaporation to dryness of the following volumes, 50 c.c., 20 c.c., 10 c.c., 6·7 c.c., corresponding to the four strengths mentioned above. The residue in each case therefore is about 1 grm. The specific gravity of each filtrate should also be taken. The quantities of "total soluble matter" found in this way may be stated in percentages of the original extract, or as a percentage of the total soluble matter found in the usual analysis. As moreover the sediment formation which results from the use of strong liquors is due to the separation from solution of the more difficultly-soluble tannins, it is also very suitable to state the results not only on the total soluble matter but also on the tannin content as ascertained by analysis. The authors give results that have been obtained by this method on a very great variety of tanning extracts, and show that a valuable criterion is supplied for the judgment and comparison of different extracts. The results are stated in all the ways mentioned above, and on the basis of both shake and filter methods of de-tannising, and are also given for both methods of dissolving the four infusions. The results according to the two methods of analysis give of course different figures, but point to the same conclusions. The method of dissolving with hot water is considered more generally useful and quicker to carry out. The following table is compiled from the results given, the figures being determined by the hot solution method and stated on the basis of the tannin content, as determined by the official (shake) method of analysis.

Nature of extract.	Analysis.				Percentage of available tannin.			
					Strength.			
	Tannin.	Non-tans.	Insoluble.	Water.	1.	2.	3.	4.
Oakwood (1.)	22·2	18·0	0·3	59·5	90·1	88·7	86·9	86·5
Oakwood (2.)	23·6	17·1	0·0	59·3	91·1	92·4	90·7	91·5
Oakwood (3.)	22·3	19·6	0·2	57·9	94·6	92·4	91·9	91·9
Chestnut (1.)	26·3	14·6	0·7	58·4	93·5	94·3	96·9	97·7
Chestnut (2.)	33·2	15·2	1·1	50·5	88·3	94·6	95·8	99·1
Chestnut (3.)	28·9	9·8	0·2	61·1	95·9	95·5	96·9	97·2
Chestnut (4.)	29·5	11·2	0·5	58·8	94·2	95·3	96·3	95·6
Ordinary solid quebracho (1.)	62·1	11·7	9·0	17·2	87·0	74·4	62·6	62·5
,, ,, ,, (2.)	67·2	9·6	8·1	15·1	87·2	77·5	68·3	59·7
Liquid quebracho (3.)	31·0	5·9	2·3	60·8	91·0	85·2	84·5	83·9
,, ,, (4.)	31·4	7·3	1·3	60·0	85·7	86·9	84·1	85·0
,, ,, (5.)	30·6	7·8	0·1	61·5	92·8	91·8	93·1	95·2
,, ,, (6.)	32·5	7·0	0·9	59·6	93·8	95·4	96·0	99·1
,, ,, (7.)	29·2	8·7	0·3	61·8	98·3	97·6	97·8	100·0
,, ,, (8.)	33·5	9·2	0·8	56·5	93·7	94·9	94·9	99·4
,, ,, (9.)	29·1	8·8	0·0	62·1	99·0	99·0	97·3	100·0
,, ,, (10.)	30·4	8·5	0·0	61·1	98·0	98·7	96·4	100·0
,, ,, (11.)	29·0	6·8	2·4	61·8	101·0	101·0	102·0	106·0
,, ,, (12.)	33·5	15·6	0·9	50·0	100·6	100·9	104·2	102·9
Pine (1.)	16·5	23·1	1·2	59·2	94·5	94·5	89·1	92·1
,, (2.)	14·2	17·4	2·5	65·9	90·9	78·9	76·8	77·5
Mallet	32·8	11·1	0·8	55·3	98·2	95·5	95·8	96·7
Mangrove	30·6	11·3	1·4	56·7	100·0	101·0	101·3	102·3
Mimosa	18·4	9·9	0·4	71·3	94·6	92·4	92·4	91·8
Myrobalans	18·2	16·7	3·6	61·5	90·1	86·8	86·8	91·2

It was expected that the solubility would decrease, and the separation of the difficultly-soluble tannins take place to a greater extent when infusions of increasing strength were employed, and although this actually occurs in many cases, the figures given above show that it is by no means an invariable rule. The authors specify four different cases:—(1). The available tannin value decreases from the weakest to the strongest infusions, in which group are included the non-treated quebracho extracts. (2). The available tannin is nearly the same at different strengths, being nearly 100 per cent. in the case of many chestnut and chemically treated quebracho extracts, and mangrove extract, but distinctly less in the case of oakwood, mallet and mimosa extracts, and for some chestnuts and treated quebracho extracts. (3). The available tannin increases with the strength of the infusion, in which class fall most chestnut and many treated quebracho extracts. (4). The available tannin first rises and then falls as the strength of the infusion is increased, myrobalans and many treated quebracho extracts falling in this group. From this it is clear that it is not merely the nature of the tanning material from which the tannin extract is made which influences the solubility of extracts, but also the nature of the treatment in the course of manufacture. In those cases where the solubility increases with the strength of the infusion, it is evident that the difficultly-soluble tannin is more easily soluble in concentrated solutions than in weak, and hence that it will be most profitable to employ such extracts for strong liquors. It is suggested that this new process will be chiefly useful in the case of new extracts and where a complete investigation of any one extract is desired.
—H. G. B.

Tannin analysis. J. Paessler. Collegium, 1908, 209—240, 241—243.

The commission of the German Section of the International Association of Leather Trades Chemists has investigated the new official method, and made comparisons with previously used methods. Their principal conclusions are now given. Dry chromed powder (Paessler's manufacture), when used in the shake method, gives the same non-tannin results as freshly chromed white powder, and lightly chromed powder may be kept for 2 years without causing an influence on the results. Hide powder freshly chromed with 2, 4, and 8 per cent. respectively of chromic chloride, gave high values for non-tannins. The nature of the shaking apparatus has no influence on the results, and the time of shaking is almost immaterial, if it lies between 5 and 20 minutes. Even in the shake method there is a certain amount of absorption of non-tannins by the hide powder. The extent of the difference in the results between the old and new methods was investigated for certain tanning materials. The influence of the method and extent of washing the powder was determined; concordant results could be obtained after a few washings.—H. G. B.

Artificial degras; Manufacture of ——. U. J. Thuau. Le Cuir, 1908 [2], 15—16; [3], 4—5; [4], 8—9.

Moellon-degras is the genuine degras obtained by alternately fulling hides or skins with cod oil and exposing them to oxidation by the air. The chemical transformation is completed by allowing the hides to heat in pile, turning occasionally. The hides are next thrown into a cauldron of boiling water, and the greater part of the residual fat is then wrung out. The remaining water and oil are squeezed out by a hydraulic press. The liquid product of these two operations is pure moellon, from which most of the water can be eliminated by decantation and heating. *Degras pure* is obtained by a further treatment of the hides after they leave the hydraulic press. They are soaked in a hot lye of potassium carbonate (2·5° B.) at 35° C. for one hour and then wrung out. The alkali is neutralised with a solution of dilute sulphuric acid which decomposes also any soap formed by the action of the potassium carbonate on the oil. This degras, after decantation, is reheated with superheated steam to remove the greater part of the water. *Degras of commerce* is made from moellon-degras and "degras pure" by admixture with various fish oils and animal fats, the former alone being insufficient to meet the demands of tanners. If the added fats or oils do not contain unsaponifiable matter, the mixture is very suitable for leather dressing. The constituent which is said to determine its value as a ready emulsifier and tanning agent, is "degragene" (oxidised fatty acids), and good French degras should contain 10—12 per cent. of degragene and about 20 per cent. of water. In England, where the hides are piled longer, a content of 20 per cent. of degragene is reached, but the oil has also abstracted nitrogenous matter from the hide, which gives it a syrupy consistency and less penetrating power, and hence commercial degras cannot be judged solely by its degragene content. The free fatty acids should not reach 25 per cent. (calculated on the anhydrous fatty matters) and there should not be more than 3 per cent. of unsaponifiable matter (mineral oils, resin oils, cholesterol, &c.). One process of manufacture is to boil 80 kilos. of pale fish oil for 1½ hours in a copper cauldron with 1 kilo. of caustic lime which has been slaked by a caustic soda solution of 25° B. The mixture is constantly agitated to avoid blackening from carbonisation. When clear, the liquid is strained through silk into a wooden vat. The residue is mixed with water at 35° C. and again strained into the vat, the contents of which are incessantly agitated until cold. After some days, 20—40 kilos. of degras are added with agitation. An intimate mixture of 80 kilos of refined "suintine," 30 kilos. of palm oil, and 20 kilos. of fish oil is made at 40° C. in the cauldron, and is then added to the contents of the vat with agitation. The whole is left to settle, and after several hours a good commercial degras is obtained. If the mass remains fluid, the water has been employed too hot. *Compound degras* may be classed between commercial and artificial degras. It contains a certain amount of pure moellon, but too little to curry leather perfectly. The principal components are fish oil, oleine, bone oil, and cottonseed oil, with resin oil, mineral oil, and rosin as adulterants. In one process, 25 kilos. of whale oil are heated to 80° C., and 800 grms. of slaked lime mixed with a little water are added and well mixed; next are added 50 kilos. of moellon, 20 kilos. of refined "suintine," 50 kilos. of palm oil, and 20 litres of water. The mixture is agitated until cold. *Degras for leather dressing* contains a considerable amount of tallow; it is somewhat difficult to attain a good mixing in its preparation. In one process, 50 kilos. of moellon degras and 120 kilos. of whale oil are heated for 2 hours at 80° C., filtered hot, and 50 litres of water and 600 grms. of ammonia added. Then 25 kilos. of tallow are melted in, with stirring, and the mixture is agitated until it is quite cool. *Artificial degras* contains no moellon or degras, but is made from certain oxidised oils and fats. The most common materials used for preparing this class of degras are "suintine," whale oil, and oleine. "Suintine," which is obtained by degreasing sheeps' wool with soap solution after it has been washed with water, readily emulsifies with water and does not easily oxidise and become rancid. Hence it is much used as a base for the preparation of artificial degras. In one method 40 kilos. of crude "suintine" and 20 kilos. of whale oil are heated for 2 hours at 80° C., and after filtration, 5 kilos. of tallow, 5 kilos. of mineral oil, and 25 kilos. of water are added and well mixed. Artificial degras with whale oil as base is made in the following manner. The whale oil is first oxidised,—in the Livaché process by means of finely divided lead,—in the German process by heating to 80° C. with 3 per cent. nitric acid, and afterwards neutralising with ammonia,—in another process by a current of air at 50° C. The artificial degras may then be prepared from 45 kilos. of the oxidised whale oil, 25 kilos. of refined "suintine," 4 kilos. of mineral oil, 4 kilos. of tallow, 2 kilos. of resin, and 20 kilos. of water. Another artificial degras is prepared by heating at 40° C. a mixture of cod liver oil and "suintine" with hydrogen peroxide, and agitating for several hours with compressed air at 2 atmospheres. The author states that these artificial products are of comparatively little value, their power of emulsifying with water being their sole recommendation for leather dressing.—H. G. B.

Leather; Analysis of ——. A. W. Hoppenstedt. J. Amer. Leather Chem. Assoc., 1908, **3**, 255—267.

The report of the committee of the Amer. Leather Chemists' Assoc. on leather analysis is given by its chairman. The methods for the determination of moisture, oil, ash, hide substance, glucose, and Epsom salts (magnesium sulphate) are stated to be satisfactory, but it is considered desirable that there should be further investigation of the determination of water-soluble matter, and a uniform method prescribed for the calculation of the combined tannin.—H. G. B.

Patents.

Casein [and sizing composition]; Manufacture of ——. H. V. Dunham, Bainbridge, N.Y., Assignor to Casein Co. of America, New York. U.S. Pat. 897,885, Sept. 8, 1908.

A compound of casein and hydrofluoric acid is obtained by heating milk, mixing it with commercial hydrofluoric acid in the proportion of 0·5—1 quart of acid to 1000 quarts of milk, and then separating the whey. Claim is also made for a sizing solution composed of about 94 per cent. of "caseinate of hydrofluoric acid" and 6 per cent. of borax, mixed with water.—A. S.

Tannin extracts; Processes for decolouring ——. C. Feuerlein, Feuerbach-Stuttgart, Germany. Eng. Pat. 25,182, Nov. 13, 1907.

See Fr. Pat. 383,890 of 1907; this J., 1908, 414.—T. F. B.

XV.—MANURES, &c.

Calcium cyanamide crude ("Kalkstickstoff"); Absorption of —— *in the soil.* H. Kappen. Landw. Vers.-Station, 1908, **68**, 301—331. Chem. Zentr., 1908, **2**, 818—819.

According to the author, calcium cyanamide in contact with cold water decomposes into calcium hydroxide and a less basic compound, $Ca(CN.NH_2)_2$. This latter can be obtained as doubly-refractive crystals by evaporating *in vacuo* concentrated solutions of crude calcium cyanamide. It is also obtained, mixed with crystals of dicyandiamide, on allowing solutions of cyanamide in which calcium hydroxide has been dissolved, to evaporate. From solutions of this compound and also of crude calcium cyanamide, even if evaporation be prevented and carbon dioxide excluded, there separate after one or more days, cyanamide and rhombic crystals of the compound, $CN.N(CaOH)_2+6H_2O$, very slightly soluble in water. On prolonged warming of solutions of crude calcium cyanamide at 40°—50° C., calcium hydroxide separates, and cyanamide or dicyandiamide is formed. The calcium cyanamino-carbonate produced when carbon dioxide is led into very concentrated solutions of crude calcium cyanamide, cannot be obtained from dilute solutions, but decomposes immediately into calcium carbonate and free cyanamide. Experiments on the decomposition of crude calcium cyanamide under the influence of absorptive substances, especially soils, gave the following results. Under the absorptive action of the soil, monobasic calcium cyanamide, $Ca(CN.NH_2)_2$, is decomposed into lime and cyanamide, the former of which is more readily absorbed by the soil than the latter. Cyanamide is also produced by the action of carbon dioxide. In soils of strong absorptive power, by the combined influence of the soil and of carbon dioxide, crude calcium cyanamide is rapidly converted into free cyanamide, which is more readily decomposed by bacteria than the strongly alkaline, monobasic calcium cyanamide, and is thus more easily rendered available as a plant food. In soils of weak absorptive power, the decomposition of the crude calcium cyanamide proceeds much more slowly, and germination and plant growth may be affected injuriously.—A. S.

Calcium carbide; Absorption of nitrogen by ——. [*Potassium carbonate as a catalyst*]. G. Pollacci. *See* VII.

Patent.

Fertilisers ["ammoniated superphosphate"]; Process of making ——. J. R. Young, Norfolk, Va. U.S. Pat. 897,695, Sept. 1, 1908.

"Ammoniated superphosphate" is made by thoroughly incorporating about 700 lb. of finely-ground bone phosphate with 600—800 lb. of the undried "press-cake" of refuse animal matter, containing 40—50 per cent. of moisture, and adding to the mixture about 700 lb. of strong sulphuric acid (preferably 66° B.); the mass is agitated until the action partially subsides, and is then allowed to set. Soluble calcium phosphate, calcium sulphate, ammonium sulphate, and sulphur dioxide are produced in the reaction.—F. Sodn.

XVI.—SUGAR, STARCH, GUM, &c.

Sugar ; Determination of —— in beetroot sugar products, and chiefly in rootlets and dried pulp. J. Robart. Bull. Assoc. Chim. Sucr. et Dist., 1908, **26**, 65—67.

The author recommends the following method for determining the sugar-content of dried rootlets and dried pulp :—The normal weight of a standard refined sugar, *i.e.*, the amount, which when dissolved and made up to 100 c.c., gives a solution polarising 100°, is determined. Half the normal weight of the sample to be analysed is introduced into a 200 c.c. flask, the same quantity of the sample together with the normal weight of the refined sugar being introduced into a second 200 c.c. flask. The solutions are clarified with basic lead acetate, made nearly up to volume, digested for an hour at about 85° C., cooled in a cold water-bath, and made up to exactly 200 c.c. The flasks are now stoppered, shaken, heated on the water-bath for 20 minutes, and then allowed to cool. Throughout these operations, the solutions must be frequently shaken. The cooled solutions are filtered, and polarised in 400 mm. tubes. The percentage of sugar in the sample is calculated as follows :—If the polarisation of the half normal weight of sample is say 24·8°, and that of the half normal weight of sample together with the normal weight of refined sugar is 127°, the polarisation of the refined sugar is $127-24\cdot8=102\cdot2°$; hence the volume occupied by the solution is $\frac{200\times100}{102\cdot2}=195\cdot7$ c.c., that occupied by the fibre and lead precipitate being $200-195\cdot7=4\cdot3$ c.c., and the true percentage of sugar in the sample is $\frac{(24\cdot8\times2)\times195\cdot7}{200}=48\cdot5$. —L. E.

Maple products ; Three new preliminary tests for ——. A. P. Sy. J. Amer. Chem. Soc., 1908, **30**, 1429—1431.

Colour test.—Fifteen c.c. of syrup, or 15 grms. of sugar with enough water to make 15 c.c., are treated, in a test-tube, with 3 c.c. of pure amyl alcohol and 1 c.c. of a 20 per cent. solution of phosphoric acid ; the whole is well mixed, and allowed to stand until the alcohol separates. With pure maple products, the alcoholic layer always shows a decided brown colour ; with adulterated samples, the colour varies from a very pale, to a light brown, according to the proportion of maple product ; cane products containing caramel give no colour. *Foam test.*—Five c.c. of syrup are treated, in a narrow tube graduated to 0·1 c.c., with 10 c.c. of water, the mixture is vigorously shaken for half a minute and allowed to stand for 10 minutes, the volume of the foam then being read. With pure, normal, maple products, the amount of foam is never less than 3 c.c., but it falls below this amount in the case of adulterated or mixed products. *Volume of basic lead acetate precipitate.*—The author recommends the following modified method :—Five c.c. of syrup, or 5 grms. of sugar with water to make 5 c.c., are treated, in a 25 c.c. measuring cylinder, with 10 c.c. of water and 2 c.c. of basic lead acetate, the whole is well mixed and allowed to stand for 20 hours, the volume of the settled precipitate then being read. For pure maple products this will be over 3 c.c., and usually, over 5 c.c. ; with adulterated products the volume is less.—L. E.

Organic non-sugar [*betaïne*] *; Technical utilisation of ——.* F. Ehrlich. Zentralbl. Zuckerind., 1908, **16**, 1271. Chem.-Zeit., 1908, **32**, Rep. 482.

Molasses contains up to 7 per cent., and vinasse from molasses up to 17 per cent. of betaïne, which can be readily separated by prolonged extraction with alcohol, and concentration of the alcoholic solution. From the resulting syrup, betaïne hydrochloride separates on addition of hydrochloric acid. The anhydrous hydrochloride is quite stable, but is completely hydrolysed in aqueous solution. In view of this, the salt has already been extensively used in medicine, under the name of "acidol," as a substitute for hydrochloric acid, and the author suggests that it would be useful as a standard substance for alkalimetry.—A. S.

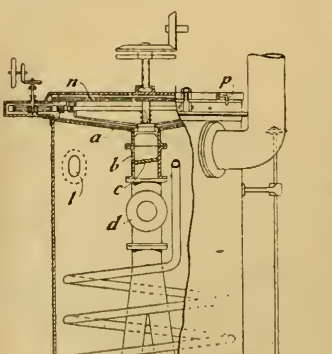
Enzyme in gums ; Nature of the soluble, hydrating ——. Volcy-Boucher. Bull. d. Sciences Pharmacol., 1908, **15**, 394—398. Chem. Zentr. 1908, **2**, 1048—1049.

The author examined about 30 different gums, gum-resins, gum-tannins, and resins for the presence of emulsin. All the products containing gum, with the exception of the kino of *Pterocarpus marsupium*, were found to contain a soluble enzyme capable of decomposing amygdalin. Soluble gums were more active than insoluble ones. The action of gum-resins was greater, the larger the content of soluble gum ; the gum-resins of *Araucaria* species were particularly active. Resins free from gum had no action on amygdalin ; gum-tannins acted only slowly. The inactivity of *Pterocarpus marsupium* kino is probably due to the high content of tannin, or to destruction of the enzyme by heating in the preparation of the commercial product. There appear to be other hydrating enzymes, besides emulsin, present in gums : moringa gum contains myrosin in addition to emulsin. —A. S.

Patents.

Sugar from beetroot and cane juices ; Process for extracting —— without formation of molasses. F. Hlavati. Fr. Pat. 389,378, April 6, 1908.

This process relates to the working up of sugar juice, which, on leaving the diffusion battery, has been treated with a sufficient quantity of a suitable sulphate (iron sulphate) to convert all alkali salts into sulphates. At the second defecation a quantity of sulphide (calcium sulphide) is added with the lime, so that during the subsequent saturation, the metallic oxide and pectin substances are precipitated. The filtered and concentrated juice is treated with so much ammonia that the calcium salts are subsequently precipitated during sulphitation. The juice is then filtered, concentrated, and centrifuged. The mother syrup resulting from the last operation is added to fresh juice, the whole being treated as before. When the mother syrup is sufficiently rich in alkali sulphates, the latter are separated by crystallisation, the mother liquor containing the remainder of the sugar being added to fresh juice.—L. E.



Sugar juice ; Combined saturator and filter for ——. O. Bönke. Ger. Pat. 199,429, Oct. 31, 1906.

The saturation-chamber is separated from the filter-chamber above by the impermeable partition, *a*, which is provided with a tube, *b*, extending down into the saturation-chamber. The lower part of this tube is branched, and communication between it and the filter-chamber can be cut off by means of a valve, *c*. The juice is introduced into the saturation-chamber through the tube, *c*, and the carbon dioxide or other gas is forced in at *d*, the valve, *c*, being closed. When saturation is complete, *d* is closed, *c* is opened, and steam or compressed air is introduced at *l*, forcing the saturated juice up through the tube, *b*, into the filter-chamber, and through the layer of filtering material, *n*, the filtered juice flowing out through the outlet, *p*. The material on the filter is removed by mechanically driven scrapers, and falls down through the tube, *b*, into the chamber, *h*, where it is compressed by means of the piston, *g*, and forced out through the door, *z*. The degree of compression is regulated by means of a weighted lever which operates against the door, *z*.—A. S.

XVII.—BREWING, WINES, SPIRITS, &c.

Malt; Respiration of ——, and the consequent loss of starch. E. Lühder. Z. Spiritusind., 1908, **31**, 401—403.

Two samples of barley and one of rye were used. Ten kilos. of each were steeped for 48 hours, lime-water being added to disinfect the grain. The pieces, being too small to be worked on a floor, were grown in boxes with perforated bottoms, at temperatures ranging from 54 to 64° F. The starch content of the raw grain and of the green malts after 8 and 18 days respectively was determined by Maercker's method. Owing to the difficulty of weighing a true sample of wet malt, all determinations were made on 250 corns and calculated on the known weight of 250 corns of raw grain. In the 8-day old malts the acrospire had reached the apex of the corns, while in that 18 days old, it was twice as long. The author finds that in 8 days growth the barleys lost 8·4 per cent. and the rye 5·4 per cent. of their starch, while in 18 days the losses had increased to 31 and 32 per cent. respectively. To decide whether the constant removal by diffusion through the perforations in the bottom of the malting boxes, of the carbon dioxide produced, had unduly stimulated the respiration of the grain, two pieces were worked for 20 days at 66° F. with one of the malting boxes placed in an outer case to retain the carbon dioxide. Both showed a loss of 48 per cent. of their starch. The author points out the error which is imported into distillery calculations by assuming the starch content of such "well-grown" malt as being the same as that of the raw barley.—R. L. S.

Malt analysis; determination of extract. II. H. A. Hunicke. J. Amer. Chem. Soc., 1908, **30**, 1431—1443. (See also this J., 1904, 1106.)

The author has shown by numerous experiments on the determination of malt extract, that in filtering the mash, the first portion of the filtrate is of considerably lower density than the later fractions. Frequent stirring during mashing, besides increasing the density of the whole filtrate, is a partial remedy for the non-uniformity of the fractions, but to reduce this error to a negligible amount, it was found necessary to dilute the hot mash with hot water. The author recommends the following method for determining extract:—Fifty grms. of malt are ground to finest powder if the maximum extract is required, or in the Seck mill set at 25 for the practical yield. The ground malt is caught in a copper beaker (500—600 c.c. capacity); 200 c.c. of water, at such a temperature that the mixture may be at 45° C., are added, the whole being heated in a water-bath, with regular stirring. With the apparatus used, the author found it preferable to give the charge a rotary motion (6 rotations every 5 minutes) by means of a thermometer serving as a stirring rod. After 30 minutes' digestion at 45° C., the temperature is allowed to rise 1° C. per minute until it reaches 70° C., at which point it is kept for 1 hour. Ten c.c. of mercuric chloride solution (of such concentration that the diluted wort may contain 0·002 per cent. of the salt) and 200 grms. of water at 70° C. are now added. (Mercuric chloride completely inhibits the action of diastase.) The whole is stirred during the addition of the water, which takes 10 minutes, and for 5 minutes longer. The mash is cooled and made up with cold water to 450 grms., vigorously stirred, and filtered. The first 150 c.c. of filtrate are returned to the filter, 300 c.c. being then collected for a specific gravity determination. The author considers that with a properly designed mechanical stirring apparatus, and electrically heated water-baths in which the water is made to circulate, the process is the best available. In some further experiments, he has shown that the grain residues retain a portion of the extract very tenaciously, and that the paper used for filtering the wort has a similar effect, though only to a slight extent. He has also confirmed an earlier observation made by himself to the effect that the smaller the amount of malt taken for analysis, the lower is the percentage of extract. His results indicate that the decreased yield is primarily due to the retarding effect of dilution on the diastatic action. —L. E.

Patents.

Alcohol, low wines, and raw or other spirits and the like; Apparatus for the distillation of ——. E. R. Royston, Liverpool. From Victoria Distillery Co., Hong Kong. Eng. Pat. 7479, April 4, 1908.

The apparatus consists essentially of a number of communicating cauldrons or stills, a distilling and rectifying column, and cooling and refrigerating vessels, with the necessary connections so arranged that the wash passes through the whole system of the vapour condensing and cooling parts of the apparatus for preheating it prior to its entry into the distilling column. The first cauldron is mounted above a furnace, and the second one, which is divided into two sections, in a flue communicating with the furnace. The rectifying column is disposed above the second cauldron. The wash flows from the supply tank to the lower end of the refrigerating column, up through the latter, and then through the wash or cooling cylinder, and in its passage through these vessels is heated by means of coils through which the vapours from the rectifying column pass in the opposite direction. From the cooling cylinder, the wash passes to the lower end of the rectifying column, whence it falls into the upper section of the second cauldron, flowing then in turn to the lower section of the latter and then to the first cauldron. The vapour from the first cauldron passes in turn through the lower and upper sections of the second cauldron on its way to the rectifying column, and then from the top of the column to the cooling and condensing coils. An auxiliary water-cooled condenser may be interposed between the refrigerating and cooling vessels.—A. S.

Rectifying column. E. G. Hager and A. Gebauer. Ger. Pat. 200,980, Nov. 5, 1907.

The column is provided with a number of plates in the usual manner, each of which is connected to the one next below by an overflow tube. The plates are arched and are arranged in pairs; the upper one of each pair extends on all sides to the wall of the column and is provided with a central opening for the vapour; the lower one has no opening, but does not extend to the wall of the column, thus leaving an annular passage for the vapour. The column is preferably mounted above a still filled with water, into which the crude spirit is introduced in the form of vapour.—A. S.

Wines and alcohols; Constant pressure filter for ——. F. P. Vidal and J. Sicard. Fr. Pat. 389,323, April 17, 1908.

The apparatus includes a wicker-lined, truncated, conical receiver, provided with a perforated, false bottom near the narrow end. The receiver contains a cylindrical wicker basket on which is mounted a plaited filtering membrane; one end of this membrane (that near the narrow end of the receiver) is tied up, and the open end of the bag-shaped filter thus formed is hermetically joined to the broad end of the receiver. A pipe, provided with a cock, passes through the broad end of the receiver and connects the filter with the reservoir containing the liquid to be filtered. This reservoir is connected to a pump by a pipe which, passing vertically downwards in the reservoir, is curved upwards at its lower extremity and has an enlarged orifice. The reservoir is provided with a valved discharge cock in order to maintain any constant pressure desired. The filtered liquor passes through the perforated false bottom of the receiver and thence to the collecting vessel. Any gas which accumulates in the receiver is allowed to escape from time to time by a cock at the top of the receiver.—L. E.

Alcoholic beverages; Process of partial purification and of rapid maturation of ——. A. Haeck. Fr. Pat. 389,333, Mar. 11, 1908.

The liquor is heated in a vessel under a pressure diminished to any desired extent, sufficient air being admitted to this vessel to carry over the vapour. The objectionable constituents which are volatilised, pass to a condenser, the condensed liquid being collected in a receiver.—L. E.

Spirits, especially cognac; Ageing and improving ——. P. Schlichting and S. Cohn. Ger. Pat. 200,395, Oct. 24, 1906.

The ageing of spirits is generally attributed to a gradual oxidation of the higher alcohols and aldehydes, and esterification of the acids formed. According to the present process, the spirit is subjected to the joint action of hydrogen peroxide, manganese peroxide, and powdered charcoal. The oxidation and esterification are stated to be completed in a few days, and the spirit is then filtered.—A. S.

Alcohol; Process of combined denaturalisation and carburation of ——. A. J. Durupt, Paris. Eng. Pat. 17,841, Aug. 6, 1907. Under Int. Conv., Aug. 8, 1906.

See Fr. Pat. 368,713 of 1906; this J., 1907, 29.—T. F. B.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, AND DISINFECTANTS.

(*A.*)—FOODS.

Cocoanut oil [and palm-kernel oil in butter] and lard; Detection of ——. G. Fendler. Arbb. aus dem. Pharm. Inst. d. Univ. Berlin, 1908. Chem. Zentr., 1908, 2, 911—912.

The author makes use of the high content of lauric and myristic acids in cocoanut and palm-kernel oils in order to detect the latter in butter and lard, by determining: (1), differences in the solubility of the non-volatile fatty acids in 60 per cent. (by vol.) alcohol; and (2), differences in the boiling points of the ethyl esters prepared from the fats. (1). After the determination of the Reichert-Meissl value, the residue in the distilling flask is dissolved in 50 c.c. of petroleum ether, and 25 c.c. of the solution are allowed to evaporate in a 200 c.c. flask in presence of 10 grms. of dry powdered pumice. 50 c.c. of alcohol of sp. gr. 0·9123 (at 15° C.) are then added, and the mixture allowed to stand for 1 hour at 15° C., with frequent agitation. 10 c.c. of the filtered solution are titrated with $N/10$-alkali, and the number of c.c. used, multiplied by 10, is called the "alcohol-solubility value." It amounts to 40—48 for butter, 14—18 for lard, 192·5—205 for cocoanut oil, and 188 for palm-kernel oil. (2). On fractional distillation of the ethyl esters prepared from the fat, the portion distilling between 240° and 300° C. will be larger, the greater the content of glycerides of lauric and myristic acids in the fat, that is the more cocoanut or palm-kernel oil there is present. 85 grms. of the melted fat are mixed with petroleum ether (40 c.c. in the case of butter or 60 c.c. for lard) and then with $N/1$ alcoholic alkali (70 c.c. for butter, 60 c.c. for lard); the mixture is shaken until it becomes clear and allowed to stand overnight. After addition of 100 c.c. of 99 per cent. alcohol and 200 c.c. of water, the petroleum ether solution of the esters is separated from the soap solution, washed repeatedly with alcohol and water, and the petroleum ether distilled off. The residual esters are then fractionally distilled, and the portion coming over below 300° C. (uncorr.) measured, the number of c.c. being termed the "distillate value." This amounts to 2·5—6·1, generally 3—4 for butter, 37—42 for cocoanut oil and palm-kernel oil, and 0·5—1·1 for lard.—A. S.

Lard and other fats; Determination of water in ——. K. Fischer and W. Schellens. Z. Untersuch. Nahr. Genussm., 1908, 16, 161—165.

It was found by Polenske (Arb. a. d. Kaiserl. Gesundheitsamte, 1907, 25, 505) that anhydrous lard dissolved about 0·45 per cent. of water at 96° C., and about 0·15 per cent. at 42° C., and that it was possible to determine the amount of water between these limits from the temperatures at which the melted filtered fat became turbid. In the authors' experiments with 5 samples of lard of different origin, the following results, in substantial agreement with Polenske's figures, were obtained:—

Water, per cent. . .	0·45	0·40	0·35	0·30	0·25	0·20	0·15
Average turbidity temperature, °C.	95·2	90·8	85·0	75·8	64·6	53·2	41·2

Polenske's method is therefore recommended as giving more accurate results in the determination of water in lard than the tedious official German method. Of the numerous samples of lard examined, few contained more water than 0·2 per cent., and none more than 0·3 per cent.; and the author therefore agrees with Polenske that lard should not show a turbidity temperature exceeding 75° C. The method is not applicable to the examination of tallows, for it was found that samples containing the same proportion of water showed widely discordant turbidity temperatures.—C. A. M.

Patents.

Food for cattle; Manufacture of ——. A. Zimmermann, London. Eng. Pat. 27,549, Dec. 13, 1907.

The saccharine fibrous product obtained by treating wood, moss-litter, etc., as described in Eng. Pats. 258 of 1900 and 12,588 of 1901 (this J., 1900, 1028; 1901, 1008), is extracted with hot water to remove the sugar, and the insoluble woody residue is dried until it contains about 20 per cent. of moisture. A portion of the extracted sugar is converted by fermentation into alcohol and removed by distillation. The residual unfermented saccharine and other organic substances are then concentrated to a syrup containing about 20 per cent. of water, which is added to the dried woody portion, and the mixture is incorporated with an equal weight of molasses. (See also this J., 1908, 826.)—W. P. S.

Flour; Process for the production of a digestible —— *from bran.* T. Schlüter, jun., Foerderstedt, Germany. U.S. Pat. 897,854, Sept. 1, 1908.

Bran is mixed with boiling water to a thin pulp, then heated quickly to a temperature of 100° C., dried at a temperature of about 70° C., and the solid mass obtained ground to a flour.—W. P. S.

Carbon dioxide gas [for aerated waters, etc.]; Process of producing sterilised —— *with disinfectant properties.* E. Bouchaud-Praceiq. Fr. Pat. 388,970, June 14, 1907.

Carbon dioxide gas, for aerating and purifying water, etc., is produced by adding a small quantity of water to the contents of a cartridge consisting of a mixture, in molecular proportions, of an alkali bicarbonate and a salt of a metal forming an insoluble carbonate, *e.g.*, gypsum or alabaster, to which is added a small quantity of salt, *e.g.*, an alkali peroxide, percarbonate, or perborate, which evolves oxygen and ozone when moistened. Before mixing, the alkali bicarbonate and other salts are sterilised by means of ozone; the gypsum, etc., is sterilised by heating. The cartridge is preferably made up in two envelopes, an inner one of gauze and an outer one of paraffined paper; the latter is removed before use.—A. G. L.

Butter substitute. A. G. Fabre. Fr. Pat. 389,093, Mar. 18, 1908.

To 75 parts of melted beef-fat are added 20 parts of milk and 5 parts of liquorice. The mixture is then worked, filtered, and poured into moulds.—W. P. S.

Milk; Process for drying ——. P. Plumey. Fr. Pat. 389,127, April 10, 1908.

The milk is evaporated under reduced pressure to the consistency of a paste, and then placed in a trough, from which a roller delivers it on to a second roller, which in turn deposits a film of the milk on to the surface of a third roller. The latter roller is heated internally by means of boiling water, which is introduced through a pipe passing through the axle and reaching nearly to the upper part of the roller. The dry film of milk is removed from the hot roller by means of a scraper. This second part of the drying process is carried out under atmospheric pressure. —W. P. S.

Liquids of all kinds, especially milk, blood, blood-serum, and other albumin solutions; Process for the concentration and drying of ——. W. Eichholz. Ger. Pat. 199.993. Aug. 16, 1907.

The liquid is saturated with compressed air and then injected, in a fine stream, into a vacuum chamber, which may be heated.—A. S.

Milk; Preservation of —— by removal of the oxygen contained in it. A. Flügge. Ger. Pat. 201,225, April 18, 1907.

The milk is treated with freshly-precipitated ferrous carbonate in the proportion of about 0·02 grm. per litre. Oxygen and sulphur compounds (hydrogen sulphide) are thus removed, and the iron oxide formed or the unaltered carbonate have, it is stated, no injurious action on the taste or quality of the milk.—A. S.

Food product; Nitrogenous ——. K. Okazaki, Assignor to H. Yenjo, Tokyo. U.S. Pat. 897,392, Sept. 1, 1908.

See Fr. Pat. 376,373 of 1907; this J., 1907, 1025.—T. F. B.

Coffee; Treatment of ——. J. F. Meyer, L. Roselius, and K. Wimmer, Bremen, Germany. U.S. Pat. 897,763, Sept. 1, 1908.

See Fr. Pat. 364,389 of 1906; this J., 1906, 903.—T. F. B.

Coffee; Preparation of ——. J. F. Meyer, L. Roselius, and K. Wimmer, Assignors to Kaffee-Handels Akt.-Ges., Bremen, Germany. U.S. Pat. 897,840, Sept. 1, 1908.

See Fr. Pat. 364,389 of 1906; this J., 1906, 903.—T. F. B.

Tea product and process of making same. J. F. Meyer and K. Wimmer, Bremen, Germany. U.S. Pat. 897,764, Sept. 1, 1908.

See Fr. Pat. 368,804 of 1906; this J., 1907, 30.—T. F. B.

Liquids; Process and means for treating —— to prevent their fermentation. E. W. Kuhn. Fr. Pat. 389,270, April 15, 1908. Under Int. Conv., April 16, 1907.

See Eng. Pat. 8823 of 1907; this J., 1908, 764.—T. F. B.

Alimentary preparations by means of cereals; Manufacture of ——. L. C. Reese. Fr. Pat. 389,656, April 27, 1908. Under Int. Conv., Jan. 22, 1908.

See Eng. Pat. 1528 of 1908; this J., 1908, 764.—T. F. B.

(*B.*)—SANITATION; WATER PURIFICATION.

Sewage sludge as a manure. Times, Sept. 28, 1908. [T.R.]

In the spring of 1905 the Board of Agriculture were approached by the Royal Commission on Sewage Disposal with the view of obtaining facilities for testing under practical conditions the value of various sewage sludges as manures for crops. The Board made arrangements with several experimental stations to carry out the tests, and the results of these have now been published as a Parliamentary Paper [Cd. 4286]. Seven different sludges have been tried on mangels and turnips, on hay, on grassland in ordinary farm conditions, and on wheat at the pot culture station of the Woburn Experimental Farm. The results have in no case justified the hope that sewage sludge is likely to be used extensively as a manure. All through the series of experiments there has been a strong similarity in the action of the various sludges, which, on the whole, have produced little effect on the crops, so that their manurial value is a very doubtful quantity, especially when applied to quick-growing crops.

Patents.

Water-purifying [clarifying] apparatus. F. Grimm, Halle, Germany. Eng. Pat. 7505, April 4, 1908.

The apparatus is intended for the removal of mud from water. It consists of a tank divided longitudinally into two portions; at the bottom of the two chambers thus formed, are provided a number of funnel-shaped depressions, each fitted with a discharge pipe connected to a main through which the mud is carried away. The water enters the tank at one end, after having passed through a sand-trap, and the mud is deposited in the funnels; baffle-plates placed above the funnels cause the lighter portions of the mud to settle quickly. The clarified water leaves the tank at the opposite end to the inlet. The mud collecting in the discharge pipes of the funnels is forced into the main pipe by means of compressed air, a travelling platform carrying pipes which fit into the funnels being provided for this purpose.—W. P. S.

Waste-waters containing cyanides and sulphocyanides; Process of freeing —— from poison. P. Goldberg, Assignor to Chem. Fabr. Flörsheim Dr. H. Noerdlinger, Flörsheim on the Maine, Germany. U.S. Pat. 897,735, Sept. 1, 1908.

The water is acidified and a current of hot air is blown through it in order to drive off the poisonous compounds present.—W. P. S.

(*C.*)—DISINFECTANTS.

Cresols; Disinfecting power of the three isomeric —— when mixed with soaps. H. Schneider. Arch. Hyg., 1908, **67**, 1—34. Chem. Zentr., 1908, **2**, 896.

Comparative experiments showed that in presence of a linseed oil soap rich in fatty acids, there is no notable difference in the bactericidal power of the three individual cresols, and that mixtures of the three isomerides act more uniformly and somewhat better than the individual compounds.—A. S.

Patents.

Fertiliser; Insecticide ——. F. G. Dokkenwadel. Fr. Pat. 389,720, April 29, 1908.

See U.S. Pat. 888,148 of 1908; this J., 1908, 635.—T. F. B

XIX.—PAPER, PASTEBOARD, &c.

Rag half-stuffs; Manufacture of commercial ——. W. Ebert. Papier-fabrikant, 1908, **6**, 1619—1622, 1677—1681, 1794—1798.

The enormous development of commercial half-stuffs made from wood and straw has created a demand for similar pulps prepared from rags. The idea that rags could only be worked successfully in the paper mill itself has been overcome with some difficulty, and this prejudice, together with the fact that the purchaser of rag pulps is more dependent on the integrity of the seller than the purchaser of raw rags, calls for the exercise of the greatest care on the part of the manufacturer of the half-stuff. Records should be kept at every stage of the process. Such records include the determination of the losses incidental to threshing, cutting, and dusting, records of the proportion and concentration of the alkali used for boiling each class of rag, the pressure and time of boiling, the loss of weight suffered in boiling, the time of washing, etc. The changes which take place in the composition of the alkaline liquor from hour to hour, during boiling, afford a valuable control of the suitability or otherwise of the conditions adopted. These changes may be conveniently followed by the method proposed by Stepanoff, which consists in determining the electrical conductivity of the lye at regular intervals of time. It is sometimes advantageous to wash the rags with hot water and soap in the rotary boiler before boiling; it is always best to wash them with hot water in the boiler after boiling, because the impurities are then in the most soluble condition and the rags are most receptive. Washing is completed in the breaking engine, and the end of the washing should always be controlled by testing with phenolphthalein, since any residual alkali may be the cause of serious irregularities in the subsequent bleaching process. The breaking operation is one of the most important of the whole series, as the half-stuff may easily be spoilt by beating too short or too "wet." This operation must be modified by experience, according to the strength and texture of the rags under treatment, and should be controlled by microscopic observations. It will be found convenient to run the washed and broken half-stuff over a "presse-pate" before bleaching, as this eliminates residual dissolved impurities, facilitates records of the losses due to washing and breaking, and permits the use of highly concentrated stuff in the bleaching engine. The statistics of the bleaching process should be carefully recorded, *i.e.*, proportion of fibre, concentration of chlorine, proportion of chlorine to fibre, alkalinity or acidity of mixture, temperature, time, decrease of chlorine strength during bleaching, increase of acidity, quantity of acid added, loss of fibre substance, etc. Electrolytic bleach liquor is better than bleaching powder, on account of the absence of alkalinity and the consequent non-necessity for the use of acid. The simultaneous action of acid and hypochlorite is a frequent cause of the formation of oxycellulose and subsequent yellowing of the pulp. Acidimetric determinations in the presence of bleach must be made after the addition of hydrogen peroxide and standard sodium hydroxide, using phenolphthalein as indicator. Samples of liquor may be drawn from the engine by fixing a piece of wire gauze over the mouth of a funnel, inserting it in the pulp and passing a pipette down the stem.—J. F. B.

Sulphite wood pulp digester; Explosion of a ——. [T.R.] Papier-Zeit., 1908, **33**, 2695.

ON June 28th at Kotka in Finland a sulphite wood pulp digester of 27 cb.m. capacity burst at a pressure of 9 atmospheres with disastrous results. The digester was designed for a working pressure of 10 atmospheres, but as a general rule had not been used at a higher pressure than 6—6·5 atmospheres. The rupture occurred along the welded seam connecting the cylindrical portion of the digester with the conical bottom; this latter portion remained in its place, but the rest of the boiler was blown through the roof to a distance of 175 metres from its original position. The cause of the explosion was readily traced to the deficient welding of the seam. The thickness of the plates was 22 mm., but along the seam which burst, the welding had only united to a depth of 3—5 mm. from the outside; on the inside the joint was not welded. Subsequent examination showed that several other boilers made by the same firm were defective at the same seam, although all the other seams were soundly welded. The makers explained that in the construction of the digester this was the last joint to be welded, and that, until recently, they found it extremely difficult to weld it on both sides; this difficulty has now been overcome. —J. F. B.

PATENTS.

Indurated fibre [paper]; Process for manufacturing ——. I. W. Marshall, Assignor to T. E. Marshall, Yorklyn, Del. U.S. Pat. 897,758, Sept. 1, 1908.

A NUMBER of sheets of vegetable paper possessing a soft and porous texture are independently treated with a solution of zinc chloride, and after the excess of solution has been removed, the sheets are pressed into intimate contact between two heated cylinders, the upper cylinder being maintained at a temperature twice as high as that of the lower one. The single sheet thus obtained is cooled in air and then passed through a series of water baths until all traces of zinc chloride have been removed. The sheet is then dried and finally passed between calendar rollers.—P. F. C.

Cellulose [acetylated] derivatives and their solutions; Preparation of ——. Knoll und Co. First Addition, dated April 16, 1908, to Fr. Pat. 376,578, April 10, 1907 (this J., 1907, 988).

IN the production of solutions of cellulose acetate by the action of a mixture of acetic anhydride, acetic acid, and sulphuric acid upon cellulose, the subsequent action of the contained sulphuric acid on the dissolved cellulose derivative is inhibited by the addition of a salt of nitric acid, *e.g.*, ammonium nitrate, equivalent to the quantity of sulphuric acid present. The latter acid is neutralised by the base of the nitrate, whilst the liberated nitric acid, exerts a bleaching action on the solution and combines with the cellulose to form a mixed ester.—J. F. B.

Alkali-cellulose xanthate; Preparation of powdered soluble ——. H. Lyncke, Berlin. Eng. Pat. 8023, April 10, 1908. Under Int, Conv., Sept. 21, 1907.

SEE Fr. Pat. 388,915 of 1908; this J., 1908, 956.—T. F. B.

Cellulose derivatives and their solutions; Manufacture of ——. G. W. Johnson, London. From Knoll und Co., Ludwigshafen on Rhine, Germany. Eng. Pat. 8727, April 21, 1908.

SEE Addition of April 16, 1908, to Fr. Pat. 376,578 of 1907; preceding.—T. F. B.

Viscose, etc.; Filaments from ——. U.S. Pat. 896,715. *See* V.

Viscose solutions free from sulphides; Preparation of —— Fr. Pat. 389,284. *See* V.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

Codeine; Characters of ——. D. B. Dott. Pharm. J., 1908, **81**, 108.

THE official B.P. characters and tests may, according to the author, be usefully corrected and amplified as follows:—Occurring in octahedral prisms. Solubility, in ether of sp. gr. 0·735, 1 : 30; in pure ether, nearly 1 : 50; in 90 per cent. alcohol, 1 : 1·6; in chloroform, approximately 1 : 1. Melting point, 156° C. A fragment warmed with sulphuric acid to which a minute particle of sodium arsenate is added, develops a strong blue colour.—J. O. B.

Kola; Chemistry of fresh ——. *Preparation of crystalline kolatin.* A. Goris. Ber. deutsch. pharm. Ges., 1908, **18**, 345—354.

KOLATIN, $C_8H_8O_4$, was prepared from sterilised kola nuts by a method previously described (this J., 1907, 713). When crystallised from water it melts at 148° C., and is optically inactive. It gives an emerald-green coloration with ferric chloride, changing to red on the addition of ammonia, or violet with sodium carbonate. It is faintly acid to litmus, and reduces Fehling's solution, and ammoniacal silver nitrate. It is precipitated by lead acetate, but not by albumin. Its physiological action has been examined.—F. SHDN.

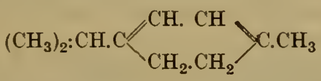
Terpenes and essential oils. 95th Communication. Alcohols of the terpinene series (terpinenols). O. Wallach. Annalen, 1908, **362**, 261—284.

THE active acid, $C_{10}H_{18}O_6$, melting at 206° C., obtained from trihydroxyterpane (this J., 1907, 1160) was oxidised at 60°—70° C. with potassium permanganate and sulphuric acid. On steam-distillation, a diketone, $C_8H_{14}O_2$, was obtained, which boiled at 211° C., had the sp. gr. 0·938 at 18° C., and $n_D = 1{\cdot}4305$ at 18° C. It is undoubtedly ω-dimethylacetonylacetone. The inactive acid, $C_{10}H_{18}O_6$, m. pt. 188°—189° C., obtained by the oxidation of trihydroxyterpane (*loc. cit.*), when oxidised in the same way as the above acid, yielded the same diketone. From these results, the above two acids melting at 206° and 188°—189° C. respectively are the active and inactive modifications of *αα'*-dihydroxy-*α*-methyl-*α'*-*iso*propyladipinic acid. The inactive acid, m. pt. 188°—189° C., was synthesised from ω-dimethylacetonylacetone (obtained by the oxidation of β-thujaketo-acid) in order to confirm its constitution. An unsaturated alcohol, $C_{10}H_{17}OH$, boiling at 208°—210° C., was isolated from the lower-boiling fractions of terpineol. This alcohol is terpinenol-

[$1\Delta_3(=\Delta_4)$-*p*-menthenol-(1)], and on oxidation gives 1.3.4-trihydroxyterpane, m. pt. 120°—121° C., which on further oxidation yields the active and inactive acids, $C_{10}H_{18}O_6$, melting at 206° and 188°—189° C. respectively. Sabinene hydrate, obtained from sabinaketone (this J., 1907, 1214), has $[\alpha]_D = +53·67°$ in ether, and the terpinenol-(4) obtained therefrom has $[\alpha]_D = +10·53°$ in the same solvent, and is identical with that obtained from the oils of cardamom and marjoram. Terpinenol-(1) can be made from sabinaketone (this J., 1908, 468). The author has found that when synthetic terpinenol-(1) is distilled at the ordinary pressure, it boils at about 215° C., loses water, and forms phellandrene. Sabinaketone was treated with *iso*propylmagnesium iodide, the mixture treated with ice-water, and distilled with steam. The di-*iso*propyl derivative obtained in this way is a tertiary alcohol, boiling at 102°—107° C. at 14 mm. When shaken with dilute sulphuric acid, it slowly takes up water, forming a terpin, m. pt. 139° C. The tertiary alcohol takes up hydrogen chloride to form a bihydrochloride, $C_{12}H_{22}Cl_2$, m. pt. 111°—112° C. The corresponding bibromide melts at 120°—121° C.—F. Shdn.

Terpenes and essential oils. 96th Communication. Terpinene and its modifications. O. Wallach. Annalen, 1908, **362**, 285—304.

Sabinaketone was treated with methylbromacetic acid and zinc in benzene solution. The product was heated with acetic anhydride and hydrolysed, when sabinaketolacetic acid was obtained, melting at 67°—68° C. On distillation the acid loses carbon dioxide and passes into *β*-terpinene. This hydrocarbon boils at 173°—174° C., has the sp. gr. 0·838—0·840 at 22° C., and $n_D = 1·4751—1·4754$ at 22° C. With hydrogen chloride it yields terpinene bihydrochloride. When treated with bromine, a tetrabromide, m. pt. 154°—155° C., is produced. *β*-Terpinene was shaken with oxygen and water in direct sunlight, when cuminaldehyde was formed. Terpinene bihydrochloride (m. pt. 52° C.) was converted into terpinene and oxidised at 0° C. by alkaline permanganate. The products of oxidation were an erythritol, $C_{10}H_{20}O_4$, melting at 237°—238° C., and inactive *αα′*-dihydroxy-*α*-methyl-*α′*-*iso*propyladipinic acid, melting at 189° C. Terpinene is therefore *α*-terpinene, and has the constitution :—



The terpinene prepared by the inversion of pinene, and the terpinene obtained by a series of reactions from sabinaketone, give the same products on oxidation as *α*-terpinene. When sabinene hydrate is made from sabinaketone, using an excess of methylmagnesium iodide, terpinene appears as a by-product.—F. Shdn.

Oil of sage ; Essential ——. T. F. Harvey. Chem. and Drug., 1908, **73**, 393.

The author gives the results of the analysis of four samples of Dalmatian and one sample of Spanish sage oil.

Source.	Rotation 100 mm. tube.	Solubility in 80 per cent. alcohol.	Acid value.	Ester value.	Total borneol, per cent.	n_D at 20° C.	Sp. gr.	Percentage by vol. distilling : below 170° C.	170°—200° C.	200°—220° C.
Dalmatia .	+12·45°	1 vol. and more	1·6	6·7	9·9	1·4626	0·9210	3	65	21
,,	+13·62°	,, ,,	2·2	6·9	9·5	1·4619	0·9229	3	63	22
,,	+ 9·93°	,, ,,	2·2	7·0	10·5	1·4618	0·9225	3	61	22
,,	+10·23°	,, ,,	1·3	8·5	14·8	1·4645	0·9253	2	55	31
Spain	+ 9·60°	2 vols.	0·6	17·2	15·2	1·4619	0·9053	13	64	10

Oils from different countries show considerable differences. Dalmatian oil is derived from *Salvia officinalis* and Syrian oil from *S. triloba*. The former may be taken as the type of ordinary sage oil, its characters, so far as they have been recorded, being :—Sp. gr. 0·915—0·930 ; optical rotation, +4° to +25° ; solubility in 80 per cent. alcohol, 1 in 1 vol. and more ; acid value, 1·3—2·2 ; ester value, 6·7—12·6 ; saponification value, 6—18 ; total borneol, 9·5—14·8 per cent. ; n_D at 20° C., 1·4618—1·4645. It distils chiefly between 170° and 220° C., and contains pinene, cineol, thujone, borneol, and possibly camphor.

—A. S.

Terpin ; Some reactions of ——. E. Isnard. Ann. Chim. analyt., 1908, **13**, 333—335.

Terpin (terpene dihydrate) crystallises in orthorhombic prisms, and is soluble in 200 parts of cold water and in 6·5 parts of alcohol. It melts at 104° C., and boils at 258° C. If the solid is treated with pure concentrated sulphuric acid on a watch-glass, a chrome-yellow colour is produced, changing to salmon-pink. If this mixture be treated with 10 per cent. caustic soda, the resinous odour produced by the acid becomes more pronounced and the colour disappears. Pure phosphoric acid brings about similar changes when the mixture is warmed. Nitric acid when added after the sulphuric acid, produces a yellow colour, followed by decolorisation and resinification. Terpin dissolves in nitric acid without coloration, and a drop of sulphuric acid added produces a red spot. Sulphuric acid added after ammonium nitromolybdate produces an indigo-blue colour; when added after chromic acid it gives a green colour changing to brown. The terpin when mixed with sulphuric acid and added to Koelbrunner's reagent (ferric chloride and potassium ferricyanide) causes an immediate blue precipitate. An alcoholic solution of terpin gives a blue coloration slowly changing to indigo-blue with a reagent formed by adding nitric and sulphuric acids to ammonium molybdate solution.—F. Shdn.

Guanidine salts [thiocyanate] ; Manufacture of ——. H. Laparre. Mém. poudres et salpêtres, **13**, 321. Z. ges. Schiess. u. Sprengstoffw., 1908, 3, 250—251.

The production of guanidine thiocyanate by heating the corresponding ammonium salt is accompanied by the formation of hydrogen sulphide, which, unless removed, reacts with some of the undecomposed ammonium thiocyanate to form carbon bisulphide and other sulphur compounds. This can be prevented by employing a current of air to carry away the hydrogen sulphide during the operation. The ammonium salt is heated in a vessel of enamelled iron, the temperature being quickly raised to 180° C. and the supply of air so regulated that no odour of carbon bisulphide is detected ; in the course of an hour the temperature is allowed to reach 190° C. and in two hours, 200° C. ; the mass is then maintained at 205° C. and samples are tested every 15 minutes with Nessler's solution (containing 50 grms. of potassium iodide per litre), until the reagent gives a pale lemon-yellow precipitate, when the operation is stopped. A greenish-white crystalline mass of guanidine thiocyanate is thus obtained, which, after one crystallisation, is quite pure. The advantages claimed for this method of carrying out the process over that hitherto adopted are : (1), a yield of 60 per cent. on the ammonium salt used, as compared with one of 35 per cent. ; (2), an increased speed of reaction, consequent on the higher temperature employed, the period of heating lasting only 5—6 hours ; (3), the possibility of following the course of the reaction ; (4), the absence of noxious gases.

—F. Sodn.

Esters ; Purification of ——. I. K. and M. A. Phelps and E. A. Eddy. Amer. J. Sci., 1908, **26**, 253—256.

A quantity of the pure diethyl ester of succinic, malonic, or benzoic acid was mixed with small quantities of the corresponding free acid, some hydrochloric or sulphuric acid, and absolute alcohol. The mixture was treated with an excess of dry potassium carbonate, and the whole heated to about 100° C. under diminished pressure for an hour, when the temperature was raised and the liquid products distilled off. On fractionating the distillate under reduced pressure, almost the whole of the ester was recovered in a pure condition, showing that this method can be used to determine the ester formed in a reaction where the products are similar to those described above.—F. Shdn.

Ester formation; Influence of catalytic agents in ——. (1). *Esterification of cyanacetic acid.* I. K. Phelps and E. W. Tillotson, jun. Amer. J. Sci., 1908, **26**, 264—266. (2). *Hydrobromic acid and zinc bromide in the formation of ethyl benzoate.* I. K. and M. A. Phelps and E. A. Eddy. *Ibid.*, 281—289. (3). *Effect of certain sulphates on benzoic and succinic acids.* I. K. Phelps, H. E. Palmer, and R. Smillie, *Ibid.*, 290—295. (4). *Esterification of benzoic acid with certain chlorides.* I. K. and M. A. Phelps and E. A. Eddy. *Ibid.*, 296—300.

(1). Cyanacetic acid was mixed with absolute alcohol alone or charged with dry hydrochloric acid gas in order to form the ester, and either zinc chloride or sulphuric acid was added as a catalyser. Several experiments were carried through in which these conditions were varied. The ester may be obtained in theoretical amount when sulphuric acid is used as a catalyser under proper conditions. (2). The esterification of benzoic acid was studied under varied conditions of time, temperature, and weight of reacting materials. Zinc bromide and hydrobromic acid were used as catalysers, and the results compared with those obtained when hydrochloric acid was used. The best conditions for the formation of a given organic acid ester have to be ascertained by experiments. The best conditions for the formation of ethyl chloride or ethyl bromide are not the best for the formation of other esters. (3). The effect of various acid sulphates on the formation of the esters of succinic and benzoic acids has been studied by the authors. The acid sulphates of potassium, ammonium, sodium, pyridine, and aniline were used for this purpose. The authors find that none of the acid sulphates, when present in amounts of equal concentration of "acid hydrogen," is as efficient as sulphuric acid in catalytic effect, although acid sodium sulphate is nearly so. Of the other salts mentioned, the acid sulphates of pyridine and aniline are least effective, and the potassium salt is not so good as the ammonium salt. (4). The effect of various metallic chlorides on the formation of ethyl benzoate from benzoic acid and ethyl alcohol was examined by the authors. They find that the catalytic action is specific and individual for each chloride. Of the salts tried, zinc chloride, cupric chloride, and stannic chloride gave the best results, followed by bismuth chloride, antimony trichloride, and mercuric chloride.—F. Shdn.

Radium; Preparation of —— from pitchblende. H. Paweck. Z. Elektrochem., 1908, **14**, 619—623.

The author gives a detailed table showing the preparation of radium chloride as it is being carried out at the recently erected works in Joachimsthal. The uranium ore is first picked by hand, ground to a fine powder and roasted with 15 per cent. of sodium carbonate and 2 per cent. of sodium nitrate. The product is ground and washed with water, then treated with concentrated sulphuric acid and a little nitric acid, washed out with water, and the solution containing uranyl sulphate worked up for uranium pigments, whilst the residue forms the starting point for the preparation of radium. This is dried in the air, digested with dilute caustic soda, the residue washed and treated with dilute hydrochloric acid (the liquid contains most of the polonium and actinium), then washed with water and boiled with sodium carbonate solution for 10 hours. In this way the greater part of the impurities (iron, aluminium, calcium, silicon, lead, etc.) is removed and the sulphates of radium and barium converted into the carbonates. The residue is washed free from sodium sulphate and digested with pure dilute hydrochloric acid. The filtrate contains part of the radium and the residue is twice subjected to the above treatment with sodium carbonate, washing, and digestion with hydrochloric acid, whereby two more filtrates containing radium are obtained. The three filtrates are united and filtered from the lead chloride which separates out on standing. The liquid is now treated with dilute sulphuric acid, the precipitated crude sulphate boiled with concentrated sodium carbonate solution, and the residue of carbonates and undecomposed sulphates washed and added to pure dilute hydrochloric acid. The liquid, after removal of lead by means of hydrogen sulphide, is evaporated to dryness and digested with concentrated hydrochloric acid, which dissolves calcium and strontium chlorides and leaves a residue of barium and radium chlorides. A further quantity of crude chloride is obtained from the undecomposed sulphate by removing lead chloride with hot water and converting the sulphate into chloride by the above process. The crude radium chloride is now freed from barium chloride by fractional crystallisation, the latter being the more soluble. Up to May 30, 1908, the first portion of the crude sulphate had been produced.
—J. C. C.

Organic non-sugar [betaine]; Technical utilisation of ——. F. Ehrlich. *See* XVI.

Holland; Duty-free admission of certain chemicals into ——. Board of Trade J., Sept. 24, 1908. [T.R.]

A Dutch Royal Decree, dated 11th August, provides that the under-mentioned articles may be exempted from Customs duty, provided that they are imported into the Netherlands for use as auxiliaries in factories or industrial establishments, and that certain conditions set out in the Decree are complied with:

Sulphuric ether, for use in the manufacture of incandescent gas mantles, the preparation of photographic paper, exhausting air, the manufacture of cocaine, smokeless powder, and imitation gold leaf, and the chemical washing of textiles.

Amyl acetate, for use in the manufacture of varnishes.

Acetic ether, for use in the manufacture of smokeless powder and the chemical washing of textiles.

Butyl chloride and *butylxylol*, for use in the manufacture of artificial musk.

Collodion, for use in the preparation of photographic paper, the manufacture of whale-bone, and of incandescent gas mantles.

"*Massé*," in pieces weighing not more than 50 grammes, for the strengthening of yarns.

Paraffin oil, for use in the manufacture of quinine.

Zapon lacquer.

Patents.

Compounds for internal use; Production of ——. H. Belart, Huddersfield. Eng. Pat. 9246, April 29, 1908. Under Int. Conv., June 15, 1907.

Aqueous solutions of eugenol or *iso*-eugenol are mixed with albumin, and the product is washed, dried, and heated to 115°—120° C. The compounds are for use in the treatment of tuberculosis.—T. F. B.

Camphor; Process and apparatus for the manufacture of synthetic —— and recovery of the by-products. A. Sauvage. Fr. Pat. 389,092, Mar. 16, 1908.

The various processes and apparatus comprised in this specification relate to:—(1). The production of dry hydrogen chloride by heating aqueous hydrochloric acid in jacketed stoneware vessels at 100° C. The gas is further dried by concentrated sulphuric acid in coke towers and cooled to a very low temperature. (2). The production of pinene hydrochloride by the projection of a very fine spray of dry turpentine oil into an atmosphere of hydrogen chloride, the whole apparatus being cooled to a very low temperature. (3). The separation of the liquid hydrochloride from the solid hydrochloride, by washing the product with a saturated alcoholic solution of the solid hydrochloride. (4). Conversion of the pinene hydrochloride into camphene by treatment in an autoclave with twice its weight of alcohol, containing sodium hydroxide equivalent to the chlorine. (5). The separation of the camphene and the sodium chloride from the alcohol by diluting the latter to a density of 76°—78° Tr., floating off the supernatant camphene and removing the salt by sedimentation, the separation being assisted by intense refrigeration. (6) Systematic washing of the salt and recovery of the alcohol. (7). Rectification of the alcohol and preparation of alcoholic sodium hydroxide therefrom. (8). Oxidation of the camphene by means of a per-salt of potassium and sulphuric acid, the acid being introduced gradually into the middle of the mass.—J. F. B.

Borneols: Bromo-isovaleric esters of ——. Chem. Fabr. vorm. E. Schering. Fr. Pat. 389,327, Feb. 20, 1908. Under Int. Conv., Feb. 22, 1907.

Esters of borneol or *iso*borneol with bromo-*iso*valeric acid are prepared in any of the following ways:—(1), By heating borneol or *iso*borneol with the anhydride or with a halide of bromo-*iso*valeric acid; (2), by heating the borneols with bromo-*iso*valeric acid in the presence of a suitable condensing agent, such as sulphuric acid, zinc chloride or hydrogen chloride; (3), by the bromination of the *iso*valeric ester of borneol or *iso*borneol; (4), by heating bromo-*iso*valeric acid with camphene in presence of a condensing agent, such as zinc chloride; in this case only the *iso*bornyl ester is obtained.—J. F. B.

Mixtures of artificial perfumes, containing ionone; Process for the preparation of ——. P. Coulin. Ger. Pat. 199,550, June 6, 1906.

The mixture of aldehydes obtained by the action of acids on the unstable disulphonic acid of dihydrocitral, and subsequent addition of alkali, is condensed with acetone in the presence of an alkaline substance, and the condensation product is treated with acid. The final product has an odour resembling that of roses and irone.—A. S.

Oxalic acid from materials containing cellulose; Process for preparing ——. A. Droste. Ger. Pat. 199,583, June 2, 1906.

Materials containing cellulose are oxidised by means of permanganates or manganates in solutions of sodium hydroxide or carbonate of specific gravity 1·04 to 1·1. The yields of oxalic acid are higher than those obtained by heating cellulose with caustic potash, the process being carried out at a much lower temperature, and little oxidation of the oxalic acid occurring.—T. F. B.

Thio-compounds from fatty aldehydes, sodium thiosulphate, and acids; Process for preparing ——. L. Vanino. Ger. Pat. 199,757, April 11, 1907.

Fatty thio-compounds are obtained by the action of sodium thiosulphate and acids on aldehydes in concentrated aqueous solutions. Trithioformaldehyde is obtained in the cold from formaldehyde and sodium thiosulphate in presence of hydrochloric acid.—T. F. B.

α-Bromoisovalerylquinine; Process for preparing ——. Knoll und Co. Ger. Pat. 200,063, April 27, 1907.

α-Bromoisovalerylquinine, which is said to be of therapeutic value, is obtained by the action of α-bromo-*iso*valeryl chloride or bromide on quinine or a quinine salt.—T. F. B.

Condensation products from halogenated phenols, formaldehyde, and ammonia; Process for preparing —— *insoluble in water, soluble in organic solvents.* F. Hoffmann-La Roche und Co. Ger. Pat. 200,064, March 9, 1907.

Halogenated phenols are treated with aqueous solutions of ammonia and formaldehyde, and after the reaction is finished, the mixture is evaporated to dryness, and the residue purified by solution and re-precipitation. The products are applicable as antiseptics.—T. F. B.

p-Dimethylaminophenylarsinic acid; Process for preparing ——. A. Michaelis. Ger. Pat. 200,065, July 21, 1907.

Quantitative yields of *p*-dimethylaminophenylarsinic acid are said to be obtained from *p*-dimethylanilinearsenious oxide, $(CH_3)_2N.C_6H_4.AsO$, by oxidation with hydrogen peroxide in alkaline solution.—T. F. B.

Methylethyl ketone; Process for preparing basic compounds from ——. W. Traube. Ger. Pat. 200,203, May 22, 1906.

Basic compounds, suitable for pharmaceutical purposes, are obtained by treating with acids in presence of alcohol, the product resulting from the action of ammonia on methylethyl ketone.—T. F. B.

Pharmaceutical compounds [Acylsalicylic anhydrides]; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 22,627, Oct. 14, 1907.

See Fr. Pat. 388,167 of 1908; this J., 1908, 917.—T. F. B.

Tartaric acid; Process of making ——. J. McDougall, Greenwich Park. U.S. Pat. 898,253, Sept. 8, 1908.

See Eng. Pat. 4613 of 1907; this J., 1907, 1215.—T. F. B.

Proteids with bismuth iodide; Process of manufacturing compounds of ——. A. Busch, Brunswick, Germany. U.S. Pat. 898,311, Sept. 8, 1908.

See Eng. Pat. 17,169 of 1906; this J., 1907, 343.—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Patents.

Photographic plates or films; Iso- or orthochromatic ——. T. MacWalter, High Barnet. Eng. Pat. 17,453, July 30, 1907.

In order that the plate may act as its own isochromatic screen, tartrazine is dissolved in the emulsion, for example 25 c.c. of a 2·5 per cent. aqueous solution of the dyestuff to each litre of emulsion.—T. F. B.

Non-actinic screens for photographic and like purposes. X. Jeannet and E. Mauvillin, Paris. Eng. Pat. 8368, April 15, 1908. Under Int. Conv., April 20, 1907.

Substitutes for "non-actinic" glass are obtained by precipitating in a colloid solution a "non-actinic" salt in a fine state of division, and shaping the colloid as required. For instance, 10 c.c. of a 10 per cent. solution of lead nitrate are mixed with a hot, aqueous, 10 per cent. solution of gelatin; 10 c.c. of a 10 per cent. solution of potassium bichromate are then slowly added, and the excess of soluble salts washed out: the emulsion is heated on a water-bath at about 45° C., filtered, and formed into the desired shape.—T. F. B.

Cupric bromide intensifier in stable, powdery form; Preparation of a ——. Akt.-Ges. f. Anilinfabr. Ger. Pat. 201,168, Aug. 31, 1907.

By mixing anhydrous cupric sulphate in powder with powdered sodium or potassium bromide, a stable product is obtained, which, when dissolved in water, forms a cupric bromide intensifier. It is best to use more than one mol. of copper sulphate to two mols. of bromide.—T. F. B.

XXII.—EXPLOSIVES, MATCHES, &c.

Explosion; Circumstances attending an —— which occurred in a cartridge hut at the factory of Messrs. Curtis's and Harvey, Ltd., at Cliffe, Kent, on June 5, 1908. Major A. Cooper-Key, H.M. Chief Inspector of Explosives. [Cd. 4295.]

Two work girls were engaged in filling paper cartridge wrappers with No. 1 dynamite, composed of nitroglycerin (75 per cent.) and kieselguhr (25 per cent.). They were using what is known as a "dynamite pump." It was found on trying a similar machine to the one involved in the accident, that a slight lateral pressure on the plunger so far diverted it from the "true," that it would foul the rim of the socket on the downward stroke, the result being a severe glancing blow on a film of nitroglycerin between two brass surfaces. It was also found that the kieselguhr contained a large proportion of sand, and that there were in this sand a number of irregularly shaped hard fragments of what appeared to be granite or quartz, some not less than 1/10 inch across. The inspector considers that there were present beyond all reasonable doubt fragments of quartz or granite of a size quite sufficient to divert the plunger to the extent necessary to cause it to strike the socket a glancing blow. Had previous recommendations made in regard to accidents in other factories caused by similar "pumps" been carried out, and had the kieselguhr been sifted through a 30-mesh sieve instead of a 12-mesh, as was the practice, the explosion might not have happened.—G. W. McD.

Explosion of detonators; Circumstances attending an —— at the factory of the Patent Electric Shot Firing Co., Newbold, Derbyshire, on June 29, 1908. Captain H. Coningham, H.M. Inspector of Explosives. [Cd. 4293.]

THE explosion occurred whilst some work girls were employed in the operation of attaching fuses to detonators. The actual cause of the accident appears to have been due to a small quantity of composition adhering to the interior side of a detonator, and the friction caused in trying to remove the jammed detonator exploded this detonator and communicated the explosion to the other detonators. The cause of the fuse jamming when placed in the detonator may have been due to the adherent composition. In order to prevent future accidents of a similar nature, the company in question have decided to purchase detonators of a different manufacture and adopt a different process in the attachment of the fuse. —G. W. McD.

Coal dust experiments. [T.R.] *See* II.

PATENTS.

Explosive or blasting agent for blasting rock or the like. W. Eberle, Ettlingen, Germany. Eng. Pat. 15,195, July 17, 1908.

THE explosive consists of potassium nitrate (12), sulphur (3), charcoal (1), and horse dung (1 part).—G. W. McD.

Explosives; Process of preserving ——. J. Ortiz, Greenville, Del., Assignor to the E. I. du Pont de Nemours Powder Co., Wilmington, Del. U.S. Pat. 897,923, Sept. 8, 1908.

THE explosive is enclosed in an air-tight compartment, the air in the compartment is displaced by previously dried air, and the dry air is then rarefied.—G. W. McD.

Solvent naphtha; Process of nitrating ——. G. Schulz, Munich, Germany. U.S. Pat. 898,144, Sept. 8, 1908.

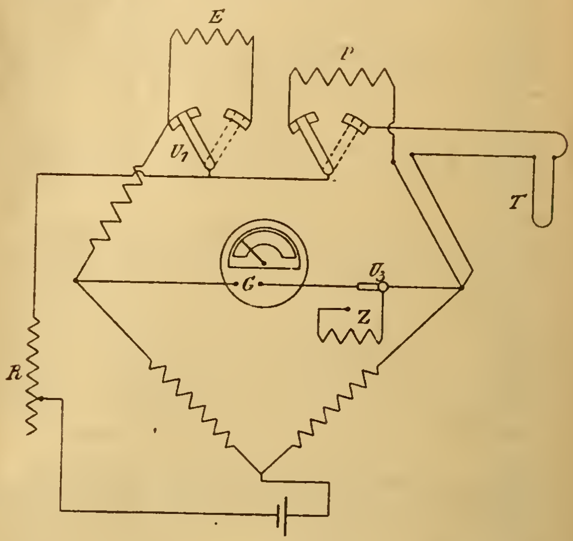
SEE Eng. Pat. 19,565 of 1907; this J., 1908, 421.—T. F. B.

XXIII.—ANALYTICAL CHEMISTRY.

APPARATUS.

PATENTS.

Thermometers; Electric resistance ——. J. Y. Johnson, London. From W. C. Heraeus, Hanau-on-the-Maine, Germany. Eng. Pat. 27,569, Dec. 13, 1907.



THE claim is for the use of additional resistances as indicated in the diagram. By means of the resistance, E, which can be thrown into the circuit by the switch, U_1, the zero point can be altered. The sensitiveness of the galvanometer, G, and consequently of the thermometer, T, can be increased by putting in the resistance, Z, by means of the switch, U_3. The accuracy of the thermometer can be checked by substituting for the thermometer, T, the resistance, P, which has a definite resistance, equal to that of the thermometer for a definite temperature. When current from a central station is employed, a constant potential is obtained by connecting a polarisation-cell in parallel with the bridge, R. The cell itself is connected in series with iron resistances.—W. H. C.

Gases; Apparatus for the automatic analysis of —— *and for recording the results.* M. C. Brenot. Fr. Pat. 389,498, April 22, 1908.

THE apparatus described refers more particularly to the automatic determination of oxygen or carbon dioxide in the gases resulting from various combustion processes. It consists of:—(1), an aspirating arrangement; (2), a vessel for measuring off a definite volume of gas for analysis; (3), an absorbing vessel, containing an appropriate reagent; (4), a vessel for receiving the residual gas; (5), a recording instrument; (6), a system of three-way taps, controlled electrically, for establishing the requisite connections at the proper time. The special features are:—(*a*), the three-way "taps," each of which consists of a closed glass trough having three tubulures, and capable of moving about a horizontal axis, in such a way that the tubulure at one end or the other is always closed by mercury; by means of electro-magnets, operating alternately, under each end of the trough, this can be swung into either of the two positions of stability; (*b*), the receiving bell for the residual gas, and its trough, the shape of which, in vertical section, forms the arc of a circle; the centre of this circle constitutes the fulcrum of a lever, to one arm of which the bell is attached, so that, as gas enters the bell, this rises in a circular path and actuates the recording pen; accuracy of working and reduced friction are claimed for this arrangement. Very little current is consumed in working the apparatus, since the electric circuits are broken as soon as each movement is effected.—F. SODN.

Gas mixtures ; Apparatus for the analysis of ——. W. S. Hubbard, Leicester. U.S. Pat. 897,900, Sept. 8, 1908.

See Eng. Pat. 19,513 of 1906 : this J., 1907, 1110.—T. F. B.

INORGANIC—QUANTITATIVE.

Ferric oxide ; Chemically pure ——, *as standard substance for the volumetric determination of iron in hydrochloric acid solution.* L. Brandt. Chem.-Zeit., 1908, 32, 812—814, 830—832, 840—843, 851—853.

The author confirms the statement that a given amount of iron requires, when titrated in hydrochloric solution according to Reinhardt, more permanganate than when titrated in sulphuric acid solution, and finds that, within limits wider than are ever likely to be reached in ordinary practice by different operators, the amount of stannous chloride in excess used in the reduction (and hence also of mercurous chloride present) does not affect the amount of this difference. Accordingly, no method of standardising the permanganate solution in which sulphuric acid is used, is trustworthy for determinations of iron in ores, and a standard substance of rigorously definite composition is required, which can be dissolved in hydrochloric acid and titrated in exactly the same way as an ore. Metallic iron is unsuitable, not only because of the carbon it contains, but also because of a possible content of copper, chromium, and other metals, the behaviour of which with permanganate is irregular. Electrolytic iron is too troublesome to prepare, and unless refined by a second deposition may contain occluded hydrogen and even carbon. Ferrous-ammonium sulphate is not only liable to alter in composition by efflorescence or atmospheric oxidation, but may under certain circumstances produce nitric acid during the oxidation of its solution, and hence hydroxylamine during the subsequent reduction. Oxalates give for the most part uncertain results, though the author has found Sörensen's pure sodium oxalate to behave similarly to iron in the matter of the difference between titration in sulphuric acid solution and titration by Reinhardt's method, and the substance could very well be used to standardise a permanganate solution accurately, with sulphuric acid, and this permanganate solution be then used for Reinhardt titrations, having determined, by titrating a pure iron solution in both ways, what the difference to be subtracted from the Reinhardt result was, under the actual working conditions. The author, however, prefers to use pure ferric oxide as standard substance, and prepares it as follows :—Metallic iron (which should be chosen free from zinc and cobalt) is dissolved in hydrochloric acid, the hot solution treated with hydrogen sulphide and filtered, and the precipitate oxidised by means of nitric acid. The liquid is evaporated to dryness twice with concentrated hydrochloric acid, and the residue taken up with dilute hydrochloric acid. It is now, in presence of a large amount of hydrochloric acid, shaken in a separating funnel with several successive quantities of ether, till all the ferric chloride has been dissolved out. The united ethereal solutions are filtered, the ether is evaporated or distilled off, and the residue is evaporated several times in a porcelain dish with nitric acid, finally with addition of ammonium nitrate. The residue separates cleanly from the porcelain ; it is powdered in a porcelain mortar, ignited at a gentle heat in a platinum dish, in quantities of 40—50 grms. at a time, then repeatedly mixed with ammonium carbonate, and again, stirring frequently, brought gradually to a red heat and kept at that temperature till constant in weight. Prepared in this way, the oxide is perfectly free from other metallic oxides, contains no nitrate (as shown by diphenylamine), and no ferrous oxide, for it gives the same value in titration as the oxide prepared from it by solution, treatment with nitric acid, and precipitation by ammonia. The standardisation with this oxide is carried out in exactly the same way as the titration of an ore. The author dissolves 1 grm. of ore in 50 c.c. of strong hydrochloric acid, and if much evaporation has occurred, makes up to the original volume with acid of sp. gr. 1·1. With ores not wholly soluble, 5 grms. are treated with acid and filtered, and the washed residue is evaporated with sulphuric and hydrofluoric acids, then dissolved in hydrochloric acid and the solution added to the main solution. The whole is then made up to a known bulk, and an aliquot portion taken for titration.—J. T. D.

Organic non-sugar [betaïne] ; Technical utilisation of ——. F. Ehrlich. *See* XVI.

ORGANIC—QUALITATIVE.

Naphthoresorcinol as a reagent for some aldehyde- and keto-acids. J. A. Mandel and C. Neuberg. Biochem. Zeits., 1908, 13, 148—151.

The reaction with naphthoresorcinol and fuming hydrochloric acid is not characteristic of glucuronic acid and its derivatives as stated by Tollens (this J., 1908, 716). It was given by a large number of aldehyde- and keto-acids examined by the authors.—A. S.

Maple products ; Three new preliminary tests for ——. A. P. Sy. *See* XVI.

Cocoanut oil [and palm-kernel oil in butter] and lard ; Detection of ——. G. Fendler. *See* XVIII*A*.

Terpin ; Some reactions of ——. E. Isnard. *See* XX.

ORGANIC—QUANTITATIVE.

Rubber goods ; Direct determination of the mineral constituents in ——. F. Frank and E. Marckwald. *See* XIII*C*.

Solubility of tanning extracts ; Determination of ——. J. Paessler and T. Veit. *Sec* XIV.

Tannin analysis ; Report of the German section's commission on ——. J. Paessler. *See* XIV.

Leather ; Analysis of ——. A. W. Hoppenstedt. *See* XIV.

Sugar ; Determination of —— *in beetroot sugar products, and chiefly in rootlets and dried pulp.* J. Robart. *See* XVI.

Malt analysis ; determination of extract II. H. A. Hunicke. *See* XVII.

Lard and other fats ; Determination of water in ——. K. Fischer and W. Schellens. *See* XVIII*A*.

New Books.

Mines and Quarries : General Report and Statistics for 1907. Part II.—Labour. [Cd. 4,305.] Wyman and Sons, Fetter Lane, E.C. Price 9d.

This publication contains a general report and statistics relating to persons employed and accidents at mines and quarries in the United Kingdom, and to the enforcement of the Mines and Quarries Acts.

According to these statistics the total number of persons employed at mines and at the quarries under the Quarries Act in the United Kingdom and the Isle of Man during the year 1907 was 1,060,034, of whom 972,220 were employed in or about mines, and 87,814 in or about quarries. Compared with the preceding year, there is an increase of 59,644 persons employed at mines. In 1907, 1,283 separate fatal accidents occurred in or about mines and quarries, causing the loss of 1,368 lives, showing an increase of 93 in the number of fatal accidents and of 93 in the number of lives lost, as compared with 1906.

Report of the Royal Commission on Sewage Disposal. Appendix No. 8. [Cd. 4286.] Wyman and Sons, Fetter Lane, E.C. Price 3d. (See page 995.)

Patent List.

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

Applications.

19,264. Act.-Ges. f. Kohlendestillation, and Holbeck. Regenerative furnaces.* Sept. 14.

19.347. Skinner. Machinery for mixing or agitating liquids. [Addition to No. 21,160 of 1906.]* Sept. 15.

19,373. Koniges. Furnaces.* Sept. 15.

19,525. Smith. Continuous kiln. Sept. 17.

19,668. Hommel, and Metals Extraction Corporation, Ltd. Liquid distributers for absorbing towers. Sept. 18.

19,960. Knowles and Ankers. Apparatus for the manufacture of crystals. Sept. 23.

19,999. Foucar and Joselin. Still-heads. Sept. 23.

20,113. Black and Lennox. Apparatus for evaporating water from impure liquid, for washing smoke and for condensing gases. Sept. 24.

20,204. Black and Lennox. Machine for drying briquettes of coal, peat, etc., salt, chemicals, sand, and other wet materials. Sept. 25.

Complete Specifications Accepted.

20,349 (1907). Soc. l'Air Liquide. *See under* VII.

20,697 (1907). De Ferranti. Conducting gaseous endothermic reactions. Sept. 23.

23,330 (1907). Peat and Bonin. Apparatus for subjecting gases to the action of liquids. Sept. 30.

26,619 (1907). Carmichael and Morrow. Apparatus for heating, cooling, evaporating, or condensing. Sept. 23.

1108 (1908). Sprenger. Heating and drying chambers. Sept. 30.

1168 (1908). Schmatolla. Furnaces, kilns, etc. Sept. 13.

9868 (1908). Cantenot. Apparatus for the continuous evaporation of saline solutions. Sept. 30.

11.062 (1908). Payne. *See under* IX.

13,013 (1908). Watson. *See under* XVII.

II.—FUEL, GAS, AND LIGHT.

Applications.

19,311. Siemens und Halske A.-G. Manufacture of incandescence bodies of tungsten. [Ger. Appl., Sept. 26, 1907.]* Sept. 14.

19,337. Graf and Jarrett. Manufacture of combustible smokeless and odourless gas. Sept. 15.

19,363. Pettibone. Manufacture of gas.* Sept. 15.

19,659. Thompson (Von Inwald). Manufacture of incandescent filaments for electric lamps.* Sept. 18.

19,847. Glühlampenwerk Anker. Preventing the disintegration into fine dust of electric incandescence filaments in a vacuum. [Ger. Appl., Oct. 3, 1907.]* Sept. 22.

19,928. Barth. Manufacture of fuel for internal combustion engines. [Ger. Appl., Aug. 6, 1908.]* Sept. 22.

19,932. Siemens und Halske A.-G. Manufacture of filaments for electric incandescence lamps from tungsten or its alloys. [Ger. Appl., Sept. 26, 1907.]* Sept. 22.

20,014. Lake (International Gas Development Co.). Manufacture of gas.* Sept. 23.

Complete Specifications Accepted.

10,305 (1907). Dunnachie. Recovery of ammonia and other by-products from the gases of furnaces, retorts, coke ovens, &c. Sept. 30.

20,352 (1907). Tonkin and Puplett. Gas producer plants. Sept. 23.

20,718 (1907). Lynde. Apparatus for producing gas for illuminating, heating, or power purposes. Sept. 23.

22,561 (1907). Hense. Manufacture of liquid combustible. Sept. 30.

25,435 (1907). Poulain. Combustible or carburetting liquids for internal combustion engines. Sept. 23.

25,896 (1907). Lewis and Briggs. Suction gas producer plant. Sept. 23.

8508 (1908). Dunal and Masse. Treatment of coke. Sept. 30.

12,809 (1908). Otto-Hilgenstock Coke Oven Co. (Otto und Co.). Removing tar from the hot gases of coke ovens, gas retorts, etc. Sept. 23.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

Application.

19,271. De Fazi and Claussen. Deodorising naphtha, petroleum, and other mineral oils. Sept. 14.

IV.—COLOURING MATTERS AND DYESTUFFS.

Applications.

19,563. Ges. f. Chem. Industrie in Basel. Manufacture of a halogen derivative of indigo. [Fr. Appl., Nov. 11, 1907. Addition to No. 10,326 of 1907.]* Sept. 17.

19,641. Newton (Bayer und Co.). Manufacture of alizarin. Sept. 18.

19,793. Ges. f. Chem. Industrie in Basel. Manufacture of chlorinated derivatives of indigo. [Addition to No. 9546 of 1907.]* Sept. 21.

20,003. Basler Chem. Fabr. Manufacture of vat dyestuffs. [Ger. Appl., Oct. 17, 1907. Addition to No. 344 of 1908.]* Sept. 23.

20,094. Imray (Soc. Chem. Ind. in Basle). Manufacture of sulphurised vat dyestuffs of the anthracene series.* Sept. 24.

Complete Specifications Accepted.

21,109 (1907). Ellis (Chem. Fabr. vorm. Sandoz). Manufacture of colouring matters of the gallocyanine series. Sept. 30.

22,967 (1907). Bloxam (Act.-Ges. f. Anilinfabr.). Manufacture of sulphurised dyestuffs. Sept. 30.

28,493 (1907). Newton (Bayer und Co.). Manufacture of an anthracene dyestuff. Sept. 30.

553 (1908). Newton (Bayer und Co.). Manufacture of leuco derivatives of the gallocyanine series. Sept. 30.

5589 (1908). Meister, Lucius, und Brüning. Manufacture of red vat dyestuffs. Sept. 30.

10,096 (1908). Act.-Ges. f. Anilinfabr. Manufacture of polyazo dyestuffs with aid of *p*-aminophenylarsinic acid. Sept. 30.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

Applications.

19,276. Chandelon. Apparatus for the manufacture of glossy artificial threads.* Sept. 14.

19,310. Imray (Soc. Chem. Ind. in Basle). Producing in printing blue-violet to lilac coloured tints fast to washing and light.* Sept. 14.

20,047. Mueller and Roberts. Dyeing machines for textiles. Sept. 23.

20,173. Raw and Orr. Treatment of fibrous substances. Sept. 25.

20,200. Johnson (Kalle und Co.). Production of discharge effects on textile fibres or fabrics. Sept. 25.

20,264. Martyn and Gill. Treating and waterproofing loosely woven fabrics. Sept. 26.

Complete Specifications Accepted.

21,405 (1907). Courtauld and Co., and Wilson. Manufacture of threads, filaments, strips, or films of cellulose. Sept. 30.

22,788 (1907). Hunt and Moscrop. Kiers for boiling, bleaching, and otherwise treating textile materials. Sept. 23.

2876 (1908). Venter. Purifying and clarifying the soda lye rendered impure by the mercerisation process. Sept. 30.

5595 (1908). Courtauld and Co., and Wilson. Manufacture of threads, filaments, strips, or films of cellulose. Sept. 30.

VII.—ACIDS, ALKALIS, AND SALTS.

Applications.

19,302. Malcolm and Munton. Treatment of brine. Sept. 14.

19,369. Eastwick. Treatment of waste hydrated sulphate of lime.* Sept. 15.

19,402. Hurford. Obtaining free nitrogen from atmospheric air.* Sept. 15.

19,528. Ashworth. Production of reducing agents. Sept. 17.

19,656. Schulthess. Method and apparatus for slaking lime.* Sept. 18.

19,738. Loesekann. Manufacture of artificial cryolite from fluorspar. Sept. 19.

20,102. Thom and Pryor. Manufacture of lime and carbonic acid gas. Sept. 24.

20,171. Erste Oesterr. Sodafabr., and Opl. Manufacture of sulphuric acid.* Sept. 25.

20,198. Willcox (Badische Anilin und Soda Fabrik). Manufacture of solid hydrosulphites. [Addition to No. 19,762 of 1899.]* Sept. 25.

20,199. Johnson (Badische Anilin und Soda Fabrik). Manufacture of stable anhydrous hydrosulphites. [Addition to No. 10,771 of 1907.]* Sept. 25.

20,204. Black and Lennox. *See under* I.

Complete Specifications Accepted.

10,305 (1907). Black and Lennox. *See under* I.

20,349 (1907). Soc. l'Air Liquide. Separation of the constituents of gaseous mixtures, particularly of air. Sept. 23.

20,648 (1907). Hartenstein. Apparatus for manufacturing carbide. Sept. 23.

23,217 (1907). Johnson (Verein Chem. Fabriken). Manufacture of a reduction product from sodium sulphate. Sept. 23.

23,794 (1907). Gossage and Sons, and Weissmüller. Manufacture of silicates of soda and potash. Sept. 23.

2382 (1908). Kaesmacher. Separation and concentration of acids. Sept. 23.

2678 (1908). Herrenschmidt. Separation of metalloids from compounds with alkali metals, alkaline earth metals, earth metals, rare and aluminous earths. Sept. 23.

2719 (1908). Feld. Treatment of sulphur dioxide and sulphuretted hydrogen to obtain sulphur. Sept. 30.

2876 (1908). Venter. *See under* V.

4761 (1908). Rademacher. Manufacture of a zinc salt of formaldehyde-sulphoxylic acid. Sept. 30.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Complete Specifications Accepted.

6230 (1908). Barnett. Cement for use in the manufacture of artificial stone. Sept. 23.

11,062 (1908). Payne. Manufacture of firebricks, crucibles, retorts, etc. Sept. 23.

X.—METALS AND METALLURGY.

Applications.

19,314. Bernard and Sanna. Apparatus for treating fine mineral matters.* Sept. 14.

19,356. McCarty. Metallurgical furnaces.* Sept. 15.

19,380. Howard and Hadley. Treating the fumes of spelter furnaces. Sept. 15.

19,413. Robbins and Macready. Alloy. Sept. 16.

19,585. Usine de Desargentation. Eliminating lead, arsenic, and antimony from copper matte and ores, and simultaneously recovering copper as metal. [Ger. Appl., May 6, 1908.]* Sept. 17.

19,667. Hommel, and Metals Extraction Corporation, Ltd. Furnaces for volatile metals. Sept. 18.

19,882. Angel. Treatment and reduction of complex sulphide and other ores. Sept. 22.

Complete Specifications Accepted.

13,689 (1907). Mrazsek. Soldering aluminium and its alloys. Sept. 23.

20,377 (1907). Herrenschmidt. Extraction of alloys of metals and metalloids with boron from ores or compounds. Sept. 23.

21,335 (1907). Crawford. Manufacture of alloys of steel. Sept. 30.

21,428 (1907). Thomlinson. Consolidating flue dust or fine ore, etc., containing iron, manganese, etc., for use in making iron or steel. Sept. 30.

24,612 (1907). Viel. Production of aluminium. Sept. 30.

25,357 (1907). Rosalt. Extraction of metals from ores. Sept. 30.

3480 (1908). Westman. Reduction of arsenical ores. Sept. 23.

3680 (1908). Hiorth. Reduction of ores, principally iron ores. Sept. 23.

5413 (1908). Roe. Puddling furnaces. Sept. 30.

5506 (1908). Debus and Debus. Crucible furnaces. Sept. 30.

11,605 (1908). Classen und Co. Manufacture of soldering flux. Sept. 23.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

Application.

19,265. Marsh. Electric furnaces. [U.S. Appl., Sept. 19, 1907.]* Sept. 14.

Complete Specifications Accepted.

1344 (1908). Salzer. Manufacture of electrolytic depositions of chromium. Sept. 30.

1420 (1908). Chloride Electrical Storage Co., and Heap. Treatment of wood for use in electric batteries and electrolytic cells. Sept. 30.

4940 (1908). D'Várad and Meislinger-Meszlényi. Production of positive storage battery plates. Sept. 23.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES INDIA-RUBBER, Etc.

(*A.*)—Pigments, Paints.

Applications.

19,588. Elam. Copying ink.* Sept. 17.

20,174. Everett and Cooper. Manufacture of printing ink. Sept. 25.

Complete Specifications Accepted.

20,379 (1907). Herrenschmidt. Manufacture of coatings for painting. Sept. 23.

8688 (1908). Bezzant and Bezzant. Making machine ruler's inks, etc. Sept. 23.

(*B.*)—Resins, Varnishes.

Application.

19,833. Pellnitz. Production of resinous turpentine oil from pine oil. [Ger. Appl., Sept. 20, 1907.]* Sept. 21.

(*C.*)—India-Rubber.

Applications.

19,593. Blum and Carpenter. Manufacture of artificial Para rubber. Sept. 17.

20,030. Gottschalk and Lilley. Synthetic production of indiarubber. Sept. 23.

Complete Specification Accepted.

23,031 (1907). Perkin, and Whipp Bros. and Todd, Ltd. Manufacture of an elastic or resilient material. Sept. 30.

XV.—MANURES, Etc.

Application.

19,902. Lake (American Bacteria-ized Fertiliser Co.). Fertilisers.* Sept. 22.

Complete Specification Accepted.

9694 (1908). Halvorsen, and Norsk Hydro-Elektrisk Kvaelstofaktieselskab. Manufacture of fertilisers. Sept. 23.

XVI.—SUGAR, STARCH, GUM, Etc.

Application.

19,726. Klopfer. *See under* XVIII.*A*.

XVII.—BREWING, WINES, SPIRITS, Etc.

Applications.

19,346. Epstein. Treatment of the residue of distillers, brewers, vinegar makers, etc. Sept. 15.

19,348. Carroll. Distilling spirits. Sept. 15.

20,086. Rogerson. Treatment of beer with a view to its sterilisation and the precipitation of albumen. Sept. 24.

Complete Specification Accepted.

13,013 (1908). Watson. Apparatus for drying brewers' and other by-products and other moisture laden substances. Sept. 30.

XVIII.—FOODS; SANITATION, WATER PURIFICATION; AND DISINFECTANTS.

(*A*.)—Foods.

Applications.

19,246. Evans and Bibby. Manufacture of feeding cake. Sept. 14.

19,455. Rousseau. Colloidal cream and its manufacture. [Fr. Appl., Sept. 20, 1907.]* Sept. 16.

19,542. Mislin. Utilisation of the waste products of milled or ground cereals. Sept. 17.

19,684. Schwartz and Schwartz. Manufacture of aerated beverages. Sept. 19.

19,726. Klopfer. Recovery of starch and gluten from wheat flour. [Ger. Appl., Oct. 4, 1907.]* Sept. 19.

Complete Specification Accepted.

6179 (1908). Wulfing and Fischer. Obtaining a pure, neutral sodium salt of lactalbumen soluble in water. Sept. 30.

(*B*.)—Sanitation; Water Purification.

Application.

19,648. Lajoie. Apparatus for purifying water. [Fr. Appl., Oct. 24, 1907.]* Sept. 18.

Complete Specification Accepted.

21,566 (1907). Thomson, and Oxychlorides, Ltd. Treatment of sewage. Sept. 30.

XIX.—PAPER, PASTEBOARD, Etc.

Complete Specification Accepted.

21,405 (1907) and 5595 (1908). Courtauld and Co., and Wilson. *See under* V.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

Application.

20,050. Heitkorn. Manufacture of camphor. [Comprised in No. 11,248 of 1908.]* Sept. 23

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Applications.

19,297. Boult (Neue Photographische Ges.). Manufacture of pigment pictures.* Sept. 14.

20,111. Soc. Anon. des Plaques et Papiers Photographiques A. Lumière et ses fils. Screen or plate for direct colour photography. [Fr. Appl., Oct. 21, 1907.]* Sept. 24.

Complete Specifications Accepted.

22,244 (1907). Lees. Treatment of the films of photographic negatives, etc. Sept. 30.

23,812 (1907). Child. Colour photography. Sept. 23.

XXII.—EXPLOSIVES, MATCHES, Etc.

Applications.

19,334. Holmes. Explosive compounds. [U.S. Appl., Dec. 28, 1907.]* Sept. 15.

20,214. Palmer. Explosives.* Sept. 25.

20,279. Bawden. Explosives.* Sept. 26.

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I.—PLANT, APPARATUS, AND MACHINERY.

Congress of the Refrigerating Industries. Times Eng. Suppl., Oct. 14 and 21, 1908. [T.R.]

THE first International Congress of the Refrigerating Industries was opened at Paris on Oct. 5. One section was devoted to low temperatures and their general effects; the next dealt with refrigerating machinery and cold storage; the third related to the cooling of food; the fourth to the utilisation of cold in various industries; the fifth to the use of low temperatures for trade and transportation; and the sixth to the consideration of legislation on this subject. Among the papers read were "Liquefaction of Helium" by Prof. Kammerlingh Onnes of Leyden, "Liquid Air Machines" by Mr. G. Claude, "Heat Insulation" by M. Bost, "Thermal Units" by M. Leblanc, and "Rotary Compressing Machines" by the Abbé Audriffen.

The Congress devoted much time to considering the action of cold on articles of food. The services of refrigeration in brewing are well known, and Dr. Haas and Mr. Pini have shown that, in hot countries, chilling the must of wine during fermentation might possess great advantage. Mr. Heiss of Staubing, Bavaria, gave a paper on the equipment of refrigerated slaughter-houses, and the transportation of refrigerated produce received much attention. On the industrial side, M. de Goes of the Dyle and Bacalan Co. explained the use of intense cold on the manufacture of smokeless powders, Mr. Gayley read a note on drying air by refrigeration for blast furnaces at the Carnegie Steelworks at Pittsburg, Mr. Guiselin described its use in the extraction of paraffin, and M. Bianchi of Florence described its use for keeping humidity constant in the manufacture of matches free from phosphorus. The next Congress will take place in 1910 at Vienna.

Iron; Influence of silicon on the physical and chemical properties of ——. A. Jouve. *See* X.

PATENTS.

Grading or classifying pulverulent or comminuted materials; Machines for ——. A. R. Robertson, Glasgow. Eng. Pat. 19,736, Sept. 4, 1907.

THE material to be graded is fed into the annular space between two concentric conical drums having corrugated or roughened faces and mounted on a vertical shaft. Water or any other suitable liquid is fed into the interior of the inner drum, issues in jets through openings in its conical surface, and plays upon the material. Both drums are rotated at a high speed in the same direction, but one at a slightly higher speed than the other, so that they have relatively a slow rotation in opposite directions. The graded materials are delivered from the lower edge of the cone into as many stationary concentric troughs as there are grades of material.—W. H. C.

Centrifugal drying machines actuated by fluid pressure. J. W. and W. A. Macfarlane, Renfrew, N.B. Eng. Pat. 20,177, Sept. 10, 1907.

IN an installation of several centrifugal machines driven by water from a steam-driven pump, the speed of which is automatically regulated by the water pressure, the speed will reach minimum conditions when the machines are worked in regular rotation. The minimum conditions of speed of the pump are maintained either by interlocking the valves of the different machines, or, by limiting the flow of liquid from the pump and using check devices on the machines. The delivery pipe of the pump may be constricted and valves placed on the machines which automatically close when the water pressure falls.—J. W. H.

Desiccating; Process of and apparatus for ——. C. K. Mills, London. From D. R. Hendricks, New York. Eng. Pat. 25,436, Nov. 16, 1907.

THE liquid or solution to be dried, is sprayed into a vertical cylinder into the lower part of which heated air is introduced, in sufficient quantity to complete the desiccation. The air is kept in whirling motion in the cylinder by means of a fan wheel and is withdrawn by means of a fan or blower, through a pipe extending through the centre of the top to within a short distance from the bottom. The air laden with the dry particles is delivered by the blower in a horizontal direction into a polygonal conical separator. The latter is provided with inwardly projecting vertical vanes which form dead air spaces, through which the solids fall to the bottom of the cone, whence they are withdrawn through a rotating air lock. The air, carrying with it the lighter particles of solid matter, leaves the separator through a central vertical pipe extending downwards into the vessel, and is delivered into a second separator where it is caused to pass through a liquid spray which arrests the remaining particles. Either water or a portion of the original liquid may be used for the purpose, and when sufficiently saturated, it is returned to the front end of the apparatus and submitted to the desiccation process, for the recovery of the solid particles it has taken up.—W. H. C.

Furnaces. F. Dahl, Bruckhausen on the Rhine, Germany. Eng. Pat. 21,103, Sept. 23, 1907.

THE air used for combustion in the furnace is preheated by being made to pass through passages arranged on the covering arch. For this purpose a portion of the arch, preferably the back portion, is made of metal provided with tubes, ribs, or corrugations.—J. W. H.

Filter and strainer: Mechanical rotary or revolving —— *for separating solids and suspended matters of all kinds from their accompanying fluids.* L. Jones, London. Eng. Pat. 27,674, Dec. 16, 1907.

A SERIES of buckets, which may if desired be perforated, so as to act as strainers, are arranged radially around the periphery of an annular rotary straining drum mounted on an axis. The liquid to be filtered, is delivered into the buckets in a regulated stream and causes them and the strainer to rotate. The liquid passes through the perforated buckets and through the perforated outer wall of the strainer into a suitable receptacle, and the solids are discharged from the buckets, as they successively attain the highest position, into a hopper fixed within the space enclosed by the annular strainer and provided with a discharge pipe.—W. H. C.

Boiler scale; Method of removing ——. Sauerstofffabrik Berlin, Ges. m.b.H., Berlin. Eng. Pat. 7836, April 8, 1908. Under Int. Conv., April 12, 1907.

THE incrustation is heated with the flame of an oxyhydrogen blowpipe, whereupon it is said to "jump off."—J. W. H.

Distilling apparatus and method of distillation. A. de Focatiis, New Orleans, La. U.S. Pat. 898,861, Sept. 15, 1908.

THE apparatus consists of a boiler or still surmounted by a fractionating column. The claim is for the provision of a heater, external to the column, situated at about half its height above the still and heated by a steam coil. The liquid flowing down the column is withdrawn, circulated through the heater and returned to the column at substantially the same point from which it was withdrawn. —W. H. C.

Condensation of vapours; Process for the fractional ——. L. Löwenstein, Vienna. U.S. Pat. 898,980, Sept. 15, 1908.

THE mixture of liquids is distilled under reduced pressure and the mixed vapours are passed through a condenser, the jacket of which is filled with a liquid having a boiling point equal to that of the constituent it is desired to separate. The liquid in the jacket is exposed to the same degree of reduced pressure as the mixture being distilled, and is heated to boiling by those vapours in the mixture which have a higher boiling point, the vapours being condensed. Hence, only that constituent which has the same boiling point as the liquid in the jacket passes on to another cooler and is condensed separately.—W. H. C.

Distilling apparatus. Dampfkessel- und Gasometerfabr. A.-G. vorm. A. Wilke und Co. Ger. Pat. 200.929, Sept. 6, 1907.

A PIPE leads from the still to the lowest compartment of a rectifying column. The partitions in the rectifying column have each two openings, of which one serves, as usual, as a means of communication between adjacent compartments, whilst through the other passes a pipe extending through the column, and leading to a condenser. The ordinary outlet pipe in the roof of the column leads to the same or to a separate condenser. In the lowest compartment of the column is a pivoted lever, carrying a cap at either end, so adjusted that each cap can close one of the openings in the partition, whilst the other opening is left free. By this arrangement the vapours from the still can, at will, be either passed in turn through the different compartments of the rectifying column, or passed directly to the condenser through the pipe extending through the column. —A. S.

Separation of the solid and liquid constituents of fluid masses, such as mineral slimes or mud; Process and apparatus for ——. H. G. Nichols. Fr. Pat. 389,706, April 28, 1908. Under Int. Conv., Feb. 4, 1908.

THE invention consists in facilitating the separation by removing the solids, as soon as they are deposited, from the bottom of the settling vessel by means of an endless travelling band or other suitable device. The clear liquid is removed at a point as near to the inlet as possible. —W. H. C.

Concentration of solutions by freezing and the separation of the soluble matter from the crystals of ice. E. Monti. Fr. Pat. 390,085, May 9, 1908.

THE claim is for improvements in the process and apparatus described in Fr. Pats. 324,474 of 1902 and 357,770 of 1905 (this J., 1903, 567; 1906, 113). To reduce the cost of construction of the apparatus, the cooled brine is circulated through horizontal pipes embedded in the wooden or concrete walls of the freezing chamber and connected with vertical distribution boxes at either end. The frozen mass is systematically watered or sprayed from above by a solution contained in a closed vessel, suspended from rails fixed above the freezing tank. The liquid is forced through perforations (partially or completely closed as desired), in the bottom of the closed vessel by the aid of an inert gas under pressure.—W. H. C.

Crystallisation in motion; Process and apparatus for ——. L. Laessig. Ger. Pat. 200,533, March 24, 1907.

PLATES or trays are arranged cascade-fashion in a vertical column, and the liquid under treatment enters at the top and flows down from one plate or tray to the next. The crystals produced collect on a screen or sieve in the lower part of the column and are continuously removed by a conveyor working just above the screen.—A. S.

Furnaces, kilns. etc. E. Schmatolla, Berlin. Eng. Pat. 1168, Jan. 17, 1908.

SEE Fr. Pat. 386,694 of 1908; this J., 1908, 740.—T. F. B.

Extraction apparatus. L. F. Jury, Vernaison, France. U.S. Pat. 898,482, Sept. 15, 1908.

SEE Fr. Pat. 358,783 of 1905; this J., 1906, 327.—T. F. B.

Filter. F. Tiemann, Berlin. U.S. Pat. 899,194, Sept. 22, 1908.

SEE Eng. Pat. 3290 of 1908; this J., 1908, 437.—T. F. B.

Evaporation of saline solutions; Apparatus for the continuous ——. E. Cantenot. Fr. Pat. 389,917, May 5, 1908. Under Int. Conv., May 6, 1907.

SEE Ger. Pat. 200,199 of 1907; this J., 1908, 940.—T. F. B.

II.—FUEL, GAS, AND LIGHT.

Gas producer practice. W. A. Bone and R. V. Wheeler. Iron and Steel Inst., Sept., 1908. [Advance proof.]

FURTHER experiments have been carried out with the same producer as before (see this J., 1907, 674), the saturation temperature of the blast being lower. The depth of incandescent fuel was reduced from 7 ft. to 3 ft. 6 ins., and certain alterations were made in the producer, notably the cutting off of the cast-iron bell below the gas outlet, and the elimination of the angle at the boshes. The load on the producer was more than doubled as compared with the earlier trials. Each trial lasted continuously for a full week. The chief results of the trials are shown in the following table:—

Steam saturation temperature of blast		60° C.	55° C.	50° C.	45° C.
Coal consumption at producer, cwt. dry coal per hour		17·5	18·6	17·5	18·4
Coal consumption for blower engine, cwt. per hour		0·65	0·65	0·65	0·65
Total carbon losses per cent. (in tar, ashes, and soot)		8·0	9·15	7·9	7·3
Percentage composition of the gas	Carbon dioxide	5·10	4·40	2·50	2·35
	Carbon monoxide	27·30	28·10	30·60	31·60
	Hydrogen	15·50	15·45	12·35	11·60
	Methane	3·05	3·00	3·00	3·05
	Nitrogen	49·05	49·05	51·55	51·40
	Total combustibles	45·85	46·60	45·95	46·20
Calorific value of gas	gross	178·7	180·8	178·5	180·0
	nett	166·9	169·1	168·7	170·5
(British thermal units per cubic foot, at 0° C. and 760 mm.)		—	—	—	—
Yield of dry gas, cubic feet at 0° C. and 760 mm. per ton of dry coal		135,000	132,700	132,500	133,700
Lb. of steam in blast per lb. of coal gasified		0·454	0·325	0·21	0·2
Percentage of steam decomposed		76	100	95	100
Cubic feet of air (at 0° C. and 760 mm.) in blast per lb. of dry coal gasified		37·45	36·75	38·6	38·8
Ratio of $\frac{\text{oxygen from steam}}{\text{oxygen from air}}$		0·44	0·42	0·3	0·33
Efficiency ratio, including steam for blower engine		0·725	0·722	0·718	0·73

The efficiency ratio is calculated on the net calorific values of fuel and gas; no allowance is made for fuel for raising steam, as only exhaust steam was added to the blast. The coal consumption during the day shifts was practically double that during the night shifts, but the composition of the gas samples varied within practically the same limits. No trouble was experienced from the formation of clinker, but when the saturation temperature was reduced to 45° C., the ashes fused and ran through the fire-bars. The experiments show that a high rate of gasification can be maintained with the blast saturated at 50° to 60° C., and that under these conditions, the gas is very suitable for furnace work, whilst a wide variation in the load does not affect the quality of the gas. The losses of carbon were not affected by the reduction in the depth of incandescent fuel. The gas made with the blast, saturated at 55° C., was found to pass unchanged through regenerators at about 1100° C., the proportions of carbon dioxide, carbon monoxide, hydrogen, and steam being nearly those calculated to be in equilibrium at that temperature.—A. T. L.

Fuel; The purchase of ——. *Pts. I. and II.* Times Eng. Suppl., Aug. 26, and Sept. 2, 1908. [T.R.]

In Part I., the advantages of contracts for coal based on laboratory tests of moisture, ash, and calorific value, are referred to and described, whilst in Part II., some details of the practical operation of such systems of purchase, drawn chiefly from American sources, are given. The United States Treasury Department, it is mentioned, now obtains more than one-half of the fuel required for the Government Departments upon a strict specification, based on the laboratory examination by the fuel-testing division of the Geological Survey.

Fuel consumption; Scientific control of ——. H. E. Armstrong. Iron and Steel Inst., Sept., 1908. [Advance proof.]

Power supply and its effect on the industries of the north-east coast. C. H. Merz. Iron and Steel Inst., Sept., 1908. [Advance proof.]

The author describes the effect of the supply of electrical power on the industrial development of the north-east coast district. It is stated that apart from the power companies, there is practically no coal burned in the Tyne district for power purposes except in chemical factories. It is probable that the future power requirements of the district will be largely met by electricity produced by the utilisation of the waste heat and gases from blast-furnaces and coke ovens.—A.S.

Peat; Utilisation of —— [*for making gas or charcoal, with recovery of by-products*]. H. R. Sankey. British Assoc., Dublin, 1908. Engineering, Sept. 11, 1908, 355—360.

The author reviews existing methods for utilising peat, with special reference to the scheme recently sanctioned by Parliament for an electric power station at the Bog of Allan, near Robertstown in Ireland. It is proposed to use the partially dried peat, containing as much as 60 per cent. of water, in gas producers with plant for the recovery of ammonium sulphate; earlier schemes have required peat containing only 25 per cent. of water. Current will be obtained from generators, of 500 to 1000 kilowatts, driven by gas engines. The producers will be worked continuously at full load, and during the hours of small demand for electricity, the surplus gas will be used for heating, for drying peat, or burned to waste. The cost of fuel is estimated at 3s. per ton of dry peat, or 0·05d. per unit generated, whilst the net profit on the ammonium sulphate will be 4s. per ton of dry peat. Power will be available at a low enough cost for industries such as the manufacture of carbide, cyanamide, Acheson graphite, etc. Of several methods described for getting the peat, digging by means of an ordinary grab appears the most suitable. The peat may be dried by spreading on the ground to a thickness of 4 ins., and scoring over the surface with a rake; the peat soon separates into sods, which are stacked and after a few days, in the summer, contain only 60 per cent. of water. The drying is more rapid if the wet peat be passed through a press. The surplus gas could be used for drying peat in the winter by the Ekenberg process, in which the wet substance is heated in ovens at 150° C. and partly carbonised; in this way, peat can be produced of the required dryness and containing all the by-products, in less than an hour. The utilisation of peat, as carried out at Beuerberg, near Munich, is described. The air-dried peat is further dried by exhaust gases from the coking ovens, and the moisture reduced to 25 per cent. Peat-charcoal is produced in closed retorts heated externally, and the flue gases are afterwards passed into other retorts in which peat is partially carbonised and converted into "semi-peat-coke." Pitch, tar, and liquor are obtained from the gases distilled from the peat, and the washed gases are used for heating the retorts. The liquor is worked up for acetic acid, methyl alcohol, and ammonium sulphate. The tar yields gas oil, paraffin, and carbon suitable for arc lamp electrodes; or it may be saponified with lime and mixed with resin oil, to produce a valuable wagon-grease. The charcoal or coke is dense and hard, and contains very little sulphur.—A. T. L.

Calcium hydride; Methane-synthesis by means of ——. M. Mayer and V. Altmayer. Ber., 1908, **41**, 3074—3080.

Calcium hydride was prepared by passing hydrogen over metallic calcium, heated in an electric furnace, till combination was complete, carbon monoxide being then passed over at regulated temperatures, the gaseous products analysed. The most favourable temperature for the production of methane was found to be 500° C., at which temperature the issuing gas consisted of 60—65 per cent. of methane and 35—30 per cent. of hydrogen. Up to a rate of about 1 c.c. per minute, increase in the rate of passage of the gas increased the proportion of methane produced. The residue in the tube consisted (besides undecomposed hydride) of lime, calcium carbide and nitride (from nitrogen introduced as impurity in the gas), and free carbon, so that the action is complex. The two following equations probably represent the chief reactions occurring:—

$$3CaH_2+3CO=CH_4+3CaO+2C+H_2\,;$$
$$CaH_2+2C=CaC_2+H_2.$$

When carbon dioxide instead of monoxide was passed over the hydride, the results were generally similar: the chief reaction is probably expressed by the equation $2CO_2+4CaH_2=CH_4+4CaO+C+2H_2$. Lampblack and calcium hydride, heated together at 500° C. yield a gas containing 40 per cent. of methane and 57 per cent. of hydrogen.—J. T. D.

Patents.

Fuel [*from sewage sludge*]; *Manufacture of* ——. T. D. Kelly, Forest Gate, and R. C. Lowry-Corry, London. Eng. Pat. 2609, Feb. 5, 1908.

Dried sewage sludge is treated with lime, and then powdered and mixed with about 10 per cent. of salt water and with 20 per cent. of tar or petroleum-refuse to which 3 to 5 per cent. of sulphuric acid or sulphur have been added. The whole is then well mixed, and a quantity of coal dust is added according to the calorific value of the fuel required. The mixture is pressed into the shapes required, or allowed to set and then broken up. The fuel is suitable for use in the manufacture of cement or lime.—A. T. L.

Coal; Process of burning ——. H. A. Poppenhusen, Evanston, and J. Harrington, Chicago. U.S. Pat. 898,134, Sept. 8, 1908.

Coal is continuously fed into and through the furnace, so as to form a layer, and a coking heat is first applied to the top surface of the layer without aeration. Air is then admitted to the bottom layer to effect combustion. The upper portion of the layer of coal is continuously agitated during the coking operation to prevent caking, but in such a manner as not to stir or mix the coal constituting the layer.—G. W. McD.

Coal; Briquetting ——. C. L. J. Dorel. Fr. Pat. 390,115, July 18, 1907.

The coal, in a powdered or granular condition, is incorporated with a solution of pitch, with tar containing pitch, or, with pitch to which light tar oils have been added. The mass is then heated to recover the solvent or light oils, or to remove the lighter constituents of the tar and to eliminate moisture, and the material is finally pressed into briquettes. When using anthracitic coal, some finely-powdered bituminous coal is added to the solution of pitch.—A. T. L.

Briquettes; Preparation of a plastic mass for moulding into ——. Wulff und Co. Fr. Pat. 390,291, May 15, 1908.

The process consists in vaporising one or several of the agglomerants, and introducing the vapour into the powdered combustible either alone or together with other liquid or powdered materials. The material to be vaporised, *e.g.* naphthalene, is first liquefied and then admitted through a cock into a vaporising chamber, the cock being opened and closed mechanically at regular intervals. The vapour is introduced through an injector into the mixing vessel, the other materials used, *e.g.* pitch, being led by branch pipes to the same injector.—A. T. L.

Coke-ovens. R. Fabry, Chesterfield. Eng. Pat. 21,593, Sept. 30. 1907.

In a regenerative coke-oven in which the air for combustion is pre-heated by the waste gases from the heating flues, the combustible gas is supplied to each heating flue by four or more burners, arranged at intervals in the path of the heating gases. The maximum temperature in the flues is considerably less than if the whole of the gas for each flue were introduced at one point, the heating is more uniform, and the flow of heating gases can be reversed without reversing the admission of gas. As applied to an oven with horizontal retort chambers and with regenerators arranged transversely beneath the retort chambers, two burners are provided at each end of each heating flue, and horizontal baffles and a central vertical baffle are arranged in each flue, so that between successive burners the gases pass to the centre of the flue and back, or from one end of the flue to the other. —A. T. L.

Coking ovens; Regenerative ——. F. Richter, Sheffield. Eng. Pat. 2550, Feb. 5, 1908.

In a horizontal oven, the dividing walls between adjacent coking chambers are formed with a series of vertical air-heating flues between two series of vertical heating flues. Each series of heating flues is divided into two sections connected by down-pipes with a common chimney flue running transversely beneath the centre of the oven. The flues in each section are connected at their lower ends with a common combustion chamber, and at their upper ends with a common exit flue leading to the down-pipe. The air flues are connected at their upper ends with a common inlet passage, and the air enters the adjacent combustion chambers through two orifices at the lower end of each flue.—A. T. L.

Coke oven. L. Bansart. Fr. Pat. 390,204, May 14, 1908.

The patent relates to a horizontal coke oven which can be worked with or without recovery of by-products. A separate heating system is provided for each half of the oven, and a chimney flue common to both systems runs transversely beneath the centre of the coking chambers. When working with recovery of by-products, the air for each heating system enters by a conduit parallel to the chimney flue, and passes through openings in the roof of this conduit into flues running beneath each coking chamber. The air escapes through openings in the roof of each flue into a parallel flue to which gas is admitted, and the mixed air and gas pass through similar openings into a combustion flue beneath the sole of each coking chamber. The heating gases pass up and then down in a series of flues between adjacent coking chambers, and finally escape to the chimney flue through conduits arranged between the air flues, and running transversely around the main air conduits. When working without recovery of by-products, the distillation gases pass through a separate set of outlets from the coking chambers, and are admitted to the heating flues from two main gas flues running transversely across the top of the coking chambers at each end. Air is admitted to the heating flues, and the heating gases pass downwards at the ends of the coking chambers, then upwards at the central part, and finally downwards to the chimney flue.—A. T. L.

Carburetting liquids; Combustible or ——, *for use with internal-combustion engines and for lighting and heating.* C. Poulain, Paris. Eng. Pat. 25,435, Nov. 16, 1907.

A gaseous mixture, consisting of oxygen, methane, hydrogen, and acetylene, with nitrous oxide also if desired, is dissolved in the strongly cooled hydrocarbon or other liquid fuel, such as alcohol, benzene, petroleum, turpentine, etc. The cold solution is sealed up in cans, and the pressure generated at atmospheric temperature keeps the gases in solution. The gaseous mixture is obtained by adding water to a mixture of chloride of lime, sulphates of iron, magnesium, and zinc, and carbides of calcium and manganese. The gases are washed with water and then dried. Nitrous oxide, if used, is obtained by heating ammonium nitrate, and is washed with potash and ferrous sulphate.—A. T. L.

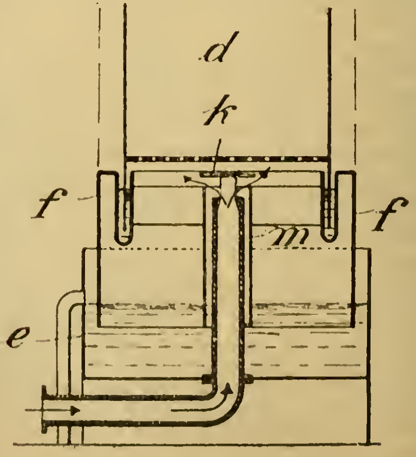
Fuel for use in internal-combustion engines and for other purposes. C. E. H. Medberger and A. F. F. Medberger. Fr. Pat. 389,616, April 25, 1908. Under Int. Conv., Oct. 4, 1907.

Petroleum is washed with sulphuric acid of 28°—30° B., and then with soap solution. Powdered chalk or sodium carbonate is next added and the mixture stirred and filtered. Alcohol containing a small quantity of naphthalene and sodium or potassium carbonate, is then added; the mixture is stirred, decanted, and filtered, and finally a sufficient quantity of light hydrocarbon is added to render the fuel readily inflammable. The exhaust gases of an engine using this fuel have no unpleasant odour.—A. T. L.

Gas-retort furnace. A. Valuy. Fr. Pat. 389,846, May 2, 1908.

The producer is built beneath the retort-chamber and does not project beyond the front line of the bench as in the ordinary system. Steam generated from water sprayed into a pan below the producer, passes through the bed of fuel along with the primary air, and causes the formation of a mixture of producer- and water-gas. The mixture passes from the lower part of the back of the producer, by a vertical flue, to a horizontal flue provided with burner openings, beneath the retort chamber. The secondary air is preheated in regenerators, placed on either side of the producer, by the waste gas as it passes to the main flue.—W. H. C.

Power-gas producing plant. C. Whitfield, Shortlands, Kent. Eng. Pat. 23,679, Oct. 26, 1907.



The invention relates to a device for regulating the flow of gas from the producer to the scrubber, so as to maintain a constant pressure within the latter. As applied to a pressure plant, a bell, *f*, open to the scrubber, *d*, carries a water-trough to seal the open lower end of the scrubber, and is itself sealed in a tank, *e*. The bell is suspended by cords passing over pulleys and provided with counter-weights. On any increase of pressure within the scrubber, the bell rises, carrying with it a pipe, *m*, which co-operates with a fixed plate, *k*, to reduce or close the inlet passage for gas. In a similar arrangement for use with a suction gas-producer, a sealing trough for the inner edge of an annular bell is formed around the outside of the scrubber, and the valve device is omitted. Other forms of flexible connection may replace the water troughs.—A. T. L.

Gas producers. E. Schmatolla, Berlin. Eng. Pat. 5188, Mar. 7, 1908.

The patent relates to a furnace grate for gas producers, consisting of stationary bars provided with lateral projections at either end, and movable bars arranged between the stationary bars and supported by the projections. The movable bars are provided with toothed extensions, by which they may be drawn forward to remove slag; they may be moved independently, or simultaneously, and they may pass through stuffing-boxes in the casing of the producer, so as to be operated without opening the ash-pit.—A. T. L.

Gas generators. I. A. Chavanne, Paris. Eng. Pat. 8397, April 15, 1908. Under Int. Conv., April 17, 1907.

The base of the generator comprises an annular water-trough and a central conical casting, formed with one or more helical threads on its outer surface. The fuel is supported partly by the cone, and partly by the annular base of the trough, and rotation of the cone causes the regular descent of the fuel-bed. A perforated conical cap forming the apex of the cone serves for the introduction of the blast, and may also have helical threads on its surface. The blast pipe is arranged along the axis of the cone, and is formed with a flange carrying a ball-race for an upper bearing within the cone, which is also supported by rollers at its base.—A. T. L.

[Producer] gas; Process of manufacturing ——. H. Pettibone, New Rochelle, N.Y., Assignor to The Power and Mining Machinery Co., New Jersey. U.S. Pat. 898,601, Sept. 15, 1908.

Part of the gas is compressed and used in a jet exhauster to draw air through the gas producer, and deliver the main portion of the gas into a holder, or direct to a furnace. —A. T. L.

Gas producer. W. B. Hughes, Cleveland, Ohio. U.S. Pat. 899,050, Sept. 22, 1908.

In a gas producer in which the blast is introduced centrally at the base of the fuel column, the mouth of the vertical blast-pipe is guarded, and the blast is spread, by two horizontal discs arranged one above the other. The lower disc is provided with a central orifice or nozzle extending downwards, and the upper disc is formed with a central conical projection on its lower surface.—A. T. L.

Coal gas and analogous gases; Treatment of ——, *for obtaining extraneous matters, such as tar constituents and ammonia, therefrom.* W. Feld, Hönningen-on-Rhine, Germany. Eng. Pat. 20,139, Sept. 9, 1907.

The various constituents in the hot gases are separated by a system of fractional cooling, or by fractional coolings combined with successive washings. Condensation between the retorts and the first cooler or washer may be prevented by lagging the main, or by heating it, or by increasing its sectional area according to the number of retorts connected to it. The gases enter the first washer at say 200° C. and are cooled therein to the dew-point for the constituents boiling above 300° C., which may be say 160° C.; the tar and the bulk of the constituents boiling above 300° C. are thus condensed. The gases are cooled in a second washer to say 80° C., the dew-point for water being say 75° C., thus separating the constituents boiling between say 180° C. and 300° C. The gases may be cooled in further stages to 60° C., 35° C., and 25° C. The cooling is preferably effected by pumping in liquor condensed in the next washer. The gases leaving the last washer may be again washed with a liquid of higher boiling point obtained at an earlier stage, in order to remove constituents with which the gases are not saturated at the lowest temperature. When it is required to separate constituents for which the dew-points are near together, the volume of gases is increased as described in Eng. Pats, 27,567, 27,568, and 28,390 of 1907 (this J., 1908, 495, 890), for example, by adding gases or vapours which contain less of the undesired constituent.—A. T. L.

Tar; Removing —— *from the hot gases from coke ovens, gas retorts, or the like.* The Otto-Hilgenstock Coke-Oven Co., Ltd., London. From Dr. C. Otto und Co., G.m.b.H., Dahlhausen, Germany. Eng. Pat. 12,809, June 15, 1908.

The hot gases are forced through a down-pipe by means of an injector fed by a pump with coal-tar, ammoniacal liquor containing tar, or a mixture of the two. To prevent clogging of the injector, a thin tar, or some of the tar passing to the injector, is sprayed into the gas before it reaches the injector. The tar is collected in a seal-box at the bottom of the down-pipe.—A. T. L.

Gas; Devices for automatically indicating the presence of ——. J. Ontö and J. Vago, Budapesth. Eng. Pat. 6667, Mar. 25, 1908.

The apparatus is of the type in which the presence of gas causes the heating of platinum sponge, whereby an electric circuit is closed and an alarm given. The platinum sponge is arranged in contact with a thread, preferably of pyroxylin, which is ruptured when heated by the platinum. One end of the thread is fixed, and the other end is attached to a contact plate, which, under the influence of its weight or of a spring, closes the circuit when the thread is broken. The platinum sponge may be protected by a shell of porous material.—A. T. L.

Refractory bodies [filaments]; Manufacture of ——. The British Thomson-Houston Co., Ltd., London. From General Electric Co., Schenectady, U.S.A. Eng. Pat. 20,227, Sept. 10, 1907.

A metallic binding material is impregnated with a mixture of a refractory metal, such as tungsten, molybdenum, tantalum, titanium, or boron, and a refractory oxide such as thorium oxide, zirconium oxide, or cerium oxide. The product is shaped into filaments or supports for use in incandescent lamps, and then heated electrically in an atmosphere of hydrogen; if desired, the filaments are first baked in an evacuated glass tube heated by a Bunsen burner. The supports are subjected to a further treatment by heating momentarily in air or oxygen to oxidise the metal at the surface, and then heating *in vacuo* to drive out the oxide thus formed. A suitable binder for use with tungsten and thorium oxide, consists of an alloy of 42 parts of cadmium, 5 to 10 parts of bismuth, and 53 parts of mercury; the alloy is soft and plastic when warmed. The proportions used are 35 per cent. of the alloy, with 65 per cent. of the refractory material. The latter may contain only a proportion of tungsten or as much as 50·1 per cent., one suitable composition being 31·2 per cent. of tungsten and 68·8 per cent. of thorium oxide. The filaments have a much higher resistance and greater stiffness than pure tungsten filaments, and the life, when operating at 1 watt per candle, may exceed 1000 hours. The filaments are connected to the leading-in wires by means of a paste consisting of fine tungsten powder mixed with about 0·1 per cent. of water-glass. —A. T. L.

Filaments for electric incandescent lamps. Wolfram-Lampen Akt.-Ges., Augsburg, Germany. Eng. Pat. 8421, April 15, 1908. Under Int. Conv., May 13, 1907.

A filament of very high specific resistance, consists of tungsten with an addition of not more than 10 per cent. of chemically pure thorium oxide. The thorium oxide must be free (as shown by the spectroscope) from elements of the gadolinium and yttrium group and of the didymium group. If this condition be not fulfilled, or if more than 10 per cent. of thorium oxide be used, electrolytic dissociation takes place when the filament is heated by the current.—A. T. L.

Filaments for electric glow lamps; Manufacture of —— from refractory materials in the colloidal state. H. Kuzel, Baden, Austria. Eng. Pat. 12,968, June 17, 1908. Addition to Eng. Pat. 28,154 of 1904 (this J., 1906, 115).

Refractory elements in the colloidal state, with or without the addition of the finely-powdered elements, are worked into plastic masses and brought to the desired shape, then dried, and heated electrically. The preliminary heating to 60 or 80° C. to render the filaments conducting, described in the principal patent, is dispensed with, and the heating is effected by the passage of a current at 400 to 1000 volts, the voltage being reduced to 110 or 220 as the conductivity increases.—A. T. L

Filaments and electrodes for electric lamps. F. J. Planchon. First Addition, dated April 29, 1908, to Fr. Pat. 387,942, May 18, 1907 (this J., 1908, 849).

The process described in the principal patent is extended to the use of the oxides of niobium, thorium, and zirconium, in addition to those previously employed. The oxide may be used in acid, as well as in alkaline solution, and the solution of the albuminoid substance may be acid, aqueous, or alkaline.—A. T. L.

Drying coal, coke, slag, and other materials; Machine for ——. J. Black, A. H., H., and A. B. Lennox. Fr. Pat. 390,166, May 12, 1908. Under Int. Conv., May 24, 1907.

See Eng. Pat. 12,087 of 1907; this J., 1908, 396.—T. F. B.

Coke oven; Horizontal regenerative ——. F. J. Collin, Dortmund, Germany. U.S. Pat. 898,439, Sept. 15, 1908.

See Eng. Pat. 7650 of 1907; this J., 1907, 861.—T. F. B.

Water-gas; Process of generating ——. H. Strache, Vienna. U.S. Pat. 898,803, Sept. 15, 1908.

See Eng. Pat. 28,177 of 1902; this J., 1903, 486.—T. F. B.

Incandescence mantles. A. Simonini. Fr. Pat. 389,876, May 4, 1908.

See Eng. Pat. 10,233 of 1908; this J., 1908, 932.—T. F. B.

Filaments for illuminating and heating purposes; Process of and means for manufacturing ——. G. Michaud and E. Delasson, Montreuil, France. Eng. Pat. 4461, Feb. 27, 1908. Under Int. Conv., June 10, 1907.

See Fr. Pat. 378,665 of 1907; this J., 1907, 1131.—T. F. B.

Electric glow lamps; Process of electrically connecting filaments to supply wires in ——. H. Kuzel, Baden, Austria. U.S. Pat. 898,979, Sept. 15, 1908.

See Fr. Pat. 366,267 of 1906; this J., 1906, 1035.—T. F. B.

Hydrogen; Manufacture of —— from water-gas. Fr. Pat. 389,671. *See* VII.

Gaseous mixtures; Apparatus for automatically sucking —— into an apparatus, etc. Ger. Pat. 201,048. *See* XXIII.

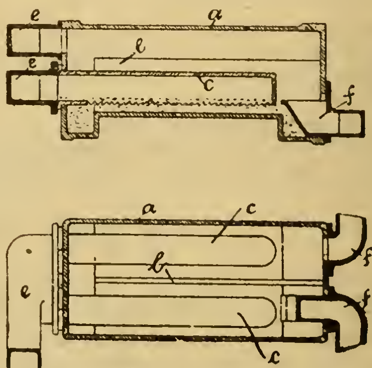
III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

Calcium acetate; Commercial analysis of crude ——. W. Fresenius and L. Grünhut. Z. anal. Chem., 1908, **47**, 597—623.

The authors have made a detailed investigation into all the known methods for determining the amount of acetate in crude calcium acetate (this J., 1904, 305, 530). These methods are as follows: (1), direct titration with a mineral acid using "methyl violet" as an indicator; (2), repeated evaporation with a known amount of sulphuric or phosphoric acid, until all the acetic acid has volatilised, with subsequent titration of the free sulphuric acid or phosphoric acid; (3), precipitation by oxalic acid with subsequent filtration, and determination of the total acidity, and acidity due to oxalic acid, in the filtrate; (4), distillation with hydrochloric acid, and titration of the distillate for total acidity and hydrochloric acid; (5), distillation with phosphoric acid, and titration of the distillate with sodium hydroxide (the method used by Bayer und Co., Elberfeld). The authors find that none of the methods gives absolutely correct results, as small quantities of propionic and butyric acids are estimated along with the acetic acid. For all practical purposes, however, the last method given above is quite satisfactory. The details are as follows: 5 grms. of the material, 100 c.c. of water, and 15 c.c. of phosphoric acid (sp. gr. 1·7) are introduced into a 500 c.c. flask. This is provided with a double-bored cork. One hole serves for a tube conveying a slow stream of air, free from carbon dioxide, into the flask; through the other hole passes a tube leading the vapours to a condenser. The flask is heated over a free flame until the residue amounts to 25 c.c. The flame is then removed for a moment, whilst 50 c.c. of boiled water are introduced into the flask. The contents are then distilled again until 25 c.c. are left. This process is repeated four times. The distillates are united and titrated with standard sodium hydroxide solution, using phenolphthalein as an indicator. 50 c.c. of water are now again added to the residue in the distilling flask and another distillation performed. The distillate will still be slightly acid. If it require only one drop of the sodium hydroxide solution to cause a change of colour after adding the phenolphthalein, this distillate is neglected; if, however, it should require more, the first titration number must be corrected accordingly, and the distillation repeated until the prescribed condition is fulfilled.—C. E. F.

Patents.

Ammonia still. L. Dill. Ger. Pat. 200,592, April 19, 1907.



The patent relates to the form and arrangement of the compartments of apparatus for the manufacture of ammonium sulphate from gas-liquor. These compartments consist of long casings, *a*, connected at one end to withdrawable pipes, *f*, which serve for the introduction of the gas-liquor; and at the other end to pipes, *e*, also withdrawable, for the introduction of steam. Long hoods or bells, *c*, dipping into the gas-liquor, are provided for the better distribution of the steam. When the pipes, *e*, are removed, these hoods can be easily withdrawn from the compartments. The compartments are divided by partitions, *b*, into two portions, in each of which there is a distributing hood.—A. S.

Petroleum; Treatment of crude ——. Rütgerswerke-Actienges. Fr. Pat. 389,860, May 2, 1908.

The petroleum is distilled under reduced pressure in the presence of superheated steam. The still is a cylindrical vessel 1·40 to 2 m. diameter and 0·80 to 1·20 m. high, and is heated externally. The temperature of the still is kept at 380°—400° C. and superheated steam is admitted, whilst oil is supplied continuously from a number of jets, until 2000 kilos. per sq. m. of surface at the base of the still have been added. The supply of steam is then increased, and the temperature raised to from 425° to 430° C. The process is interrupted when the residue (asphaltum) in the still contains only 5 to 10 per cent. of volatile constituents. The steam supply should be superheated to 450° to 500° C., and should amount to 30 to 40 per cent. of the weight of oil. The jets of oil are inclined downwards towards the base of the still, and preferably the steam-jets are arranged to spray the oil.—A. T. L.

Crude petroleum, petroleum spirit, and other liquids; Rectifying ——. E. Guillaume. Fr. Pat. 390,119, July 19, 1907.

A rectifying column is provided with outlets at successive points in its height, and the vapours from each outlet are passed through a concentrating column and thence to a condenser. The liquid from the base of each "concentrating column" flows back to the rectifying column at a point below the corresponding outlet. To obtain a fraction of constant boiling point from each portion of the rectifying column, the outlets from the condensers are regulated as described in Fr. Pat. 365,417 (this J., 1906, 947), and the admission of vapour to each concentrating column is regulated by a cock according to the indications of a thermometer at the base of each column.—A. T. L.

IV.—COLOURING MATTERS AND DYESTUFFS.

Polyazo-dyestuffs; New black —— from tetrazodiphenyl and resorcinol. L. Paul. Z. angew. Chem., 1908, **21**, 2086—2088.

The dyestuff produced by the interaction of one molecule of tetrazodiphenyl and two molecules of resorcinol in aqueous solution, can combine with a further molecule of tetrazodiphenyl in presence of sodium carbonate. The product is a brown dyestuff, having no affinity for unmordanted cotton. In the presence of caustic soda, the original dyestuff absorbs a greater proportion of tetrazodiphenyl, giving a black dyestuff which also has no affinity for unmordanted cotton, but which can be produced on the fibre. This is best effected directly, by treating 2 grms. of cotton with a 2½ per cent. solution of resorcinol: the cotton is squeezed out and treated with 10—15 c.c. of tetrazodiphenyl solution (1·9 grms. of benzidine in 100 c.c.) and 10 c.c. of caustic soda solution (1 : 5). The black obtained, has a brownish "overhand" tone and hence is scarcely of technical value. Dianisidine gives no better shade and the use of Meldola's Blue base or Fast Blue base (tetrazodiphenyl+1 mol. of *a*-naphthylamine) and subsequent treatment with other diazo-compounds such as *p*-nitrodiazobenzene give similar effects, which are not superior.—J. C. C.

meri-Quinone-imines. II. R. Willstätter and J. Piccard. Ber., 1908, **41**, 3245—3252. (Compare this J., 1908, 621.)

A continuation of the authors' former work. Wurster's Red from aminodimethylaniline has hitherto been described as the bromide. The corresponding nitrate (*asym-meri*-quinonedimethyldiimonium nitrate)

$$NO_3.N(CH_3)_2 : C_6H_4 : NH_2.NO_3+(CH_3)_2N.C_6H_4.NH_2,$$

is prepared by leading nitrous gases into a cooled solution of dimethylphenylenediamine (2 grms.) in 96 per cent. alcohol (75 c.c.) and concentrated sulphuric acid (5 c.c.). The salt crystallises out and is washed with alcohol and ether; it is green in the solid state and gives red solutions. A complex *meri*-quinonoid coloured salt is obtained by oxidising *asym*-dimethylphenylenediamine in acetic acid solution with potassium ferricyanide; black, right-angled tables are formed which appear green by transmitted light and give red solutions in water and alcohol, in which solvents they are sparingly soluble: the salt dissolves readily, however, in dilute sulphuric acid, giving a pale brown solution. Its constitution is:

$$HN : C_6H_4 : N(CH_3)_2.Fe(CN)_6H_2+2H_2N.C_6H_4.N(CH_3)_2.$$

By the oxidation of tetramethylphenylenediamine, Wurster and Schobig obtained an indigo-blue dye-salt which was regarded as *holo*quinonoid. The authors find, however, that in this reaction, two *meri*-quinonoid compounds are formed: the one is Wurster's blue salt $[C_{10}H_{19}N_2Fe(CN)_6]$ and is obtained by carrying out the oxidation in sulphuric acid solution; the other is a violet salt $[C_{30}H_{49}N_6Fe(CN)_6]$ and is prepared in acetic acid solution.

meri-Quinonoid salts are also furnished by the oxidation of benzidine with chromic acid. By adding chromic acid or potassium bichromate to excess of an acetic acid solution of benzidine at 0° C., a dark blue micro-crystalline salt with a red reflex is precipitated, which is insoluble in water, but sparingly soluble in hydrochloric acid with a yellow colour, and to which is assigned the constitution

$$HN : C_6H_4 : C_6H_4 : NH+4H_2N.C_{12}H_8.NH_2+4H_2CrO_4.$$

When an acetic acid solution of benzidine is added to an ice-cold acetic acid solution of chromic acid, there is formed a brown precipitate, violet by transmitted light, having the constitution:

$$NH : C_6H_4 : C_6H_4 : NH+3H_2N.C_{12}H_8.NH_2+5H_2CrO_4.$$

Its behaviour towards water and hydrochloric acid is the same as that of the preceding salt.

The green and yellow series of dye-salts prepared by oxidising tetramethylbenzidine have been further examined. The formula previously assigned to the yellow *holo* quinonoid sulphate, namely:

$$HO_4S.N(CH_3)_2 : C_6H_4 : C_6H_4 : N(CH_3)_2.SO_4H+2H_2O$$

is confirmed and the green chloride is shown to be *meri*-quinonoid and to have the constitution:

$$Cl(CH_3)_2N : C_6H_4{:}C_6H_4 : N(CH_3)_2Cl + (CH_3)_2N.C_{12}H_8.N(CH_3)_2 + 6H_2O.$$

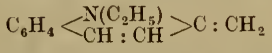
—J. C. C.

Cyanine dyestuffs; Constitution of ——. E. Vongerichten and C. Höfchen. Ber., 1908, **41**, 3054—3062.

The authors confirm the formula hitherto adopted for Ethyl Red (diethyl*iso*cyanine iodide), namely,

$$C_{23}H_{25}N_2I \text{ or } C_{23}H_{23}N_2I.$$

The presence of a tertiary nitrogen atom was proved by the fact that the compound combines with ethyl iodide. Also it is certain that the methyl group of the quinaldine part of the molecule is essential to the formation of Ethyl Red because neither benzylidenequinaldine nor *a*-*iso*propylquinoline gives *iso*cyanine dyestuffs. The group,



$$C_6H_4 <\substack{N(C_2H_5)\\ CH : CH}> C : CH_2$$

is present in the dyestuff, and is derived from the quinaldine ethiodide which is used; this is proved by the oxidation of Ethyl Red with excess of potassium ferricyanide, whereby N-ethyl-*a*-quinolone is produced: the same product is obtained by oxidising chloro-Ethyl Red prepared from 6-chloroquinoline, consequently it does not arise from the quinoline part of the molecule. Further, the latter is condensed at the γ-carbon atom, for whilst N-methyl-γ-quinaldone (after treatment with phosphorus pentachloride) gives an *iso*cyanine dyestuff with the carbinol base from quinaldine ethiodide, neither N-methyl-*a*-quinolone nor N-methyllepidone do so. Chloro-Ethyl Red (diethylchloro*iso*cyanine iodide), prepared from 6-chloroquinoline by the same method as is used for Ethyl Red, occurs in two allotropic modifications, namely, as dark brownish-violet, flat, needles and as beetle-green crystals. The alcoholic solutions are rather bluer than those of Ethyl Red. The authors' experiments show that the *iso*cyanine formation depends on the production of the carbinol base from quinaldine alkyliodide by the action of caustic potash; the reason why two molecules of quinoline ethiodide to one molecule of quinaldine ethiodide is a ratio giving the best yield, is, that by the action of caustic potash, the former is decomposed into quinolone and tetrahydroquinoline which take no part in the reaction. It is therefore necessary to use twice the theoretical amount of caustic potash and quinoline ethiodide in order to obtain a good yield.—J. C. C.

Quinoline bases; Action of acid esters on ——. J. Spady. Ber., 1908, **41**, 2902—2907.

When a mixture of quinaldine (72 grms.) and methyl salicylate (42 grms.) is heated in a Wurtz distilling flask for 5 hours to 200—220° C., carbon dioxide is evolved, phenol distils over, and a residue is left which, after boiling with alcohol, consists of a yellow crystalline dyestuff, $C_{22}H_{20}N_2$, m.pt. 190—191° C. This dyes silk, and tannin-mordanted cotton, in shades resembling those produced by Quinaldine Yellow. Quinoline also condenses with methyl salicylate to yield a compound,

$$C_{20}H_{22}O_2N_2,\tfrac{1}{2}H_2O,$$

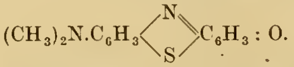
which forms orange needles sintering at 281—282° C., and melting at a higher temperature with decomposition. Methyl benzoate and quinaldine give a very small amount of a yellow crystalline dyestuff.—J. C. C.

Sulphide dyestuffs; Constitution of the blue ——. A. Bernthsen. Chem.-Zeit., 1908, **32**, 956—957.

It has been suggested that blue sulphide dyestuffs are thiazine derivatives, but this has not yet been proved. By the oxidation of a mixture of aminodimethylaniline and thiosulphuric acid in faintly acid solution, *p*-aminodimethylanilinethiosulphonic acid is formed,

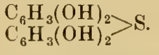
$$(CH_3)_2N(NH_2).C_6H_3.S.SO_3H.$$

It can be converted into Methylene Violet,



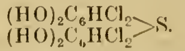
The latter when heated with sodium sulphide, yields blue sulphide dyestuffs, but there is no proof that the Methylene Violet nucleus remains intact. Quinone when treated with thiosulphuric acid, thioester-acids, or thiocyanic acid, yields sulphur compounds which can be converted into the mercaptan of quinol, and the latter can react with another molecule of the quinone to yield a sulphide compound :—

$$O:C_6H_4:O \rightarrow C_6H_3(OH)_2S.SO_3H \rightarrow C_6H_3(OH)_2SH \rightarrow$$



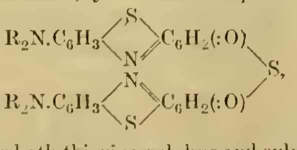
$$\left.\begin{matrix}C_6H_3(OH)_2\\C_6H_3(OH)_2\end{matrix}\right>S.$$

Dichloroquinone reacts in a similar manner. Aminodimethylanilinethiosulphonic acid reacts with the thiosulphonic acid or mercaptan of dichloroquinol to form chloro-Methylene-Violet-sulphonic acid or chloro-Methylene-Violet-mercaptan. These reactions proceed very smoothly, the halogen in the molecule considerably accelerating the formation of the dyestuff. By using the dimercaptan of dichloroquinol, the dimercaptan of chloro-Methylene-Violet can be obtained in a similar manner, the reaction proceeding smoothly at the ordinary temperature. The SH-group in chloro-Methylene-Violet-mercaptan, might be either in position 2 or 4, but the former is shown to be the most probable. Two molecules of the mercaptan of dichloroquinol can unite to form the compound,



$$\left.\begin{matrix}(HO)_2C_6HCl_2\\(HO)_2C_6HCl_2\end{matrix}\right>S.$$

and this, when condensed with the thiosulphonic acid of aminodimethylaniline, yields the compound,



which contains both thiazine-sulphur and sulphide sulphur. In an analogous manner dyestuffs with still longer chains can be prepared, but the colour is influenced little by the molecular weight.—A. S.

Dyestuffs; Synthesis of —— by means of sulphurous acid esters. H. T. Bucherer. Chem.-Zeit., 1908, **32**, 938.

By the condensation of 1.2.4-aminonaphtholsulphonic acid with a mixture of phenylhydrazine and sodium bisulphite, two yellow substances are produced, one readily soluble in water, and the other soluble with difficulty. The former, on treatment with dilute alkali at the ordinary temperature, yields a yellowish-red *β*-naphtholazo dyestuff, $C_{10}H_5(SO_3Na)(OH).N:N.C_6H_5$, slightly soluble in water, and also a more soluble, yellowish-red *α*-naphtholazo dyestuff, identical with that obtained from diazobenzene and 1.4-naphtholsulphonic acid. The slightly soluble yellow condensation product is not affected by cold dilute alkali, but when heated with strong alkali, yields a bluish-red dyestuff, which is coloured violet by dilute hydrochloric acid. Similar results are obtained by the condensation with phenylhydrazine and bisulphite, of the disulphonic acid obtained by treating R-salt with nitrous acid, and reducing the product, and of the azo dyestuff formed by the combination of diazobenzene and Schäffer's acid.—A. S.

Dye-salts; Theory of ——. H. Fecht. Ber., 1908, **41**, 2983—2987.

The author considers that the great change in colour which many aromatic compounds exhibit as a consequence of the so-called "addition" of inorganic acids or of acid chlorides, is not satisfactorily explained by the assumption of a change of constitution or of the "auxochromic" influence of the acid residue. He is of the opinion that the depth of colour often depends on the extent of the difference in the electrical properties of the two components. Thus the compound of quinone and phenol is red, that of quinone and *p*-phenylenediamine or benzidine, is blue (as is also the compound of di-iododiphenyl dichloride and benzidine) and that of chloranil and benzidine is possibly green. Willstätter has shown that the compound of di-iminodiphenyl and benzidine gives yellow solutions which become blue when the quinonoid components are rendered more negative through salt formation, but that this colour is lost when salt formation occurs in the positive half. Conversely the compound of quinone and phenol becomes blue when the latter is rendered more positive, *i.e.*, as sodium salt. That such double compounds are often coloured only when one component is rendered more negative (or positive), and lose this property when the difference in electrical property is diminished, is shown by the difference in colour of the bases of the triphenylmethane dyestuffs and their salts with acids. Moreover, if a chlorine atom is introduced into the nitrogen-free benzene ring of Malachite Green, the colour is changed to blue, but if the chlorine is attached to the basic nitrogen, the colour turns to yellow. When, however, several basic nitrogenous groups are attached to the negative components, the colour is intensified on salt formation (Safranines). Hence the halogens, hydroxyl, or amino-groups can increase or diminish colour according as the difference in the positive and negative relation of the two components is raised or lowered thereby.—J. C. C.

Patents.

Azo-dyestuffs; Production of new ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co. Eng. Pat. 16,011, Oct. 18, 1907.

New azo-dyestuffs are prepared by combining in alkaline solution the diazo-compounds of the naphthylamines or their sulphonic acids or derivatives thereof with 1-amino-7-naphthol-4-sulphonic acid or its (amino) alkylated derivatives. The shades produced on wool in an acid bath are brown to deep black; for example, the dyestuff produced from *α*-naphthylamine and 1-amino-7-naphthol-4-sulphonic acid dyes wool in violet-black tints.—J. C. C.

Anthraquinone derivatives; Production of new ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 390.157, May 12, 1908. Under Int. Conv., May 27, 1907, Jan. 28 and Feb. 8, 1908.

When halogenated anthraquinones or anthraquinonesulphonic acids are treated with alkali sulphides or polysulphides in the presence of a diluent or a solvent, new compounds similar to mercaptans are obtained which can be used for the production of dyestuffs. Example: A mixture of 10 kilos. of α-chloroanthraquinone with a solution of 50 kilos. of sodium sulphide and 6 kilos. of sulphur in 100 kilos. of 50 per cent. alcohol, is boiled for 4 hours. The product, which separates on cooling, dyes cotton a dull red changing to yellowish-green in the air. From 1-chloro-4-hydroxyanthraquinone, blue needles are obtained, which dye cotton a salmon-red. β-Chloroanthraquinone gives a product dyeing cotton in yellow shades. By a similar process, 1-amino-2 : 4-dibromoanthraquinone yields a violet powder which dyes cotton from the hydrosulphite vat in violet-red shades, and 4-bromo-1-anthrapyridone furnishes a dyestuff, which gives a yellow vat with hydrosulphite, dyeing cotton orange-yellow. When a mixture of 10 kilos. of α-chloroanthraquinone with a solution of 100 kilos. of sodium sulphide in 50 litres of water and 100 litres of alcohol is boiled until the chloro-compound has disappeared, the mercaptan, $C_{14}H_8O_2S$, m. pt. 187° C., is obtained. By boiling 1 kilo. of 4-p-tolylamino-1-chloroanthraquinone with 15 kilos. of alcohol and 15 kilos. of sodium hydrogen sulphide (28 per cent., NaSH) for 8 hours, the sodium salt of the 4-p-tolylamino-1-mercaptan derivative separates; the free mercaptan crystallises in blue needles and on sulphonation gives a dyestuff producing violet shades on wool. 4-Aminoanthraquinone-1-mercaptan, prepared from 1-chloro-4-aminoanthraquinone, dyes cotton violet-red. Similarly, potassium anthraquinone-α-sulphonate gives a mixture of the mercaptan and the disulphide of anthraquinone and sodium anthraquinone-1-mercaptan-5-sulphonate, prepared from anthraquinone-1 : 5-disulphonic acid, dyes wool yellow from an acid bath.—J. C. C.

Vat dyestuffs; Production of red ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 390,352, May 18, 1908. Under Int. Conv., June 1 and Aug. 10, 1907.

The reaction by which disubstituted phenylthioglycollic acids are transformed into red dyestuffs by warming with sulphuric acid (monohydrate) can be brought about by using chlorosulphonic acid. By this method the process goes on more smoothly and it can also be applied to the case of monohalogenated phenylthioglycollic acids and disubstituted derivatives such as 3 : 4-dichlorophenylthioglycollic acid. Example: 1 part of p-chlorophenylthioglycollic acid is added to 5 parts of chlorosulphonic acid (free from sulphuryl chloride). The resulting dyestuff is a bronzy red powder producing red shades on cotton from the vat.—J. C. C.

Vat dyestuffs containing sulphur; Manufacture of ——. O. Imray, London. From Soc. Chem. Ind. in Basle, Switzerland. Eng. Pat. 7583, April 6, 1908.

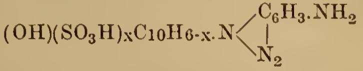
When 2-methylanthraquinone, 2-methylhalogenanthraquinones, ω-mono- or di-halogen-2-methylanthraquinones, or ω-mono- or di-halogen-2-methylhalogenanthraquinones are heated with sulphur, vat dyestuffs are obtained which give orange to yellow shades (except in the case of 2-methylanthraquinone which gives dirty brownish-olive tints) on cotton. The crude dyestuffs prepared in this way are treated with a solution of sodium hypochlorite; the resulting vat dyestuffs produce orange to yellow shades on cotton, which are very fast to washing, light, and chlorine. The use of hypochlorite apparently effects a purification of the crude dyestuffs.—J. C. C.

Vat dyestuff from indirubin and process of making same. G. Engi and J. Fröhlich, Assignors to Soc. Chem. Ind. in Basle, Basle, Switzerland. U.S. Pat. 898,452, Sept. 15, 1908.

Dihalogenated derivatives of indirubin are obtained by condensing dihalogenated isatins with "an indoxyl compound." They yield with the usual reducing agents, yellowish vats, from which cotton is dyed violet shades fast to washing and to chlorine.—T. F. B.

Aminoarylaziminonaphtholsulphonic acids and dyestuffs derived therefrom; Production of ——. Soc. Chem. Ind. in Basle. Fr. Pat. 390,223, July 22, 1907.

Aminoarylazimino-derivatives of the sulphonic acids of 2-amino-5-naphthol of the general formula



$$(OH)(SO_3H)_xC_{10}H_{6-x}.N\begin{matrix}\diagup C_6H_3.NH_2\\ \quad | \\ \diagdown N_2\end{matrix}$$

are prepared, for example, as follows: sodium 2-naphthylamine-5 : 7-disulphonate is condensed with 2 : 4-dinitro-1-chlorobenzene in the presence of sodium acetate; the sodium dinitrophenyl-2-naphthylamine-5 : 7-disulphonate produced, is reduced with sodium sulphide to sodium p-nitro-o-aminophenyl-2-naphthylamine-5 : 7-disulphonate, which is then treated with sodium nitrite in sulphuric acid solution. The resulting nitro-azimino-compound is reduced with iron filings to the aminoazimino-compound and by fusing this with caustic soda, aminophenylazimino-5-naphthol-7-sulphonic acid is obtained. This acid yields a sparingly soluble diazo-derivative which gives yellowish-red to bluish-red azo-dyestuffs when combined with the usual components, and a Bordeaux red dyestuff is obtained when the diazo-compound is added to a solution of sodium carbonate. The ordinary diazo-compounds combine with the acid, giving yellowish-red to bluish-red dyestuffs having a good affinity for cotton and which can be diazotised and developed either in substance or on the fibre. The acid may also be used in conjunction with tetrazo-compounds to give simple or mixed disazo-dyestuffs which produce orange to blue shades on cotton, and these can also be diazotised and developed on the fibre, giving shades fast to washing.—J. C. C.

Thioindigo dyestuffs; Oxide of ——. B. Homolka, Frankfort, Assignor to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. U.S. Pat. 898,738, Sept. 15, 1908.

Oxides of the thioindigo dyestuffs are said to be obtained by treating the dyestuffs with oxidising agents. They are insoluble in water, ether, and petroleum spirit, soluble in boiling chloroform or xylene, or in concentrated sulphuric acid. They also dissolve in dilute solutions of sodium hydroxide or neutral sulphites.—T. F. B.

Gallocyanine dyestuff and process of making same. C. de la Harpe and R. Burckhardt, Assignors to Dye Works formerly L. Durand, Huguenin, et Cie., Basle, Switzerland. U.S. Pat. 898,842, Sept. 15, 1908.

The gallocyanine derived from gallamide is heated with ammonia in presence of an aromatic nitro-hydrocarbon, such as dinitrobenzene, and the product obtained is treated with a reducing agent. The resulting dyestuff produces vivid, pure, greenish-blue shades on chrome-mordanted cotton.—T. F. B.

Vat dyestuffs; Production of red ——. Badische Anilin und Soda Fabrik. Second Addition, dated April 1, 1908 (under Int. Conv., Mar. 2, 1908), to Fr. Pat. 365,920, May 4, 1906 (this J., 1906, 979; 1907, 960).

By the condensation of 6- or 7-halogenated 1-amino-anthraquinone or a mixture of the two, or by condensing these with an αα-diaminoanthraquinone or with a ββ-dihalogenated anthraquinone by a process similar to that described in the chief patent (but using sodium carbonate and copper oxide instead of sodium acetate and cuprous chloride), red vat dyestuffs are obtained.
—J. C. C.

Dyestuffs of the anthraquinone series; Process for preparing blue vat ——. Badische Anilin und Soda Fabrik. Ger. Pat. 200,015, Sept. 21, 1907. Addition to Ger. Pat. 198,025, June 23, 1907. (See this J., 1908, 745.)

Dinitrodianthraquinonylamine is treated with fuming sulphuric acid and sulphur in presence of glacial acetic acid or acetic anhydride; the dyestuff thus obtained, like that produced according to the principal patent, dyes cotton clear blue shades from the hydrosulphite vat.—T. F. B.

Azo dyestuffs; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 23,026, Oct. 18, 1907.

See Fr. Pat. 383,000 of 1907; this J., 1908, 278.—T. F. B.

Colouring matter [from p-chloroquinaldine]; Manufacture of a yellow —— *and of an intermediate compound for use therein.* P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 28,266, Dec. 23, 1907.

See U.S. Pat. 890,588 of 1908; this J., 1908, 744.—T. F. B.

Azo dyestuff. W. König, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 899,171, Sept. 22, 1908.

See Eng. Pat. 16,011 of 1908; preceding.—T. F. B.

[Thioindigo] dyestuffs dyeing from a vat like indigo; Production of halogenated ——. Soc. pour l'Ind. Chim. à Bâle. Third Addition, dated July 19, 1907, to Fr. Pat. 372,627, Dec. 17, 1906.

See U.S. Pat. 887,609 of 1908; this J., 1908, 622.—T. F. B.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

Metastannic acid [in silk weighting]. P. Heermann. Färber-Zeit., 1908, **19**, 318—320.

Whether metastannic acid, when present in the stannic chloride used for silk weighting, has any tendering action upon the charged silk is still an open question. The author disagrees with certain statements made by Bayerlein (this J., 1907, 962) with regard to the detection of metastannic acid in standing weighting baths and controverts the statement that this acid cannot be produced in the bath during the process of silk weighting. Opalescence in the bath is often noticed in practice and although a solution of pure stannic chloride of 50° B. will remain clear for months, yet the greater the degree to which it is diluted, the greater is its tendency to decompose. The impurities introduced into the bath during working may so increase the rate of decomposition that opalescence, due to the separation of metastannic acid, is noticeable in a few hours. The usual test for the presence of metastannic acid with caustic soda, was declared by Bayerlein to be valueless, since he obtained a precipitate in a solution of stannic chloride which he knew to be free from metastannate, but which contained calcium salts. It is here pointed out that the precipitation of calcium salts by caustic soda under such circumstances is well known, but that the precipitate being dense and powdery could never be mistaken for one of metastannic acid, which is voluminous and gelatinous. Bayerlein's proposed test (warming with solution of arsenious acid, with a little hydrochloric acid) was not found to be generally applicable. The results obtained with old, impure "pink baths" were not satisfactory, and the author thinks that the caustic soda test is still the best, even when the stannic chloride solution is contaminated with calcium salts. —F. M.

Patents.

Retting of flax, hemp, and other textile fibres; Process and apparatus for the industrial and bacteriological ——. A. Collard-Bovy and A. van Seters. Fr. Pat. 390,055, May 8, 1908.

In order to remove all colouring matters and tannic acids from the fibres, the flax or other material is first treated for 24 hours with water which is maintained at a certain constant temperature. The water is then run off and cold air is forced through the mass. The material is next retted by submitting it for 4 days to the action of a mixture of water, which is obtained from a working retting system (and is therefore charged with the active retting bacilli "*Granulobacter Pectinovorum*" and "*Urocephalum*"), and clean water which has been previously warmed to the temperature experimentally found to be the most suitable for the process. During the first three days this mixture is constantly renewed. When the retting process is complete, a current of air is again blown through the material. All these operations are effected in a reservoir which is horizontally divided into two compartments. In the upper compartment the material to be treated is placed, whilst the lower one is provided with a number of perforated pipes by means of which the various liquids and air currents enter the apparatus.—P. F. C.

Kiers for boiling, bleaching and otherwise treating textile materials. E. W. Hunt and W. Moscrop, Manchester. Eng. Pat. 22,788, Oct. 16, 1907.

The improvement claimed is applicable to high- or low-pressure kiers, and consists in the employment of a back-pressure valve which causes the liquor to flow continuously in a desired direction. In a low-pressure kier the central puffer pipe rises from a chamber (in which the liquors are heated by steam pipes), which communicates with the space below the false bottom of the kier by means of the back-pressure valves. In a high-pressure kier the heater is in a separate vessel; a back-pressure valve is placed in the pipe which connects this vessel with the space beneath the false bottom of the kier, and a pipe leading from the top of the heating vessel discharges the boiling liquor over the goods. In both high- and low-pressure kiers the discharge of the liquor from the heating vessel creates a partial vacuum behind the back-pressure valve, causing the liquor to flow from the bottom of the kier, and this circulation of the liquor from the top to the bottom of the kier precludes the possibility of "lifting" or displacement of the goods during boiling.—F. M.

Dyeing cotton and the like; Appliances for use in ——. C. H. Pugh, Ltd., and J. Read, Birmingham. Eng. Pat. 28,060, Dec. 20, 1907.

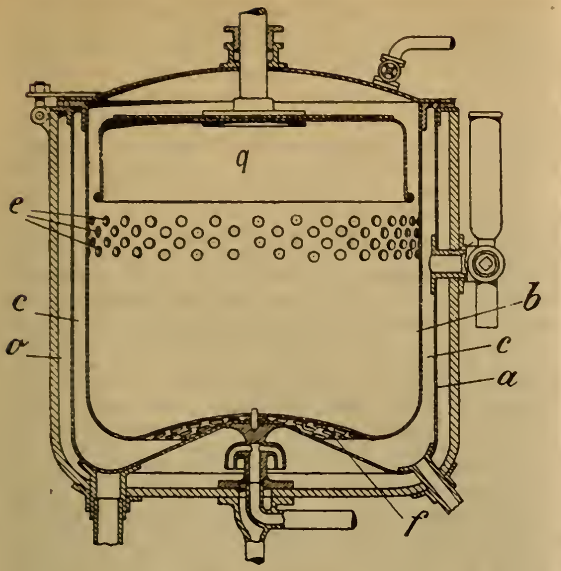
The tapered, perforated spindles upon which cops, cheeses, etc., are wound, are usually made from sheet metal blanks, which are bent to shape and the ends then closed to prevent the escape of the dye-liquor. These ends are often burred or roughened by coming into contact with certain parts of the dyeing machine, and besides the danger of these rough ends damaging the cotton, they may become so opened, as to permit of the escape of the dye-liquor. To avoid these risks it is proposed to form the perforated metal sheet into the required tapered tubular form, but instead of drawing out the end to a point, to close it with a solid plug or cap, around the tapered shaft of which the spindle tube is moulded, to form a perfect seal.—F. M.

Dyeing and bleaching textile materials; Apparatus for ——. H. Bodin and J. Gaudit. Fr. Pat. 389,713, April 29, 1908.

The apparatus consists of a large vat divided into three compartments, the middle one being the largest and serving as the dye-vessel proper. The dyeing is carried out without the assistance of pressure in circulating the dye-liquors, these being prepared in one of the smaller compartments and transferred by means of a rotary pump to the other, which is in direct communication with the space below the perforated false bottom, upon which the material to be dyed rests in the dye-vessel. The liquid flows upward through the material, which is kept in position by a cloth-covered wooden frame, and overflows into the first compartment; this circulation is maintained until the dyeing is completed.—F. M.

Textile substances and mixing liquids, etc.; Apparatus for treating ——. R. Diederichs. Fr. Pat. 390,105, May 11, 1908.

The vessel, *a*, contains a second vessel, *b*, of less diameter, and the space, *c*, between them serves as a circulating space for the liquid. At the height of the normal level of the liquid in the apparatus, the inner vessel, *b*, is provided with a number of perforations, *e*. The bottom, *f*, of this vessel is also perforated. An aspirating bell, *g*,



movable in a vertical direction inside the inner vessel, *b*, is provided with a perforated bottom, covered on its upper side with a sheet of felt, thus forming a sort of valve arrangement. The material to be treated is placed in the inner vessel, *b*, and the solution for the treatment in the outer vessel, *a*. The solution can be heated by means of the chamber, *o*, which is placed in connection with a steam supply. In working the apparatus, the aspirating bell is forced downwards and the felt is raised by the pressure of the solution and of the air, whilst some of the solution is expelled through the perforated bottom, *f*, of the vessel, *b*, into the outer vessel. It then rises in the intervening space, *c*, again enters the vessel, *b*. through the holes, *e*, falling on to the descending aspirating bell. The bell is maintained at its lowest position for a short time and then slowly raised. The felt now presses tightly on the perforations, forming a tight joint, and a rarefied atmosphere is produced inside the vessel, *b*. The compressed material therefore expands and readily absorbs the solution which is aspirated through the holes, *e*, and down the annular space, *c*, to enter the vessel, *b*, as a quick current through the perforated bottom, *f*.—P. F. C.

Bleaching process. Kirchhoff und Neirath. Fr. Pat. 390,154, July 20, 1907.

See Eng. Pat. 15,137 of 1907 ; this J., 1908, 682.—T. F. B.

Soda-lye rendered impure by the mercerisation process ; Process for purifying and clarifying the ——. O. Venter, Chemnitz, Saxony. Eng. Pat. 993, Jan. 15, 1908. Under Int. Conv., March 28, 1907.

See Fr. Pat. 387,621 of 1908 ; this J., 1908, 852.—T. F. B.

[Textile] materials ; Apparatus for subjecting —— to the action of liquid under pressure. L. Détré, Rheims, France. U.S. Pat. 898,444, Sept. 15, 1908.

See Eng. Pat. 25,208 of 1904 ; this J., 1905, 330.—T. F. B.

Wool mixtures fast to light ; Production of —— [by dyeing]. L. Cassella und Co. First Addition, dated July 17, 1907, to Fr. Pat. 388,442, May 30, 1907.

See Eng. Pat. 17,430 of 1907 ; this J., 1908, 559.—T. F. B.

Embossing effects on fabrics or the like ; Method of producing ——. E. A. F. Düring, Berlin. Eng. Pat. 8876, April 23, 1908. Under Int. Conv., May 3, 1907.

See Fr. Pat. 387,564 of 1908 ; this J., 1908, 854.—T. F. B.

VII.—ACIDS, ALKALIS, SALTS, AND NON-METALLIC ELEMENTS.

Manganese oxides, MnO_2 and Mn_2O_3 ; Temperatures of dissociation of —— in air and oxygen. R. J. Meyer and K. Rötgers. Z. anorg. Chem., 1908, **57**, 104—112. Chem. Zentr., 1908, **1**, 927.

Manganese dioxide, MnO_2, is stable when heated to 500° C., but at 530° is slowly but completely converted into the sesquioxide, Mn_2O_3, which at a higher temperature is itself converted into Mn_3O_4 ; this compound does not lose any more oxygen at 1300° C. On heating the oxide, so obtained, Mn_3O_4, in air at temperatures of 530—960° C. no oxygen is absorbed, but the oxide formed by reducing the dioxide with hydrogen, Mn_3O_4, readily takes up oxygen and is converted into the sesquioxide. Both the dioxide and sesquioxide give the oxide, Mn_3O_4, when heated to 1090° C. in oxygen. On allowing this oxide to cool in air, no change takes place, but on cooling in oxygen, the sesquioxide is obtained.—A. G. L.

Arsenious sulphide ; Coagulation of —— by barium chloride. J. Duclaux. J. Chim. Phys., 1908, **6**, 592—595.

When a solution of colloidal arsenious sulphide containing an excess of hydrogen sulphide was coagulated by barium chloride in the cold, and filtered, avoiding access of air, the filtrate contained no hydrogen sulphide ; on the other hand it contained arsenious acid in a quantity corresponding with that of the absorbed barium oxide and the acidity shown by the liquid. The author concludes that the hypothesis explaining the cause of the adsorption of barium oxide during such coagulation, advanced by Whitney and Ober (that the barium chloride is hydrolysed), and by Linder and Picton (this J., 1906, 67) (that barium sulphide is formed by the excess of hydrogen sulphide present in arsenious sulphide) do not conform to the facts, and that probably substitution of barium ions in place of a univalent radical such as AsO is the real cause of the phenomenon.—E. F.

Fused salts ; Densities of some ——. K. Arndt and A. Gessler. Z. Elektrochem., 1908, **14**, 665—667.

The following results of density determinations are given :—

Temp.° C.	KCl.	NaCl.	$CaCl_2$.	$SrCl_2$.	$BaCl_2$.	$NaPO_3$.	B_2O_3.
700	—	—	—	—	—	2·22	—
800	1·498	1·540	—	—	—	2·18	—
850	1·465	1·505	2·03	—	—	—	—
900	1·444	1·480	2·01	2·69	—	2·14	1·520
950	—	—	1·99	2·67	—	—	—
1000	—	—	1·97	2·645	3·12	2·10	1·508
1050	—	—	—	2·62	3·09	—	—
1100	—	—	—	—	—	—	1·495

The densities of mixtures of potassium and sodium chlorides, or of calcium and strontium chlorides, are those calculated from the densities of the components ; but mixtures of sodium metaphosphate and boric anhydride show very considerable contraction of volume.—J. T. D.

Cobalt ; A volatile compound of —— with carbon monoxide [Cobalt carbonyl]. L. Mond, H. Hirtz, and M. D. Cowap. Chem. News, 1908, **98**, 165—166.

The authors have obtained cobalt carbonyl by the action of carbon monoxide, under pressure, on finely-divided cobalt. Pure cobalt oxide was first reduced by hydrogen, at 5—10 atmos. pressure and at the lowest possible temperature, and then a slow current of carbon monoxide at 100 atmos. was passed through the apparatus (a steel retort lined with copper) at a temperature of 150°—200° C. ; in the condensing bottle, kept cool by ice, large orange crystals of the cobalt carbonyl were obtained. The compound has the formula, $Co(CO)_4$, corresponding to the liquid nickel carbonyl, and melts at 42°—46° C. ; it is insoluble in water, but more or less soluble in organic solvents. In an atmosphere of carbon monoxide, decomposition commences at 40°—45° C. and is complete at 130°—135° C., metallic cobalt remaining as a residue. Cobalt carbonyl is gradually decomposed by air with formation of a deep violet substance. It is very slowly attacked by non-oxidising acids, but almost instantaneously converted by oxidising acids, or by bromine or chlorine, into the corresponding cobalt salt, with the evolution of carbon monoxide.—F. Sodn.

Phosphoric acid ; Action of —— on silica and silicate glasses. K. Hüttner. *See* VIII.

Iron ; Influence of silicon on the physical and chemical properties of ——. A. Jouve. *See* X.

Sulphides ; Melting and subliming of some ——. W. Biltz. *See* X.

Patents.

Sulphuric acid ; Purification of —— from arsenic and selenium. H. W. Crowther, West Bromwich, F. P. Leach, Wylde Green, and W. T. Gidden, Langley. Eng. Pat. 20,509, Sept. 14, 1907.

Sulphuric acid of about 140° T., containing arsenic and selenium, is mixed with a small quantity of hydrochloric acid (say about 2 per cent. of acid of 30—32 per cent. strength), and is then allowed to stand in contact with broken sulphur, preferably in the cold, for about two hours. The more highly oxidised arsenic is thus reduced and can be removed as arsenious chloride by a current of air. If, however, the total arsenic, stated as arsenious acid, exceed 0·15—0·2 per cent., that present in the arsenious state is first removed by hydrochloric acid and air. The necessity for prolonged treatment with sulphur may be avoided by adding 0·5—2 per cent. of flowers of sulphur, together with the hydrochloric acid, and then removing the arsenic, selenium, etc., by a current of air as before ; practically all the arsenic is thus removed in one operation, even if its amount exceed 0·2 per cent. The process may be worked continuously by passing the mixture of sulphuric and hydrochloric acids down a tower packed with sulphur, a current of air being supplied. Or, sulphur dioxide may be employed instead of sulphur, preferably by subjecting the sulphuric acid, mixed with hydrochloric acid, to a stream of air or other inert gas containing a small quantity of sulphur dioxide. All these modifications of the process are applicable to cold sulphuric acid and in the presence of selenium, but the strength of the acid must not be allowed to fall below 135° T. The air carrying the arsenic and hydrochloric acid is first passed into strong hydrochloric acid to deposit sulphur and selenium, and then into water to decompose the arsenious chloride, depositing arsenious oxide and giving hydrochloric acid solution.—F. Sodn.

Lead chambers for the manufacture of sulphuric acid ; Construction of —— [for use with atomised water]. A. Gaillard, Barcelona, Spain. Eng. Pat. 11,732, May 29, 1908.

The substitution of atomised water for steam in the lead chamber involves the construction of chambers of sufficient height to ensure complete vaporisation of the water, before it has time to reach the floor of the chamber. According to the present invention, the necessary height is secured locally by erecting on the roof of the chamber, leaden cones or cylinders connected to the roof by autogenous soldering or hydraulic joints. The atomising nozzle is placed in the upper part of the extension, and beneath each nozzle is arranged, on the floor of the chamber, a dish, reservoir, or inclined plates of resistant material, so that any water not sufficiently atomised, owing to partial blocking of the nozzle or other cause, is caught and runs out of the chamber by a special tube or channel, instead of diluting the acid. It is claimed that existing chambers are readily adapted to working with atomised water in the above manner, and great economy is effected in the construction of new chambers for this purpose.—F. Sodn.

[Sodium] Sulphate and sulphuric acid ; Preparation of —— from bisulphate. O. Zahn. Fr. Pat. 389,898, May 5, 1908.

Sufficient water is added to the bisulphate to produce hydrated sulphuric acid and the normal sulphate, any excess of water being avoided. For example, 100 kilos. of bisulphate are brought into solution with 6—7 kilos. of water ; part of the hydrated sulphuric acid escapes during heating, whilst the mixture becomes pasty, and in this state is introduced into a muffle and calcined.

—F. Sodn.

Sulphurous and sulphuric acids ; Process and apparatus for the manufacture of ——. A. Saint-Beuve and G. Marconnet. Fr. Pat. 390,323, May 16, 1908. Under Int. Conv., May 18, 1907.

Pyrites or other sulphide is ground to an impalpable powder, and is blown by means of a current of air, into a combustion-chamber constructed of refractory material. In this way the combustion proceeds continuously, the combustion-chamber being provided with an exit for the sulphur dioxide, and a discharge opening for the removal of the residue. The pyrites may be mixed with combustible substances, substances which accelerate combustion, or fluxes, all in the state of fine powder. It is fed from a hopper into a horizontal chamber fitted with a screw conveyor, which delivers it on to a pivoted plate in a vertical chamber, into which the suction pipe of a fan opens. The screw conveyor and fan are worked from a common shaft, and the proportions of pyrites and air may be further controlled by varying the inclination of the pivoted plate, whereby the pyrites is directed nearer to or further from the suction pipe of the fan. The fan delivers the mixture of pyrites and air into the combustion-chamber, through a pipe entering the latter tangentially.—A. S.

Quicklime ; Process and apparatus for slaking ——. W. Schulthess. Fr. Pat. 390,357, May 18, 1908.

The apparatus comprises a horizontal slaking chamber mounted on a hollow shaft, and connected at either end with a closed receptacle. Steam under pressure is introduced into the slaking chamber, and also water through nozzles on the hollow shaft. The receptacles are provided with conical valves actuated by rods connected to pistons. The discharging receptacle has two such valves, operated simultaneously, so that when it communicates with the slaking chamber, it is cut off from the atmosphere, and *vice versa.* The quicklime is fed into the charging receptacle, then on opening the valve, falls into the slaking chamber, through which it is propelled by means of blades on the hollow shaft, and then passes into the discharging receptacle. A cylindrical screen may be disposed at the inlet end of the slaking chamber. The inner surface of the screen is provided with longitudinal bars, and a number of balls are placed in the interior of the screen, thus forming a kind of ball-mill, to break up any lumps of lime, which might otherwise escape slaking.—A. S.

Sodium and potassium silicates ; Manufacture of ——. W. Gossage and Sons, Ltd., Widnes, and R. E. Weissmüller, Runcorn. Eng. Pat. 23,794, Oct. 28, 1907.

Sodium or potassium silicate is manufactured in a dry and readily soluble condition by subjecting the molten silicate to the action of steam, air, or other gas, at any desired temperature, so as to bring it into a form resembling cotton-wool. This may be done by directing a jet of gas with great force against the molten material as it runs from the furnace in which it is produced. The advantages claimed are a lower cost in packing and freightage of these new articles of manufacture, as compared with a solution, and their ready solubility in boiling water at the ordinary pressure, entailing no special plant at the place of utilisation.—F. Sodn.

Substitute for fuller's earth and process for the production thereof. L. G. Hill, Bristol. Eng. Pat. 27,500, Dec. 13, 1907.

Argillaceous rock, such as slate, is ground to a fine powder, which may be subsequently kilned and levigated if desired.—C. A. M.

Barium and strontium nitrates ; Process of obtaining ——. H. Weyer, Dellbrück, Germany. Eng. Pat. 9772, May 5, 1908.

Calcium nitrate, in solution, undergoes double decomposition with the hydroxide, oxalate, or phosphate of barium or strontium, when heated, insoluble calcium compounds and a solution of barium or strontium nitrate being formed. The reaction is best effected under pressure.—F. Sodn.

Sodium nitrite ; Preparation of pure ——. Norsk Hydro-Elektrisk-Kvaelstofaktieselskab, Christiania, Norway. Eng. Pat. 11,415, May 26, 1908. Under Int. Conv., June 1, 1907.

Solutions of sodium nitrite frequently contain sodium bicarbonate which crystallises with the nitrite. The object of the present patent is to get rid of this impurity by heating the solution, so as to concentrate it and convert the bicarbonate into the more soluble normal carbonate, from which the nitrite is readily separated in the pure state by crystallisation.—F. Sodn.

Lead arsenate ; Process of making ——. E. E. Luther and W. H. Volck, Watsonville, Cal. U.S. Pat. 892,603, July 7, 1908.

Litharge is suspended in a solution of arsenic acid, in the presence of nitric or acetic acid as a catalyst ; lead arsenate is thus formed. 1—3 lb. of the catalyst to 100 lb. of litharge is recommended, and the proportions of lead oxide and arsenic anhydride are calculated from the formula of the desired product (lead pyro- or ortho-arsenate).—F. Sodn.

Arsenic trioxide ; Preparation of ——. U. Wedge, Ardmore, Penn. U.S. Pat. 894,764, July 28, 1908.

The object of the patent is the recovery of arsenic, as commercially pure trioxide, from the sulphide of arsenic constituting a waste product of sulphuric acid manufacture. The sulphide is roasted in a molten and flowing state so as constantly to expose a fresh surface, and for this purpose, either a stationary furnace with sloping hearth or a rotary furnace is employed. The latter is preferred for dealing with large quantities of material and consists of an ordinary inclined rotary kiln heated by gaseous fuel, into the upper end of which the sulphide is fed ; the vapours pass from this into a vertical receiver containing sections of chequer brickwork maintained at a high temperature, so as to ensure the roasting of any escaping sulphide, and thence to a tower where they meet a downward stream of water ; the arsenic trioxide is carried down and accumulates at the bottom of the tower. The trioxide vapour condenses more readily than does the sulphide, and it is sometimes advantageous to employ primary and secondary condensing chambers, separated by a reheater for the oxidation of accompanying sulphide vapour.—F. Sodn.

Salt ; Production of blocks of ——. P. J. B. Vincent. Fr. Pat. 390,155, July 20, 1907.

The claim is for the addition of sodium phosphate or phosphoric acid, or both, to the salt, whilst the latter is being melted, in order to obtain a white product without the necessity of decanting the fused salt. The phosphate reacts with the impurities (compounds of calcium, iron, magnesium, etc.) to form white compounds, which are not injurious, but have a certain alimentary value.—A. S.

Hydrogen ; Manufacture of —— *from water-gas.* L. Vignon. Fr. Pat. 389,671, April 27, 1908.

Water-gas, cooled and washed, is treated in a scrubber with cuprous chloride solution (alkaline, acid, or saline) ; the hydrogen is thus obtained free from carbon monoxide, which is absorbed. The latter gas is recovered by heating the solution or subjecting it to reduced pressure, and the cuprous chloride is then used again in the absorption tower. The carbon monoxide may be utilised by mixing it with air and burning it in the water-gas generator, after passing through a regenerator heated by this gas, so as to supply the heat necessary for the formation of the water-gas, or this may be effected by burning it in a vertical shaft, filled with refractory material, fixed in the centre of the generator.—F. Sodn.

Acids [especially sulphuric acid] ; Separation and concentration of ——. C. Kaesmacher, Valverde del Camino, Spain. Eng. Pat. 2382, Feb. 3, 1908.

See Fr. Pat. 386,783 of 1908 ; this J., 1908, 749.—T. F. B.

Sulphuric acid and sodium sulphate ; Manufacture of ——. U. F. Benker, Clichy, France. U.S. Pat. 899,284, Sept. 22, 1908.

See Fr. Pat. 381,863 of 1906 ; this J., 1908, 225.—T. F. B.

Fluorine from ores ; Process for removing —— *by treatment with a strong acid, such as sulphuric acid.* G. Delplace. Fr. Pat. 390,006, April 13, 1908.

See Ger. Pat. 200,747 ; this J., 1908, 981.—T. F. B.

Sodium sulphate and carbonaceous matter ; Manufacture of a reduction product from ——. G. W. Johnson, London. From Verein Chemischer Fabriken, Mannheim, Germany. Eng. Pat. 23,217, Oct. 21, 1907.

See Addition of Feb. 11, 1908, to Fr. Pat. 383,136 of 1907 ; this J., 1908, 856.—T. F. B.

Solutions containing ammonia ; Treatment of ——, *and the obtainment of ammoniacal salts.* R. Fousset, Paris. Eng. Pat. 25,311, Nov. 14, 1907.

See Fr. Pat. 382,269 of 1906 ; this J., 1908, 226.—T. F. B.

Gaseous mixtures ; Separation of the constituents of —— *and particularly of atmospheric air.* Soc. L'Air Liquide (Soc. anon. pour l'Etude et l'Exploitation des Proc. G. Claude), Paris. Eng. Pat. 20,349, Sept. 12, 1907. Under Int. Conv., Nov. 22, 1906.

See Fr. Pat. 381,866 of 1906 ; this J., 1908, 227.—T. F. B.

Metalloids ; Process of separation of the —— *from the compounds they form with the alkaline metals, the alkaline-earth metals, earth metals, rare earths, and aluminous earths.* H. Herrenschmidt, Paris. Eng. Pat. 2678, Feb. 6, 1908. Under Int. Conv., Feb. 7, 1907.

See Fr. Pat. 384,604 of 1907 ; this J., 1908, 510.—T. F. B.

VIII.—GLASS, POTTERY, AND ENAMELS.

Phosphoric acid ; Action of —— *on silica and silicate glasses.* K. Hüttner. Z. anorg. Chem., 1908, **59**, 216—224. Chem. Zentr., 1908, **2**, 927—928.

Above 300° C., phosphoric acid attacks vessels of fused silica. The compound formed is obtained more easily on heating together powdered anhydrous silica and metaphosphoric acid, the clear solution first produced yielding a white minutely crystalline precipitate consisting of a substance, SiO_2,P_2O_5, which is regarded as silicyl metaphosphate, $SiO:(PO_3)_2$, analogous to boryl phosphate. The same substance is obtained on heating silicon tetrachloride and phosphoric acid together. Heated in a Bunsen flame the compound begins to decompose ; in the oxy-hydrogen flame it is completely dissociated into silica and phosphoric anhydride. The compound is not attacked by boiling water or strong acids, except hydrofluoric acid. By treatment with a mixture of hydrofluoric and sulphuric acids it is completely volatilised. When heated in hydrogen, phosphoric acid is driven off. The solubility of silica in phosphoric acid increases with an increase in temperature or concentration. Phosphoric acid also attacks glass, porcelain, and other silicates, silicyl phosphate and phosphates of the bases present being formed. A clear solution is usually produced, unless an excess of silicate is used.—A. G. L.

Copper ; Production of bright mirror-like deposits of —— *on glass by the reduction of Fehling solution.* P. Neogi. Z. anorg. Chem., 1908, **59**, 213—215. Chem. Zentr., 1908, **2**, 991.

In the glass vessel to be coated with copper, a copper sulphate solution is mixed with the smallest quantity of an alkaline tartrate solution which will redissolve the precipitated copper hydroxide. A concentrated solution of formaldehyde is added, the vessel is inclined, and heated at one point until a small patch of metallic copper is obtained. The vessel is then rotated, the deposition of copper going on continuously.—A. G. L.

Enamelling of iron. R. Vondracek. Sprechsaal, 1908, **41**, 475—477, 493—495, 507—508.

The enamelling of metal, owing to its greater contraction, is more difficult than the enamelling of clay ware. Breidenstein has constructed an instrument for measuring the difference in contraction between metal and glaze (Ger. Pat. 181,556). The iron used for enamelling need not be very pure, but at the temperature 800°—1000° C., enamels containing tin, lead, antimony or zinc would be reduced by the carbon in the iron, and the evolution of carbon dioxide would cause "bubbling." Steel or wrought-iron is better for use than cast-iron. The amount of silicon in the iron should be as small as possible, as it causes the carbon to separate in leaflets which are difficult to remove from the surface of the metal and lead to the formation of holes. As flux, 1 kilo. of felspar, 1·5 kilos. of borax, and 0·25 kilo. of cryolite are used for each ton of iron. The carbon in the surface layer of the iron is burnt out with the aid of oxidising agents. According to various patents, chlorate, nitrate, manganese dioxide or red lead have been proposed. Sodium carbonate has also been recommended; by its use silicon, sulphur and phosphorus are also removed. Or, again, the metal is dipped in 25 per cent. sulphuric acid, whereby a layer of iron sulphate is formed, which oxidises the carbon on heating. The carbon can also be removed by regulating the composition of the fire-gases in burning, according to the reversible reactions: $Fe + CO_2Fe \rightleftarrows O + CO$, and $CO_2 + C \rightleftarrows 2CO$. At 550° the first reaction gives 64 per cent. by weight of carbon monoxide and 36 of carbon dioxide; at 900° C. the ratio is 71·5 : 28·5. If, therefore, the proportion of carbon dioxide be greater than in these ratios, the iron will be oxidised. The cleaning of the metal-surface for taking the enamel is performed by "pickling," or by means of a sand-blast, or electrolytically. The pickling is effected by sulphuric acid (5—10 per cent.), or by hydrochloric or hydrofluoric acid, or by commercial sodium sulphate, which contains 1·5 per cent. of free acid. Hydrofluoric acid (2—10 per cent.) is recommended, as it removes sand and rust without attacking the metal, and the process is finished in 15 minutes. After pickling, the metal is washed with water or with a dilute solution of sodium carbonate. In the electrolytic process, sodium sulphate is used as electrolyte and the iron as cathode. Owing to the formation of the hydroxide of the metal as by-product, this method is said to be the cheapest. Before enamelling, an "undercoat" is deposited to prevent action between the metal and enamel, and to obtain good adhesion. The undercoat may be of silicious material, or of some suitable metal (cobalt, nickel, copper, aluminium, gold) which is often deposited electrolytically. Metallic undercoats, however, are liable to come off in the firing of the enamel. Silicious undercoats may be caused to adhere to the metal before firing by deposition from solutions of acids, alkalis, or gums. The composition of a good undercoat is: $1\cdot0R_2O$, $0\cdot5$—$0\cdot6B_2O_3$, $4\cdot0$—$6\cdot4SiO_2$. The enamel itself may contain 35—40 per cent. of silica and 6—10 per cent. of boric anhydride, with opaque material.—H. H. S.

Vitreous enamelling; Draft regulations for ——. [T.R.]

A set of draft regulations has been issued by the Home Secretary for use in all factories and workshops where vitreous enamelling of metal and glass is carried on; the regulations do not, however, apply to the enamelling of jewellery or watches, the manufacture of stained glass, or enamelling by means of glazes or colours containing less than 1 per cent. of lead. Any objections to the draft regulations must be sent to the Home Secretary by Nov. 18th.

Patents.

Glass-furnaces. C. Royer. Fr. Pat. 390,102, May 11, 1908.

A crucible furnace, with several fire-places, is provided with a central shaft, placed between the fire-places, and communicating in its upper part with an annular chamber surrounding the shaft. Air is drawn from outside the furnace into the central shaft through flues placed above the fire-places and heated by the flames from the latter. The hot air from the shaft passes down through the annular chamber, and emerges from this chamber by means of radial passages, which conduct it to points near the crucibles, where it mixes with and ignites the gases from the fire-places.—A. G. L.

Glass; Manufacture of ——. A. W. Onslow. Fr. Pat. 390,321, May 16, 1908. Under Int. Conv., Mar. 24, 1908.

A glass-furnace containing one or more pots is heated by means of compressed gas supplied to burners of the type described in Eng. Pats. 7608 of 1902 and 24,064 of 1904 (this J., 1902, 851; 1905, 611) which are placed below the crucibles. The flames surround the pots completely, the burnt gases escaping through an opening at the top of the furnace provided with a damper, or, preferably, passing through flues leading to chambers in which other pots are preheated. Channels are formed in the furnace walls below the level of the burners; should the pot break, the molten glass flows through these channels into a trough from which it may be recovered.—A. G. L.

Potters' ovens or kilns; Gas-fired ——. A. Woolley, Longton, Staffs. Eng. Pat. 19,695, Sept. 3, 1907.

The object of the invention is to provide means for controlling the firing of the kiln. For this purpose, a well is formed below the main exhaust flue of the kiln, at the point where the flues from the interior of the kiln enter it. Communication between these flues and the main flue is controlled by a fireclay plug, preferably of conical shape, which is mounted on a fireclay table secured to the top of a square bar, which moves vertically up and down in the well. On three sides of the bar there are guides bearing rollers which press against the faces of the bar. The lower part of the fourth face is provided with rack teeth, which engage a pinion wheel mounted on a shaft extending outside the well, and there provided with a wheel by which it can be turned.—A. G. L.

Glass; Process for making ——. Siemens und Halske A.-G. Fr. Pat. 389,962, May 7, 1908. Under Int. Conv., May 11, 1907.

See Eng. Pat. 9563 of 1908; this J., 1908, 750.—T. F. B.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Fire-bricks; Note on the determination of the heat-conductivity of ——. M. Simonis. Sprechsaal, 1908, **41**, 547—549.

The author measured the fall in temperature along the axis of composite firebricks formed by grinding two bricks so as to fit together exactly, after cutting parallel grooves one cm. apart in one of the bricks to allow of the insertion of thermocouples. The two bricks were pressed together by means of clamps, and covered with a layer of carborundum kept in position by a small frame, the carborundum being heated from above by an inclined burner. From the author's results it appears that when equilibrium is established, the ratio of the temperature at a point on the axis 1 cm. from the carborundum to the temperature at a point 2 cm. from the carborundum equals a constant. The ratios obtained for a firebrick, carborundum brick, and a porous brick were respectively 1·30, 1·26 and 1·40; the water absorbed by the bricks being 15·9, 9·2, and 40·5 per cent. respectively. In spite of these results, the author believes that the heat conductivity of a heat insulator depends only on the amount of air contained in the insulator, and consequently that the determination of the water absorption is more important than the direct measurement of the conductivity.—A. G. L.

Patents.

Fire bricks, crucibles, retorts, and the like fire resisting articles; Manufacture of ——. S. Payne, Brighton. Eng. Pat. 11,062, May 21, 1908.

A mixture in suitable proportions of clay, tar, water, sea sand, fine flint gravel or other form of silica and Portland cement or gypsum, is moulded into firebricks, crucibles, etc., and these are dried and hardened by exposure to the air, no burning being required.—A. S.

Ceramic and refractory products; Manufacture of ——. H. Herrenschmidt. Fr. Pat. 389,863, July 10, 1907.

About one-half of the refractory material (fireclay, sand, etc.) usually employed is fused and allowed to solidify before mixing it with the other half, to which a binding agent (clay, kaolin, etc.) may be added. It is claimed that the product obtained conducts heat well, and is suitable for making crucibles, zinc retorts, etc.
—A. G. L.

Mica powder; Production of ——. A. B. C. Rogers, Agra, India. Eng. Pat. 12,570, June 11, 1908.

Flake or scale mica is saturated with an "anti-lubricating" liquid, such as a solution of alum, and ground in a suitable mill. The resulting powder is then washed; but for many purposes, as for providing a non-inflammable coating, it may be used without washing.—F. Sodn.

Plaster of Paris; Revitalising discarded ——. J. E. Eastwick, Philadelphia, Pa. U.S. Pat. 898,451, Sept. 15, 1908.

Waste hydrated calcium sulphate is "revitalised" by drying or partially drying it, and then saturating in a solution of sulphuric acid, alum, and water, to which glue may also be added; the material is then calcined.
—F. Sodn.

Plaster; Process for making —— and "accelerators" to be mixed with it. H. S. Spackman Engineering Co. Fr. Pat. 390,194, May 13, 1908.

A lime-plaster is mixed with an "accelerator," which increases its strength and shortens the setting time. The accelerator is essentially a calcium aluminate, containing about 40 per cent. of alumina, and obtained by burning lime with clay, kaolin, etc. A suitable composition for a wall plaster consists of 10 per cent. of the "accelerator," 2 of plaster of Paris, 2 of infusorial earth or other silicious material, and 86 of slaked lime. The initial setting time of the mixture is stated to be 15 minutes, and the final, 15 hours.—A. G. L.

Wood; Preserving ——. W. Buchler, Assignor to G. W. Bestor, Minneapolis, Minn. U.S. Pats. 899,237 and 899,480, Sept. 22, 1908.

(1). Wood, is immersed in a non-aqueous preservative liquid contained in a closed vessel, which is heated sufficiently to expel a part of the gaseous and aqueous constituents of the wood. The aqueous layer accumulated on top of the preservative agent having been removed, the vessel is allowed to cool, and pressure is exerted by which the agent is driven into the pores of the wood. The surplus liquid is next drained away, and the wood immersed in a cold compressed gas which drives the agent further into the wood, after which the gas is allowed to expand. (2). Wood is introduced into a closed vessel, which is evacuated, and then filled with a warm, non-aqueous preservative agent. After applying pressure to drive the liquid into the wood, the surplus liquid is removed, and the vessel filled with cold compressed air (under relatively low pressure), which is finally allowed to expand.—A. G. L.

Wood; Process of preserving ——. C. Howard, New York, N.Y. U.S. Pat. 899,400, Sept. 22, 1908.

Wood is dried by heating, and treated with a cold solution containing less than 20 per cent. of magnesium sulphate. The wood is again dried by heating, and while hot, is treated with a hot solution containing less than 6 per cent. of barium chloride.—A. G. L.

Concrete and lime-mortar; Process for the preparation of waterproof ——. P. Mecke. Ger. Pat. 200,968, Feb. 15, 1908.

A paste prepared by treating basic calcium oleate (obtained by adding ammonium oleate to a mixture of freshly slaked lime and water) with aluminium sulphate, is added to the concrete or mortar.—A. S.

Rotary furnaces [for cement]; Burning process employed in ——. K. von Radlowski, Rajkowey, Russia. Eng. Pat. 2528, Feb. 4, 1908.

Coal is mixed with the cement raw materials, before or after grinding. The mixture is burnt in a rotatory kiln, into which air only is blown from the lower end. It is claimed that the clinker obtained is better burnt, and more easily ground than that made as usual, and that the kiln lining suffers less. (Reference is directed to Eng. Pats. 5719 of 1890 and 4813 of 1899; this J., 1891, 466; 1900, 248).—A. G. L.

Cement; Refractory —— for building purposes. P. Timofeoff. First Addition, dated May 6, 1908, to Fr. Pat. 368,339, July 24, 1906 (this J., 1906, 1221).

White gypsum is burnt at about 136° C. and mixed with 2—5 per cent. of a mixture of 3—1 parts of dextrin with 1—2 parts of water-glass. Small quantities of substances are then added, which either increase the resistance of the cement and hasten its setting, *e.g.*, acids and salts capable of liberating silica from the water-glass, or tannin, quartz, etc., or which render the cement more refractory and delay its setting, *e.g.*, basic substances, borax, Portland cement, gum arabic, casein, etc., or which render the cement more refractory, but have no effect on the rate of setting, *e.g.*, barium chloride, fluorspar. The cement is then gauged with water as usual. Or else, the soluble constituents of the cement may be dissolved in the water used for gauging. The set cement may also be burnt at a red-heat, powdered, and mixed with the materials constituting the original cement, a more refractory cement being thus obtained.—A. G. L.

Cement; Process of making ——. Soc. J. et A. Pavin de Lafarge. Fr. Pat. 390,290, May 15, 1908.

Bauxite, preferably ferruginous and containing less than 60 per cent. of alumina, is fused with sufficient lime to give a product corresponding to the formula, $SiO_2,2CaO+Al_2O_3,CaO$. The fused mass is granulated and quickly cooled as usual, after which it is powdered.
—A. G. L.

Cement, minerals and similar substances; Process for treating —— in a rotatory kiln. G. Polysius. Fr. Pat. 390,316, May 16, 1908. Under Int. Conv., May 18, 1907.

The material is burnt and cooled completely in one cylinder only. For this purpose, the usual rotatory kiln is greatly prolonged beyond the burner towards the discharge end, and cold air is sucked or blown into this end, passing over the burnt material and cooling it.
—A. G. L.

Adhesive; Preparation of an ——. H. Reuss. Ger. Pat. 201,309, Feb. 4, 1906.

A mixture of a solution of rubber in benzene, Venice turpentine, and the vegetable glue known in commerce as "Sichelleim" is mixed with water, and heated and stirred until it begins to swell up. The jelly obtained on cooling is mixed with the necessary quantity of plaster of Paris containing about 2 per cent. of magnesium carbonate, in order to obtain an adhesive, which, it is stated, is not altered by change of temperature and can be used on wood, glass, etc., and even on damp walls.
—A. S.

Woods; Process and apparatus for the injection of ——. M. Boucherie, Paris. Eng. Pat. 1854, Jan. 27, 1908. Under Int. Conv., Jan. 28, 1907.

See Fr. Pat. 373,992 of 1907; this J., 1907, 762.—T. F. B.

Stone or marble ; Manufacture of —— artificially. T. M. Thom, Cheshunt, Assignor to Lithographic Stone and Marble Co., Ltd., London. U.S. Pat. 898,703, Sept. 15, 1908.

See Eng. Pat. 9633 of 1907 ; this J., 1907, 1281.—T. F. B.

X.—METALS AND METALLURGY.

Iron ores ; Mechanical cleaning of ——. T. C. Hutchinson. Iron and Steel Inst., Sept., 1908. [Advance proof.]

The author, after ten years' experience of smelting Cleveland ironstone, emphasises the advantage of carefully cleaning the ore, by hand picking or otherwise, before charging it into the blast-furnace. Tables are given, from actual practice, showing the cost of smelting ironstone from the same main bed but with varying admixtures of impurities. Tables of analyses, costs, etc. are also given. —F. R.

Sulphur in pig-iron and steel ; Determination of —— by the hydrogen jet method. R. Bolling. Engineering News, 1908, **59**, 505—506.

The gases evolved on treating the sample with acid are burnt in admixture with pure hydrogen, and the sulphur dioxide formed is absorbed in a dilute solution of sodium carbonate and estimated gravimetrically as barium sulphate or volumetrically by titration with iodine. Five grms. of pig-iron or steel drillings are placed in a flask fitted with a thistle funnel and with inlet and outlet tubes for a current of pure hydrogen from a Kipp's apparatus. After displacing the air, the outlet tube is connected to a jet arranged within a wide glass cylinder provided with an air inlet ; hydrochloric acid is then introduced into the flask ; the jet is ignited by a spark, and the products of combustion aspirated through a gas washing bottle charged with sodium carbonate solution. At the end of the reaction, the gases in the flask are again displaced by pure hydrogen. For a gravimetric determination, a 5 per cent. solution of sodium carbonate is used, containing a few drops of potassium permanganate, but for a volumetric determination, an 8 per cent. solution is used and no permanganate is added.—A. T. L.

Steel ; Practical experiments in ——. C. L. Huston. J. Franklin Inst., 1908, **165**, 371—384.

By means of a large number of tensile strength and carbon determinations on test-pieces from different parts of the same ingots, the author shows that a large amount of segregation occurs in mild steel plates. The carbon is always highest at the centre of the top of the ingot ; next to this, the zone of gas-bubbles, which extends all round the ingot, roughly parallel to, and some distance from, the surfaces of the ingot, is richest in carbon, the percentage falling off considerably towards the outside, and slightly towards the centre of the ingot. Thus in one case, the carbon varied from 0·60 per cent. at the centre of the top to 0·15 at the edges of the top, 0·28 at the centre of the ingot, 0·23 at the edges of the bottom, and 0·30—0·51 per cent. at the zone of gas-bubbles. Since the tensile strength follows the carbon content, the author believes that the best procedure would be to leave a wide margin in specifications of tensile strength, a lower tensile strength being accepted if the ductility were correspondingly increased.—A. G. L.

Steels ; Constitution of carbon ——. E. D. Campbell. Iron and Steel Inst., Sept., 1908. [Advance proof.]

After reviewing our present knowledge of the constitution of carbon steels, the author points out that the assumption of the existence of only one definite carbide of iron, Fe_3C, does not afford a complete and satisfactory explanation of some well known facts. An account is then given of the electrolytic recovery and examination of the carbides from two samples of tool steel containing 1·17 per cent. of carbon, one sample having been converted into troostite and the other into martensite. If was found that practically all the carbon even in hardened steel may be recovered as carbide residue. Analysis of the carbide residue from the martensite gave 12·43 per cent. of carbon and 51·94 per cent. of iron with about 31 per cent. of loosely combined water and over 4 per cent. of silicon, manganese, phosphorus, and sulphur. The empirical formula of the carbide was thus very nearly Fe_9C_{10}. The carbide recovered from the troostite contained 7·55 per cent. of carbon and 72·42 per cent. of iron with about 15 per cent. of combined water, the ratio of iron to carbon in this case corresponding very nearly to the formula, Fe_2C. Portions of the carbide residues were dissolved in dilute nitric acid under the same conditions as those employed for the colorimetric determination of carbon, complete solution being obtained in both cases. The carbide from the troostite gave a darker colour than that from the martensite, the ratio being 19·7 to 10, and the same colour as that given by the carbide recovered from a carefully annealed specimen of tool steel containing 1·28 per cent. of carbon. The author is of opinion that a number of carbides of iron should be recognised instead of the single carbide, Fe_3C, and that the constitution of these carbides resembles that of the hydrocarbons, since it has been shown that the products of solution of iron and steel in dilute acids contain a number of saturated hydrocarbons of the paraffin series and unsaturated hydrocarbons of the olefine series. It is also suggested that, as in the case of saline solutions, carbides of iron in solid solution in iron undergo ionic and molecular dissociation, which in both cases is a function of the carbon concentration and the temperature. Thus the analyses indicate marked dissociation, ionic as well as molecular, in the carbides from martensite; while in the case of troostite, almost complete association and polymerisation of the dissolved carbides is indicated. The general formula, C_nFe_{2n} is given for carbides in solid solution, and $C_nFe_{2n}Fe_n$ for carbides crystallised from solid solution, as in pearlite, the additional iron being iron of crystallisation.—O. F. H.

Vanadium-iron alloys. R. Vogel and G. Tammann. Z. anorg. Chem., 1908, **58**, 73–82. Chem. Zentr., 1908, **1**, 2141—2142.

The thermal examination of alloys of vanadium and iron, prepared by the alumino-thermic process, shows that these two metals form a continuous series of mixed crystals, the eutectic point in the case of alloys containing about 1 per cent. of silicon being about 1435° C. (32 per cent. of vanadium). If the alloys contain about 7·5 per cent. of silicon, the eutectic point is depressed to 1380° C., and no mixed crystals are formed between the limits 55 and 90 per cent. of vanadium. Microscopic examination of the alloys containing between 20 and 52 per cent. of vanadium showed that these undergo a transformation at 1100°—1250° C., which is not indicated on the cooling curves of the alloys ; the alloys are homogeneous when cooled rapidly, but non-homogeneous when cooled slowly. The eutectic alloy (32 per cent. of vanadium) does not exhibit this transformation. In the presence of 10 per cent. of vanadium, the transformation points of iron can no longer be observed. Vanadium containing 7·5 per cent. and 1·21 per cent. of silicon respectively melts at 1680° C., and $1750° + 30°$ C. Vanadium-steels show a brilliant, coarsely-crystalline fracture, and with the exception of those very rich in iron, are hard and tolerably brittle. When the content of silicon rises as high as 7·5 per cent., the hardness and brittleness increase to such an extent that the alloys can no longer be worked, and when hammered, break like glass. Alloys free from silicon are readily attacked by nitric acid, but those containing 7·5 per cent. of silicon, only by hot *aqua regia*.—A. S.

Steel and wrought iron tubing ; Relative corrosion of ——. H. M. Howe and B. Stoughton. Eng. and Min. J., 1908, **86**, 563.

The authors advance the opinion, based on their own tests and on others of which they have information, that good modern makes of steel tubing resist corrosion as well as, and in some cases even better than, wrought iron. They except, however, the case of such a corrosive agent as mine water containing sulphuric acid, where the tests proved unfavourable to even modern steel tubing. Details are not given in the paper except, that among others, tests were made by exposing steel and wrought iron pipes, side by side, to the action of hot water, hot aërated salt water, acid coal-mine water, etc., and by leaving them buried in dampened ashes. The time of treatment varied from 7 to 26 months, the longest being in the case of a Gayley blast-drying coil. The authors consider that the prejudice against steel is based on insufficient evidence or on tests made on steel of old makes and inferior quality. —F. R.

Iron; Influence of silicon on the physical and chemical properties of ——. A. Jouve. Iron and Steel Inst., Sept., 1908. [Advance proof.]

The magnetic susceptibility of ferrosilicon decreases with increase of silicon, the curve showing three breaks corresponding to the compounds, Fe_2Si, FeSi, and $FeSi_2$. The resistance to the action of acids increases with the proportion of silicon, the corrosion in the case of high-grade ferrosilicons being negligible. Details of commercial tests on basins, tubes, pipes, tubs, and vats made of these alloys are given. Thus an alloy containing only 20·6 per cent. of silicon lost only 0·06 per cent. after being in contact with hot sulphuric acid (22° B.) for two months, and alloys containing higher percentages of silicon have successfully withstood the action of strong nitric acid. (See also this J., 1908, 751.)—O. F. H.

Lead sulphide and its oxidation products; Chemical equilibria in the reactions between ——. *III.* R. Schenck and W. Rassbach. Ber., 1908, **41**, 2917—2925.

In order to clear up some uncertainty in the results of their previous work (this J., 1907, 764, 826), the authors determined the cooling curves of 25 different mixtures of lead oxide and lead sulphate and from the results constructed the equilibrium-curve of the system. Pure lead sulphate does not melt completely at 1000° C.; the oxide melts at 879° C. The solidification-curve shows two maxima, at 966° and 951° C. respectively, corresponding to the basic sulphates, $PbSO_4,PbO$ and $PbSO_4,2PbO$. A third basic sulphate may also be formed, *viz.*, $PbSO_4$, 3PbO, but is only stable below 880° C., above which temperature it decomposes, with formation of the compound, $PbSO_4$, 2PbO. There are three eutectic points at 820° C. (87 per cent. of lead oxide), 940° C. (53 per cent. of lead oxide), and 950° C. (30 per cent. of lead oxide). At 850° C. lead sulphate undergoes a dimorphous transformation, and at 450° C., there is indication of a transformation of the basic sulphate, $PbSO_4,2PbO$. The authors determined the pressure of the sulphur dioxide evolved from mixtures of lead sulphide and the three basic sulphates at different temperatures by the method previously described (this J., 1907, 764). Satisfactory results could be obtained only with the basic sulphate, $PbSO_4,PbO$. The reaction with this compound may be expressed by the equation,

$$2(PbSO_4,PbO)+3PbS \rightleftarrows 7Pb+5SO_2.$$

If the results, together with those previously obtained, be expressed graphically, the field is seen to be divided into four parts, in which, with rising temperature (up to the lowest eutectic point, 820° C.), the final products of the roasting of lead sulphide are respectively: lead sulphate, basic lead sulphate, $PbSO_4,PbO$, lead oxide (or a highly basic sulphate), and metallic lead containing some sulphide.—A. S.

Lead silicates; Formation of —— *and their function in modern processes for extracting lead.* S. Hilpert. Metallurgie, 1908, **5**, 535—539.

By heating a mixture of lead sulphate and silica in the proportions, $PbSO_4:SiO_2$, at varying temperatures for 30 minutes in a current of nitrogen, and determining the loss in weight and composition of the residue, the author found that the formation of lead silicate begins at about 720° C., proceeds slowly at temperatures below about 860° C., and is very rapid at 860°—900° C., no lead oxide being volatilised. By heating mixtures in the proportions $2PbSO_4:1SiO_2$, $1PbSO_4:1SiO_2$, $2PbSO_4:3SiO_2$, and $1PbSO_4:2SiO_2$ at 930° C. and 1000° C. for different periods, he found that at 930° C. only in the last mixture was the velocity of reaction appreciably greater than in the others, whilst at 1000° C. every increase in the proportion of silica present had a marked effect, the last mixture having a much higher velocity of reaction than the others, which also differed considerably amongst themselves; the mixture, $1PbSO_4:2SiO_2$, remained perfectly solid, the two intermediate mixtures liquefied partially, and the mixture, $2PbSO_4:1SiO_2$, liquefied wholly. From these results the author concludes that the chief function of the additions (lime, gypsum, iron spar) made in the converter process for winning lead is to prevent the mixture from liquefying, difficultly fusible silicates being produced. The fact that the reactions in the converter take place at temperatures far below those used in his own experiments, he explains by the far greater velocity of the blast used in the converter, which carries away the sulphur trioxide produced.—A. G. L.

Lead oxide; Volatility of —— *from its silicate solutions.* S. Hilpert. Metallurgie, 1908, **5**, 539.

Intimate mixtures of lead oxide and silica in different proportions were heated for varying periods at 930° C. and 1000° C., and the loss in weight determined. It appears that at 930° C., lead oxide does not volatilise appreciably from mixtures richer in silica than the ortho-silicate, $2PbO,SiO_2$, whilst at 1000° C. the same is true of mixtures richer in silica than the metasilicate, PbO,SiO_2. —A. G. L.

Copper-tin alloys. O. Sackur and H. Pick. Z. anorg. Chem., 1908, **58**, 46—58. Chem. Zentr., 1908, **1**, 2140—2141.

The precipitation method used previously by Sackur (see this J., 1904, 791; 1905, 803) has been applied to copper-tin alloys. If a copper-tin alloy be shaken with a solution of lead chloride, precipitation of lead and solution of tin will take place only if the alloy contain some uncombined tin. This is the case with the alloys containing more than 44 per cent. of tin. Alloys containing less than 43 per cent. of tin do not precipitate appreciable quantities of lead from a solution of lead chloride, and hence must contain the tin in the form of a compound having a lower solution-pressure than that of tin. Alloys containing from 40 to 43 per cent. of tin precipitate copper from solutions of cuprous chloride or bromide; alloys with less than 40 per cent. of tin, on the other hand, will precipitate copper only from solutions of cupric chloride or sulphate. Copper and tin thus form two compounds of potentials equal to those shown by the alloys containing 0—40 and 40—43 per cent. of tin respectively, whilst the alloys containing more than 43 per cent. of tin exhibit the same potential as tin. From the known solubilities of the cuprous halides and the normal potential of copper, the potentials of the two compounds of copper and tin may be calculated. The formulæ of the two compounds are probably Cu_3Sn and Cu_5Sn_2 (or possibly Cu_2Sn).—A. S.

Bronze, brass, and similar alloys; Analysis of ——. E. Schürmann and H. Arnold. *See* XXIII.

Silicon-aluminium alloys. W. Fraenkel. Z. anorg. Chem., 1908, **58**, 154—158. Chem. Zentr., 1908, **2**, 143.

Aluminium and silicon when fused together are miscible in all proportions, but form no compounds. Mixed crystals are formed at both ends of the series, containing respectively up to about 2 per cent. of aluminium and up to about 0·5 per cent. of silicon. The eutectic alloy melts at 578° C. and contains 10 per cent. of silicon. —A. S.

Thorium and nickel; Alloy of ——. E. Chauvenet. Bull. Acad. roy. Belg., Classe des sci., 1908, 684—685. Chem. Zentr., 1908, **2**, 1095.

By heating a mixture of thorium chloride and metallic lithium in a nickel boat in a vacuum, a well-defined thorium-nickel alloy, Th_2Ni, was obtained, which, however, always contained about 10 per cent. of thoria. It forms gray leaflets or a black powder, which ignites spontaneously on rubbing or on heating to 115° C. It is rapidly dissolved by hydrochloric acid, and when heated to 400° C., is stated to decompose with evolution of nickel carbonyl "and separation of carbon." It is not magnetic.—A. S.

Sulphides ; Melting and subliming of some ——. W. Biltz. Z. anorg. Chem., 1908, **59**, 273—284. Chem. Zentr., 1908, 2, 1094—1095.

The author's experiments were made with about 0·1 grm. of substance, this being heated on a plate of magnesia, in a current of nitrogen, in a tube of porcelain glazed outside, or of magnesia, in a carbon resistance furnace, which admitted of any changes being directly observed. Synthetic lead sulphide sublimed at about 950° C. in feathery aggregates of crystals, belonging to the regular system; galena from Freiberg melted at 1112°±2° C. With pure zinc blende from Santander, sublimation was first observed at 1178°±2° C.; wurtzite obtained by heating precipitated zinc sulphide in a current of nitrogen sublimed in needles at 1185°±6° C. Artificial greenockite in the form of hexagonal amber-yellow crystals, was obtained by heating precipitated cadmium sulphide in a current of nitrogen; it sublimed at 980° C. Cinnabar and black precipitated mercuric sulphide sublimed at 446°±10° C. Precipitated ferrous sulphide melted at 1197°±2° C. to a yellowish mass with a metallic lustre. Precipitated nickel sulphide, NiS, melted at 797°±2° C. to a crystalline, white mass with metallic lustre. Cobalt sulphide gave a similar yellowish-white mass melting above 1100° C. Stannous sulphide melted at about 870° C. with absorption of heat, remained liquid between 870° and 1000° C., became tough and then completely solid between 1000° and 1100° C., and melted again with absorption of heat at about 1120° C.; it sublimed freely above 1100° C.—A. S.

Tinning of metal articles ; Draft regulations for the ——. [T.R.]

The Home Secretary has issued a set of draft regulations which are to apply to all factories and workshops in which the coating of metals with lead, or a mixture of lead and tin, is carried on. Any objections to the draft must reach the Home Secretary by Nov. 18th next.

Antimony and arsenic production of the United States. U.S. Geol. Survey, 1908. [T.R.]

The following table shows the production of antimony and arsenic in the United States during the past seven years:—

	Arsenic.		Antimony.	
Year.	Short tons.	Value.	Short tons.	Value
1901........	300	$18,000	2,649	$542,020
1902........	1,353	81,180	3,561	634,506
1903........	611	36,691	3,128	548,433
1904........	36	2,185	3,057	505,524
1905........	754	35,210	3,240	705.787
1906........	737	63,460	1,766	602,549
1907........	1,751	163,000	2,022	622,046

The figures for arsenic represent the production of white arsenic or the arsenic content of ores expressed as white arsenic. Those for antimony include that contained in antimonial lead and that produced from foreign and domestic ores. The imports of white arsenic, arsenic metal, and arsenic sulphides in 1907 amounted to 5164 tons, and of Paris green and London purple to 133,422 lb. Imports of antimony (metal and regulus) in 1907, were 9,600,901 lb.; crude antimony and ore, 2,771,387 lb.; antimony salts, 682,192 lb.; of a total value of $1,686,802.

Patents.

Pig iron for the manufacture of steel in the converter; Production of ——. A. Zenzes, Charlottenburg, Germany. Eng. Pat. 23,627, Oct. 25, 1907.

A pig-iron containing less than 3 per cent. of carbon is produced by adding ferrosilicon (10 per cent.) before or after melting ordinary steel scrap in a cupola. The duration of the blow in the subsequent treatment of this pig-iron in the converter is stated to be reduced by about one-third.—J. W. H.

Refining iron ; Process of ——. S. B. Sheldon, Buffalo, N.Y. U.S. Pat. 898,513, Sept. 15, 1908.

The improvement consists in transferring to an auxiliary furnace a part of the slag remaining at the end of a refining operation, adding fresh basic material in quantities sufficient to maintain uniform "basic efficiency," applying sufficient heat to fuse the added material and allow the shotted metal in the slag to accumulate, and then transferring the molten slag, or part of it, to a refining furnace, to be used as part of the charge for another refining operation. Pig metal may be added to the shotted metal which accumulates in the auxiliary furnace.
—F. Sodn.

Ores ; Apparatus for roasting and sintering ——. A. S. Dwight and R. L. Lloyd, New York. Eng. Pat. 25,985, Nov. 23, 1907.

Finely divided ores such as sulphide copper ores, which when once ignited will continue to burn in an oxidising atmosphere, are roasted in receptacles which have perforated bottoms and are moved over an air chamber connected with an exhaust fan or chimney. Air is thus drawn from above downwards through the ore, combustion being started in the upper layers of ore by means of a row of gas jets, which direct flames on to the upper surface of the ore. One form of the apparatus consists of a series of pans or buckets attached to an endless chain and supported on rails. The bottom of each bucket is perforated and on this a layer of limestone, sintered ore, or ironstone is delivered from a hopper; this layer serves to protect the bottom of the bucket from the action of the reaction-products. The bucket is next passed beneath a second hopper, from which it receives its full charge of finely divided ore, and is then passed over the air chamber after combustion has been started by means of gas jets. A hood is provided over the air chamber in order to retain the heat of combustion, and the sintered ore is discharged by automatically tipping the buckets.
—O. F. H.

Desulphurising ores ; Method of ——. K. A. Johansson, Sandviken, Sweden. U.S. Pat. 899,219, Sept. 22, 1908.

Iron or manganese ores are desulphurised by mixing them with a mineral containing free silicic acid, pressing the mixture into briquettes, and roasting the latter.
—A. S.

Ores containing zinc and other volatilisable metals ; Process of treating complex —— *for the production of oxides.* G. M. Rice, Worcester, Mass. U.S. Pat. 899,322, Sept. 22, 1908.

Complex sulphide ores containing zinc, lead, etc., are crushed and mixed with a quantity of finely-divided metallic iron chips more than sufficient to combine with the sulphur to form ferrous sulphide and to form a slag with the silica in the ore. The mixture is heated in a suitable furnace to a temperature sufficient to drive off the volatilisable metals and to melt the residue to matte and slag, these latter being subsequently separately drawn off. The fumes from the furnace are mixed with air and led to suitable condensing chambers to recover the zinc as oxide and the lead as sulphate.—A. S.

Ore ; Method of treating ——. J. T. Jones, Iron Mountain, Mich., Assignor to G. A. St. Clair, Duluth, Minn. U.S. Pat. 899,405, Sept. 22, 1908.

The ore is roasted in an oxidising atmosphere so as to expel the sulphur, without melting the ore, and is then treated, "under confinement," with fresh hydrocarbon fuel, whereby the latter is volatilised by the heat of the ore, producing a de-oxidising atmosphere, which reduces the metallic oxides in the roasted ore to metal.—A. S.

Furnace ; Desulphurising ——. R. Hübner, New York. U.S. Pat. 899,403, Sept. 22, 1908.

The furnace consists of a number of superposed ore-chambers, provided with openings through which the ore may pass from one chamber to the next lower one. Devices are provided by which any chamber can be isolated from the others, and each chamber has a separate exhaust channel leading to the outside of the furnace.
—A. S

Alloys or the like of metals and metalloids with boron ; Extraction of —— from ores or compounds. H. Herrenschmidt, Paris. Eng. Pat. 20,377, Sept. 12, 1907. Under Int. Conv., Sept. 18, 1906.

See Fr. Pat. 369,878 of 1906 ; this J., 1907, 208.—T. F. B.

Arsenical ores ; Process of reducing ——. G. M. Westman, New York. Eng. Pat. 3480, Feb. 15, 1908.

See U.S. Pats. 879,931 and 879,932 of 1908 ; this J., 1908, 339.—T. F. B.

Ores, principally iron ores Method for reducing ——. K. A. F. Hiorth, Christiania. Eng. Pat. 3680, Feb. 18, 1908. Under Int. Conv., Feb. 21, 1907.

See Fr. Pat. 387,284 of 1908 ; this J., 1908, 818.—T. F. B.

Ferruginous ore ; Process of treating —— for the manufacture of iron and steel therefrom. M. Moore, Melbourne, and T. J. Heskett, Brunswick, Victoria. Reissue No. 12,856, dated Sept. 22, 1908, of U.S. Pat. 791,928, June 6, 1905.

See Eng. Pat. 26,131 of 1907 ; this J., 1908, 813.—T. F. B.

Copper and copper alloys ; Process of casting ——. C. Gautsch, Munich, Germany. U.S. Pat. 898,638, Sept. 15, 1908.

See Fr.Pat. 365, 733 of 1906 ; this J., 1906, 990.—T. F. B.

Metals ; Extraction of —— from their ores. J. Turton, Johannesburg. U.S. Pat. 899,146, Sept. 22, 1908.

See Eng. Pat. 25,672 of 1905 ; this J., 1906, 1101.—T. F. B.

Metals ; Separation of —— from their ores. J. D. Wolf, London. U.S. Pats. 899,149 and 899,478, Sept. 22, 1908.

See Eng. Pat. 20,322 of 1905 ; this J., 1907, 52.—T. F. B.

Metals ; Process and apparatus for annealing and tempering ——. H. Krautschneider, Berlin. U.S. Pat. 899,452, Sept. 22, 1908.

See Eng. Pat. 14,479 of 1904 ; this J., 1905, 849.—T. F. B.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(*A.*)—ELECTRO-CHEMISTRY.

Fused salts ; Electric conductivity of ——. K. Arndt and A. Gessler. Z. Elektrochem., 1908, **14**, 662—665.

The authors have determined the electric conductivities at varying temperatures of haloid salts of potassium, sodium, calcium, and silver, and also of sodium metaphosphate and boric anhydride. The results show that at the same temperature, a chloride conducts better than the corresponding bromide, and the latter again better than the iodide. The conductivity of a sodium salt is about 1½ times as great as that of the corresponding potassium salt. Silver chloride has the highest conductivity of any salt examined. The increase of conductivity with temperature is much less rapid than in the case of aqueous solutions. In nearly all cases the increase is proportional to the rise of temperature, and in the case of alkali-metal bromides and iodides, the conductivity is proportional to the absolute temperature. In most cases the conductivity of mixtures of similar salts is the mean of those of the components. The results for silver haloids confirm those long ago obtained by Kohlrausch. The figures given are too numerous to quote, but to show their order of magnitude a few of those at 800° C. may be cited (in reciprocal ohms per centimetre cube) : silver chloride, 4·98 ; sodium bromide, 3·06 ; potassium chloride, 2·19 ; calcium chloride, 1·90 ; sodium metaphosphate, 0·80 ; boric anhydride, 0·000007.—J. T. D.

Polynitro-compounds ; Partial electrolytic reduction of ——, in presence of vanadium salts. H. Hofer and F. Jakob. Ber., 1908, 41, 3187—3199.

In presence of quadrivalent vanadium compounds, the partial reduction of polynitro-compounds can be carried out electrolytically, the current density being so arranged that a constant cathode-potential is maintained : that, namely, at which the electrolytic reduction of the higher vanadium salt balances its production through the reducing action of the lower salt on the hydroxylamino-compound. The monamino-derivatives of 1 : 2 : 4-dinitrotoluene, *m*-dinitrobenzene, 1 : 2 : 6-dinitrotoluene, 1 : 2 : 4-dinitrophenol, 1 : 2 : 4 : 6-trinitrotoluene, and picric acid, have all been thus obtained. Dinitroazoxy-compounds were produced as by-products.—J. T. D.

Patents.

Batteries ; Primary ——. W. A. F. Bleeck, South Brisbane, Australia. Eng. Pat. 5297, March 9, 1908.

The cell consists of a zinc rod in a porous pot surrounded by a perforated cylinder of carbon in an outer containing vessel. The exciting liquid is a solution of sodium hydroxide, and the depolarising fluid consists of : chromic acid, 5 oz. ; hydrogen peroxide (3 per cent.), 10 fluid oz. ; hydrochloric acid, 5 fluid oz.—J. W. H.

Electric accumulators ; Increasing and regenerating the capacity of ——. Akkumulatoren-Werke Witten, G.m.b.H. Ger. Pat. 201,147, Sept. 3, 1907.

In order to prevent the active material of the negative electrodes of accumulators from shrinking and thereby becoming inactive, it has been proposed to add carbon thereto. The patentees have found that it is not necessary for the carbon to be mixed with the active material, but that the most satisfactory results are attained, if it be added in the form of a fine powder, *e.g.*, as soot, to the electrolyte. When assembling a new accumulator battery, it is sufficient to cover the electrolyte in the several cells with a layer of soot, which gradually mixes with the liquid during the charging.—A. S.

Spongy metal plates resistant to air ; Preparation of —— for electric accumulators. W. Heym. Ger. Pat. 201,750, Aug. 1, 1907.

It has been found that negative electrodes of spongy metal, when completely dried in absence of air or oxygen, do not undergo oxidation when subsequently brought in contact with air. The charged negative electrodes are treated with suitable neutralising agents, the adherent electrolyte is removed by washing, and the electrodes then dried without access of air. The drying may be effected by introducing the electrodes into a vessel previously heated to a high temperature, whereupon the steam evolved displaces the air ; subsequently the steam is removed by means of an air-pump. The electrodes are transferred from this vessel into another one filled with alcohol to remove the last traces of moisture, and may afterwards be dried in the air.—A. S.

Electrode. H. S. Blackmore, Mount Vernon, N.Y. U.S. Pat. 893,565, July 14, 1908.

The electrode consists of calcium carbide or other metallic carbide mixed with a binding material such as carbon. —O. F. H.

Electric-furnace process. G. O. Seward and F. von Kügelgen, Holcombs Rock, Va., Assignors to Electro Metallurgical Co., West Virginia. U.S. Pat. 898,691, Sept. 15, 1908.

A deep layer of the charge of granulated material is maintained above the molten bath, and also surrounding the lower part of an upright sectional electrode, so that the arc produced between the molten bath and the electrode is buried beneath the charge. The renewal of the electrode material is effected by successively attaching new sections to the electrode above the charge, and the electrode is fed gradually downwards. The granular material is thus prevented from falling in beneath the electrode.—B. N.

Furnace ; Electric ——. Westdeutsche Thomasphosphat-Werke. First Addition, dated March 30, 1908, to Fr. Pat. 388,668, March 28, 1907 (this J., 1908, 948).

ONE or more poles of a continuous or alternating current are connected separately to one or more electrodes, placed above the bath, with which they form electric arcs. Lower electrodes, penetrating into the bath through the base of the furnace, are provided, and these may be connected together, or disconnected, by means of an interrupter in series with a rheostat. In an alternative form, the lower electrodes are simultaneously or separately connected, by means of interrupters each in series with a rheostat, with the neutral point of the source of current. In a third form, a single upper electrode, above the bath, is connected to one pole of the source of current, the other pole being connected simultaneously or separately, by means of interrupters and rheostats, with three electrodes, two of the latter entering the bath through the sides, and the third through the base of the furnace. A fourth form is described for use with polyphase currents, preferably triphase, the three phases being connected to three electrodes above the bath, whilst the neutral wire is connected to three electrodes passing through the base of the furnace, by means of interrupters, each in series with a rheostat.—B. N.

Furnace ; Electric ——. E. Cornelius. Fr. Pat. 390,220, May 14, 1908. Under Int. Conv., May 15, 1907.

THE chamber of the furnace is annular, and is so arranged that the introduction, heating, and emptying of the charge may be carried on simultaneously and continuously. A rotating arm is attached at one end to the centre of the furnace, the other end carrying an electrode which is suspended within the annular chamber, so that by the rotation of the arm, the place of heating may be displaced along the length of the chamber. The furnace is intended especially for the manufacture of graphite or carborundum, or the graphitisation of objects.—B. N.

Retort, with internal electric heating, for reacting on carbon, or other bodies in presence of carbon, with compounds of sulphur or chlorine, such as sulphides or chlorides. C. Combes. Fr. Pat. 390,266, July 23, 1907.

THE retort is provided with a lining of carbon, for example, wood charcoal, which is a bad conductor of electricity, and with an internal heating resistance, formed of a mixture of conducting carbon, such as coke, and of poor-conducting carbon, such as wood charcoal, in proportions regulated to give the required resistance. The charge is thus heated to a temperature higher than that of the walls of the furnace, the reverse of the result produced by external heating of the furnace. The length of life of the walls is thus increased, and the introduction of objectionable impurities is avoided. Different forms of furnaces are described for ensuring the renewal of the internal resistance material continuously and automatically, and for permanently maintaining the composition of the mixture.—B. N.

Milk ; Process for transforming —— *into a solid substance* [*electrical insulator*]. G. V. Frye. Fr. Pat. 389,835, May 2, 1908.

THE milk is first subjected to the action of an electric current and is then treated with an oxidising agent, such as nitric acid, in order to precipitate "the solids." The precipitate is separated, and moulded into various shapes by means of hydraulic pressure, the products thus formed being afterwards dried completely by the application of heat. Collodion and oil may be added to the mass in order to produce elastic substances. The product is chiefly of use as an electrical insulator.—W. P. S.

Carbide ; Apparatus for manufacturing ——. H. L. Hartenstein, Duluth, Minn., U.S.A. Eng. Pat. 20,648, Sept. 17, 1907.

SEE Fr. Pat. 383,053 of 1907 ; this J., 1908, 281.—T. F. B.

Ozone ; Apparatus for the production of ——. J. R. Quain, Assignor to E. Applegarth, London. U.S. Pat. 898,506, Sept. 15, 1908.

SEE Eng. Pat. 3905 of 1906 ; this J., 1906, 992.—T. F. B.

Electrolytic apparatus. M. Ruthenburg, Lockport, N.Y. U.S. Pat. 898,785, Sept. 15, 1908.

SEE Eng. Pat. 29,655 of 1906 ; this J., 1908, 166.—T. F. B.

Filaments for electric incandescent lamps. Eng. Pat. 8421. *See* II.

Filaments for electric glow lamps. Eng. Pat. 12,968. *See* II.

Refractory bodies [*filaments*] *; Manufacture of* ——. Eng. Pat. 20,227. *See* II.

Filaments and electrodes for electric lamps. Addition to Fr. Pat. 387,942. *See* II.

(*B.*)—ELECTRO-METALLURGY.

PATENTS.

Furnace ; Electric —— *for the manufacture of steel.* Soc. des Aciéries et Forges de Firminy. First Addition, dated May 1, 1908, to Fr. Pat. 387,747, March 4, 1908 (this J., 1908, 864).

ANY appropriate refractory material, basic, acid, or neutral, may be mixed with the carbonaceous material used in the construction of the furnace.—B. N.

Furnace ; Electric induction —— *for metallurgical work.* Ges. für Elektrostahlanlagen m.b.H. Fr. Pat. 389,826, May 2, 1908.

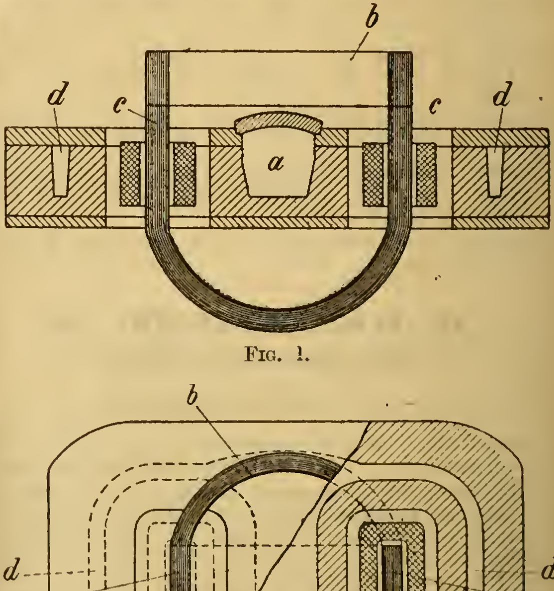


FIG. 1.

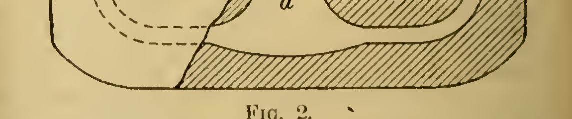


FIG. 2.

THE dispersion of the lines of force which leave the iron core is prevented by using for the construction of the latter, sheets having a much greater width than thickness. Two branches, *c*, which are surrounded by channels of fusion, *d*, are opposed to each other as shown, so as to form a central crucible, *a*. The branches are connected, above and below, by laminated pieces, *b*, so bent as to avoid the sheets crossing those of the branches, *c*, at the points where they meet. The upper piece, *b*, is made semicircular and placed horizontally, in order to render the central crucible more accessible.—B. N.

Furnace ; Electric induction —— operated by means of an alternating current. Ges. für Elektrostahlanlagen m.b.H. Fr. Pat. 389,827, May 2, 1908.

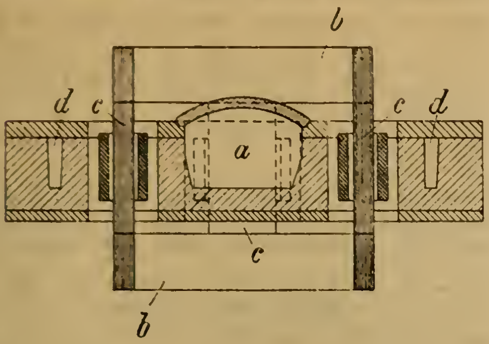


Fig. 1.

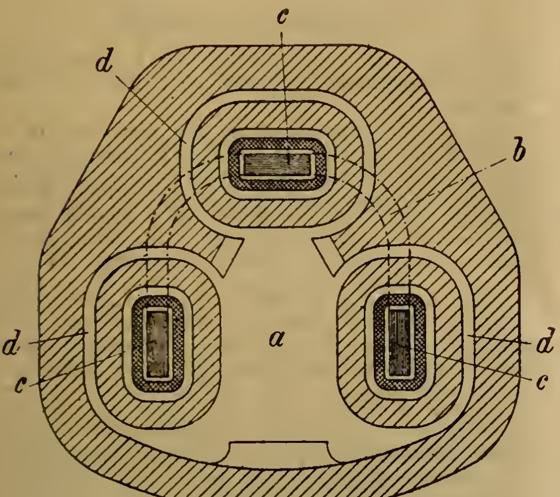


Fig. 2.

The furnace is arranged for a triphase or polyphase alternating current. The core consists of three laminated branches, *c*, each with an elongated transverse section, disposed in the form of a triangle. Two of the branches are arranged with the laminations parallel, while the laminations of the third are at an angle of 90° with the others. Each branch is surrounded by a fusion channel, *d*, connecting with a central crucible, *a*, thus producing under the influence of an alternating current, an energetic circulation in the channels and especially in the central crucible. The branches of the core are connected above and below by common pieces, *b*, the upper one being bent suitably towards the back of the furnace.—B. N.

Lead or tin ; Process for the production of a brilliant black colour on castings of ——. A. Wolff und Co. Metallenwarenfabr. G.m.b.H. Fr. Pat. 389,632, April 25, 1908. Under Int. Conv., Jan. 31, 1908.

After being electroplated with copper, the articles are olished and treated in an electrolytic bath containing rsenic for example, which produces the black colour desired.—O. F. H.

Degreasing [metallic objects for electro-plating] ; Apparatus for —— with means for separating the fat. A. Barth. Fr. Pat. 390,051, May 8, 1908.

The apparatus claimed has for its object the prevention of a fresh contamination of the surface of metallic objects for electrolytic plating, etc., by the grease floating on the surface of the cleansing bath. The main tank has two chambers at the height of the surface of the liquid, through one of which the cleansing agent enters, whilst the grease floating on the surface is carried through the second chamber, into a tank, where the fat is separated, the residual liquid being pumped back into the storage tank to be used again. In another form of apparatus claimed, the cleansing tank is circular and the surface liquid is driven by a rotatory movement into a surrounding decantation tank.—C. A. M.

Slags, etc. ; Process of treating —— in order to obtain alloys of iron and silicon. Soc. des Cuivres de France. Fr. Pat. 390,264, July 23, 1907.

Slags, etc., containing iron and silicon, are mixed with a reducing agent, such as carbon, and heated in an electric furnace, in order to obtain ferrosilicon. Slags from copper smelting, containing about 40 per cent. of silica and 50 per cent. of iron, when treated in this manner, yield an alloy containing about 40 per cent. of silicon. Various additions may be made to the mixture of slag and reducing agent, with a view to obtain alloys containing manganese, aluminium, etc., in addition to iron and silicon. Further, other metals not entering into the ferrosilicon alloy may be recovered by condensation, concentration in a fresh slag, etc.—A. S.

Electrolysing drum for the anodic treatment of solid substances, especially for metallurgical purposes. H. Sackur. Ger. Pat. 201,018, Sept. 8, 1907. Addition to Ger. Pat. 194,528.

The drum described in the main patent (this J., 1908, 631) is suitable for the anodic treatment of ores, for the recovery of metals contained therein. When used for this purpose, the openings through which the electrolyte flows into the anode chamber, are closed by screens. The anode chamber is provided with a charging opening, closed by a lid or door. The faces of the anode chamber adjacent to the cathode chamber, are closed by permeable walls (diaphragms), which are removable.—A. S.

Silvered surfaces of glasses ; Electrolytic process and apparatus for covering the —— with a protective metal. Soc. anon. The Cupargo Glass. Fr. Pat. 390,280, May 15, 1908. Under Int. Conv., June 15, 1907.

See Eng. Pats. 16,538, 16,539 and 18,210 of 1907 ; this J., 1908, 847.—B. N.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

Oleander oil. J. Camo. Bull. d. Sciences Pharmacol., 1908, **15**, 441—444. Chem. Zentr., 1908, **2**, 1108.

The seeds of *Nerium oleander* contain 16 per cent. of a brown fatty oil, having the following characters :—Saponification value, 202—203 ; Reichert-Meissl value, 10·26 ; iodine value, 88 ; apparent acetyl value, 30·4 ; true acetyl value, 0 ; unsaponifiable matter, 19·5 per cent. The unsaponifiable matter consisted of wax and a phytosterol.—A. S.

Patents.

Lime salts of fatty acids ; Manufacture of insoluble ——. H. N. Barrett, Baybridge, Ohio, Assignor to Medusa Concrete Waterproofing Co., Sandusky, Ohio. U.S. Pat. 898,547, Sep. 15, 1908.

Fatty matter is mixed with 12 to 20 per cent. of its weight of slaked lime, and the mixture heated to about 400° F., until no further reaction occurs and water and glycerol have been eliminated.—C. A. M.

Soap ; Manufacture of —— [in the form of flakes, scales, etc.]. E. V. Schou, Ealing, Middlesex. Eng. Pats. 20,916, Sep. 20, 1907, and 26,540, Nov. 30, 1907.

Soap in a liquid condition is passed between a pair of hollow rollers, rotating in opposite directions and separated from one another by a distance of not more than 1 mm. The rollers are cooled internally to a temperature of about −12° C., and the thin sheet of soap is removed from the rollers by means of scrapers. The flakes of soap obtained may be employed as such, or crushed to powder, or moulded into bars. It is claimed that liquid soap containing excess of water may be directly solidified by the process without the addition of compounds such as sodium silicate, etc.—W. P. S.

Soaps containing peroxides; Manufacture of ——. R. Wolffenstein, Berlin. Eng. Pat. 16,823, Aug. 10, 1908. Under Int. Conv., Aug. 20, 1907.

Soaps containing active oxygen are obtained by treating free fatty acids, such as are commonly used in the manufacture of soap, with molecular proportions of alkali salts of "per-acids," such as sodium perborate or percarbonate, at the temperature of a boiling water bath, a little water being added if required.—C. A. M.

Saponification; Process of ——. P. A. Barbe, F. Garelli, and G. de Paoli. First Addition, dated April 29, 1908, to Fr. Pat. 372,341, Dec. 8, 1906 (this J., 1907, 537).

Claim is made for special apparatus in which the various operations of saponification with ammonia, separation of solid and liquid fatty acids, conversion of the latter into solid products (hydroxystearic acids, etc.), preparation of potassium and sodium soaps from the ammonium soaps, and recovery of the ammonia, may be carried out in a continuous cycle. Claims are also made for saponification by means of ammonia in the regeneration of lactones and anhydrides of iso-oleic and hydroxystearic acids and their separation from oleic acid; and for the use of centrifugal force in the separation of mixtures of sodium or potassium soaps with ammonium salts and the subsequent washing of the soaps with brine to recover all the ammonia.—C. A. M.

Soap with a basis of saponin. A. F. Ribard. Fr. Pat. 390,029, May 1, 1908.

Saponin powder obtained as described in Fr. Pat. 332,561 of 1903 (this J., 1903, 1250) is macerated for 8 days with 80 per cent. alcohol, and the alcoholic extract mixed with an equal proportion of an oil or fat. The resulting emulsion is left for 24 hours for the alcohol to separate, and the lower layer, which contains all the saponin, is then saponified. A still more soluble soap may be obtained by adding to the soap thus prepared, 10 per cent. of an aqueous extract of saponin. Since saponin is not decomposed by salts such as chlorides or bromides, these soaps may be used with sea water.—C. A. M.

Soft soap; Manufacture of ——. H. Weinstein. Fr. Pat. 390,372, July 25, 1907.

A soft soap is prepared from a mixture of dry soap powder with sodium or potassium carbonate, glycerin, and water, which is heated with constant stirring to the boiling point and subsequently for, say, 12 to 24 hours at about 50° to 60° C. Or, the dry soap powder may be replaced by a mixture of fats with a soda or potash lye.
—C. A. M.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c

(*A.*)—PIGMENTS, PAINTS.

Patents.

Colours, paints, and dye-stuffs; Process and device for agitating and mixing ——. W. E. Evans, London. From Minimax Consolidated, Ltd., Berlin. Eng. Pat. 19,427, Aug. 29, 1907.

The paint is placed in an air-tight vessel or container; a tube passes through the cover of the vessel and extends nearly to the bottom, where it sub-divides into a number of branch pipes provided with nozzles. Air is forced through this tube, and, bubbling up through the paint, mixes the same. The compressed air collects in the vessel above the paint, and the pressure produced may be utilised for forcing the paint from the vessel into a spraying device. A manometer and safety-valve are provided on the cover of the vessel, and a tap on the air tube allows the quantity of air admitted to the vessel to be regulated.—W. P. S.

Painting; Manufacture of coatings for ——. H. Herrenschmidt, Paris. Eng. Pat. 20,379, Sept. 12, 1907. Under Int. Conv., Sept. 24, 1906.

See Fr. Pat. 379,964 of 1906; this J., 1907, 1287.—T. F. B.

Paint compounds; Manufacture of ——. W. E. Lake, London. From W. N. Blakeman, New York. Eng. Pat. 7090, March 31, 1908.

See U.S. Pats. 883,514 and 883,515 of 1908; this J., 1908, 456.—T. F. B.

[*Paint*] *oils.* W. E. Lake, London. From W. N. Blakeman, New York. Eng. Pat. 7103, March 31, 1908.

See U.S. Pat. 883,521 of 1908; this J., 1908, 456.—T. F. B.

Oils used for painting. W. N. Blakeman. Fr. Pat. 389,769, March 31, 1908.

See U.S. Pat. 883,521 of 1908; this J., 1908, 456.—T. F. B.

(*B.*)—RESINS, VARNISHES.

Jalap resin: Valuation of ——. W. B. Cowie. Brit. Pharm. Conference, Aberdeen, 1908. Pharm J., 1908, **81**, 363—365.

The following determinations and tests are recommended:—(1). Moisture at 110° C. (2). Ash. (3). Solubility in ether: 1 grm. of the powdered anhydrous resin is rubbed in a mortar for 2½ mins. with 10 c.c. of ether of sp. gr. 0·720. The ether solution is filtered through cotton-wool into a tared flask, and these operations are repeated thrice on the residue in the mortar. The filter is finally washed with 5 c.c. of ether, the combined filtrates are distilled, and the residue weighed after drying at 110° C. (4). Acid value, operating on 1 grm. of the anhydrous resin dissolved in 30 c.c. of neutral alcohol. (5). Saponification value, titration with $N/2$ hydrochloric acid after one hour's boiling with $N/2$ alcoholic potassium hydroxide. (6). 0·25 grm. of the resin, dissolved in 5 c.c. of acetic anhydride should give no purple colour when treated with 2 drops of strong sulphuric acid (absence of colophony). (7). A small quantity of the resin, moistened with alcohol, should give no greenish-blue colour with ferric chloride reagent (absence of guaiacum). (8). The resin should yield no soluble substances when triturated with water; it should be free from bitterness; and when boiled, should give no reaction for starch. Jalapin, the resin of jalap insoluble in ether, has the acid value 2·8, saponification value 408, $[\alpha]_D = -39{\cdot}5°$. Commercial "white jalap resin" is practically identical with this; it gives:—moisture, 3 to 3·1 per cent.; ash, 0·02 to 0·022 per cent.; soluble in ether of sp. gr. 0·720, 0·3 per cent.; acid value, 2·8; saponification value, 417; $[\alpha]_D = -37{\cdot}5°$. Two samples of brown jalap resin gave the following figures:—Moisture, 5·0 and 5·6 per cent.; ash, 0·3 per cent.; soluble in ether, 10 per cent.; acid value, 11·2 and 14 per cent.; saponification value, 333 and 338 per cent. The acid value of the white resin should not exceed 8·4, nor that of commercial brown resin, 20.—J. O. B.

Scammony resin: Valuation of ——. W. B. Cowie. Brit. Pharm. Conference, Aberdeen, 1908. Pharm. J., 1908, **81**, 365.

The examination of scammony resin should be made on similar lines to that of jalap resin (see preceding abstract). Two specimens of white scammony resin were completely soluble in ether of sp. gr. 0·720, and gave the following figures:—Moisture at 100° C., 2·52 and 5·3 per cent.; ash, 0·02 per cent.; acid value, 2·8; saponification value, 241; $[\alpha]_D = -25°$. Pure scammonin gave similar results: Acid value, 2·8; saponification value, 240; $[\alpha]_D = -25°$. "Pure brown scammonium" gave 4·5 and 5·1 per cent. of moisture at 100° C.; 0·15 per cent. of ash; acid value, 25·2 and 28; saponification value, 263. One grm. of white scammonin should be readily soluble in 15 c.c. of ether of sp. gr. 0·720; and 95 per cent. of the brown resin should dissolve in that solvent. The limit for acid value should be 8·4 for white resins and 34 for brown. Pure

scammonin melts completely at 130° C.; the white commercial resin at 120° C., and the brown resin at 100° C.
—J. O. B.

Scammony resin, Mexican; Characters of ——. W. B. Cowie and B. M. Brander. Brit. Pharm. Conference, Aberdeen, 1908. Pharm. J., 1908, **81**, 366.

The resin extracted from the drug by the authors and also two commercial specimens were examined, the following results being obtained:—Moisture, 2 to 3·05 per cent.; ash, 0·16 to 0·20 per cent.; solubility in ether of sp. gr. 0·720, 68·6 to 72 per cent.; acid value, 8·4; saponification value, 295 to 327. Flueckiger states that the resin is completely soluble in ether, but insoluble in carbon bisulphide. The authors find the solubility in carbon bisulphide to be 4·8 per cent. The saponification value of the portion soluble in ether was 333 and that of the insoluble residue 357. The resin melts completely at 100° C.; the resin soluble in ether at 103° C.; the resin insoluble in ether at 113° C.; the resin soluble in carbon bisulphide at 75° C., and the residue insoluble in carbon bisulphide at 115° C. The rotatory power of the resin ranges from $[\alpha]_D = -18{\cdot}75°$ to $-27°$.—J. O. B.

Antiar resin. A. Windaus and A. Welsch. Arch. Pharm., 1908, **246**, 504—508.

The latex of *Antiaris toxicaria* contains a poisonous glucoside, *antiarin*, and a resin. On treating the resin with alcohol a crystalline substance can be obtained. After recrystallisation from ether and methyl alcohol, this melted at 176° C., and the results of analysis showed the formula to be $C_{39}H_{56}O_2$. On hydrolysis it yielded *a*-amyrin and cinnamic acid.—F. Shdn.

Patent.

Machine ruler's inks; Impts. in making ——, *and for other purposes in which ox gall is used.* S. Bezzant, Bristol, and R. Bezzant, Cardiff. Eng. Pat. 8688, April 21, 1908.

In order to preserve raw ox gall so that it is instantly ready for use in the "making ready" of inks for the purpose of machine ruling, it is brought quickly to 220° F. and 8 drachms of pure glycerin are slowly added to each pint of the raw gall; the solution is then beaten, 8 drachms of sheet gelatin are added, and the whole passed through a fast beating machine at 212° F., after which the preparation is drawn off into a cooling chamber to set into a jelly. Or, a complete ruling ink preparation may be made by adding ink powder to the boiling solution, obtained as above, to the extent of the absorbing capacity of the solution, beating the mixture at 212° F., and cooling to a jelly.—F. Sodn.

(C.)—INDIA-RUBBER, &c.

Rubber; Coagulation of —— *by means of* "*purub*" [*hydrofluoric acid*]. F. Frank. India-Rubber J., 1908, **36** (Exhibition Supplement), xiii.—xv.

"Purub" consists of a solution of hydrofluoric acid in a condition in which it can easily be shipped. Its use as a coagulant is recommended, the mode of operation being as follows. The working charge of latex—2 or 3 litres—is strained, and, if necessary, diluted to prevent spontaneous coagulation. To every litre of latex is then added a mixture of 50 c.c. of water and 5 c.c. of "purub," and the mass is stirred and allowed to stand, when the rubber collects as a compact mass on the surface of the liquid; this is removed, washed, and pressed or rolled out, and the resulting strips pressed into blocks ready for shipment. It is stated that rubber prepared in this way vulcanises so quickly, that the sulphur is in complete combination with the rubber before it combines with any litharge present in the mixing.—E. W. L.

Vulcanisation as applied to tyre repairs. C. Beadle and H. P. Stevens. Commercial Motor, 1908, **8**, 23—24.

When the inner-tube of a motor tyre is repaired by "vulcanising on" a patch, it is impossible to avoid heating the rubber of the tube in the immediate neighbourhood of the patch, and thus, to a greater or less degree, injuring it. The authors have made a number of experiments upon the effect produced on the tensile strength and elasticity of the rubber by vulcanising such patches at different temperatures and for varying lengths of time. They find that when the time of vulcanisation is constant, the tensile strength decreases as the temperature of vulcanisation increases, this effect being more marked in the case of old tubes than with new ones. Since, within certain limits, the strength of the rubber of the patch itself increases with the temperature of vulcanisation, time remaining constant (at say 17 minutes), it follows that there is a point at which the patch is as strong as the inner tube in its neighbourhood. The mixing should be so compounded that the patch may "cure" at as low a temperature in as short a time as possible. The following figures show the extent to which the weakening effect may proceed with a 17 minutes cure:—

	Relative breaking strain after curing at a pressure and temperature of				
	20 lb. and 127·5° C.	25 lb. and 132° C.	30 lb. and 135° C.	35 lb. and 139° C.	50 lb. and 148·5° C
Tube adjacent to patch ...	96	57	53	51	42
Patch consisting of compound "A"	60	62	—	—	—
Patch consisting of compound "B"	91	107	129	169	150

N.B.—Breaking strain of original tube before patching = 100
—E. W. L.

Rubber-producing plant in Mexico; Discovery of a ——. Board of Trade J., Oct. 8, 1908. [T.R.]

The "Mexican Herald" of Sept. 21 reports the discovery of a rubber-producing tree, called the *palo amarillo*, which grows wild in large numbers throughout Mexico, and is stated to yield 10 per cent. of rubber and 40 per cent. of varnish and soap material, whereas guayule yields about 8 per cent. of rubber and no by-products. A company has been formed at New York, with a capital of 20 million dollars, to work the *palo amarillo*.

Patents.

Liquids similar to rubber latex from old rubber or rubber waste; Process for the preparation of —— *which can be filtered.* M. Fraenkel and Runge. Ger. Pat. 200,667, Nov. 11, 1906. Addition to Ger. Pat. 197,154, July 24, 1906.

In the process described in the main patent (this J., 1908, 989), the final operation of heating with water under pressure is not always necessary. In many cases it is sufficient to stir the mass well with hot or even with cold water.—A. S.

Albumen; Processes of treating vegetable —— *and products* [*rubber substitutes*] *therefrom.* F. G. Wiechmann, New York. Eng. Pat. 6573, March 24, 1908.

See Fr. Pat. 388,492 of 1908; this J., 1908, 909.—T. F. B.

Elastic masses from chromated gelatin for use as substitutes for rubber and other materials; Process for making ——. R. Neufeld. Fr. Pat. 390,183, May 13, 1908.

See Eng. Pat. 22,382 of 1907; this J., 1908, 759.—T. F. B.

XIV.—TANNING, LEATHER, GLUE, SIZE.

Tannins of New Caledonian woods. U. J. Thuau. Collegium, 1908, 376—380.

Analyses are given of various parts of the tannin-yielding trees of New Caledonia, particularly of the "palétuvier," "minea," "acacia" (*A. granulosa*), gaïac (A. *spirabilis*), and "oakgum" (*Spermolepsis gummifera*). Extracts have been made from some of these materials, though crudely, and analyses of these are also given.—H. G. B.

Tannin. K. Feist. Chem.-Zeit., 1908, 32, 918—919.

The formula for tannin is discussed and further suggestions made.—H. G. B.

Colloid reaction for some metallic salts; A very sensitive ——. [*Detection of sulphite-cellulose waste lyes in tanning extracts.*] E. Stiasny. Collegium, 1908, 348, 357.

If 5 c.c. of a 0·1 per cent. tannin solution and 10 c.c. of sodium sulphate solution be added to 2—5 c.c. of a solution containing aluminium salts, a flocculent precipitate is obtained on heating. By this reaction, it is stated, 0·01 mgrm. of alumina can be detected in 1 c.c. of solution. The tervalent aluminium ion acts on the negatively charged colloid particles, and the tannin-aluminium complexes so formed are precipitated by the addition of electrolytes such as sodium sulphate. Salts of calcium, barium, strontium, magnesium, zinc, lead, chromium, iron, and manganese give the same reaction but with far less delicacy. Manganese salts, however, are nearly as sensitive as aluminium, if sodium acetate be substituted for sodium sulphate. The author applies the reaction for the detection of sulphite-cellulose waste liquors as adulterants in tanning extracts. These liquors contain no true tannin but by ordinary analysis show a considerable quantity of matter absorbed by hide. They contain, however, small quantities of manganese and aluminium salts. If by heating 5 c.c. of a solution of the suspected extract with 10 c.c. of 10 per cent. sodium acetate, no precipitate is obtained, one can conclude that no considerable quantity of the sulphited by-product is present. A positive reaction, however, does not conclusively point to the opposite conclusion.
—H. G. B.

Unhairing with sulphurous acid. U. J. Thuau. Collegium, 1908, 362—366.

The author advocates a process in which salted hides are put directly into a sulphurous acid solution of 3°—10° B. They are ready for unhairing in about 8 days. The swelling action of the acid is counteracted by the salt present, which produces a "pickling" effect. The advantages of this process over the ordinary method of liming are that there is no need for the processes of soaking and deliming, and that as the reagent is an antiseptic, there is no putrefaction, no unpleasant odour, and no trouble with effluents. The hair and epidermis also are quite undamaged, the reagent only attacking the albuminous matter which surrounds the hair root. The pelt also remains in good condition. The yields of pelt are approximately the same as by the lime process, but the leather weights after tannage show a 9 per cent. increase. The finished leather is clear, not brittle, and contains no free sulphuric acid.—H. G. B.

Tanning process; A contribution to the knowledge of the ——. A Ricevuto. Z. Chem. Ind. Kolloide, 1908, 3, 114—118.

The author reviews the general behaviour of colloid solutions under the influence of the electric current, in both the presence and absence of electrolytes. He points out that gelatin solutions behave normally, and that the particles of gelatin travel to the anode or cathode according as the solution reacts alkaline or acid, being indifferent in neutral solutions. Hence experiments of this nature were undertaken with tannin solutions, which, being colloidal, should behave similarly. According to the accepted theories also, neutral tannin solutions should give no precipitate with neutral gelatin solutions. The author prepared tannin infusions by Procter's methods from gall-nuts, sumach, chesnut wood, pine bark and quebracho wood, and dialysed them in order to obtain complete separation from electrolytes. The solutions, however, always remained acid, and were therefore finally neutralised by the addition of $N/100$ sodium hydroxide. The gelatin solution was also dialysed and became neutral thereby. Experiments were then made by mixing together 5 c.c. of each of these solutions in the presence of 0, 2, 4, 10, 20 and 40 c.c. respectively of $N/100$ acetic acid. Clear solutions were obtained with no acid present and with only 2 c.c.; 4 c.c. caused opalescence, and larger quantities caused precipitation. The solutions were of 0·4 per cent. strength. A similar series of experiments are recorded with increased concentrations: 5 c.c. of 0·46 per cent. gelatin solution and 3 c.c. of 1·72 per cent. tannin solution. In this case 10 c.c. of acid were required to produce turbidity. The precipitates were filtered off and weighed. The influence of the degree of dissociation of the acid was demonstrated by substituting $N/100$ hydrochloric acid for the acetic acid. In this case 2 c.c. of acid were sufficient to cause precipitation, and the amount of precipitate rapidly decreased as the quantity of acid was increased. The author also passed a current from a bichromate cell through solutions of the tannins of 3½ per cent. strength, and found that in acid solution the liquid at the cathode remained clear, or became clearer, and that at the anode there was a great accumulation of the colloid particles with distinct intensification of colour. In neutral solutions no perceptible change took place, and in alkaline solutions the particles travelled towards the cathode. In similar experiments with a 10 per cent. chrome alum solution, the liquid at the anode was clear at first, but became increasingly turbid by the gradual increase of the amount of caustic soda used in making the solution "basic," until finally the colloidal chromium hydroxide travelled only towards the anode. The author points out the importance of the quantity of acid in early tan-liquors, the desirable amount being that which produces the optimum precipitation. In the two-bath process of chrome tannage, a tanning action is ascribed to the sulphur formed in the second bath, by virtue of the negative charge carried by sulphur in colloidal solution.
—H. G. B.

Chrome tanning; Chemistry of ——. E. Stiasny. Collegium, 1908, 337—348.

The one-bath process is discussed in the light of the recently published researches on the constitution of chromium salts in aqueous solution. It is pointed out that both the blue and green sulphates of chromium, in either very dilute or only moderately dilute solutions, hydrolyse to give free sulphuric acid and a basic chromium sulphate. The acid, being in crystalloidal solution, quickly penetrates the hide fibres in tannage, and is reversibly adsorbed. The basic part changes by polymerisation into colloid complexes, which however still possess considerable power of diffusion. The basic part is therefore only gradually adsorbed, but irreversibly, being transferred into a gel form. The author believes that the two products of hydrolysis act quite independently; in the first stages of tanning much of the acid and little of the basic salt will be taken up, but as the tannage proceeds, the absorption of the basic salt becomes relatively stronger, so that the basicity of the tanning liquor at first quickly increases and then gradually decreases. This view is borne out by a series of experiments in which the tanning liquor was analysed at the commencement of an experimental tannage, and ¼, 1, 4, 24 and 48 hours afterwards. The test was carried out in three ways, with chromium sulphate alone, with the basic sulphate, $Cr(OH)SO_4$, and with the latter in the presence of common salt. The influence of the degree of dilution on the basicity of the adsorbed salt was also investigated. With white hide powder and chromium sulphate solutions of 0·037 per cent. and 1·0 per cent. strengths, it was found that from the dilute solution a basic salt, and from the strong solution, an acid salt was taken up by the hide. With solutions of aluminium sulphate of similar strength, the same result was obtained. The addition of either crystalloidal or colloidal matters to the tanning liquors was found to have little influence on the amount of chrome absorbed, but the degree of basicity had a strong influence, the absorption being greater the greater the basicity. The two-bath process was also investigated. In the first (chroming) bath the author attempted to ascertain the influence of various added electrolytes. He discovered that the nature of the cation is quite immaterial, but that the anions have a marked influence in reducing the absorption of chrome, and that bivalent ions have a much greater influence than univalent ions. He also investigated the effect of varying amounts of hydrochloric acid, and found that the amount of chrome absorbed approached a maximum as the quantity of hydrochloric acid approached that necessary to liberate all the chromium as free chromic acid, and hence concludes that free chromic acid is much more readily absorbed than its salts. In the second (reduction) bath the author investigated the nature of the reaction. He found that the equation

$$K_2Cr_2O_7 + 6HCl + 3Na_2S_2O_3 = 2KCl + 4NaCl + Na_2SO_4 + 2H_2O + 2Cr(OH)SO_4 + 3S,$$

does not represent the entire truth, for the weight of sulphur obtained is always considerably less than here represented, and varies with the conditions of the experiment By changing these conditions a reaction was obtained in which no sulphur was deposited. This was thoroughly investigated and proved to correspond with the equation :

$$3K_2Cr_2O_7 + 16HCl + 4Na_2S_2O_3 = 6KCl + 6NaCl + Na_2S_4O_6 + 5H_2O + 4Cr(OH)SO_4 + 2Cr(OH)Cl_2.$$

This reaction is believed to take place in practice along with the previous one, the precise share of each depending upon the mode of procedure. It is pointed out that only basic chromium sulphate is absorbed by the skin, and that the basic chloride formed in the second reaction is converted into basic sulphate by reaction with the sodium sulphate formed in the first reaction.—H. G. B.

Dissolved hide substance in soak and lime liquors ; Rapid method for the determination of ——. E. Stiasny. Collegium, 1908, 371—372, 373—375.

The action of "soaks" and "limes" on hide involves the formation of albumoses, peptones, amino-acids, etc., by the hydrolysis of the proteins. The method proposed by the author for the determination of dissolved hide-substance in these liquors is based on the fact that the action of formaldehyde on the products of hydrolysis of proteins is to raise their acid character according to the typical reaction :

$$R\begin{cases}COO \\ —NH_3\end{cases} + H.CHO = R\begin{cases}COOH \\ N=CH_2\end{cases} + H_2O.$$

The liquor is titrated with caustic soda before and after the addition of formaldehyde, and the difference in the titrations gives a means of estimating the amount of decomposition products. "Soaks" and "limes," however, often contain the sulphides of sodium and calcium ; these must be removed by the addition of zinc sulphate in excess. The caustic hydroxides are also thereby removed. Any ammonia is converted into ammonium sulphate, which is acted upon by formaldehyde, giving free sulphuric acid which is then titrated. For soak liquors 200 c.c. are placed in a 250 c.c. flask, 20 c.c. of 5 per cent. zinc sulphate solution are added, the whole is made up to the mark, shaken, allowed to stand for a few minutes, and poured through a folded filter. Fifty c.c. of the filtrate are titrated with *N*/5 caustic soda and phenolphthalein, and the titration is repeated in the presence of 10 c.c. of 40 per cent. neutral formaldehyde solution. A series of experiments showed that 1 c.c. difference in the two titrations corresponds to about 7·4 mgrms. of nitrogen. The procedure is exactly the same for lime liquors except that 50 c.c. of zinc sulphate solution are used. The proportionality between the titration difference and the amount of nitrogen is in this case different and less regular, because of the varying percentage of nitrogen in the many kinds of decomposition products found in lime liquors. The titration difference, however, gradually increases with the age of the lime liquor.—H. G. B.

Leather ; Method of testing ——. W. Fahrion. Chem.-Zeit., 1908, **32**, 888—889.

The method is based on the property possessed by properly tanned leather of resisting the action of boiling water. This "hot water test" is carried out by heating 1 grm. of the finely-divided leather with 70—80 c.c. of distilled water in a Jena flask for 10 hours on a boiling water-bath, the flask being shaken at intervals and water added to make up for that lost by evaporation ; after cooling to 75°—80° C., the volume is made up to 100 c.c., and the whole well shaken and filtered into a dry beaker through a somewhat coarse linen filter ; 50 c.c. of the filtrate are removed without delay and evaporated to dryness in a platinum dish on the water-bath, and the very hygroscopic residue is dried to constant weight at 105°—110° C. and incinerated, so as to obtain the percentage of organic matter soluble in water. Moisture and ash are determined in a second portion of the sample. The quantity of organic constituents, not dissolved by water, expressed in percentage on the dried and ash-free substance, is called the "water-stability" [wasserbeständigkeit] of the sample : thus the water-stability of hide powder is approximately zero and that of an ideal leather would be 100. Great accuracy is not claimed for the test, but it is of value for purposes of comparison, particularly in experiments with hide powder.—F. Sodn.

Patents.

Tanning liquors ; Process for utilising sapped ——. G. W. Childs, New York. U.S. Pat. 899,006, Sep. 15, 1908.

The alkaline mineral impurities in spent tanning liquors are precipitated by means of reagents that form insoluble compounds with them, and the supernatant liquid is separated from the precipitate, heated *in vacuo* to eliminate volatile impurities, and concentrated to a sp. gr. of 1·05 to 1·3. The product may then be used again for impregnating leather.—C. A. M.

Leather-like products from intestines ; Process of manufacturing ——. A. Thiemt und Co. Fr. Pat. 389,719, April 29, 1908.

The inflated intestines are tanned by means of a vegetable tannin, and coloured in the usual manner. They are then treated with an emulsion of soap or oil (fat-liquor) and afterwards worked while in a moist condition. The leather obtained may be used as a substitute for morocco leather, etc.—W. P. S.

XV.—MANURES, &c.

Ammonium sulphate ; [Detection of impurities in ——]. F. J. Lloyd. Chem. News, 1908, **98**, 172—173.

Samples of ammonium sulphate, recently examined by the author, have been found to contain certain organic compounds which seriously affect its manurial value and have an injurious effect on the fermentation of molasses, when the salt is added as a source of nitrogen. The presence of the impurity may be detected by dissolving 1 grm. of the salt in 5 c.c. of water and adding strong ammonia, when an intense violet colour is obtained. The detection of thiocyanates, in the presence of these organic compounds, should be made in the following manner :—5 grms. of the sulphate are moistened with strong ammonia and then dried in a water-oven ; when quite dry, the material is ground with 5 c.c. of alcohol, the alcohol is filtered off, and the filtrate diluted with water and tested with ferric chloride in the usual way. In the author's opinion ammonium sulphate, to be employed as a manure, should pass both of these tests.—F. Sodn.

Ammonium nitrate ; Employment of nitrogen in the form of ——. T. Pfeiffer, A. Hepner, and L. Frank. Mitt. Landwirtsch Inst. Kgl. Univ., Breslau, 1908, **5**, 341. Biedermann's Zentr., 1908, **37**, 663—664.

It is stated that ammonium nitrate has recently been manufactured commercially at a price which renders it available for manurial purposes. Experiments with carrots, barley and oats indicate that ammonium nitrate takes a middle position between Chili saltpetre and ammonium sulphate, showing to a certain extent the unfavourable properties of the latter. The addition of common salt had hardly any perceptible influence in increasing its activity. The addition of phosphorite was found to be advantageous both to the yield and to the using up of the available nitrogen.—E. F.A.

Stable manure ; Decompositions in, and the action of ——. B. Sjollema and J. C. de Ruyter de Wildt. Verslagen van landbouwk. onderzoek. Rykslandbouw proefstation, 1097, 21. Biedermann's Zentr., 1908, **37**, 652—654.

The stable manure was freshly collected and preserved for some months at different temperatures both with and without the free access of air. It was analysed before and after treatment, and its manurial value compared. (*a*). After two months' aerobic fermentation at room temperature, there was a loss of 13 per cent. of pentosans and 10 per cent. of organic substance. (*b*). Under the same conditions at 35° C. the fermentation was stronger; the loss of organic substance amounted to 32 per cent. and of nitrogen to 16·9 per cent. (*c*). Anaerobic fermentation at room temperature showed a large increase in the amount of nitrogen as ammonia and a loss in the amide nitrogen. (*d*). Under anaerobic conditions at 35° C. an active methane fermentation was displayed, there being a loss of 46 per cent. of pentosans and the total disappearance of amide nitrogen. Manurial experiments with oats showed manure (*d*) to give a distinctly higher yield than the three others, and considerably more of the available nitrogen was consumed by the plant. The authors consider that the value of the manure increases as its pentosan constituents are decomposed.—E. F. A.

Stable manure ; Action of ——. J. Stoklasa. Fühling's Landwirtsch. Zeit., 1907, 409. Biedermann's Zentr., 1908, **37**, 666—667.

The author divides the bacteria of stable manure into the following groups :—(1), those bacteria which decompose the organic nitrogenous substances to ammonia ; (2), those which oxidise ammonia to nitrous acid ; (3), those which reduce nitrates to nitrites and to ammonia ; (4), denitrification bacteria which reduce nitrates to nitrites and these to nitrogen ; (5), nitrification organisms which oxidise nitrous to nitric acid ; (6), bacteria capable of forming proteins and organic nitrogen compounds from ammonia and nitrous and nitric acids. All these bacteria likewise decompose organic substances, *e.g.*, cellulose, pentosans, etc., to organic acids and to carbon dioxide, methane, and hydrogen. The author attributes the working of stable manure to four factors. (1). It brings a number of easily decomposable organic substances to the soil which may serve as a source of carbon for the nitrogen-assimilating bacteria. (2). It also brings all the plant foods. These are present at first as organic substances and subsequently rendered soluble by bacterial action. (3). It carries the most important groups of bacteria which bring about the soil fermentation. (4). Stable manure increases the hygroscopic character of the soil especially in sandy soils.—E. F. A.

Sugar cane ; Alkaline soil waters and their effect on the growth of the ——. J. B. Harrison. Int. Sugar J., 1908, **10**, 500—509.

On many long cultivated heavy clay soils in British Guiana the plants hang back in their growth after the dry season sets in, although the soil proper, only a few inches from the surface, contains a supply of water requisite to keep the plants in a healthy condition. The soil water in such cases is very markedly alkaline and the alkalinity is to a great extent of a permanent type. In consequence of this, ammonium sulphate gives better results than does sodium nitrate when these manures are applied in the form of heavy dressings. Further the alkalinity, replenished by that of the soil water brought up by capillarity during the dry seasons, enables ammonium sulphate to be used year after year without souring the soil. The alkalinity is increased by cultivation and tends to become excessive with consequent falling off in the crops. It further acts detrimentally on the flocculation of the heavy clay soils especially when assisted by the alkali set free from sodium nitrate dressings. Adequate deep drainage and the application of heavy and repeated dressings of gypsum are advisable in such cases of permanent alkalinity. The author considers that the susceptibility of the Bourbon cane to injury by drought and by fungus attacks is due in part at least to the defective conditions of soil-hygiene under which in places they are now cultivated.—E. F. A.

Tobacco ; Manuring of ——. P. Wagner, R. Dorsch, G. Hamann, and A. Münzinger. Arbb. der Deutsch. Landwirts. Ges., 1908, [138]. Biedermann's Zentr., 1908, **37**, 593—604.

By restricting or increasing the amount of potash (K_2O) in the manure, the percentage of potash in the dried substance of the tobacco leaf was made to vary from 0·51 to 6·15 per cent., the highest yield of leaves obtained being those containing 2·3 per cent. of potash. Under actual field conditions the amount of potash varied between 1·14 and 7·06 per cent. The time of smouldering is increased in fermented leaves with a high potash content. Unfermented leaves smoulder for a much shorter period and are not influenced by the potash content. Tobaccos with a low percentage of potash and a high chlorine content burn badly ; those with low chlorine and high potash content smoulder till almost completely burnt. The amount of chlorine may vary from 0·1 up to over 4 per cent. according to the manuring. It is estimated that the tobacco plant takes up from the soil 121 kilos. of potash per hectare and that about 200 kilos. of a soluble potassium salt must be added yearly to the soil to supply this quantity. It is advisable to grow tobacco on the same land for several years in succession to make full use of the potash. When farmyard manure is used, it should be applied in the autumn to enable the chlorides to be washed out. Kainite and potassium phosphate should not be used as manures for tobacco ; the best nitrogenous manure in addition to farmyard manure is ammonium sulphate.—E. F. A.

Mossland ; Reclamation of ——. Times, Oct. 12, 1908. [T.R.]

A series of experiments has been carried out by the West of Scotland Agricultural College, at the instance of the Dumbarton County Council, on the reclamation of moss lands. After drainage, the lands were previously treated with lime ; it is now found that better results are obtained by dressing with basic slag and kainite, good crops of corn and potatoes having been taken recently from lands treated thus. The process has a further advantage of being cheaper than the liming process. (Compare this J., 1903, 1300.)

Patents.

Fertiliser. L. R. Coates, Baltimore, Md., Assignor to The American Bacteria-ized Fertilizer Co., Md. U.S. Pat. 899,155, Sept. 22, 1908.

The fertiliser is prepared by mixing a dry, non-hygroscopic artfiicial fertiliser with sterilised vegetable or animal matter which has been inoculated with micro-organisms capable of fixing or gathering atmospheric nitrogen, and dried.—W. P. S.

Nitrophosphates ; Preparation of —— [*Recovery of oxides of nitrogen from mixtures of the same with air*] P. A. Guye. Fr. Pat. 389,864, July 10, 1907.

Nitrophosphates (this J., 1899, 382) may be prepared by treating calcium (barium, strontium, or magnesium) phosphates, especially tricalcic phosphate, with air or other mixture of oxygen and inert gas, containing small quantities of the oxides of nitrogen, in the presence of sufficient moisture. In this process di- and mono-calcic phosphate are successively formed, and a mixture of nitrate and nitrite of calcium, in which the nitrite becomes slowly replaced by nitrate. The calcium phosphate may have been rendered more or less soluble by previous treatment with sulphuric acid, or the nitrophosphate itself may be so treated. The process is also applicable to the phosphates of iron and aluminium. If the product is to be used as a manure, lime or chalk may be added to neutralise the acidity and facilitate drying.—F. Sodn.

Manure containing nitrogen and phosphoric acid ; Process for the preparation of a solid ——. Norsk Hydro-Elektrisk Kvaelstofaktieselskab. Fr. Pat. 390,242. May 4, 1908. Under Int. Conv., May 6, 1907.

A solid fertiliser may be obtained by dissolving calcium triphosphate in an equivalent quantity of the 40 per cent. nitric acid prepared by electrical means from atmospheric nitrogen. Hot, calcined calcium nitrate is then added to the solution, the quantity added being in the proportion of 1 mol. of the nitrate to every 3 mols. of water in the solution. Evaporation takes place, and the mass, when cold, forms a solid which can be ground to a powder. It contains at least 15 per cent. of phosporic anhydride and 11 per cent. of nitrogen.—W. P. S.

Fertilisers ; Method of manufacturing ——*, and fertilisers manufactured according thereto.* B. F. Halvorsen, and Norsk Hydro-Elektrisk Kvaelstofaktieselskab, Christiania. Eng. Pat. 9694, May 4, 1908. Under Int. Conv., May 6, 1907.

See Fr. Pat. 390,242 of 1908 ; preceding.—T. F. B.

XVI.—SUGAR, STARCH, GUM, &c.

Sugar in saturation mud ; Determination of ——. F. Herles. Z. Zuckerind. Böhm., 1908, **33**, 1—4.

The method of determining sugar in saturation mud which involves neutralising the sample with acetic acid, is open to the objections that, if excess of acid is added, optically active substances other than sugar are dissolved, and also, the contents of the flask froth over. To obviate these difficulties, the author now recommends the use of lead acetate solution instead of acetic acid. The lime present in the mud precipitates lead hydroxide from the acetate ; the hydroxide dissolves in excess of acetate to form basic salt, and the sample thus becomes clarified as well as neutralised. The method is as follows :—52·1 grms. of the sample are stirred to a uniform, milky liquid in a weighing dish with a solution of lead acetate containing 200 grms. of this salt per litre. The liquid is now transferred to a 210 c.c. graduated flask (the volume of insoluble matter occupies about 10 c.c.) ; the same lead acetate solution is used for rinsing and making up to the mark. The amount of lead acetate thus used is slightly in excess of that which would be required for a mud containing 4 per cent. of lime. In the author's experience the lime-content of wet mud varies from 0·1 to 4 per cent., and therefore, the above-mentioned concentration of lead acetate solution should suffice in all cases. After making up to volume, the solution is mixed, filtered, and polarised. The results obtained by this method agree well with those obtained by the acetic acid method.—L. E.

Lævulose ; Precipitation of —— *by basic lead acetate.* H. C. Prinsen Geerligs. Int. Sugar J., 1908, **10**, 432—435.

As Watts and Tempany have shown, lævulose is not precipitated by basic lead acetate from a pure aqueous solution of invert sugar (this J., 1908, 53). The author has proved, however, that this sugar (and also dextrose, though to a much less extent) is partially carried down with the precipitate obtained by treating a solution of invert sugar and sodium chloride with basic lead acetate. He concludes, therefore, that lævulose is precipitated from neutral solutions which also contain substances capable of forming insoluble lead compounds. Since practically all cane sugar products yield such solutions, clarification with basic lead acetate will remove some lævulose. The author ascribes the decrease in reducing sugar-content observed by Watts and Tempany in clarifying raw juice (*loc. cit.*), to this cause and not to the removal of some reducing substance, other than dextrose or lævulose, as suggested by these authors.—L. E.

Sugar cane ; Alkaline soil waters and their effect on the growth of the ——. J. B. Harrison. *See* XV.

Patents.

Saccharine juices ; Process of extracting concentrated —— *from plants, etc., by lixiviation and diffusion.* F. Kollm. Fr. Pat. 390,319, May 16, 1908. Under Int. Conv., June 5, 1907.

A solution of molasses, or sugar syrup, containing not less than 2 per cent. of sugar is employed in place of water in extracting beetroots, sugar canes, etc., by the processes of lixiviation and diffusion.—W. P. S.

Sugar ; Manufacture of fermentable —— *from materials containing starch or cellulose.* B. Hafner and F. Krist, Vienna. Eng. Pat. 24,503, Nov. 5, 1907.

See Fr. Pat. 383,776 of 1907 ; this J., 1908, 415.—T. F. B.

Boiling pans and vacuum apparatus or the like ; Apparatus for producing a uniform circulation of the crystallised material or massecuite in ——. F. Tiemann, Tucuman, Argentine Rep. Eng. Pat. 3467, Feb. 15, 1908. Under Int. Conv., Aug. 16, 1907.

See Fr. Pat. 386,957 of 1908 ; this J., 1908, 795.—T. F. B.

XVII.—BREWING, WINES, SPIRITS, &c.

Malting. A. R. Ling. J. Inst. Brewing, 1908, **14**, 494—521.

The conversion of raw grain into malt is recognised by the appearance of friability which is the effect of "modification." This process is not accompanied by any fundamental change in the condition of the starch itself, as was formerly believed, but is the result of a physiological transformation of the protoplasmic matrix in which the starch granules of the endosperm are embedded. In their classical study of the germination of the *Gramineæ* (Chem. Soc. Trans. 1890, **57**, 458) Brown and Morris attributed the phenomenon of modification to the liquefaction of the cell walls of the endosperm by the action of a cyto-hydrolysing enzyme, secreted by the absorptive epithelium of the scutellum. This dissolution of the membranes prepared the way for the diffusion of the amylolytic enzyme, secreted by the same epithelium, throughout the substance of the endosperm. Later, Brown and Escombe admitted the simultaneous production of diastase in the endosperm, but only in the peripheral aleurone layers. Several chemists, including principally J. Grüss and the present author, have disputed this view and have shown that the cell walls are not dissolved but merely eroded and rendered transparent. (See this J., 1904, 1156.) Their continuity in finished malt may be demonstrated by staining with a dyestuff, such as "Congo red," which has a direct affinity for cellulose. Moreover these membranes possess, in a certain degree, semi-permeable properties, and the general distribution of a colloidal substance like diastase, by osmotic migration through the cell walls, becomes inconceivable. In replacement of Brown and Morris's explanation of the accumulation of the diastase throughout the endosperm, the alternative view based on its formation *in situ*, is put forward, and the foundation of such a theory was laid in a recent paper by Ford and Guthrie (this J., 1908, 239). These authors showed that diastase is produced throughout the whole tissue of the endosperm, though most profusely in the aleurone layer, and that this production (by "auto-digestion") may be stimulated by certain amphoteric nitrogenous matters or by foreign proteolytic enzymes. Correlating these observations with his own, the author concludes that raw barley, whilst probably containing no soluble proteolytic enzyme ready formed, contains throughout the endosperm, mother-substances from which both proteolytic and amylolytic enzymes are produced under the stimulus of moisture and diffusible amphoteric saline or nitrogenous matters. He assumes that a proteolytic enzyme is first produced, the action of which on the protoplasmic matrix constitutes the phenomenon of "modification," and that this proteolytic enzyme, acting on some other nitrogeneous constituent of the endosperm, *e.g.* the "translocation diastase" admittedly present in the raw grain, converts it at the same time into the true amylolytic diastase of malt. This view does not preclude the possibility of intensified production of diastase in particularly active secretory tissues, such as the aleurone layer and the epithelium, especially under conditions in which the supply of readily assimilable nutriment is cut off. According to the above theory, the possible production of enzymes in any given corn is limited by the quantity of protoplasmic mother-substance, and the maximum production of enzymes throughout the whole endosperm should synchronise with complete "modification." Hence the difference between the actual and the maximum possible ("autodigestion") diastatic activity of a corn should be a measure of the progress of "modification." If the growth of the embryo be "forced" in the early stages of germination, absorption takes place more rapidly than "modification"; the cells of the endosperm at the basal end become depleted and those at the distal end are practically raw; such "forced" malt is "undermodified." In such a case the assimilation of soluble matters by the growing plant will have been so intense that the percentage of these matters in the malt will be relatively small, whereas in a normally modified malt, in which assimilation has been properly restricted, the soluble matters will have accumulated. Yet the demand of certain analysts for a low percentage of soluble matters is such that much of the malt now produced is "undermodified." In antithesis to this kind of "forcing" there is another type which may be described as "over-modification." This occurs if the malt be allowed to "sweat" during the later stages of flooring, and to "stew" at the early stages of kilning, so that undue activity of the enzymes occurs. In such cases the soluble matters accumulate and the proportion of nitrogeneous substances thus entering the wort may be greater than the yeast can assimilate and the beer is subject to "frets." In order to avoid both these evils, the details of the treatment must be varied to suit the peculiarities of every different type of barley, and the author states certain broad principles which should govern the practical operations of malting. He favours the practice of slow withering, since this mellows the grain, and he condemns the practice of loading the grain fresh on the kiln and the rapid removal of moisture in order to restrict the percentage of soluble matters. The "autodigestion" processes, which go on during withering and in the early stages of kilning, complete the "modification," and produce flavouring and colouring substances. The author has observed that, although this is the critical stage as regards the production of these substances, no actual colour is developed until the final curing stage. He attributes this fact to the formation at the lower temperatures of compounds between the sugars and the amino-derivatives, which compounds are susceptible to caramelisation at the curing temperature. In the discussion of this paper, R. L. Siau mentioned that, whereas the percentage of soluble matters increases during the early stages of kilning, it decreases again during the curing stage, and suggested that this decrease corresponds with the conversion of some of the soluble constituents into colouring matters.—J. F. B.

Final attenuation and malt analysis. O. Pankrath. Woch. f. Brau., 1908, **25**, 591—596. (Compare Schifferer, this J., 1904, 907; Schönfeld, this J., 1906, 998.)

The author finds that pale malts saccharify more rapidly than high-dried malts and yield worts which attenuate further than those obtained from the latter. When a saccharification temperature of 75° C. (167° F.) is employed, the iodine reaction of the starch disappears sooner than at 70° C. (158° F.), but the wort obtained in the former case contains less fermentable sugar than that in the latter. The final attenuation of the wort is only slightly altered by boiling a part of the mash, the chief part being played by the mashing temperature. The higher the latter the less will be the final attenuation; in this connection dark malts are influenced more by change of mashing temperature than are pale ones. The results obtained agree in general with those of Graf (Z. ges. Brauw., 1905, 365).—T. H. P.

Malting of barley; Relation between diastase and sugar during the ——. E. Glimm. Z. ges. Brauw., 1908, **31**, 439—442.

Daily samples of three green malts were taken from the floor, and the moisture, diastatic power, and reducing sugars estimated, the last two values being then calculated on the solids. From the figures given it is seen that up to the eighteenth day there is an exact parallelism between diastatic power and reducing sugars, but from that time onwards, the diastatic power falls rapidly, while the sugars increase until the twenty-second day and afterwards remain practically constant in quantity. The sucrose present increases regularly up to the fourteenth day and afterwards varies but slightly. Dextrin was sought for in vain in an aqueous extract of the mass left after exhausting the green malt with alcohol for the removal of the sugars.—R. L. S.

Hops; The recognition of sulphuring in ——. D. Wiegmann and J. Carl. Allgem. Z. Bierbrau. und Malzfabr., 1908, **36**, 473—474.

Hops are usually tested for sulphuring by adding 50 c.c. of a 5 per cent. aqueous extract of the sample to 25 c.c. of hydrochloric acid of sp. gr. 1·12 contained in a conical flask in which lies a piece of pure zinc approximately 1 cm. long. Any hydrogen sulphide generated is revealed by the formation of a stain on the lead acetate paper with which the neck of the flask is covered. The generation of hydrogen must be very slow, otherwise hydrogen sulphide is liberated from extracts of unsulphured hops. This fact led the authors to determine the sulphur (1) in the ash, and (2) in the aqueous extract of eight samples of air-dried hops. They find the ash varies from 6·0 to 10·2 per cent. and the sulphur in it from 0·1 to 0·3 per cent. of the hops, while the aqueous extracts contain sulphur in amounts from 0·04 to 0·17 per cent. From the aqueous extracts sulphur to the amount of from 0·007 to 0·04 per cent. could be volatilised in steam with a current of carbon dioxide. As heavily recently sulphured hops only contain 0·15 per cent. of sulphur, the authors conclude that it is only possible to express an opinion as to the sulphuring of hops when an air-dried sample of the same growth is at hand as a control.—R. L. S.

Yeast poison in cereals. F. Hayduck. Z. angew. Chem., 1908, **31**, 1978—1982.

The author reviews the present knowledge of this subject (see this J., 1907, 61 and 1908, 85) with some speculation as to the mode of action of the poison. He inclines to the view that the action is a direct one, whilst Henneberg takes the view that the poison acts by favouring an autointoxication of the yeast by increasing its production of acid. The author has prepared from both bottom- and top-fermentation yeasts, extracts which in presence of sucrose are toxic to yeast.—R. L. S.

Yeasts; Researches on the physiology and morphology of ——. C. Hansen. Compt. rend. du labor. Carlsberg, 1908, **7**, 179—217.

The author reviews his work in introducing the use of pure cultures of yeast in the fermentation industries, and the more important work to which it gave rise. The first pure cultures employed technically were the so-called "bottom-fermentation Carlsberg yeasts 1 and 2." Under "2" several different yeasts were used at various times, a fact which appears to have been overlooked by many writers on the subject in spite of the author's reiterations of the fact. The detailed descriptions of the No. 1 and the original No. 2 yeasts are now published for the first time, and as the yeasts are definite races, the author proposes to name them *Saccharomyces Carlsbergensis* and *S. Monacensis* respectively, the latter name being chosen from the fact that the yeast was used in many Munich breweries. For the details of the author's methods and the characteristic features of the yeasts, the original must be consulted. The frequency with which races of yeast are described on the basis of two or three characters is deplored, and the necessity is urged

for an extended observation and record of all the physiological and morphological characters in every case.
—R. L. S.

Torulæ in English beer manufacture. H. Schiönning. Compt. rend. du labor. Carlsberg, 1908, 7, 138—178.

In examining the flora of English bottled beer Claussen (this J., 1904, 721) found certain yeasts which could not be referred to the genus *Saccharomyces* but had to be classed as *Torulæ*. These yeasts were found to produce fermentation in Danish beers in which they gave rise to a typical "English" flavour. The author has studied this group of *Torulæ* which Claussen named *Brettanomyces*. The fungi are isolated by cultivating the sediment from a bottled stock ale or stout in gelatin-wort at 25° C., when the majority of the colonies forming after twelve days and developing slowly with a greyish-white appearance will consist of *Brettanomyces*. Two types, *A* and *B*, are distinguished; both ferment wort slowly and are bottom yeasts. In *Torula A* the commonest form of cell is ellipsoid in shape, but sausage- and club-shaped cells are also seen. *Torula B* in young cultures is usually more regular in form, sausage-shaped cells predominating. Both species form rings and films in old cultures on long exposure to air. In sterilised beer the *Torulæ* grow slowly at about 25° C.; during the first week the beer becomes slightly turbid, but later on gradually clears and in 2—4 weeks is bright, with a rather compact sediment, and, if the bottle has been kept closed, is well charged with gas. The cardinal points of the temperatures of vegetative growth are: *Torula A* optimum 30—35° C., maximum 40—40·5° C., minimum 5—7° C.; and *Torula B*. optimum 30—35°, maximum 39—39·5°, and minimum 3—4° C. In wort at the ordinary temperature the cultures died in a year and a half, in 10 per cent. sucrose solution they were still alive after four years, while cultures in beer in corked bottles have survived the same length of time. The organism is very sensitive to drying, never surviving for more than about a month after being dried. Both species ferment dextrose, lævulose, sucrose, and maltose, but not dextrin. A ready means of distinguishing the two species is supplied by the fact that *Torula B* ferments lactose but *A* does not. The fermentation in all cases is slow; in wort of 13·8° Balling (sp. gr. 1·056), *A* takes about three months at 20° C. to produce the maximum quantity of alcohol, while *B* takes roughly twice as long. The greatest amount of alcohol produced was 9·87 per cent. by weight. If a small quantity of the *Torula* and a large quantity of a *Saccharomyces* be added to wort at the same time, the *Torula* will gain ground rapidly after the primary fermentation has been completed, and on longer standing, will predominate and at last the *Saccharomyces* will disappear. The author presumes that the conditioning of English stock ales is due to the fermentation by these *Torulæ* of sugars produced by the diastase of the dry hops, from the unfermentable carbohydrates left from the primary fermentation. In pitching yeast the *Torulæ* are only to be found in small numbers, owing to the slow rate at which they grow, but the author says he has found them on slips "scraped off the inside of trade casks from an English brewery." He recommends the addition of a culture of a selected type of *Torula* to beer after the completion of the primary fermentation (compare Claussen, Eng. Pat. 28,184 of 1903; this J., 1904, 1230).—R. L. S.

Fermentation; Problems of ——. Discussion at the British Assoc., Dublin, 1908.

A. Harden gave a brief account of the present position of the zymase theory starting from Buchner's discovery that an active enzyme could be expressed from living yeast. This zymase is remarkable in losing its fermentative activity after a few hours, a change attributed to the proteoclastic enzymes in yeast juice. Passage through a Martin dialyser at 50 atmospheres pressure separates the yeast juice into two substances, which separately have no action, but when united, ferment dextrose just as yeast juice does. The residue contains the enzyme, the filtrate the so-called co-enzyme. The accelerating effect of a phosphate on a fermenting mixture of dextrose and yeast juice was then described (see this J., 1906, 490, 1111; 1907, 62, 824.) Adrian Brown pointed out that fermentation is generally supposed to be controlled by the rate of diffusion of the sugar fermented into the yeast cell. Normally the enzymes are inside the cell and do not leave the cell, but under unhealthy conditions there is evidence that the enzyme leaves the cell. A. Slator discussed the factors which influence the rate of alcoholic fermentation. The conversion of dextrose into alcohol and carbon dioxide takes place in a series of reactions so that the rate of the slowest of these reactions determines the velocity of the transformation. An apparatus devised for measuring the initial velocity of fermentation was described (see this J., 1908, 653). The rate of fermentation is proportional to the amount of yeast present and independent of the concentration of the sugar. Dextrose and lævulose are fermented at approximately equal rates, galactose is fermented by some yeasts only and then after these have been grown for some time in the presence of galactose. The influence of temperature on the rate of fermentation is the same in the case of dextrose, lævulose and mannose but less for galactose. The rôle of enzymes in fermentation was considered by E. F. Armstrong who described evidence to show that the mechanism of fermentation is quite distinct from the sucroclastic enzymes. (See this J., 1905, 1247.) The three sugars which are fermented by all yeasts have a common enolic form; probably the first stage of the fermentation process consists in the conversion by means of an enzyme into the enolic form which then undergoes further change. Dextrose, mannose, and lævulose are fermented by one zymase in the yeast, galactose by a different zymase. The question of the adaptation of the organism to nutrition was then considered. It is supposed either that under new conditions of environment an entirely new and appropriate enzyme is produced in the organism or that such an enzyme, hitherto latent, becomes active. The former view was opposed by the speaker, who was supported by Gotch and Keeble. H. E. Armstrong described the work of F. Ehrlich (see this J., 1907, 28, 480), establishing the fact that fusel oil, glycerol, succinic acid, etc., formerly supposed to be by-products of the fermentation of the sugar are in reality produced by the action of yeast on the amino-acids formed from the protein complex. The occasional formation of lactic acid during fermentation is to be ascribed to some such secondary action.—E. F. A.

Denatured alcohol; Demonstrations in the production of ——. Oil, Paint, and Drug Rep., Sept. 28, 1908. [T.R.]

The U.S. Bureau of Chemistry has initiated a series of demonstrations on the fermentation industries, and has erected a plant for the manufacture of denatured alcohol from various raw materials: it is hoped that these demonstrations, which will be attended by representatives of the various State Experiment Stations, will be the means of extending the manufacture of denatured alcohol in the United States under State auspices.

Patents.

Malt drums. F. Knüttel and Berliner A.-G. für Eisengiesserei und Maschinenfabr., Charlottenburg, Germany. Eng. Pat. 28,124, Dec. 20, 1907.

The patent relates to malt drums of the type in which there is a central perforated cylinder with peripheral air conduits, and claim is made for the provision of means, such as a pipe extending from one head to the middle of the drum, for withdrawing the air from a point at or near the mid point of the axis of the drum.—R. L. S.

Beer; Manufacture of ——. A. Kummle, Kiel, Germany. Eng. Pat. 14,515, July 8, 1908.

The claims are for the addition of cones of the coniferæ instead of hops to the wort; and further the addition of lime blossoms to the wort to remove the resinous flavour imparted by the pine cones.—R. L. S.

Alcoholic beverages; Process of partial purification and rapid maturation of ——. A. Haeck. First Addition, dated March 21, 1908, to Fr. Pat. 389,333, March 11, 1908.

This additional patent refers to a modified apparatus for carrying out the process described in the main patent (this J., 1908, 994).—A. S.

[Lactic] Ferments, alimentary; Process for the industrial production of —— for hygienic and therapeutical purposes. Soc. Le Ferment. Fr. Pat. 389,730, April 29, 1908.

A nutrient solution is prepared by macerating and boiling haricot beans or other leguminous seeds, with water; the aqueous portion is then separated and, after the addition of sugar, is filtered, sterilised, and cooled. This solution is then inoculated with a pure culture of a ferment, and the precipitate resulting from the ensuing fermentation is separated by means of centrifugal action. The precipitate, consisting of bacteria encased in a mass of coagulated vegetable albumin, constitutes the product claimed.—W. P. S.

Liquids [fruit-juices, etc.]; Process and apparatus for de-alcoholising and concentrating ——. H. Herter. Fr. Pat. 390,075, May 9, 1908.

The liquid is introduced into a closed vessel surrounded by a water-jacket, the temperature of the water being maintained at about 60° C. so that the liquid in the vessel is kept at a temperature of about 50° C. When this temperature has been reached, the liquid is withdrawn through a pipe at the bottom of the vessel and pumped up to the top of the uppermost of a series of superposed vessels situated above the heating chamber. The liquid is sprayed into the upper vessel by means of perforated branch pipes; it then leaves the bottom of the vessel and is sprayed into the next lower vessel, and so on, until it falls again into the heating vessel. Pipes connected with an exhaust pump draw off the vapours from the top of each vessel and conduct them to a condenser. The circulation of the liquid through the vessels is continued until the alcohol has been removed. A higher temperature may be employed when it is desired to sterilise or concentrate the liquid.—W. P. S.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

(*A.*)—FOODS.

Patents.

Casein; Manufacture of ——. C. A. Baechler, Zürich, Switzerland. Eng. Pat. 6247, Mar. 20, 1908.

Skim milk, at a temperature of about 30° C., is treated with a solution of calcium chloride, in the proportion of 0·5 part of the salt per 1000 parts of milk. A solution of rennet is next added and the mixture is stirred vigorously as soon as coagulation commences. When the casein has been finely divided, 1 part of ammonia-alum dissolved in a little water is added per 1000 parts, the mixture is heated to a temperature of 52° C., and then cooled, the stirring being continued meanwhile. The casein is now separated, and dried, or it may be treated with the requisite quantities of a suitable acid or alkali to produce acid- or alkali-casein. The casein obtained by the process is in a finely divided condition and does not require grinding.—W. P. S.

Dehydrating food substances; Apparatus for ——. F. T. Stare, Wisconsin, U.S.A. Eng. Pat. 11,019, May 21, 1908. Under Int. Conv., May 21, 1907.

The apparatus consists of a chamber or chambers to contain the food or other substances, a condenser, an air drier, and means for maintaining a current of air through the system. The dehydrating chamber consists of a tunnel communicating by apertures along its top and bottom with two flues leading to a central valve, by which the direction of the air current may be reversed. —J. W. H.

Dryer [for fruit, etc.]. K. Weiss and H. M. Olbricht. Fr. Pat. 389,765, March 27, 1908.

A number of corrugated metal sheets are placed in a chamber heated by steam or in any other suitable manner, and form a system of narrow vertical passages down which the materials to be dried slowly pass to an oscillating discharger placed below.—W. H. C.

Butter; Process for the manufacture of ——. G. V. Frye. Fr. Pat. 389,836, May 2, 1908.

Fresh cream is cooled and submitted to the action of a current of electricity immediately before being churned. —W. P. S.

Milk; Process for transforming —— into a solid substance [electrical insulator]. Fr. Pat. 389,835. *See* XIA.

(*B.*)—SANITATION; WATER PURIFICATION.

Patents.

Water and other fluids; Method and means for the detection and determination of impurities and dissolved matter in ——. W. P. Digby and C. W. V. Biggs, London. Eng. Pat. 23,706, Oct. 26, 1907.

The method depends on the measurement of the electrical conductivity of the water or other fluid. The apparatus employed consists of a glass tube in which the water to be tested is contained; this tube may be U-shaped and is provided at its lower part with a branch pipe which is bent upwards and has a funnel-shaped end. The water is poured continuously into the funnel and leaves the limbs of the U-tube through overflow tubes, the continuous flow preventing bubbles of gas from collecting on the electrodes. One electrode is inserted in each limb of the tube and the current used may have an E.M.F. of from 50 to 200 volts. The electrodes may be made adjustable up and down the tube in order that the effective length of the path of the current may be initially adjusted to some convenient standard, or the electrodes may be fixed and the effective area of the path of the current altered by inserting a rod of insulating material in the tube. The conductivity of the water is indicated by means of an ohmmeter, and the apparatus may be used for such purposes as detecting the presence of salt in condensed water in cases where sea-water is employed to cool the condenser, etc. A modified form of the apparatus is also described.—W. P. S.

Sewage or water; Arrangements and apparatus for the purification of ——, A. Clark, Leith, and T. R. Proctor, Edinburgh. Eng. Pat. 7072, Mar. 31, 1908.

The process relates to the purification of sewage at the outfall or point where it is discharged into a river, after having been subjected to a deodorising and disinfecting process at the source. The sewage, which may or may not be mixed with flood-water, passes through inclined settling tanks fitted with baffle-plates; two of these tanks are provided, so that one may be in use while the other is being cleaned. Arrangements are made for dealing with excess of flood water. After passing through the settling tanks, the sewage is conducted to the filters, which consist of a number of revolving barrels. These are inclined and at their upper part contain spiral-shaped buckets so that the falling liquid causes the whole to revolve. The lower part of the barrels is constructed of wire-gauze sieves, and charcoal or other filtering material may be used between the sieves. Each filter may be brought into use or disconnected for cleaning as desired, the filter-barrels being so mounted that they may be tilted when it is necessary to empty them. Chemical reagents may be added to the sewage before it enters the filters. Instead of the revolving barrels, a stationary gauze cylinder may be employed, the liquid passing outside this in a downward spiral course.—W. P. S.

Fuel [from sewage sludge]. Eng. Pat. 2609. *See* II.

(C.)—DISINFECTANTS.

Patents.

Disinfectant and insecticide, and process of producing the same. F. W. Howorth, London. From Chem. Fabrikswerke Ges. m.b.H., Vienna. Eng. Pat. 20,387, Sep. 12, 1907.

The disinfectant is prepared by adding from 0·05 to 0·3 per cent. of chloropicrin, or other nitro-halogen compound of the aliphatic or aromatic series, to an emulsion of soap. Cresol, formaldehyde, naphthalene, camphor, or terpene, may also be added to the soapy mass or emulsion.—W. P. S.

Formaldehyde disinfectant. H. Schneider. Fr. Pat. 389,872, May 4, 1908.

A liquid disinfectant is obtained by mixing a solution of formaldehyde with a solution of potassium resinate; the product should contain about 25 per cent. of resin in the form of its potassium salt and about 11 per cent. of formaldehyde.—W. P. S.

Formaldehyde; Production of gaseous ——. Farbenfabr. vorm. F. Bayer und Co. Second Addition, dated April 18, 1908, to Fr. Pat. 366,605, May 26, 1906. Under Int. Conv., May 13, 1907.

See U.S. Pat. 885,233 of 1908; this J., 1908, 517.—T. F. B.

XIX.—PAPER, PASTEBOARD, &c.

Soda cellulose; By-products in the manufacture of ——. H. Bergström and O. Fagerlind. Järnkontorets Annalen, 1908, 575, 649. Chem.-Zeit., 1908, **32**, Rep., 513.

The condensed water collected during the "blowing-off" in the manufacture of cellulose by the caustic soda process was subjected to fractional distillation. The authors found in it hydrogen sulphide, methylmercaptan, methyl sulphide, ammonium sesquicarbonate, acetone, and methyl alcohol. The proportion of methyl alcohol is so large that it would probably pay to recover it. The oil which separates from the condensed water consists mainly of turpentine together with small quantities of the substances present in the water. The crude oil thus obtained from the treatment of fir or pine wood contains a relatively large amount of methyl sulphide, and the isolation of the latter in the pure condition would probably prove remunerative in large works if there were a sufficient demand for this substance.—A. S.

Cellulose and its derivatives; Plastic materials from ——. [*Cinematographic films*]. F. J. G. Beltzer. Monit. Scient., 1908, **22**, 648—662.

After a discussion of the probable mode of formation of cellulose in plants and of the structure of different forms of cellulose, the author reviews the progress which has been made in the manufacture of celluloid and substitutes for the same. Among the more important of these celluloid substitutes are those derived from cellulose acetates, since the latter are non-inflammable. Under the name of "Zellith" (cellite) (see Eng. Pat. 26,075 of 1901, this J., 1902, 1469; also Fr. Pat. 317,008 of 1901 and Addition thereto and Fr. Pat. 371,447 of 1907, this J., 1902, 873; 1903, 1015; 1907, 340), a celluloid substitute prepared from cellulose acetate and camphor has been introduced. This is non-inflammable, burning in the same manner as wool: it did not flame even when exposed for 10 mins. to the electric arc under the conditions prevailing in cinematography, and is thus specially useful for the manufacture of cinematographic films. It can be blown like glass, and can thus be used for the production of "unbreakable" vessels which are non-conductors of electricity.—A. S.

Patent.

Soda-cellulose manufacture; Process for preventing the odour which is generated during ——. O. Dietrich. Ger. Pat. 201,259, Jan. 5, 1907.

The noxious odours evolved during the treatment of wood, esparto, etc., with alkaline solutions are found to be mainly due to sulphur compounds, the formation of which is brought about, to a great extent, by the atmospheric oxygen present in the apparatus. It is therefore proposed either to remove the air from the apparatus by exhaustion, or to replace it by carbon dioxide or nitrogen. —T. F. B.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, & EXTRACTS.

Cinchona alkaloids; Modification of Florence's method for the determination of ——. N. H. Cohen. Pharm. Weekblad, 1908, [37]; Apoth.-Zeit., 1908, **23**, 702—703.

Although the method of Florence for the determination of quinine by precipitation as oxalate gives unreliable results, his process for the separation of the "total alkaloids," with the following modifications, rapidly affords satisfactory figures. Five grms. of finely powdered cinchona bark are moistened in a closed flask with 125 grms. of ether; after shaking, 5 c.c. of 15 per cent. caustic soda solution are added, and the gross weight noted. After macerating for 1 hour, with agitation every 5 mins., the mixture is boiled for half an hour under a reflux condenser. When cold, the original weight is made up by adding more ether; 5 c.c. of water are added, and the whole is thoroughly shaken. As much as possible of the ether extract is then decanted into another flask, and shaken with 20 c.c. of lime water. After separation, 100 grms. of the ethereal layer (=4 grms. of original bark) are transferred through a pledget of cotton wool to a tared flask; the ether is distilled off, and the residual "total alkaloids" weighed after drying at 100° C. for 2 hours. If the amount of non-alkaloidal impurity in this residue need be determined, it is re-dissolved in 10 c.c. of 2 per cent. sulphuric acid and shaken with two successive quantities of 10 c.c. of ether, and the ether extracts are evaporated in a tared vessel.—J. O. B.

Morphine and oxydimorphine; New reagent for the identification of ——. Hoshida. Jap. Pharm. J., July, 1908; Pharm.-Zeit., 1908, **53**, 702.

A fresh solution of 0·15 grm. of sodium molybdate and 10 drops of formalin in 30 c.c. of strong sulphuric acid is employed. With oxydimorphine this gives a violet colour, which suddenly changes to a permanent bluish-green, and is destroyed on diluting with water. With morphine, the violet colour at first formed changes to bluish-violet and finally to a dull green.—J. O. B

Strychnine standard for Nux vomica preparations. R. Wright. Brit. Pharm. Conference, Aberdeen, 1908. Pharm. J., 1908, **81**, 366; *Physiological action of brucine.* W. E. Dixon and W. H. Havey. *Ibid.*, 367.

It was formerly considered that, since brucine in quantity accompanies strychnine in *Nux vomica* preparations, until the relative physiological value of the two bases had been definitely determined, the "total alkaloids" should be taken as the basis for standardisation. Pure brucine has now been prepared, and its relative toxicity for mammals, as compared with that of strychnine has been found to be as 4 : 33. Moreover, the physiological action of brucine is quite distinct from that of strychnine, more nearly approaching that of methylstrychnine. In view of this great physiological difference, a strychnine standard alone should be adopted for *Nux vomica* preparations. —J. O. B.

Hydrastis canadensis; Determination of hydrastine in the fluid extract or rhizome of ——. P. Roeder. Apoth.-Zeit., 1908, **23**, 583.

Six grms. of the fluid extract are diluted with about 5 c.c. of water, and evaporated to drive off the alcohol. After cooling, 2 c.c. of 20 per cent. sulphuric acid are added, the mixture being allowed to stand, with occasional agitation, for from one-half to one hour. Twenty grms. of light petroleum spirit and 100 grms. of ether are added; after well shaking, sufficient 10 per cent. solution of ammonia to give an alkaline reaction (about 5 c.c.) is run in, and the whole is well shaken for 10 to 15 mins. After separation, a portion of the ether layer equivalent to 5 grms. of the original extract, is decanted and shaken with 25, 25, 10, and 10 c.c. of 0·5 per cent. hydrochloric acid, or until a drop of the acid liquid gives no reaction with Mayer's reagent. The united acid extract is filtered into a separator, the alkaloid is liberated with excess of ammonia, and extracted with 50, 30, 10, 10, and 10 c.c. of ether in succession. The ether solutions are evaporated in a tared vessel, and the residue dried at 100° C., is weighed. In the case of the rhizome, 6 grms. of the drug, in finest powder, are extracted with ether, and the ether residue is treated as above. The official method of the Ph. G. IV. is stated to give too low results.—J. O. B.

Drugs, alkaloidal, and their fluid extracts; Standards for ——. J. C. Umney and C. T. Bennett. Brit. Pharm. Conference, Aberdeen, 1908. Pharm. J., 1908, **81**, 344—346.

In the following table, the minimum standards for alkaloidal contents officially recognised for crude drugs by the British Pharmacopœia, 1898, and the United States Pharmacopœia, 1900, are compared with results obtained recently by analysis :—

Crude drug.	U.S.P. 1900 as corrected.	B.P. 1898.	Crude drugs examined recently.
Aconite root	0·50% aconitine T.	—	0·384—0·576 % aconitine (6)*
Belladonna—			
root ..	0·45 % T. alkalcids	—	0·10—0·63 % total alkaloids (19)
leaf ..	0·30 % T.	—	0·287 and 0·31 % total alkaloids
Cinchona ..	5 % total alkaloids W. 4·00 % ether soluble alkaloids	5—6 % total alkaloids W. of which 50 % must be quinine and cinchonidine	1·61—7·17 % total alkaloids (23)
Coca leaves	0·50 % ether soluble alkaloids. T.	—	0·12—1·42 % alkaloids soluble in ether (16)
Colchicum—			% Colchicine.
seed ..	0·45 % W. colchicine	—	0·60, 0·64
corm ..	0·35 % colchicine W.	—	—
Conium fruct. ..	0·50 % coniine W.	—	0·55—0·76 % coniine (4)
Guarana ..	3·50 % alkaloids W.	—	3·56—4·2 % alkaloids (9)
Hydrastis ..	2·50 % hydrastine W.	—	B.P. fluid extract gave 2·07 grms. hydrastine per 100 c.c.
Hyoscyamus leaf	0·08 % alkaloids T.	—	0·085 %
Ipecac. root	1·75 % ether soluble alkaloids T.	—	1·95—2·67 % alkaloids soluble in chloroform (10)
Nux vomica	1·25 % strychnine T.	—	Strych. 0·85, 1·36, 0·95 Tot. alk., 2·90, 2·16 Strych. 0·82, 0·70 Tot. alk., 1·68, 1·88
Opium ..	9·00 % crystallised morphine W.	9·5 % to 10·5 % anhydrous morphine Not less than 7·5 % for galenicals. T.	Moist opium: 9·1—12·8 % anhydrous morphine (17). Dry powder (natural): 12·1—15·3 % anhydrous morphine (10)
			% Alkaloids.
Pilocarpus..	—	—	—
jaborandi B.P. ..	—	—	0·455, 0·06, 0·145
microphyllus	0·50 % alkaloids T.	—	0·60, 0·67
selloanus	—	—	0·185
racemosa	—	—	0·29
Scopola ..	0·50 % alkaloids T.	—	—
Stramonium	0·25 % T.	—	—

* The figures in brackets show the number of samples examined. The letters W. and T. indicate gravimetric and volumetric methods of determination respectively.

A similar table, comparing the official requirements for alkaloids in fluid extracts of the two pharmacopœias is given, and the methods of the U.S.P., 1900, are criticised in detail.—J. O. B.

Erytaurin, a new glucoside, hydrolysable by emulsin, from the lesser centaury. H. Hérissey and L. Bourdier. J. Pharm. Chim., 1908, **28**, 252–255.

The powdered plant of the lesser centaury (*Erythrea centaurium* Pers.) was extracted with alcohol, and a crystalline substance was separated from the residue by means of water and ethyl acetate. This substance proved to be a glucoside hydrolysable by emulsin, and is styled *erytaurin* by the authors. It crystallises in masses of small colourless crystals, having a bitter taste, and $[\alpha]_D = -131{\cdot}6°$ to $-134{\cdot}4°$ in ethyl acetate. A solution of erytaurin becomes dextro-rotatory after hydrolysis by emulsin, and reduces Fehling's solution. It is not precipitated by lead acetate.—F. Shdn.

Arbutin in plants. A. Fichtenholz. J. Pharm. Chim., 1908, **28**, 255—262.

Extracts from the leaves of the bears' whortle-berry (*Arctostaphylos uva ursi* Spreng., *Ericaceæ*) were tested by means of emulsin and the effect on the optical rotation noted. The effect of emulsin on a solution of arbutin was also examined. The diminution of the optical rotation was slowest for an extract of the plant, somewhat faster after removal of the gallic acid by means of lead acetate, and decidedly faster for a solution of arbutin itself. The author concludes that the dried leaves of the whortle-berry contain at least 1·664 per cent. of arbutin. —F. Shdn.

Oleuropein, a new glucosidal substance from the olive. E. Bourquelot and J. Vintilesco. Compt. rend., 1908, **147**, 533—535.

The presence of a glucoside in the olive-plant (*Olea europœa* L.) was suspected by the change in optical rotation produced in an extract by the action of emulsin. The fresh young olives were extracted with hot 95 per cent. alcohol, the alcohol distilled off, and the residue purified by successive extractions with ethyl acetate and water. A glucoside, *oleuropein*, was finally obtained as a light-yellow powder. It has a bitter taste, and is fairly soluble in cold water and hot alcohol, insoluble in ethyl acetate. Its rotatory power is $[\alpha]_D = -127{\cdot}9°$. Its aqueous solution is coloured red by alkalis, blood-red by concentrated sulphuric acid, and green by ferric chloride. It reduces Fehling's solution. When hydrolysed by emulsin or dilute sulphuric acid, *d*-glucose is produced. The glucoside is also present in the leaves, and is associated with emulsin. —F. Shdn.

Charas of Indian hemp. D. Hooper. Brit. Pharm. Conference, Aberdeen, 1908. Pharm. J., 1908, **81**, 347—349.

An exhaustive account of the geographical source, method of preparation, commerce, and morphological characters is followed by the results of the chemical analysis of a large number of samples, given in the following table, the figures denoting percentages.

Kind of charas.	Alcoholic extract.	Vegetable matter.	Soluble ash.	Sand.	Volatile matter.
Yarkand	40·0	18·2	23·9	11·4	6·5
Amballa (Mashak)	42·7	12·9	12·4	26·2	5·8
Amritsar (Bhara) .	38·1	14·9	10·8	29·8	6·4
,, (Mashak).	46·5	12·6	10·0	27·3	3·6
Delhi dust	42·4	17·9	9·8	25·9	4·0
,, ...	42·6	18·8	11·1	23·2	4·3
,, Mashak	41·1	11·3	10·7	29·5	7·4
Bombay	36·1	20·2	11·8	27·3	4·6
Gwalior	43·3	27·7	8·2	17·7	3·1
Kumaon (wild)....	22·3	52·0	9·2	7·4	9·1
,, (cultivated)	34·2	46·30	9·0	3·0	7·5
Garwhal	41·9	37·0	7·9	5·5	7·7
Almora	36·9	40·5	10·5	4·6	7·5
Nepal	44·6	35·1	8·2	6·5	5·6
,, (Shahjahani)	44·4	37·7	9·3	4·1	4·2
Simla Momea	37·0	32·0	12·3	9·3	9·4
Baluchistan, 1903.	22·4	19·9	14·8	38·6	4·3
,, ,,	22·0	35·2	20·8	15·1	6·9
,, 1905.	24·2	16·0	13·3	39·3	7·2
,, ,,	26·0	24·1	9·6	31·0	9·3
,, ,,	24·9	27·3	11·5	25·8	10·5
Kashgar	40·2	21·1	9·2	16·8	12·7
,, ...	40·9	16·3	9·9	20·5	12·4
,, ...	48·1	15·6	8·2	16·1	12·0

The amount of nitrogen gives no indication of the value of the drug; it appears to correspond with the quantity of insoluble vegetable matter present. Preparations of charas give very slight, if any, indication of the presence of alkaloids, although extracts of bhang and of ganja frequently give such reactions. The amount of essential oil corresponds with the grade of the drug; but the proportion of resinous oil is no indication of value; the lowest grades of charas give the most extract. The iodine value and proportion of unsaponifiable matter in three samples of alcoholic extract of Kashgar charas were found to be, for the former, 234, 231, and 233; and for the latter, 87·6, 84·4 and 83·5 per cent. Older samples of charas showed a marked diminution of the iodine value of the extract. The drug gradually loses strength after the first year; in the second year it is sold as a low-grade article, or is mixed with a fresh supply, and after 3 or 4 years, it no longer produces intoxication. Hundreds of maunds, which have become useless, have to be burnt annually. Physiological experiments showed that only one sample of those examined—a specimen of the best Amritsar mashak—approached in activity an extract of Bengal ganja which was taken as a standard. Representing this charas as 32, the inferior physiological value of the other samples ranged from 24 for Delhi mashak to 1 for Gwalior charas. The amount of alcohol-extract bears no relation to the activity of the drug. The variation in activity observed at different times is attributed chiefly to the age of the samples, and not to adulteration. (See also this J., 1908, 874.)—J. O. B.

Essential oils. Homopiperonal and its derivatives. F. W. Semmler and K. Bartelt. Ber., 1908, **41**, 2751—2753.

Safrol dissolved in benzene and mixed with water was oxidised by means of ozone. The mixture was distilled with steam, and the aldehyde produced in the reaction was extracted from the residue by means of ether. The homopiperonal, $C_9H_8O_3$, thus produced, boils at 143°—144° C. at 10 mm., has the sp.gr. 1·295 at 20° C., $n_D = 1·57117$, and melts at 69° C. when crystallised from methyl alcohol. The semicarbazone melts at 189° C., and the oxime boils at 180°—181° C., at 10 mm., and melts at 124°—125° C. Homopiperonylic acid, $C_9H_8O_4$, prepared from the nitrile, melts at 127° C. Homopiperonylic alcohol, $C_9H_{10}O_3$, boils at 156° C. at 10 mm., and has $n_D = 1·54780$. Homopiperonylic acid is formed in the oxidation of safrol besides homopiperonal.
—F. Shdn.

Essential oil of parsley, and a new phenol ether therein. H. Thoms. Ber., 1908, **41**, 2753—2761.

Oil was distilled from the seeds of French parsley (*Petroselinum sativum*), some of which had been cultivated in Germany. The principal fraction from both oils contained, besides small quantities of apiol and myristicin, a new phenol ether, 1-allyl-2.3.4.5-tetramethoxybenzene, melting at 25° C. When oxidised with permanganate this phenol ether yields tetramethoxybenzenecarboxylic acid, m.pt. 87° C. When boiled with alcoholic potassium hydroxide, reduced with metallic sodium, and nitrated, a nitro-compound, $C_6H(1)C_3H_7(2.3.5)(OCH_3)_3(4)NO_2$, is produced, which melts at 65° C.—F. Shdn.

Pines of Australia. I. R. T. Baker and H. G. Smith. Roy. Soc. New South Wales, Abstract of Proceedings, Aug. 1908, iii.—v.

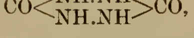
A yield of 0·6 per cent. of essential oil was obtained from the foliage of the Australian pine, *Callitris glauca*. The oil contained about 12 to 16 per cent. of bornyl acetate and geranyl acetate. The principal terpenes are *d*-pinene, *d*-limonene, and dipentene. The sp. gr. of the crude oils varies between 0·8631 and 0·8782, the optical rotation between +22·7° and +31·3°, and the refractive index between 1·4747 and 1·4779. The borneol and its acetate are dextrorotatory. A thick oil was obtained from the timber by distillation, and this was found to contain guaiacol and a new phenol styled *callitrol*. The sandarac resin obtained from this species was found to be inferior to that obtained from *C. calcarata*.—F. Shdn.

Suprarenine [adrenine], synthetic; Some reactions of ——. L. Krauss. Apoth.-Zeit., 1908, **23**, 701.

The author states that synthetic adrenine dissolves in strong sulphuric acid with the production of a yellowish tint; on adding a few drops of 25 per cent. nitric acid to this, a yellowish-red colour appears. On sprinkling a little bismuth subnitrate over the yellowish sulphuric acid solution, a brown colour changing to yellowish-red, is obtained. A mixture of formalin and sulphuric acid gives, at first, a pink, then a cherry red colour. With Froehde's reagent, the brown shade at first produced turns greenish after a short time. Fuming nitric acid dissolves adrenine with a blood-red colour, fading quickly to yellow; on evaporation, this leaves a yellow residue, which gives a fine bluish-green reaction when moistened with ammonia, passing to dull green. Adrenine dissolves in Millon's reagent with a yellow colour. The yellow solution obtained with chlorine water is changed to bright red by excess of ammonia. Potassium ferricyanide solution is coloured yellowish-red by adrenine. If a few particles of potassium ferricyanide be dissolved in a little water, and a drop or two of ferric chloride solution be added, the brown solution which results is at once changed to a bright bluish-green by adrenine. If a trace of iodic acid be dissolved in a little water and a little chloroform be added, the addition of adrenine liberates iodine which colours the chloroform pink. On standing, this colour fades from the chloroform, and the aqueous portion acquires a bright rose colour. Certain of these reactions show a resemblance to those of morphine. (See also this J., 1907, 342, 714.)—J. O. B

Dichloro-urea; Reactions of ——. F. D. Chattaway. Chem. News, 1908, **98**, 166.

When chlorine is passed into a cooled saturated solution of urea, dichloro-urea, $CO(NHCl)_2$, is produced as a white crystalline powder, soluble in water, alcohol, and ether. The compound is fairly safe to handle, but at 83° C. liberates nitrogen chloride. It is readily hydrolysed by acids or alkalis, or even by moist air, and promises to be of use as a synthetic agent, being very reactive. For instance, with excess of ammonia it gives diurea,



$$CO\genfrac{<}{>}{0pt}{}{NH.NH}{NH.NH}CO,$$

which separates as a crystalline powder, and this, when heated with strong sulphuric acid at a little above 100° C., further hydrolyses to hydrazine sulphate.—F. Sodn.

Catalytic reactions at high temperatures and pressures. XXI. Decomposition of alcohols in presence of metallic oxides. XXII Catalytic decomposition of acids. W. Ipatjew. J. Russ. Phys.-Chem. Ges., 1908, **40**, 508—513, 514—518. Chem. Zentr., 1908, **2**, 1098—1100.

From a study of the catalytic decomposition of *iso*butyl alcohol by leading its vapour over different metals and oxides, the author draws the following conclusions:—(1). If a metal is capable of effecting the catalytic decomposition of alcohols with formation of aldehydes, its oxides usually possess the same property. The catalytic decomposition of the alcohol is to be attributed to the action of water and the metallic oxide. (See this J., 1908, 684.) (2). The catalytic action of a metal (or its oxide) depends upon the position of the latter in the periodic system. For the production of aldehydes from alcohols, the metals may be arranged in the following order:—zinc, copper, nickel, cobalt, iron, manganese, chromium. Zinc is the best catalyser; freshly-reduced copper also gives good results, but soon loses its catalytic properties. (3). For the further decomposition of the aldehydes into carbon monoxide and saturated hydrocarbons, the order is: nickel, cobalt, iron, manganese; manganese is practically inactive in this respect, and copper and zinc have very little effect. (4). Metals and oxides of large atomic or molecular weight (tungsten and uranium dioxide) cause decomposition of alcohols in two ways: into aldehydes and into ethylene hydrocarbons. A further decomposition of the aldehyde was not observed with uranium dioxide, tungsten, and stannic oxide. In opposition to Senderens (this J., 1907, 715), the author maintains that alumina and kaolin are the simplest and best catalysers for the preparation of ethylene hydrocarbons from alcohols. It is true that red phosphorus accelerates the reaction, but the products then obtained are frequently not of an individual character. For example with alumina, *iso*butyl alcohol yields only *iso*butylene, whereas in presence of red phosphorus, a mixture of butylenes is obtained.

Under the influence of catalysers, acetic acid may decompose in two ways, yielding respectively, acetone and hydrogen. In the author's experiments, zinc, iron, alumina, sodium hydroxide, zinc oxide, and the carbonates of zinc, barium, calcium, and strontium were used as catalysers at temperatures ranging from 530° to 570° C. Under the most favourable conditions the ketone-decomposition may proceed to the extent of 75 per cent. of the theoretical. $2CH_3COOH = H_2O + CO_2 + (CH_3)_2CO$. The best catalysers for effecting decomposition in this manner are the carbonates, zinc oxide, and metallic zinc.—A. S.

Mercurial ointment ; Assay of commercial samples of ——. P. H. Crewe. Brit. Pharm. Conference, Aberdeen, 1908. Pharm. J., 1908, **81**, 359—360.

About 20 grms. of the ointment are saponified with 10 grms of potassium hydroxide and 100 c.c. of methylated alcohol. The soap formed is removed by washing with hot water, and the residual metallic mercury is washed, first with alcohol, then with ether, and weighed. If the globule be not quite bright, it is treated with a little hydrochloric acid to remove impurities. A number of commercial samples examined were deficient in mercury. —J. O. B.

Bismuth ; Compounds of —— *with aliphatic hydroxy-acids.* H. Telle. Arch. Pharm., 1908, **246**, 484—503.

Bismuth subnitrate was dissolved in just sufficient nitric acid, cooled to 5° C., and poured into a solution of sodium hydroxide at the same temperature. The precipitate of bismuth hydroxide, $Bi(OH)_3$, was washed by decantation and then on a filter till free from alkali and nitrate and pressed dry between sheets of absorbent paper The same product is obtained when the alkali is added to the bismuth solution, if of the same concentration and at the same temperature. Bismuth hydroxide obtained in this way was used in the following preparations. Freshly precipitated bismuth hydroxide (30 grms.) was added to 30 grms. of lactic acid (sp. gr. 1·21), and digested on the water-bath till solution took place. After standing, rhombic tablets of bismuth lactate, $BiC_6H_9O_6$, separated. These crystals are soluble with difficulty in hot or cold water, and are partly decomposed on prolonged boiling. If the above quantities of acid and hydroxide with the addition of 10 grms. of water are shaken together at the ordinary temperature, solution takes place, and on standing, crystalline needles of a hydrated bismuth lactate, $BiC_6H_9O_6,7H_2O$, separate out. This form of the lactate is soluble in about 10 parts of water. On exposure, the substance slowly loses water and the solubility decreases. The aqueous solution on standing or on boiling, deposits crystals of the anhydrous insoluble bismuth lactate. Bismuth malate was made by boiling together 5 grms. of the hydroxide, and 10 grms. of malic acid in a little water. The white precipitate which remains, was found to consist of a micro-crystalline powder of bismuth malate, $BiC_4H_3O_5, H_2O$, which is almost insoluble in water. The same substance is formed when malic acid is added to bismuth hydroxide dissolved in cold lactic acid, and the whole boiled. 20 parts of freshly prepared bismuth hydroxide were allowed to interact with a concentrated solution of 20 parts of tartaric acid for 6 hours, when the mass of fine needles, which had formed, was removed and washed. The substance obtained was acid bismuth tartrate,

$$BiC_8H_9O_{12},3H_2O,$$

hardly soluble in water, but soluble in sodium carbonate or potassium hydroxide. It is also formed when excess of tartaric acid solution is added to the soluble bismuth lactate and the whole boiled. Sodium carbonate solution was saturated with bismuth tartrate and the liquid evaporated, when a mass was left behind which could be powdered but which had no definite composition. Bismuth citrate, $BiC_6H_5O_7$, was made by boiling 10 parts of freshly-prepared bismuth hydroxide with 8 parts of citric acid dissolved in a little water. It is also formed when soluble bismuth lactate is boiled with a concentrated solution of citric acid.—F. Shdn.

Bismuth salicylate ; Detection of free salicylic acid in ——. J. B. P. Harrison. Brit. Pharm. Conference, Aberdeen, 1908. Pharm. J., 1908, **81**, 349.

One grm. of the salt is shaken with 10 c.c. of methylated ether of sp. gr. 0·720, and filtered. The ether is then evaporated, and the residue treated with 0·5 c.c. of cold distilled water. The presence of free salicylic acid is indicated by the production of a violet coloration on adding 1 drop of dilute ferric chloride reagent to this aqueous solution. The official test of the *British Pharmacopœia*, viz., treatment with alcohol and filtering, is valueless ; since the solvent causes decomposition of bismuth salicylate.—J. O. B.

Iron arsenate, official ; Characters of ——. F. B. Power and H. Rogerson. Brit. Pharm. Conference, Aberdeen, 1908 Pharm. J., 1908, **81**, 340—342.

The official description of the British Pharmacopœia 1898 for *Ferri Arsenas* as "ferrous arsenate $Fe_23AsO_4,6H_2O$ with ferric arsenate and some iron oxide," admits the indefinite nature of the product. After drawing attention to the numerous processes for the preparation of the compound published since 1828, and the varying formulæ official in the pharmacopœias of different countries at the present time, the authors give the results of the analysis of products prepared in accordance with the directions of the respective pharmacopœias. In addition to these preparations two representative samples of the B.P. product, as supplied by English manufacturers, were examined :—

Designation of preparation.	Ferrous iron.	Total iron.	Arsenic (As).
	per cent.	per cent.	per cent.
British Pharmacopœia (1898)	7·11	21·15	28·58
French ,, (1895)	4·45	20·87	28·15
Italian ,, (1892)	9·10	24·66	28·09
Spanish ,, (1905)	6·38	22·14	29·70
Commercial specimen	4·62	26·31	30·67
,, ,, ...	4·48	27·19	29·76

The figures obtained respectively for ferrous iron and arsenic in the product prepared according to the B.P. method indicate that, even when fresh, it consists mainly of ferric arsenate.—J. O. B.

Ferric arsenate ; Soluble ——. F. B. Power and H. Rogerson. Brit. Pharm. Conference, Aberdeen, 1908. Pharm. J., 1908, **81**, 342—344.

To an amount of ferric citrate solution corresponding to 145 parts of the anhydrous salt, 100 parts of anhydrous sodium arsenate are added, and dissolved by heating on the water-bath. The green solution is evaporated to a syrup, spread on glass, and dried. The bright green scales thus obtained are completely soluble in water, with an acid reaction. The solution gives a brown colour, but no precipitate, with ammonia solution. For technical purposes, a sufficiently accurate determination of the relative amounts of iron and arsenic may be made by decomposing a known weight of the compound by heating with excess of 10 per cent. sodium hydroxide solution. The precipitated ferric hydroxide is collected, dried, and ignited. The arsenic is precipitated from the filtrate, in the usual manner, with magnesia mixture and weighed as ammonio-magnesium arsenate, after drying at 100—105° C. For more accurate determinations, the separated iron and arsenic acid may be titrated iodometrically. The compound should contain from 13 to 13·5 per cent. of arsenic, equivalent to from 34 to 35 per cent. of anhydrous ferric arsenate. On account of its more definite composition, and its ready solubility in water, this preparation is preferable for medicinal use to the official form of iron arsenate.—J. O. B.

Jalap resin and scammony resin; Valuation of ——. W. B. Cowie. *See* XIII*B*.

Scammony resin, Mexican; Characters of ——. W. B. Cowie and B. M. Brander. *See* XIII*B*.

Patents.

Chlorobenzaldehydes; Process for separating o- and p- ——. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 389,750, April 30, 1908.

It is stated that there is a difference of about 5° C. between the boiling points of *o*- and *p*-chlorobenzaldehyde; a careful fractional distillation will, therefore, furnish initial fractions rich in *o*-chlorobenzaldehyde, and later fractions richer in the *p*-compound. The two compounds can then be isolated from the respective fractions by cooling, the mother-liquors and intermediate fractions being again distilled.—T. F. B.

Active principle of the suprarenal gland; Preparation of pure solutions of the ——. M. M. Freund, Berlin. Ger. Pat. 200,920, Nov. 21, 1906.

In order to prevent the risk of oxidation and coloration of solutions of suprarenin in presence of air, it is proposed to reduce the solutions electrolytically. For example, 600 c.c. of extract made from 10 kilos. of the fresh glands are filtered and reduced electrolytically for one to two hours, using a platinum cathode and carbon anode, in a porous earthenware cell. The solution will be slightly acid at the end of the reduction.—T. F. B.

Pharmaceutical preparations; Production of dry, palatable, oleaginous ——. E. Merck. Ger. Pat. 200,921, Jan. 16, 1907.

Fresh skim milk is emulsified with the desired oil (*e.g.*, castor oil, cod-liver oil, lecithin oil); it is said that the product can be evaporated to complete dryness without separation of the oil. The emulsified oil is said to resemble in taste ordinary full milk or cream.—T. F. B.

Aromatic carbonyl derivatives and camphor; Process of making ——. A. Wack, Belleville, Assignor to Verona Chemical Co., Newark, N.J. U.S. Pats. 898,942 and 898,943, Sept. 15, 1908.

See Fr. Pat. 385,700 of 1907; this J., 1908, 644.—T. F. B.

Substances containing crude tartar; Process of treating ——. V. J. Garin, Annemasse, and F. David, Cette, Assignors to Cie. Franç. des Produits Tartriques, Beziers, France. U.S. Pat. 898,866, Sept. 15, 1908.

See Addition to Fr. Pat. 374,276 of 1906; this J., 1908, 712.—T. F. B.

Eugenol and isoeugenol compounds for internal use; Process for making ——. H. Belart. Fr. Pat. 389,889, May 4, 1908. Under Int. Conv., June 15, 1907.

See Eng. Pat. 9246 of 1908; this J., 1908, 998.—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Silver-gel in photographic films. Lüppo-Cramer. Z. Chem. Ind. Kolloide. 1908, **3**, 135—136. (See also this J., 1908, 959.)

The silver image obtained by physical development with the silver-thiocyanate mixture, possesses, like Liesegang's "B"-form, a very small adsorption capacity. If the silver is dissolved out by means of chromic acid, etc., only a slight residue is left, whereas the silver image, developed in the usual way, leaves a considerable quantity of residue, consisting of an adsorption compound of the silver-gel with silver bromide and sulphide. If a negative be developed "physically" with acid metol-silver solution, and the silver removed by chromic acid, a feeble yellow image remains; but if the negative is fixed after the development, the blue colour disappears: if the silver is now removed, a strong brown residue remains. Thus metol produces a silver of similar gel-structure to that formed by ordinary chemical development, *viz.*, a very adsorbent, highly coloured silver. The behaviour of the silver-gel towards mercuric chloride and other substances throws light on the structure of the various images. The image, obtained in the ordinary way, by chemical development, is usually described as "coarse-grained"; in reality, it must be of very fine structure, as shown by its great chemical and adsorptive activity. On the other hand, images which appear on microscopical examination to be of fine grain are really coarse and more compact in structure, as indicated by their chemical properties.

Silver bromide collodion emulsions give, on development, a silver-gel analogous to "B"-silver. The behaviour of these emulsions with the various developers, and the influence of sulphites on the development (which is very similar to their influence on silver solutions), indicate that collodion has very much less true emulsifying power than gelatin. Collodion emulsions develop more rapidly than gelatin emulsions, but the deep black deposit produced with the latter is never obtained with collodion. By development of a gelatin and a collodion emulsion, of similar sensitiveness, with metol and sodium carbonate, the gelatin appears to be twice as sensitive as the collodion, but on physical development, after fixing, the collodion emulsion is at least three times as sensitive, the grain being larger. It thus appears that on exposure to light, more "silver-germ" is formed in the collodion emulsion, whereas more silver relatively is reduced by chemical development in the gelatin emulsion, a further instance of the great influence of the colloid in emulsions.—T. F. B.

Cellulose and its derivatives; Plastic materials from ——. [*Cinematographic films.*] F. J. G. Beltzer. *See* XIX.

Patents.

Developing and fixing photographic negatives or positives on any sensitive surface in daylight; Product for ——. F. Jeannot and M. Bremner. Fr. Pat. 390,265, July 23, 1907.

It is stated that combined developing and fixing solutions, which can be used in full daylight, are obtained by adding a picrate, especially that of sodium or magnesium, to the solution. The following example is given:—Picrate, 81 grms.; anhydrous sodium sulphite, 544 grms.; sodium thiosulphate, 250 grms.; diaminophenol, 125 grms. Four grms. of the mixture are dissolved in 100 c.c. of water. A thiocyanate or cyanide may also be added if desired.—T. F. B.

Aralkyl-para-aminophenols and their use as photographic developers; Manufacture of ——. A. Zimmermann, London. From Chem. Fabr. auf Actien, vorm. E. Schering, Berlin. Eng. Pat. 20,050, Sept. 7, 1907.

See Fr. Pat. 382,367 of 1907; this J., 1908, 246.—T. F. B.

XXII.—EXPLOSIVES, MATCHES, &c.

Explosion which occurred on June 23rd, at the premises occupied by The Mersey, Weaver and Ship Canal Carrying Company, Ltd., in Dawson Street, Hulme, Manchester; Circumstances attending an ——. Major A. Cooper-Key, H.M. Chief Inspector of Explosives.

The warehouse in which the fire broke out, contained some 32 tons of sodium chlorate, stored in wooden barrels, lined with stout blue paper, and in addition, in other parts of the shed, were 12 tons of potassium chlorate, and 1½ tons of barium chlorate similarly packed. In a yard adjoining the building, there were some 28 barrels of varnish. During the course of the fire, three distinct explosions took place. The Inspector considers:—(1), that the fire was undoubtedly originated by the friction of a workman's boot on a mixture of alkali chlorate and organic dust on the floor of the warehouse, the presence of this mixture being proved beyond question by the rapid spread of the flame when rubbed with the foot; (2), that one of the explosions was undoubtedly due to the mixture of fused chlorate and varnish, and the other two were most probably caused by one or more barrels of chlorate, which had up till then been partially protected from the heat, falling into the heart of the intensely hot furnace resulting from wooden staves burning in oxygen. It is suggested in order to minimise the risk of accidents such as these, that the following precautionary measures should be taken. (1). The elimination, so far as may be possible, of combustible material in the packages containing chlorate. (2). The establishment of separate buildings, of fireproof construction, for the storage of chlorate. (3). Absolute cleanliness, *i.e.*, the outside of the kegs, and the floor and walls of the store should be kept clear of all dust and dirt, and no one should enter the building in his ordinary boots. Either these should be taken off or "overshoes" should be provided as in a gunpowder magazine.—G. W. McD.

Patents.

Explosive. B. E. D. Kilburn. Fr. Pat. 389,905, May 5, 1908. Under Int. Conv., May 6, 1907.

See Eng. Pat. 10,510 of 1907; this J., 1908, 961.—T. F. B.

Cartridges and explosive charges containing ammonium nitrate; Process for making ——. J. F. Lehmann. Fr. Pat. 390,381, May 19, 1908.

See Eng. Pat. 351 of 1908; this J., 1908, 922.—T. F. B.

XXIII.—ANALYTICAL CHEMISTRY.

APPARATUS.

Patents.

Inflammable gases in air; Apparatus for detecting ——. A. Philip and L. J. Steele, Portsmouth. U.S. Pat. 899,068, Sept. 22, 1908.

See Eng. Pat. 22,129 of 1906; this J., 1907, 1212.—T. F. B.

Gaseous mixtures; Apparatus for automatically sucking ——, *into an apparatus; and for forcing them into an absorbing- and collecting vessel.* R. and T. Garternicht. Ger. Pat. 201,048, July 4, 1907.

The object of the invention is to automatically suck into a gas analysis apparatus, at frequent intervals, equal quantities of a gaseous mixture, and to force this through an absorbing liquid, whereby one of the constituents is retained. The essential feature consists in causing the liquid which overflows from the measuring vessel for the unabsorbed residue, to pass into a receptacle containing a float, which controls the valves regulating the introduction of the working liquid, the gas-inlet, and the discharge-pipe for the working liquid.—A. S.

INORGANIC—QUALITATIVE.

Colloid reaction for some metallic salts; A very sensitive ——. E. Stiasny. *See* XIV.

Ammonium sulphate; [Detection of impurities in ——]. F. J. Lloyd. *See* XV.

INORGANIC—QUANTITATIVE.

Sulphur in pig-iron and steel; Determination of —— *by the hydrogen jet method.* R. Bolling. *See* X.

Bronze, brass, and similar alloys; Analysis of ——. E. Schürmann and H. Arnold. Chem.-Zeit., 1908, 32, 886—887.

The authors find that copper may be separated from antimony by electrolysis, in the presence of a mixture of nitric and tartaric acids, and have devised the following methods for the analysis of bronze, brass, and similar alloys. *Bronze.*—The metal is treated with 5 c.c. of a 50 per cent. solution of tartaric acid, and, for 1 grm. of copper, 4 c.c. of nitric acid (sp. gr. 1·4) are gradually added with continuous stirring, the mixture being kept cold; then a further 7 c.c. of nitric acid are added to the clear solution, which is made up with water to 100 c.c. The copper is deposited from the solution by electrolysis, Frary's apparatus (this J., 1907, 875) being conveniently used; the anode is cooled by being wound round a test-tube through which a stream of water is made to pass, and the cathode is of platinum gauze fitting the vessel as closely as possible; the separation takes about an hour with a current of 1·5 amps. at 4 volts. A trace of tin, present in the copper deposit, is determined by dissolving in nitric acid, evaporating, and boiling with water to precipitate the stannic acid. The solution, after electrolysis, is made distinctly alkaline with potassium hydroxide and is treated, according to Finkener's method, with very dilute potassium sulphide solution; the small quantity of copper remaining and any lead are thus precipitated as sulphides, which are separated in the usual manner, the metals being weighed as oxide and sulphate respectively. The filtrate is boiled for 10 minutes with 0·5 c.c. of 30 per cent. hydrogen peroxide and is then neutralised with oxalic acid, an additional 5 grms. of oxalic acid are added, the solution is diluted to 400 c.c., and hydrogen sulphide passed through the boiling liquid for 30 minutes; antimony is thus precipitated as sulphide, and this is filtered off, dissolved in sodium sulphide, and the metal precipitated on a roughened sheet of platinum. Excess of ammonia is added to the filtrate from the antimony sulphide, the solution is acidified with acetic acid, and the tin precipitated with hydrogen sulphide in the boiling solution; the precipitated sulphide is washed many times by decantation with hot, very dilute acetic acid solution containing ammonium sulphate and hydrogen sulphide, and is then ignited to stannic oxide. *Brass* is dissolved in the same way and the copper removed by electrolysis; the liquid is then neutralised with ammonia, and the tin, remaining copper, lead, antimony, and arsenic are precipitated with hydrogen sulphide, after making strongly acid with sulphuric acid. The sulphide precipitate is filtered off, dissolved in a mixture of bromine and hydrochloric acid, and the solution treated by Finkener's method, and then as above. The filtrate is boiled to remove hydrogen sulphide, neutralised with ammonia, and the zinc precipitated from formic acid solution. The filtrate from the zinc is treated by known methods for the determination of nickel, iron, etc. Analyses of alloys containing: copper 40—50 per cent., tin 45—55, and antimony 5—10 per cent. may also be made by the above method.—F. Sodn.

ORGANIC—QUALITATIVE.

Colloid reaction for some metallic salts; A very sensitive ——. *[Detection of sulphite-cellulose waste lyes in tanning extracts].* E. Stiasny. *See* XIV.

Morphine and oxydimorphine; New reagent for the identification of ——. Hoshida. *See* XX.

Suprarenine [adrenine], synthetic; Some reactions of ——. L. Krauss. *See* XX.

Bismuth salicylate; Detection of free salicylic acid in ——. J. B. P. Harrison. *See* XX.

ORGANIC—QUANTITATIVE.

Nitrogen with carbon, hydrogen, etc., in organic compounds; Simultaneous determination of —— by the method of simplified elementary analysis. M. Dennstedt and F. Hassler. Ber., 1908, **41**, 2778—2782. (See also this J., 1908, 357.)

The method consists in carrying out the combustion of an organic substance in an atmosphere of pure oxygen and absorbing the excess of this in a solution of cuprous chloride in hydrochloric acid. The nitrogen gas is collected as usual and any lead nitrate that is formed is extracted from the lead peroxide with 33 per cent. alcohol, the solvent evaporated, the residue weighed, and the nitrogen content calculated as gas. The oxygen is prepared by heating potassium permanganate in a tube connected with the combustion tube and a rubber globe is interposed by means of a three-way tap in order to regulate the stream of oxygen by altering the pressure on it. If sulphur is present in the substance, it is estimated in the alcoholic extract of the lead peroxide; halogens are estimated by means of molecular silver, which follows the lead peroxide in the tube; salts of silver, platinum, etc., leave a residue of the metal in the boat.—J. C. C.

Acetate of lime; Commercial analysis of ——. W. Fresenius and L. Grünhut. *See* III.

Dissolved hide substance in soak and lime liquors; Rapid method for the determination of ——. E. Stiasny. *See* XIV.

Leather; Method of testing ——. W. Fahrion. *See* XIV.

Sugar in saturation mud; Determination of ——. F. Herles. *See* XVI.

Final attenuation and malt analysis. O Pankroth. *See* XVII.

Cinchona alkaloids; Modification of Florence's method for the determination of ——. N. H. Cohen. *See* XX.

Hydrastis canadensis; Determination of hydrastine in the fluid extract or rhizome of ——. P. Roeder. *See* XX.

Mercurial ointment; Assay of ——. P. H. Crewe. *See* XX.

XXIV.—SCIENTIFIC & TECHNICAL NOTES.

Sunlight; Catalytic reactions of ——. C. Neuberg. Biochem. Zeits., 1908, **13**, 305—320.

Uranium oxide and uranyl salts have the power of catalytically accelerating the action of light. Uranyl compounds under the influence of light, are reduced to a mixture of uranous and uranic hydroxides according to A. Bach and H. Euler.) In the author's experiments, in most cases, 1—5 grms. of the substance under examination were dissolved in 100 c.c. of water containing 0·5—1 per cent. of a uranyl salt. Under the action of sunlight, visible change took place sometimes within a few minutes, and in other cases after a few hours, whereas in control experiments with uranyl salts in the dark, and without uranyl salts in sunlight, no change was produced. The results obtained with 62 different substances are set out in a table. The action is an oxidising one. Alcohols yield aldehydes, and polyalcohols give hydroxyaldehydes or hydroxyketones. From acids there are produced aldehydic and ketonic compounds, in part containing the same number of carbon atoms as the original acid, and in part a lesser number. Monosaccharides are partly converted into osones, disaccharides and polysaccharides and glucosides are hydrolysed. *a*-Amino-acids lose ammonia and are converted into aldehydes containing an atom of carbon less. Glycerides are partially hydrolysed. Peptones and proteins are first partially hydrolysed, and the resulting amino-acids converted into aldehydes or aldehyde-acids. —A. S.

Colloidal chemistry. H. R. Procter. British Assoc., Dublin, 1908.

The differences between the colloidal and crystalloidal state were first pointed out by Graham, who introduced most of the nomenclature now in use, such as "sol" and "gel" for the apparent solution and the precipitate. Since sodium and potassium chlorides have been obtained in colloidal form in organic solvents, it is no longer possible to distinguish between colloida and crystalloid substances, but only between the colloid and crystalloid state. Colloid "sols" are unstable and liable to separate into the "gel" and the pure solvent. The organic colloid sols approach very closely to true solutions and are usually more stable than inorganic sols. Inorganic sols are invariably suspensions of very finely-divided substances in media in which they are extremely insoluble. The nature of a sol may often be changed by oxidation, reduction, or chemical substitution without destroying its colloidal character. The ultramicroscope has rendered many details of colloid sols accessible to direct observation. Inorganic sols are flocculated and precipitated by the addition of electrolytes. Organic sols are much less sensitive in this respect but are frequently flocculated by the addition of organic solvents to which inorganic sols are indifferent. When a colloid sol is precipitated by an electrolyte, the resulting gel always contains a small and apparently definite quantity of the precipitating ion of opposite sign to the particles, which cannot be removed by washing. This phenomenon is termed "co-precipitation" or "adsorption." Flocculation, whether by added electrolytes or by other colloids, is dependent on the neutralisation of the charges of this particles. Some colloids have a protective action in preventing other colloids from being precipitated: this is particularly marked in the effect of organic colloids on inorganic sols. It is probably due to the actual coating of the particles of the sol with the protective substance. The colour of metallic hydrosols is often intense and varies with their condition, especially on approaching flocculation. The drying of gels is usually a continuous process, proceeding rapidly at first but gradually becoming slower, and the vapour pressure becomes lower as dryness is approached. In most cases organic sols are simply viscous liquids which on concentration become more and more viscous, until they reach a practically solid form. Conversely in the solid form they absorb water and pass back without break to the viscous condition. Cellulose and many animal and vegetable tissues swell but do not dissolve without hydrolysis or other chemical change and may be viewed as irreversible jellies. The pressures exerted in the early stages of colloid swelling are very large. The phenomenon of "semi-permeability" is frequently exhibited by colloid gels and jellies. Dilute acids and alkalis greatly raise the maximum swelling of gelatin. The report gives a clear and concise account of the present state of the science.—E. F. A.

Trade Report.

German chemical exports for the first half of 1908. Chem. Ind., Aug., 1908.

German chemical exports during the six months ended June 30, 1908, included the following items:—The unit of weight is 100 kilos., the unit of value is 1,000 marks. The figures for the corresponding period of 1907 are given in brackets for comparison. Alizarin and alizarin dyes, quantity (48,215) 34,795, values (10,837) 8,048; aniline and other tar dyes (221,856) 189,526, (57,017) 48,708; carbolic acid (17,337) 20,901, (1,198) 1,444; potassium chloride (601,687) 597,867, (8,724) 8,669; indigo, natural and artificial (74,650) 72,888, (19,409) 18,951; potash, also wool-yolk ash (66,922) 58,983, (2,409) 2,123.

New Books.

Technical Methods of Chemical Analysis. Edited by George Lunge, Ph.D., Dr. Ing., Emeritus Professor of Technical Chemistry, Federal Polyt. School, Zürich, in collaboration with 37 authorities. English Translation from the latest German edition, adapted to English conditions of manufacture. Edited by Charles Alexander Keane, D.Sc., Ph.D., Principal and Head of the Chemistry Department of the Sir John Cass Technical Institute, London, in collaboration with T. L. Bailey, C. O. Bannister, E. J. Bevan, W. Burton, W. A. Caspari, H. G. Colman, J. T. Conroy, C. F. Cross, G. J. Fowler, A. G. Green, O. Guttmann, A. D. Hall, J. Hübner, W. J. Lambert, J. Lewkowitsch, A. R. Ling, C. A. Mitchell, F. B. Power, H. R. Procter, H. J. L. Rawlins, W. F. Reid, P. Schidrowitz, A. Smetham, W. Thomason. Vol. I. Parts I. and II. Gurney and Jackson, 10, Paternoster Row, London. 1908. Price 52s. 6d. net.

Royal 8vo, Part I. containing 519 pages of subject matter, and 146 illustrations, whilst Part II. contains 456 pages with 55 illustrations. The subject matter is classified as follows:—Part I. (A.), General Methods used in technical analysis. (B.), Special methods of technical analysis. (i.), Technical gas analysis. (ii.), Fuel. (iii.), Manufacture of sulphurous acid. (iv.), Nitric acid manufacture. (v.), Sulphuric acid manufacture. (vi.), Salt cake and hydrochloric acid manufacture. (vii.), Sodium carbonate manufacture. (*a.*), (Leblanc process). (*b.*), Ammonia-soda process. (*c.*), Caustic soda manufacture. (*d.*) Electrolytic alkali liquors. (*e.*), Crude fused soda of the cellulose industry. (*f.*), Finished products of the soda industry. (viii.), The chlorine industry, with bleaching powder, potassium chlorate, etc. Part II. (i.) Potassium salts. (ii.), Cyanogen compounds. (iii.), Clay. (iv.), Clay wares used for building purposes; Earthenware and glazes. (v.), Aluminium salts and alumina. (vi.), Glass. (Raw materials. Composition and testing of glass. Analysis.) (vii.), Calcareous cements. (*a*), Hydraulic admixtures. (*b*), Hydraulic cements. (*c*), Gypsum. (viii.), Drinking water and water supplies. (ix.), Feed water for boilers, and water for other technical purposes. (x.), Sewage and effluents. (xi.), Soils. (xii.), Air. An appendix of 64 pages follows. It contains the tables included and referred to in the text, as also some tables for correcting the volumes of gases to the normal temperature and pressure. Copious indexes of subjects and names of authors close the work.

Technical Chemists' Handbook. Tables and Methods of Analysis for Manufacturers of Inorganic Chemical Products. By George Lunge, Ph.D., Dr. Ing., Emeritus Professor of Technical Chemistry Federal Polyt. School, Zürich. Gurney and Jackson, 10, Paternoster Row, London. 1908. Price 10s. 6d.

This work, of pocket-book size is designed to take the place of the "Alkali Makers' Handbook," and the reading of the text of this English edition has been revised by Dr. C. A. Keane. It contains 256 pages of subject matter, with 20 illustrations, and an alphabetical index. The classification of the text is as follows:—I. General tables. II. Fuel and furnaces. III. Sulphuric acid manufacture. IV. Salt-cake and hydrochloric acid. V. Bleaching powder and chlorate of potash manufacture. VI. Soda ash manufacture by the Leblanc process. VII. Manufacture of soda by the ammonia process. VIII. Caustic soda. IX. Electrolytic alkaline liquors. X. Nitric acid manufacture. XI. Potassium salts. XII. Ammonia manufacture. XIII. Manufacture of coal-gas (Illuminating gas). XIV. Calcium carbide and acetylene. XV. Examination of the raw materials and products of the manufacture of fertilisers. XVI. Alumina preparations. XVII. Cement industry. XVIII. Preparations of standard solutions. XIX. Rules for sampling. XX. Comparison of the hydrometer degrees according to Baumé and Twaddell, with the specific gravities. XXI. Value of alkali per ton.

Fortschritte der Teerfarbenfabrikation und verwandter Industriezweige. An der Hand der systematisch geordneten und mit kritischen Anmerkungen versehenen deutschen Reichs-Patente, dargestellt von Dr. P. Friedlaender, Vorstand der chem. Abteilung des k.k. technologischen Gewerbemuseums in Wien. 8ter Teil. 1905—1907. Julius Springer's Verlag, Berlin. 1908. Price M.70. Bound in cloth, M.73.

Large 8vo volume, containing 1385 pages of subject matter, followed by indexes of patent numbers of volumes I. to VIII. (pages 1386—1413); French patents, 1413—1414; English patents, 1414—1415; United States patents 1415; and German patents, 1416—1419. These are followed by an alphabetical index of patent-holders, (1420—1426), and finally, one of subjects, (1427—1444). The work commences with a preface by the compiler. The text of the work is devoted to descriptions of all the German patents relating to the coal-tar dyestuff manufacture, taken out from 1905—1907, and the classification is as follows:—I. Intermediate products. a. Aliphatic compounds. b. Aromatic compounds. II. Triphenylmethane dyestuffs. III. Anthracene dyestuffs. IV. Indigo. V. Thionaphthene dyestuffs. VI. Quinone-imine-, Acridine-, and Quinoline dyestuffs. VII. Azo dyestuffs. VIII. Sulphide dyestuffs. IX. Dyestuffs of varied composition. Dyeing and Printing processes. X. Pharmaceutical products. XI. Odoriferous compounds (perfumes). XII. Appendix.

A Treatise on Colour Manufacture. A Guide to the preparation, examination, and application of all the pigment colours in practical use. By George Zerr and Dr. Rübencamp. Authorised English edition by Dr Charles Mayer. Charles Griffin and Co., Limited, Exeter Street, Strand, London. 1908. Price 30s. net.

Royal 8vo volume, containing 588 pages of subject matter, with 106 illustrations, and an alphabetical index of subjects. The text is subdivided and classified according to the following general scheme:—A The artificial mineral colours. (i.), Preparation of the materials and apparatus. (ii.), Manufacture of the artificial mineral colours. (iii.), Raw materials used in colour-making. B. The natural mineral colours (Earth colours). C. Black pigments. D. Organic colouring matters and their utilisation in making lake pigments. (i.), Natural colouring matters. (ii.), Artificial organic colouring matters. E. The uses of colours. Appendix (pages 577—588), giving various useful tables.

Hevea Brasiliensis or Para Rubber. Its Botany, Cultivation, Chemistry and Diseases. By Herbert Wright, A.R.C.S., F.L.S. Third edition. Messrs. A. M. and J. Ferguson, Colombo. Messrs. MacLaren and Sons, London. 1908. Price 10s. net. 10s. 6d. post free.

Large 8vo volume, containing 298 pages of subject-matter, with ninety illustrations, and an alphabetical index of subjects. The text is classified as follows:—I. History of Para rubber in the East. II. Botany of the Para rubber tree. III. Climatic conditions for Para rubber. IV. Cultivation of Para rubber trees. V. Para rubber soils and manuring. VI. Tapping operations and implements. VII. How to tap Para rubber trees. VIII. Where to tap. IX. When to tap. X. Yields of Para rubber. XI. Effect of tapping on the trees. XII. Physical and chemical properties of latex. XIII. Production of rubber from latex. XIV. Drying of rubber. XV. Physical and chemical properties of rubber. XVI. Purification of rubber. XVII. Vulcanisation and uses of rubber. XVIII. Kinds of Para rubber. XIX. Diseases of Para rubber trees. XX. What to do with the seeds. XXI. Estimates of rubber planters: Costs of planting rubber in Ceylon, Malaya, Java, South India, and Borneo.

CHAPTERS ON PAPERMAKING. Vol. V. Concerning the Theory and Practice of Beating. By CLAYTON BEADLE. Crosby, Lockwood and Son, 7, Stationers' Hall Court, Ludgate Hill, London, E.C. 1908. Price 5s. net.

SMALL 8vo volume, containing 176 pages of subject matter, with 30 illustrations, and an alphabetical index. The text is subdivided according to the following scheme:—I. Introduction. II. Economy of beating. III. Power consumption. IV. Comparison of beaters. V. Power consumed in "breaking," "beating," and "refining" of different materials. VI. "Circulation" and "agitation" in a Hollander. VII. Comparison of "Hollanders." VIII. Trials with breakers, Reed beaters, and Kingsland refiners. IX. Beating with continuous bleaching. X. Beaters and refiners. XI. Power in grinding wood pulp, etc. XII. Reduction in length of fibres at different stages of beating. XIII. Determining the "wetness" of beaten stuff. XIV. Position of beaters in old and modern paper-mills. Appendix, with correspondence.

AN EXAMINATION INTO THE DIVISIBILITY OF THE BRIN OR ULTIMATE FIBRE OF THE SILK OF BOMBYX MORI, OR SILK OF COMMERCE, AND OF SOME WILD SILKS, WITH ILLUSTRATIONS. By Sir THOMAS WARDLE, J.P. Followed by a separate monograph SULLO SFILACCIARSI DELLE SETE TINTE, being the Report of a similar Investigation carried out under the Auspices and in the Laboratory of the Società anonima Co-operativa per la Stagionatura e l'Assaggio delle Sete ed Affini (Laboratory of Silk Studies), Milan, Italy. Translated from the Italian by Miss K. MILNER, of Leek, and Sir THOS. WARDLE, J.P., etc. John Heywood, Ltd., Deansgate and Ridgefield, Manchester: 20, 22, 24, 26, Lamb's Conduit Street, London, W.C. 1908. Price 6s. net.

8vo volume, containing 88 pages of subject matter, with 36 illustrations, in the first portion, followed by an alphabetical index and a list of illustrations. The second monograph on the same subject (translated), contains 48 pages of subject matter, with 13 illustrative plates.

PATENT OFFICE LIBRARY: SUBJECT LISTS. New Series. AA—BE. SUBJECT LIST OF WORKS OF REFERENCE, BIOGRAPHY, BIBLIOGRAPHY, THE AUXILIARY HISTORICAL SCIENCES, ETC., IN THE LIBRARY OF THE PATENT OFFICE. Darling and Son, Ltd., 34—40, Bacon Street, E. Patent Office, 25, Southampton Buildings, Chancery Lane, London, W.C. 1908. Price 6d.

POCKET book size, contains 318 pages, and a "Key to the Classification of Headings" (AA—BE).

Patent List.

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

APPLICATIONS.

20,400. Arbuckle and Osborne. Rotary filtering apparatus.* Sept. 28.

20,479. Wilfley Mining Machinery Co., and Roudebush. Agitating apparatus for liquids or mixtures of liquids and solids. Sept. 29.

20,682. Kittle. Removing deposits or incrustations from stills, vaporisers, etc. [Comprised in No. 19,225 of 1908.] Oct. 1.

20,765. Shaw. Apparatus for evaporating or concentrating liquids. Oct. 2.

20,921. Nobel and Bessonoff. Regenerating and utilising the latent heat of vaporisation of liquids. Oct. 3.

20,972. Maschinenfabrik. Grevenbroich. Evaporating apparatus. [Ger. Appl., Oct. 8, 1907.]* Oct. 5.

21,280. Crefelder Seifenfabr. Stockhausen und Traiser. Production of emulsions. [Ger. Appl., Oct. 8, 1907.]* Oct. 8.

21,419. Liversedge. Apparatus for indicating and recording the purity of gases, and also for indicating and recording gas pressures. Oct. 10.

21,452. Arbuckle and Osborne. Filtering apparatus.* Oct. 10.

COMPLETE SPECIFICATIONS ACCEPTED.

22,646 (1907). Humphrey. Compressing air or gases. Oct. 14.

26,109 (1907). Harvey. *See under* XVI.

3360 (1908). Ekelund. Method and furnaces for drying and charring peat, sawdust, etc. Oct. 7.

5334 (1908). Ogden and Stuart. Apparatus of the ejector type for producing a vacuum. Oct. 7.

5461 (1908). Danneberg. Drying apparatus. Oct. 14.

II.—FUEL, GAS, AND LIGHT.

APPLICATIONS.

20,343. Claussen, Cobbett, and De Fazi. Liquid hydrocarbons or hydrocarbon mixtures for motive power, heating, lighting, etc. Sept. 28.

20,344. De Fazi, Claussen, and Cobbett. Filaments for electric incandescence lamps. Sept. 28.

20,686. Bowmer. Gas producers. [Comprised in No. 21,682 of 1907.]* Oct. 1.

20,777. Jarrett (Graf). Manufacture of combustible smokeless and odourless gas. Oct. 2.

20,920. Burkheiser. Purifying distillation gases and obtaining by-products. [Ger. Appl., Oct. 14, 1907.]* Oct. 3.

20,979. Zirfas. Coke ovens. Oct. 5.

21,175. Williams. Apparatus for the production of gas. Oct. 7.

21,249. Seymour. Horizontal regenerative coke ovens. Oct. 8.

21,278. Stoneham and Pearson. *See under* IX.

21,489. Gennotte. Gas retorts.* Oct. 10.

COMPLETE SPECIFICATIONS ACCEPTED.

21,682 (1907). Bowmer. Suction gas producers. Oct. 7.

21,838 (1907). Mason's Gas Power Co., and Wright. Gas producers. Oct. 14.

22,036 (1907). Lake (Michaud and Delasson). Manufacture of filaments for illuminating and heating purposes. Oct. 14.

22,293 (1907). Wirtz. Coke and similar ovens. Oct. 7.

26,816 (1907). Koch. Combustion of liquid fuel. Oct. 14.

1764 (1908). Talbot. Gas producers. Oct. 14.

2145 (1908). Koppers. Gas furnaces or coke ovens Oct. 14.

10,558 (1908). Morgan, Densley, Gray, Walduck, and Geering. Manufacture of coal, water, or oil gas, or combinations of said gases. Oct. 7.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

Applications.

20,920. Burkheiser. *See under* II.

21,267. Wallace and Raynaud. Destructive distillation of vegetable substances and resins. Oct. 8.

Complete Specifications Accepted.

15,036 (1907). Wells and Wells. Fractionating petroleum. Oct. 7.

21,742 (1907). Paterson. Manufacture of vulcanised bitumen. Oct. 7.

23,622 (1907). Philips-Smith. Lubricating compounds. Oct. 7.

517 (1908). Henderson. Apparatus for recovering gases and the lighter distillates from mineral oil stills. Oct. 14.

IV.—COLOURING MATTERS AND DYESTUFFS.

Applications.

20,367. Newton (Bayer und Co.). Manufacture of basic dyestuffs. Sept. 28.

20,368. Newton (Bayer und Co.). Manufacture of dyestuffs of the gallocyanine series. Sept. 28.

20,709. Ransford (Cassella und Co.). Manufacture of dyestuffs. Oct. 1.

20,775. Wyler, and Levinstein, Ltd. Manufacture of sulphur colours. Oct. 2.

20,802. Bloxam (Act.-Ges. f. Anilinfabr.). Manufacture of sulphurised dyestuffs. Oct. 2.

20,859. Wyler, and Levinstein, Ltd. Manufacture of sulphur colours. Oct. 3.

Complete Specifications Accepted.

23,183 (1907). Newton (Bayer und Co.). Manufacture of azo dyestuffs. Oct. 14.

28,492 (1907). Newton (Bayer und Co.). Manufacture of dyestuffs of the diphenylnaphthylmethane series. Oct. 7.

1165 (1908). Newton (Bayer und Co.). Manufacture of anthracene derivatives. Oct. 14.

1141 (1908). Johnson (Badische Anilin und Soda Fabrik). Manufacture of colouring matters of the anthracene series. Oct. 7.

4541 (1908). Imray (Meister, Lucius, und Brüning). Manufacture of dyestuffs containing sulphur or their leuco compounds. Oct. 7.

16,017 (1908). Meister, Lucius, und Brüning. Manufacture of red dyestuffs. Oct. 14.

18,736 (1908). Lauch. Manufacture of an orange lake dyestuff. Oct. 14.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

Applications.

20,316. Dreaper. Manufacture of artificial fibres and the like from cellulose. Sept. 28.

20,319. Crombie. Apparatus for making fibres from solutions. Sept. 28.

20,438. Pretori. Apparatus for extracting caustic soda lye from mercerised pieces. Sept. 29.

20,743. Kur. Dyeing and sizing, or dyeing and starching, in one operation yarns or fabrics made of vegetable fibres. Oct. 2.

21,191. Ellis (Le Crinoid Soc. Anon.). Manufacture of artificial hair or silky threads. Oct. 7.

21,285. Follet and Ditzler. Treatment of artificial threads.* Oct. 8.

Complete Specifications Accepted.

22,171 (1907). Von Kapff. Dyeing thoroughly closely woven webs or felts. Oct. 14.

22,371 (1907). Morison. Composition for preserving and waterproofing fabrics, wood, etc. Oct. 14.

25,696 (1907). British Cotton and Wool Dyers' Assoc., and Hoegger. Cop dyeing machines. Oct. 7.

963 (1908). Pickles and Pickles. Means for schreinering fabrics. Oct. 14.

VII.—ACIDS, ALKALIS, AND SALTS.

Applications.

20,366. Ellis (Chem. Werke vorm. Dr. H. Byk). Manufacture of nitric acid. Sept. 28.

20,406. Johnson (Badische Anilin und Soda Fabrik). Manufacture of compounds containing nitrogen and oxygen. Sept. 28.

20,455. Stoneham and Pearson. Fixation of atmospheric nitrogen. Sept. 29.

20,614. Strange and Graham, Ltd., Matthews, and Pim. Extraction of sodium nitrate from caliche and caliche waste. Sept. 30.

20,787. Levy. *See under* XI.

21,255. Oddo. Furnace for the combustion of mineral sulphur. [Ital. Appl., Oct. 8, 1907.]* Oct. 8.

21,427. Ryan. Burning lime, etc., and kilns therefor. Oct. 10.

21,479. Clark (Dellwik-Fleischer Wassergas Ges.). Production of hydrogen. Oct. 10.

Complete Specifications Accepted.

10,938 (1908). Brandenburg. Manufacture of tin salts. Oct. 7.

18,184 (1908). Steynis and Chaumat. Production of ozone. Oct. 7.

VIII.—GLASS, POTTERY, AND ENAMELS.

Applications.

20,768. Fuller and Riley. Manufacture of pottery ware. Oct. 2.

21,260. Salamon, Grace, and The Exploration Co. Preparation of china clay. Oct. 8.

Complete Specification Accepted.

15,670 (1908). Imray (Window Glass Machine Co.). Apparatus for drawing glass. Oct. 7.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Applications.

21,192. Lotz and Roth. Manufacture of artificial stone. Oct. 7.

21,278. Stoneham and Pearson. Fuel for use in cement kilns and smelting and other furnaces. Oct. 8.

Complete Specification Accepted.

22,371 (1907). Morison. *See under* V.

X.—METALS AND METALLURGY.

Applications.

20,305. Elborne. Agglomerating iron sands, loose powdery ores, etc., for direct ordinary furnace extraction. Sept 28.

20,407. Pim and Matthews. Manufacture of steel. Sept. 28.

20,500. Reynolds. Manufacture of steel. Sept. 29.

20,902. Williams. Extraction of metals from ores.* Oct. 3.

21,164. Carrick and Pattison. Treatment of copper mattes.* Oct. 7.

21,319. Carrick and Pattison. Treatment of ores. Oct. 9.

21,480. Clark (Dellwik-Fleischer Wassergas Ges.). Process and apparatus for making steel. Oct. 10.

Complete Specifications Accepted.

15,498 (1907). Churchward. Steel alloys. Oct. 14.

23,323 (1907). Hammersley and McChesney. Regenerative furnaces for heating or melting metals. Oct. 7.

1676 (1908). Wikstrom. Smelting. Oct. 14.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

Applications.

20,787. Levy. Electrolytic decomposition of sodium and other chlorides in the manufacture of caustic soda, etc. Oct. 2.

20,858. Gibbs. Producing metallic articles by electrodeposition. Oct. 3.

21,004. Haddan (Nya Ackumulator Aktiebolaget Jungner). Electrodes for accumulators.* Oct. 5.

21,243. Lutz. Method and apparatus for electroplating.* Oct. 8.

Complete Specifications Accepted.

22,311 (1907). Cowper-Coles. Electrodeposition of iron. Oct. 14.

22,312 (1907). Cowper-Coles. Manufacture of iron articles by electrodeposition. Oct. 14.

22,869 (1907). British Thomson-Houston Co. (General Electric Co.). Electric resistance material. Oct. 7.

3504 (1908). Wenger. Precipitation of electrolytic copper and other metals in the form of sheets or cylinders. Oct. 7.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

Application.

21,280. Crefelder Seifenfabrik Stockhausen und Traiser. *See under* I.

Complete Specification Accepted.

9744 (1908). Firth. Manufacture of pumice and like soaps. Oct. 7.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(*A.*)—Pigments, Paints.

Applications.

20,954. Sheriff, Riley, and May. Body colour for paints and colours for printing. Oct. 5.

21,407. Mortell and Mortell. Manufacture of paints, varnishes, etc., containing caoutchouc or rubber. Oct. 10.

Complete Specifications Accepted.

8550 (1908). Heckman. Pigments. Oct. 14.

18,736 (1908). Lauch. *See under* IV.

(*B.*)—Resins, Varnishes.

Applications.

21,267. Wallace and Raynaud. *See under* III.

21,387. Birchall and Russell. Sealing wax. Oct. 9.

21,407. Mortell and Mortell. *See under* XIII*A*.

Complete Specification Accepted.

4546 (1908). Meyer. Preparation of substitutes for shellac. Oct. 7.

(*C.*)—India-Rubber.

Applications.

20,896. Flamant and Worms. Extracting rubber from latex and resinous products containing rubber. [Fr. Appl., Oct. 4, 1907.]* Oct. 3.

21,265. Wallace and Raynaud. Production of india-rubber. Oct. 8.

21,271. Wallace and Raynaud. Treatment of isoprene. Oct. 8.

21,407. Mortell and Mortell. *See under* XIII*A*.

21,441. Cockerill. Treatment of indiarubber. [Appl. in Ceylon, Oct. 12, 1907.]* Oct. 10.

Complete Specification Accepted.

21,772 (1907). Heinemann. Synthetic production of indiarubber. Oct. 7.

XIV.—TANNING, LEATHER, GLUE, SIZE, &c.

Applications.

21,091. Guilleteau. Artificial leather. [Fr. Appl., Oct. 9, 1907. Addition to No. 6216 of 1907.]* Oct. 6.

21,465. Claypoole. Production of a material resembling horn, bone, ivory, etc.* Oct. 10.

21,483. Redlich and Pollak. Manufacture of quebracho extract. [Addition to No. 4358 of 1908.]* Oct. 10.

XV.—MANURES, &c.

Complete Specifications Accepted.

22,180 (1907). Fraser-Hewett and Watchurst. Fertilising compounds. Oct. 14.

8779 (1908). Marks (Dokkenwadel). Insecticide-fertiliser. Oct. 14.

XVI.—SUGAR, STARCH, GUM, &c.

Application.

20,484. Hervey. Manufacture of dextrin, gum, starch, etc. Sept. 29.

Complete Specification Accepted.

26,109 (1907). Harvey. Apparatus for heating sugar juice and other liquids. Oct. 7.

XVII.—BREWING, WINES, SPIRITS, &c.

Application.

21,068. Slavicek. Continuous distillation and rectification of alcoholic liquids.* Oct. 6.

Complete Specification Accepted.

21,730 (1907). Golby (Laidlaw). Apparatus for purifying and ageing alcoholic and other liquids and separating their volatile constituents. Oct. 7.

XVIII.—FOODS; SANITATION, WATER PURIFICATION; AND DISINFECTANTS.

(*A.*)—Foods.

Complete Specification Accepted.

5087 (1908). Wetter (Knoll und Co.). Manufacture of casein derivatives or compounds. Oct. 7.

(*B.*)—Sanitation; Water Purification.

Applications.

20,504. Candy. Apparatus for separating solid matter from sewage and other putrescible liquids. Sept. 30.

20,591. Reichling. Purifying water from sulphur. [Ger. Appl., Oct. 1, 1907.]* Sept. 30.

21,235. Adams. Apparatus for sewage purification, etc. Oct. 8.

Complete Specification Accepted.

3357 (1908). Vogelsang. Purification and filtration of water and foul liquids. Oct. 14.

(*C.*)—Disinfectants.

Complete Specification Accepted.

27,646 (1907). Huwart. Disinfecting by means of trioxymethylene. Oct. 7.

XIX.—PAPER, PASTEBOARD, &c.

Application.

20,810. Gernaert. Manufacture of paper, etc.* Oct. 2.

Complete Specification Accepted.

10,529 (1908). Meister, Lucius, und Brüning. Manufacture on the paper machine of paper having relief-like effect. Oct. 7.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

Applications.

20,377. Imray (Meister, Lucius, und Brüning). Manufacture of 1-aryl-2.4-dialkyl-3-halogenmethyl-5-pyrazolones. Sept. 28.

21,389. Lepetit. Manufacture of *p*-ethoxyphenylamidomethyl alkaline sulphites.* Oct. 9.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Applications.

20,593. Ilford, Ltd., and Potter. Screen plates for colour photography. Sept. 30.

20,971. Christensen. Manufacture of colour plates or screens for photography. [Appl. in Denmark, Jan. 25, 1908.]* Oct. 5.

21,097. Christensen. Manufacture of colour screens or plates for photography. [Addition to No. 20,971 of 1908.] Oct. 6.

Complete Specification Accepted.

22,218 (1907). Smith. Toning reagents and processes for toning photographic prints. Oct. 14.

XXII.—EXPLOSIVES, MATCHES, &c.

Application.

20,574. Farris and Jex. Blasting powder.* Sept. 30.

Journal of the Society of Chemical Industry.

No. 21, Vol. XXVII. NOVEMBER 16, 1903. No. 21, Vol. XXVII.

Nottingham Section.

Meeting held at Nottingham on Oct. 8, 1908.

MR. O. QUIBELL IN THE CHAIR.

THE USE OF ALUMINIUM IN THE ESTIMATION OF IRON.

BY F. J. R. CARULLA.

In this paper, the author recommends the use of aluminium in place of zinc for the reduction of ferric solutions before titration with potassium permanganate.

Journal and Patent Literature.

Patent Specifications may be obtained by post by remitting as follows.—

English.—8*d.* each, to the Comptroller of the Patent Office, C. N. Dalton, Esq., Southampton Buildings, Chancery Lane, London, W.C.

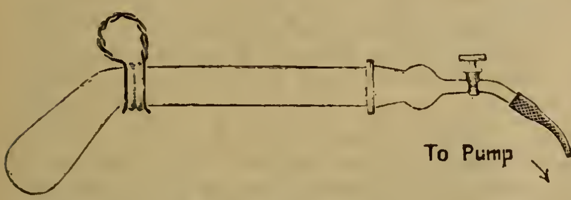
United States.—1*s.* each, to the Secretary of the Society.

French.—1 fr. 25 c. each, to Belin et Cie., 56, Rue des Francs-Bourgeois, Paris (3e.).

German—1 mark each (with full particulars), to Kaiserlich Patentamt, Berlin, Germany.

I.—PLANT, APPARATUS, AND MACHINERY.

Vacuum sublimation; Practical studies on ——. R. Kempf. J. prakt. Chem., 1908, **78**, 201—259.



The auther points out that purification by means of sublimation is worthy of more extensive application than it receives at present. Compared with crystallisation, there is little loss of material, and no foreign substances are introduced. Sublimation is also frequently preferable to distillation, as it can be effected at a lower temperature, and hence with less risk of decomposition. In the separation of mixtures by sublimation, the pressure should be so adjusted that the operation is effected at a temperature at which the vapour pressures of the constituents are most widely apart, but as the nature of the impurities is frequently unknown, it is recommended in such cases to work at the lowest practicable temperature. The author has devised a simple vacuum sublimation apparatus of refractory Jena glass (see figure). The junction between the pear-shaped receptacle and the horizontal tube is formed by ground glass flanges as in an exsiccator. The two parts of the apparatus may be held together, when the vacuum is broken, by means of a brass clip as shown. The ground surfaces of the joints are rubbed over with graphite before being brought in contact. With an ordinary water pump a vacuum of 10—15 mm. of mercury can be produced in the apparatus, and with a Geryk vacuum pump (Fleuss patent, type C), one of about 0·4 mm. For heating the apparatus, an air-bath constructed of aluminium and asbestos-board is used, having in the bottom a central hole, 1—2 cm. above which is a thick iron plate. For high temperatures several sheets of asbestos gauze may be laid on the bottom of the air-bath. The material to be sublimed should be first ground as finely as possible, and may also be mixed with powdered glass in order to increase its surface and thus accelerate sublimation. Fractional sublimation is frequently observed, part of the sublimate collecting in the pear-shaped vessel, and part in the horizontal tube.

In other cases fractionation can be effected by placing a part of the horizontal tube in the air-bath with the pear-shaped vessel, at first, and withdrawing it after the most volatile portion of the substance has sublimed. The author points out the uselessness of the so-called sublimation-temperature of a substance as frequently given in chemical literature. What is needed is a statement of the rate of sublimation at a given temperature and pressure. The article concludes with a detailed account of sublimation experiments with 53 different substances, including elements and inorganic compounds, hydrocarbons, phenols and quinones and their derivatives, dyestuffs, aldehydes, organic acids and anhydrides, amino-acids, diketopiperazines, purine derivatives, alkaloids, odoriferous compounds such as vanillin, coumarin, coniferin, and camphor, and pharmaceutical compounds such as aspirin (acetylsalicylic acid), saccharin, sulphonal (diethylsulphodimethylmethane), and veronal (C-diethylmalonylurea).

Zinc dust was readily freed from arsenic and iron, and was obtained much purer than by distillation. Sublimed, crystallised phosphorus pentoxide is much more chemically reactive than the amorphous form. Mercuric sulphide on sublimation in a vacuum, yields a black powder, which is converted into cinnabar on rubbing in an agate mortar. To obtain cinnabar directly, the sublimation must be carried on slowly and under pressure. It is possible to effect a quantitative separation of catechol and its two mononitro-derivatives, and also the detection and determination of alizarin in admixture with flavopurpurin and anthrapurpurin by fractional sublimation. By sublimation of a mixture of malic acid or succinic acid and phosphorus pentoxide, malic anhydride or succinic anhydride is obtained.—A. S.

Patents.

Erratum:—This J., 1908, 1010, col. 2, title, l. 27 from top, *for* "Medberger and Medberger" *read* "Medberg and Medberger."

Lubricating compounds [*Graphite*]. B. L. Philips-Smith, London. Eng. Pat. 23,622, Oct. 25, 1907.

The lubricating compound consists of a mixture of finely-divided graphite and either formalin and glycerin, or tannic or gallotannic acid and glycerin. The graphite is thoroughly mixed into a paste with a 40 per cent. solution of formalin, and about 2 oz. of this paste are mixed with glycerin. The graphite may be mixed with the tannic acid by the Acheson process (U.S. Pat. 844,989 of 1907; this J., 1907, 417).—W. C. H

Pressure-filter, filter-press, and process of precipitating and recovering materials from solutions. C. W. Merrill, Lead, S.D. U.S. Pats. 900,184, 900,185, and 900,186, Oct. 6, 1908.

(1). Grilles or gratings are placed on both sides of containers, and entirely within the same, and a series of such elements is assembled to form a filter-press. The sides of the containers converge towards the bottom, forming a continuous channel provided with ports communicating with the interior. A pipe, provided with corresponding ports, passes through the feed channel, and by rotating it, the ports in the containers may be opened or closed at will. (2). A container for use in a pressure-filter is provided in its side wall with a duct leading from a feed channel above the bottom of the container, and terminating in the container near the bottom. A series of such containers with suitable plates are assembled to form a pressure-filter. (3). A precipitant is added to the solution either before entering a filter or pressure-filter, or else forced into the pressure-filter itself simultaneously with the solution, which is in motion during the whole process.—C. J. G.

Filters. A. J. Boult, London. From E. Goldman and Co., Incorporated, Chicago, U.S.A. Eng. Pat. 9207, April 28, 1908.

The filter comprises a number of superposed filter cells mounted in a casing so as to leave an annular space between their outer surfaces and the wall of the casing. Each cell is in the form of a circular pan, and contains a pad of filtering material. The bottom of the pan has radial grooves at intervals, and these are connected by corrugations of part circular form. There is also a central hole in the bottom of each pan, and through these extends a pipe constructed in sections, and provided with ports communicating with the radial grooves on the bottoms of the pans. A packing ring fits around the lower outer surface of each pan and rests on the upper portion of the pan below: the packing ring has perforations communicating with the grooves on the under side of the bottoms of the pans. The liquid to be filtered enters the casing at the bottom through a pipe between the centre and the periphery, and fills the annular space between the filter cells and the wall of the casing. It then passes through ports into the upper part of the filter cells and flows through the filtering material, collecting in the grooves on the bottoms of the cells, and flowing away through the central discharge pipe. The filter is especially suitable for liquors such as beer, as it can be easily dismantled and cleaned.
—A. S.

Heating and drying chambers. P. Sprenger, Berlin. Eng. Pat. 1108, Jan. 16, 1908. Under Int. Conv., Jan. 31, 1907.

The chamber consists of two box-shaped parts, one of which is inverted over the other. The material to be dried rests on a table supported on legs which pass through the bottom of the lower box. Both boxes are suspended by chains passing over pulleys and provided with counterweights, so that when it is desired to charge or empty the chambers, the lower box can be lowered and the upper one raised. The heating or drying agent is introduced through a pipe which passes through the bottom of the lower box.—W. H. C.

Heating apparatus and method of heating materials. W. K. Stafford, Newton, Mass., U.S.A. Eng. Pat. 8267, April 14, 1908.

The material is placed on shelves within a chamber having a gas burner at the bottom, also within the chamber, and provided with inlet and outlet valves for air. These valves are so connected to the gas valve of the burner that when the latter is closed, the air valves are also closed, and *vice versa.* In this way when the gas is shut off, the vessel is closed and no waste of heat occurs.—W. H. C.

Subjecting gases to the action of liquids. J. B. Peat and H. Bonin, Redcar. Eng. Pat. 23,330, Oct. 22, 1907.

The gas is passed through a series of compartments formed by vertical partitions within a horizontal cylinder. Each partition has a central opening to allow the gas to pass and a horizontal shaft, driven from without, passes through stuffing-boxes at either end of the cylinder and extends centrally through the latter. In the first compartment the gas meets a shower or film of washing liquid produced by the impinging of a jet of liquid on to a wheel and disc mounted on the shaft. In each succeeding compartment there is a wheel with zig-zag passages also kept wet by a jet of liquid. In the last or outlet compartment there is a fan and wheel, also mounted on the shaft, but not supplied with liquid, which serves to vary the direction and speed of the gas and so cause the deposition of the liquid particles.
—W. H. C.

Kiln. H. W. Croft, Pittsburg, and O. M. Reif, Allegheny, Pa. U.S. Pat. 899,714, Sept. 29, 1908.

The kiln comprises a chamber provided with a smoke outlet communicating with radial smoke-flues arranged beneath the floor of the chamber; fire-boxes connected to the chamber, provided with sealed feed-openings and openings for removing ash, and designed to support the fuel directly on their walls and bottoms; air-supply flues adjacent to the smoke-flues and communicating with the bottoms of the fire-boxes; and an injector for producing a blast in the air-flues.—A. G. L.

Evaporator. W. Kirkwood, Chicago, Ill. U.S. Pat. 899,738, Sept. 29, 1908.

The evaporator consists of a vertical, metallic, steam heating tube closed at both ends, into which steam is introduced through the top and from which the condensed water is discharged by a tube passing through the top and extending to the bottom. A number of evaporator-tubes are grouped around, parallel to, and in metallic connection with, the steam tube. The upper ends of the evaporator-tubes open into a common collecting and separating chamber, from which the vapour and concentrated liquor are withdrawn. The lower ends of the steam and evaporator-tubes, the latter being open below, dip into a tank into which the liquid to be evaporated is fed from a float-controlled tank. The liquid rises up the tubes and is concentrated.—W. H. C.

Heating, cooling, evaporating, or condensing; Apparatus applicable for ——. J. F. Carmichael, Liverpool, and J. Morrow, Newcastle-on-Tyne. Eng. Pat. 26,619, Dec. 2, 1907.

The invention relates to heating or condensing apparatus of the type in which the liquid to be heated, or the liquid cooling medium, circulates through a number of vertical tubes surrounded by a heating medium, such as steam, or by the vapour to be condensed. One or more horizontal diaphragms are provided in the space between the tubes, so as to catch the condensed liquid running down the outer surfaces of the tubes and lead it away to suitable outlets, in order to avoid the heat-insulating effect of the film of liquid. The steam or vapour is introduced simultaneously to each of the spaces between the diaphragms.—A. T. L.

Centrifugal machine [separator]. A. J. Ericsson, Assignor to Aktiebolaget Separator, Stockholm, Sweden. U.S. Pat. 900,089, Oct. 6, 1908.

See Eng. Pat. 19,729 of 1906; this J., 1907, 81.—T. F. B.

Drying apparatus; Centrifugal ——. A. Neef, Kattowitz, Germany. U.S. Pat. 901,184, Oct. 13, 1908.

See Eng. Pat. 10,221 of 1908; this J., 1908, 795.—T. F. B

Evaporation of saline solutions; Apparatus for the continuous ——. E. Cantenot, Lons-le-Saunier, France. Eng. Pat. 9868, May 6, 1908. Under Int. Conv., May 6, 1907.

See Ger. Pat. 200,199 of 1907; this J., 1908, 940.—T. F. B.

II.—FUEL, GAS, AND LIGHT.

Patents.

Combustibles agglomerated by means of resin ; Process and apparatus for the transformation of ——. G. Dupuy. Second Addition, dated April 25, 1908, to Fr. Pat. 379,231, June 25, 1907 (this J., 1907, 1191).

The briquettes are treated with superheated steam alone, and the vessel in which the process is carried out is not heated externally, as described in the principal patent. The briquettes are first subjected, as they leave the press, to the action of a current of gas below 200° C., in order to harden the surface and prevent crushing. They are then stacked in receivers, and the receivers are placed in pairs in cells which are arranged radially about a centre and are provided with steam inlet and outlet connections. Each receiver is open at the top and has a perforated false bottom supporting the briquettes, and perforations in the walls below the false bottom. The steam, charged with volatile substances, is drawn off by a fan or pump and bubbled through water in a condenser in which the volatile substances are separated. The cold water supply to the condenser is regulated so that the steam itself is not condensed, but only cooled to the saturation point ; the saturated steam is again superheated and passed through the apparatus.—A. T. L.

Gas ; Apparatus for manufacturing ——. H. Pettibone, New Rochelle, N.Y., Assignor to the Power and Mining Machinery Co., New Jersey. U.S. Pat. 900,582, Oct. 6, 1908.

A double jet injector device, adapted to discharge jets in opposite directions, is placed in the outlet pipe of a gas generator, enabling the current through the generator to be reversed, and hot gas to be drawn off. The jets may be supplied with hot compressed gas from a suitable receptacle. The device may be used in connection with a pair of generators.—C. J. G.

Suction gas producer plant. D. Lewis and M. Briggs, Llanelly. Eng. Pat. 25,896, Nov. 22, 1907.

The producer and scrubber are mounted upon a single cast iron bed-plate formed with two circular flanges. One flange supports a water-pan and a cylindrical ring which together form the ash-pit of the producer, and the second flange carries a ring upon which the shell of the scrubber is supported. The flanges have equally spaced bolt-holes so that the producer and scrubber can be arranged with the doors in convenient positions. A vaporiser, comprising a water-jacket surrounding the horizontal portion of the gas connection, is arranged below the scrubber, with connections for maintaining the necessary water-level. The fire-bars are mounted so that they can be withdrawn through the ash-pit door. In order to maintain sufficient draught through the producer when the load on the engine is small, the exhaust of the engine is passed through an injector device in the chimney pipe, so as to draw gas from the producer through a non-return valve except when the valve is closed by the suction of the engine.—A. T. L.

Gas producer. W. B. Hughes, Assignor to The Wellman-Seaver-Morgan Co., Cleveland, Ohio. U.S. Pat. 899,867, Sept. 29, 1908.

The producer comprises a rotating cylindrical body with stationary base and cover. The blast is admitted through a central tuyère at the base, and air and steam inlets are also provided in the top of the producer. The gas leaves by a central vertical pipe extending from the top of the producer down into the bed of fuel. A vertical poker is mounted in bearings on the cover of the producer, and is worked about a horizontal axis to stir the fuel.—A. T. L.

Gas producer plants. W. W. Tonkin and S. Puplett, London. Eng. Pat. 20,352, Sept. 12, 1907.

The patent relates to various improvements applicable to suction gas producers, and especially to producers using bituminous coal, in which the raw fuel is converted into coke in a distillation chamber above the level of the gas outlet, part of the hot gas from the producer chamber being drawn through the raw fuel and delivered, together with volatile products from the raw fuel, at or near the base of the producer chamber. The patent also covers the application of the improvements to the producer described in Eng. Pats, 15,498 of 1902 and 8827 of 1904 (this J., 1903, 860 ; 1905, 323). In order to maintain a steady flow of gas through the producer, the engine is caused to draw its supply from a "governor" comprising a flexible chamber normally distended by a balance weight or spring ; the movable wall of the chamber carries a valve which controls the area of the inlet passage for gas from the producer. At any load on the engine, the valve takes up a mean position such that the quantity of gas required at each suction stroke is drawn from the producer during the interval, long or short, between successive suction strokes. The valve may be a hollow piston valve with specially shaped ports so that the linear movement of the valve is in proportion to the rate of gas production ; the governor can then be connected with a valve which controls the quantity of hot gas drawn through the raw fuel in the distillation chamber, and also with a water-supply cock for the scrubber in order to regulate the temperature of the hot water which passes from the scrubber to a chamber in which the air supply is saturated with moisture. Suitable valves are provided so that the fan for circulating hot gases through the raw fuel can be used also for blowing the producer fire at starting. The fuel in the distillation chamber is stirred by means of rods depending from a rotating ring arranged around the lower end of the chamber. The producer itself, the regenerator for heating the air supply by means of the hot gases leaving the producer, and their connections, are enclosed in an outer casing, and the intervening spaces are packed with non-conducting material. The fuel hopper is provided with a sliding cover, having wedge-shaped fastenings such that the cover is automatically pressed against its seating when brought into the closed position.—A. T. L.

Coal gas, water [gas], or oil gas, or mixtures of these gases ; Manufacture of ——. W. H. Morgan, J. Densley, H. Gray, and G. Geering, Weston-super-Mare, and H. J. Walduck, Birmingham. Eng. Pat. 10,558, May 15, 1908.

Producer-gas or water-gas is passed into a brick-lined chamber provided with air- and oil-inlets and containing a number of vertical coal-gas retorts ; there may be two such chambers in series. When making coal-gas, the producer-gas or water-gas is burnt in the brick-lined chamber to heat the retorts, but if carburetted water-gas or oil-gas is to be made, the gas from the producer is at first used to heat the brick-lined chamber, the air supply to this chamber is then shut off, and oil is injected. The gas retorts are connected to two hydraulic mains leading to separate sealing tanks in the base of a washer, and the outlet from the second brick-lined chamber leads to a third sealing tank in the washer. The coal-gas, and the water-gas, carburetted water-gas, or oil-gas can be manufactured separately, or they can be manufactured at the same time and allowed to mix in the washer.
—A. T. L.

Coke and similar ovens. L. Wirtz, Bilston, Staffs. Eng. Pat. 22,293, Oct. 9, 1907.

The oven comprises a series of deep narrow vertical coking chambers separated by hollow partitions containing the heating flues. The coking chambers open at the top into a common gas-collecting chamber, and hinged doors at the bottom of the coking chambers open into a common water-sealed discharge chamber. The gas-collecting chamber is provided with a feeding hopper above each coking chamber, and the feeding hoppers are sealed by plates which may be lowered to admit fuel, or forced down to ram the fuel or to discharge the coke or the partially coked product. A conveyor running beneath the coking chambers carries the hot coke into a cooling chamber or through a water-seal before it is exposed to the air.—A. T. L.

Suction gas-producers. J. J. Bowmer, Newcastle-on-Tyne. Eng. Pat. 21,682, Oct. 1, 1907.

The patent relates to improvements in producers of the kind described in Eng. Pats. 21,405, 22,046, and 22,382 of 1905 (this J., 1906, 747, 1033, 1138). The usual boiler is dispensed with, and steam is obtained from the water in the sealing-trough at the bottom of the producer. The water level is close to the lowest point at which air enters the fuel column. The air supply is drawn from a heater arranged in the gas outlet. The grate, instead of being arranged vertically, is inclined upwards and away from the fire, giving access to the fire above the top of the grate. The inclined grate may be extended downwards into the water-seal, and in another arrangement the grate is horizontal and extends from the inner edge of the grate chamber away from the fire.—A. T. L.

Gas [from liquid hydrocarbons]; Apparatus and process for producing ——. W. H. Frost and J. J. Nix, Los Angeles, Cal. U.S. Pats. 900,010 and 900,065, Sept. 29, 1908.

The liquid hydrocarbon is separated into a lighter and a heavier portion, and the heavier portion is burned continuously in burners which direct the flame downwards to near the bottom of a vertical brickwork chamber, having openings to the outer air near its base, so as to maintain a zone of high temperature. The lighter oil is injected into the chamber, by means of a compressed fluid, at a point below the zone of high temperature, and gas is drawn off continuously from the top of the chamber. —A. T. L.

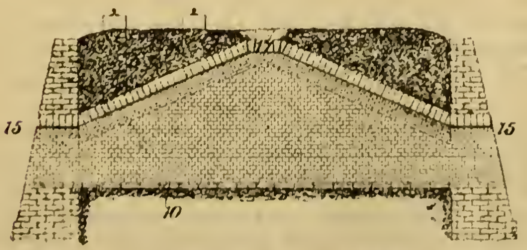
Gas; Process of manufacturing ——. H. W. Benner, Chambersburg, Pa., Assignor to International Gas Development Co., New York. U.S. Pat. 899,690, Sept. 29, 1908.

Water-gas, formed by passing steam through a bed of hot coke, is enriched by passing it up through a falling stream of powdered coal in a distilling chamber.—A. T. L.

Gases; Process of cleaning ——. A. Ernst, Pittsburg, Pa., Assignor to The Coal and Coke By-Products Co., W. Virginia. U.S. Pat. 900,062, Sept. 29, 1908.

The impure gas is charged with vapour by means of a jet of steam or by a water spray, and is then subjected to a combined beating and centrifugal action, followed by a process of washing with water. The apparatus comprises a vertical cylindrical casing, with internal water-bearing shelves, a central vertical inlet pipe, and an intermediate rotating cylindrical shell open at the lower end. The rotating shell carries projections or beaters, both on the inner and on the outer surface, inclined in relation to projections on the inlet pipe and the water-bearing shelves respectively. The impure gas, charged with vapour, passes downwards inside the rotating shell, and upwards between the water-bearing shelves, where it is subjected to a beating, spraying, and whirling action and meets successively water of increasing purity. The gas is finally passed through a water spray as it leaves the apparatus.—A. T. L.

Coke-oven. T. J. Mitchell, Connellsville, Pa. U.S. Pat. 899,886, Sept. 29, 1908.



The claim is for a coke-oven having a longitudinal section as shown in the figure. It has a level floor, 10, openings, 15, at each end, and parallel side walls higher at the middle than at the ends. The roof of the oven is arched in the direction at right angles to that of the section shown and is provided with a trunnel hole, 17, at its highest point, through which the charge is introduced. The height of the chamber is so proportioned that the charge introduced through the trunnel hole will, when levelled off, fill the oven to the level of the draught openings.—W. H. C.

Fuel, artificial; Manufacture of ——. A. W. H. Vivian, Assignor to The Composite Fuel Synd., Ltd., London. U.S. Pat. 900,619, Oct. 6, 1908.

See Eng. Pat. 7357 of 1906; this J., 1907, 461.—T. F. B.

Distillation gases; Process and apparatus for separating tar from hot —— by means of tar, gas liquor, or both these agents. Dr. C. Otto und Co. Fr. Pat. 390,470, May 22, 1908.

See Eng. Pat. 12,809 of 1908; this J., 1908, 1011.—T. F. B.

Gas generator. H. Rehmann, Mülheim-on-Ruhr, Germany. U.S. Pat. 900,955, Oct. 13, 1908.

See Fr. Pat. 377,731 of 1907; this J., 1907, 1079.—T. F. B.

Drying and, if wanted, charring peat, sawdust, and the like; Method of and furnaces for ——. N. K. H. Ekelund, Jonkoping, Sweden. Eng. Pat. 3360, Feb. 14, 1908.

See Fr. Pat. 387,198 of 1908; this J., 1908, 797.—T. F. B.

Gases; Apparatus for analysing ——. U.S. Pat. 899,774. *See* XXIII.

Gases of blast and other furnaces, retorts, coke ovens, and the like; Process and apparatus for the manufacture and recovery of ammonia and other by-products from the ——. W. J. Dunnachie, Coatbridge. Eng. Pat. 10,305, Dec. 2, 1907.

See Fr. Pat. 385,006 of 1907; this J., 1908, 496.—T. F. B.

Gases; Apparatus for removing solid and liquid particles from ——. F. Sepulchre, Liege, Belgium. U.S. Pat. 899,628, Sept. 29, 1908.

See Eng. Pat. 13,510 of 1907; this J., 1907, 1189.—T. F. B.

Gases; Process and apparatus for the determination of the calorific power of ——. Fr. Pat. 389,633. *See* XXIII.

Combustible gases; Apparatus for detecting the presence of ——. Eng. Pat. 16,670. *See* XXIII.

Combustible; Manufacture of a liquid ——. R. Hense, Charlottenburg, Germany. Eng. Pat. 22,561, Oct. 12, 1907.

See Fr. Pat. 384,946 of 1907; this J., 1908, 494.—T. F. B.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

Hemp and flax waste; Utilisation of ——. J. Csókás. Chem.-Zeit., 1908, 32, 985.

The process employed, which has been patented by Waage and Sartig, is one of destructive distillation. Large rotary retorts, capable of holding about 400 kilos. of material under working conditions, are arranged in pairs, and heated by a single source of heat between them. The following table shows the yields of the various products of the distillation, together with amount of coal consumed in the process. The first figures in the horizontal row were obtained as the mean of three experiments; those in the second row give the amounts of various products per ton of waste.

Hemp waste.		Coal consumed.	Charcoal obtained.	Total distillate.	Pyroligneous acid.	Acetic acid.	Wood spirit in pyroligneous acid.	Tar.
Weight.	Moisture.							
kilos.	per cent.	kilos.	kilos.	kilos.	kilos.	kilos.	per cent.	kilos.
838	14·5	213	281·0	356·4	326·3	39·55	3·48	30·1
							kilos.	
1000	—	266	351·9	445·4	407·8	49·43	14·18	37·6

The proportion of acetic acid in the distillate is said to greatly exceed that present in the distillate from red beech.—E. W. L.

Petroleum oils; Calorific power of —— and the relation of density to calorific power. H. C. Sherman and A. H. Kropff. J. Amer. Chem. Soc., 1908, **30**, 1626—1631. (See also this J., 1902, 624.)

COMPARATIVE determinations were made of the calorific power and specific gravity of 64 samples of typical American petroleum oils, the products being derived from the chief oil fields and ranging from light gasoline to heavy crude oil. The calorific powers were determined by combustion in oxygen in an Atwater-Mahler bomb calorimeter, and the results were expressed in British thermal units per lb., and compared with the density, expressed in degrees Baumé. It was found that a decrease in calorific power corresponded fairly closely with an increase in specific gravity, so much so that an approximate average relationship could be expressed between the two values by means of the formula—

$$\text{B.T.U.} = 18{,}650 + 40(\text{Baumé degrees}—10).$$

In the case of eight-ninths of the samples examined, the difference between the observed and calculated calorific powers was less than 1 per cent.; it was greater than 2 per cent. in one-thirtieth; and in no case was it as great as 3 per cent. An approximate indication of the relationship may also be obtained by means of the following table:—

A sp. gr. of	0·7 to 0·75	indicates about	11,700—11,350 cals.
,,	0·75—0·8	,, ,,	11,350—11,100 ,,
,,	0·8 —0·85	,, ,,	11,100—10,875 ,,
,,	0·85—0·9	,, ,,	10,875—10,675 ,,
,,	0·9 —0·95	,, ,,	10,675—10,500 ,,

Only 2 of 63 samples showed a difference of as much as 100 cals., and 7, of as much as 50 cals. between the observed and calculated calorific powers.—C. A. M.

Mineral oils; New values in the analysis of ——. R. Kissling. Chem.-Zeit., 1908, **32**, 938—940.

FROM the results of further experiments on the lines already described (this J., 1906, 977; 1907, 463), the author recommends the following as a conventional method for the examination of mineral oils:—A mixture of 50 grms. of the oil and 50 c.c. of alcoholic sodium hydroxide solution (50 parts by weight of alcohol with 50 parts of a 7·5 per cent. aqueous solution of sodium hydroxide), is heated to 80° C. in a flask beneath a reflux condenser, the flask is then closed by a stopper, and its contents continually shaken for 5 minutes. The mixture is next transferred to a separating funnel, and, after cooling, the alkaline layer containing the tarry substances from the oil, is filtered. The clear, or only slightly opalescent, filtrate is acidified with hydrochloric acid, shaken with two portions, of 50 c.c. each, of benzene in a separating funnel, the benzene extracts evaporated, and the residue of tarry matter weighed. If the mineral oil contain coke-like substances in addition to tarry matters, it should, after separation from the alcoholic alkali, be treated with 500 c.c. of Kahlbaum's "normal-benzin" (or, better, with 500 c.c. of a petroleum spirit freed from its heavier and lighter constituents), allowed to stand over night, and the coke-like substances then collected on a weighed filter, dried, and weighed. The two values thus obtained are termed the "tar value" and the "coke-value." To determine the "tar-forming value" and "coke-forming value," the mineral oil is exposed to a high temperature for a definite number of hours (*e.g.*, 50 hours at 150° C.) and the tarry and coke-like substances then determined as described above. The following results are typical of values thus obtained with different kinds of oils.

Oil.	I. Before heating.		II. After heating for 50 hours at 150° C.		Total of I.	Total of II.
	Tarry matters.	Coke-like substances.	Tarry matters.	Coke-like substances.		
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Steam-cylinder oil from Pennsylvanian petroleum	0·023	—	0·185	0·020	0·023	0·205
Spindle oil ,, ,, ,,	0·090	—	0·299	0·114	0·090	0·413
Light machine oil ,, ,, ,,	0·104	—	0·206	0·020	0·104	0·226
Transformer oil ,, Russian ,,	0·157	—	0·251	0·069	0·157	0·320
Machine oil ,, German ,,	0·227	—	0·740	0·827	0·227	1·567
Turbine oil (used) ,, Pennsylvanian ,,	1·083	trace	1·463	1·199	1·083	2·662
Steam-cylinder oil ,, ,, ,,	0·061	0·469	0·218	0·953	0·530	1·171
Cylinder oil ,, Texas ,,	1·113	—	1·377	1·294	1·113	2·671
Heavy engine oil ,, ,, ,,	1·234	—	1·220	1·128	1·234	2·348
Machine oil ,, ,, ,,	1·451	—	1·671	1·013	1·451	2·684

With the exception of the used turbine oil and steam-cylinder oils, the commercial samples examined could be classified into three groups: *viz.*, (1), those with a tar-value below 0·2, including spindle and machine oils from Pennsylvanian petroleum; (2), those with a tar-value between 0·2 and 1·0, including machine oils from Russian, American, and German petroleums; and (3), those with a tar-value above 1·0, all of which were machine oils from Texas petroleum. Classification in accordance with the sums of the tar-forming and coke-forming values, gave a different order: (1), those below 0·9, including spindle and machine oils from Pennsylvanian and German petroleum, a transformer oil from Russian petroleum, and a machine oil from American (probably Lima) petroleum; (2), those with values between 0·9 and 2·0, including the rest of the machine oils from American (probably Lima) petroleum, ordinary heavy machine oils, a transformer oil from Russian, and a machine oil from German petroleum; (3), those with values above 2·0, consisting of machine oils from Texas petroleum. Experiments with 7 samples of steam-cylinder oils, showed that those from Texas petroleum (Nos. 6 and 7) were inferior to those from Pennsylvanian oils (1 to 5), the difference being particularly pronounced in the coke-forming and tar-forming values obtained after heating the oils for 50 hours at 150° and 250° C.

Steam-cylinder oils.	Before heating.			After heating at temperature given.			
	Tarry matters.	Coke-like substances.	Total.	Tarry matters.	Coke-like substances.	Total.	° C.
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	
1. Vaporin cylinder oil (light)	0·023	—	0·023	0·126	0·010 (?)	0·136	250
2. Valvolin ,, ,, ,, ...	0·112	—	0·112	0·260	0·012 (?)	0·272	250
3. Hot-steam ,, ,, (dark)	0·058	0·458	0·516	0·095	0·380	0·475	250
4. Vulcan ,, ,, ,, ...	0·061	0·469	0·530	0·097	0·288	0·385	250
5. Hekla ,, ,, ,, ...	0·107	0·294	0·401	0·166	0·241	0·407	250
6. Texas ,, ,, (light)	1·196	—	1·196	0·960	1·275	2·235	150
7. ,, ,, ,, (dark)	1·113	—	1·113	1·377	1·294	2·671	150

These results show that Pennsylvanian cylinder oils are very resistant to the action of heat (250° C.). In the light oils there was a slight increase in tarry matters, though this was without importance from a practical point of view. In the dark Pennsylvanian oils the tarry matters increased slightly, whilst the coke-like substances showed a considerable decrease, so that the sum of the two was smaller than before. No explanation of this curious behaviour has been found. In the Texas oils there was a pronounced formation of coke (at 150° C.), so that the sum of tarry and coke-like substances was as great as in the case of heavy machine oils.—C. A. M.

Naphthenic acids and their metallic salts; Practical importance of ——. [*Paints and varnishes.*] E. Pyhälä. Petroleum, 1908, 3, 1313—1315.

THE practice of refining petroleum distillates with alkali first and then applying the acid treatment, has not found any general application, although it is attended with a considerable saving of reagent, none of the acid being consumed in the formation of naphthenic sulphonic acids as it is when the acid treatment is applied first. Apart from their use in the manufacture of soap substitutes (this J., 1908, 439), naphthenic acids can be employed in preparing substitutes for the so-called "soap varnishes." For example, the sodium salts of naphthenic acid when treated with alum solution, furnish a solid, white precipitate of the corresponding aluminium salt, which can be freed from water by dissolving it in petroleum benzine, a viscid, anhydrous, transparent salt, resembling dry gelatin, being obtained when the solvent is expelled by distillation. By adding 95 per cent. alcohol to the solution before distilling off the benzine, and then expelling a portion of the alcohol and benzine at 55°–65° C., the aluminium salt is deposited on concentration, as a swollen mass, which dries to a transparent, gelatinous, brittle substance, readily soluble in ether, petroleum spirit, oil of turpentine, etc. The solution in this last-named solvent, when applied to wood or metal, dries to a hard, colourless elastic coating. These aluminium salts can be deodorised by digestion with concentrated acetic acid, the flocculent precipitate being washed with hot water, followed by treatment with sodium carbonate solution, re-washing with water, and drying. When treated with cold caustic soda lye, the product furnishes a good soft soap, suitable for mixing with fine soaps. Ferrous sulphate precipitates from the spent alkali a greenish-white "tacky" ferrous compound, which is very unstable and finally turns dark brown. In this state it resembles putty and dries to a compact mass, soluble in ether, petroleum spirit, etc., the last-named solution forming a yellow to brown stain for wood, on which substratum it also leaves a semi-lustrous coating that can be polished. Corresponding copper and cuprammonium salts can also be prepared, with similar properties. If powdered mineral pigments be suspended in the dissolved naphthene soaps, they are carried down in the precipitate formed by alum; and, when washed, dried and dissolved in petroleum spirit, form wood stains. The dissolved, aluminium salts of naphthenic acids also form a vehicle for cheap paints.—C. S.

PATENTS.

Bitumen; Manufacture of vulcanised ——. S. Paterson, Old Charlton, Kent. Eng. Pat. 21,742, Oct. 1, 1907.

THE crude bitumen is heated in the usual way, and the separated bituminous liquid treated with, say, 5 to 7 per cent. of a hydrocarbon oil volatilising at a lower temperature than the more volatile constituents of the bitumen. The mixture is then slowly heated, and when near its m. pt., treated with, say, 2 to 4 per cent. of zinc oxide or other metallic oxide to render it more fluid and less viscous. It is then separated from the sediment and heated with sulphur or other vulcanising agent to which has been added a hard wax such as carnauba wax, the hydrocarbon oil being thus eliminated and practically perfect vulcanisation obtained. The product will vary in elasticity with the variations in the temperature and duration of heating.—C. A. M.

Petroleum; Process of fractionating ——. W. C. and F. E. Wells, Columbus, U.S.A. Eng. Pat. 15,036, June 29, 1907.

SEE Fr. Pat. 379,521 of 1907; this J., 1907, 1233.—T. F. B.

IV.—COLOURING MATTERS AND DYESTUFFS.

Malachite Green; Conversion of —— *into its carbthiol by the action of egg albumin.* D. Paterson. J. Soc. Dyers and Col., 1908, 24, 244—245.

CERTAIN dyestuffs which contain carbinol groups, *e.g.*, Malachite and China Greens, and Crystal Violet, when reduced by sulphuretted hydrogen are changed into colourless compounds different from the ordinary leuco bases; the —SH group replaces —OH in the carbinol and the resulting thio-compound has been termed a carbthiol. If to a dilute solution of Malachite Green a little egg albumin is added, and the whole gently warmed, the solution will gradually be decolorised without the albumin being dyed, this action being due to the sulphur in the albumin. On acidifying the solution with sulphuric or acetic acid, the colourless carbthiol is re-converted into coloured carbinol and the white of egg becomes dyed. If the albumin be taken out of the solution without previously acidifying, washed in water, and then put into an acidified bath, it becomes permanently dyed green. A dye-bath was prepared with China Green and Orange G; in this bath were placed a few pieces of hard-boiled white of egg and the solution warmed. The green constituent gradually disappeared and the solution and albumin became orange. On removing the latter and placing it in an acidified bath, it acquired an olive colour owing to the development of the green. If acid be added at the commencement of the experiment, the albumin is at once dyed olive and no formation of the colourless carbthiol takes place. A similar chemical action, but in a much less degree, takes place during the steaming of printed worsted yarns (see page 1056).—R. B. B.

Indigo in India. Times Financial Suppl., Oct. 30, 1908. [T.R.]

The comparatively successful resistance of vegetable indigo during the last two years is not widely known. It is true that 1907–8 was not quite as favourable as 1906–7, but prices have been well maintained on the average, especially in India, and it is significant, says the last Indian Review of Trade, that there is a ready sale for natural indigo "at prices fully 25 per cent. higher than three years ago, without any corresponding advance in the price of the synthetic substitute."

Last year there was a decrease of about 12 per cent. in the area placed under the crop, the contraction being greatest in Madras, where the holdings were small and scattered and the rainfall was untimely. The season in Bihar was favourable on the whole. The improved Java-Natal variety of indigo seems to have come to stay, and it is still hoped that the increased yield of green plant and more scientific methods of extracting the dye will enable the industry to hold its own. There is great variation in the destinations of exported Indian indigo, but it is noteworthy that in 1907–8 there was an increase in exports to the United Kingdom and the Continent of Europe.

Patents.

Trichloroindigo and process of making same. G. Engi and H. Kraft, Basle, Assignors to Soc. Chem. Ind. in Basle, Switzerland. U.S. Pat. 899,863, Sept. 29, 1908. (Compare this J., 1908, 116.)

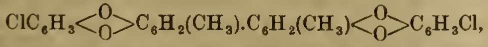
Trichloroindigo is prepared by passing chlorine into a suspension of indigo in nitrobenzene in the presence of antimony chloride. The dyestuff yields a yellow vat from which cotton is dyed in blue shades fast to washing, light, and chlorine.—J. C. C.

Vat dyestuff; Violet —— and process of making same. H. Kraft and G. Engi, Basle, Assignors to Soc. Chem. Ind. in Basle, Switzerland. U.S. Pat. 899,994, Sept. 29, 1908.

Indoxyl is condensed with the *a*-anilide of 2 : 3-diketo-dihydro-1-thionaphthene and the product is treated with bromine. A general claim is made for the use of derivatives or analogues of the two constituents. The dyestuffs obtained yield a brownish-yellow vat from which cotton is dyed in violet to violet-blue tints fast to washing, light, and chlorine.—J. C. C.

Anthracene derivatives [*dyestuffs*]; *Production of new ——.* Badische Anilin und Soda Fabrik. Second Addition, dated May 11, 1908 (under Int. Conv., April 15, 1908), to Fr. Pat. 357,239, Aug. 25, 1905 (this J, 1906, 66).

Reddish-orange vat dyestuffs are obtained when, in the process described in the chief patent, halogen derivatives of 2 : 2′-dimethyl-1 : 1′-dianthraquinonyl are used containing the halogen in the β-position in the nucleus other than that in which the methyl group is situated, for example, the β,β-dichlorodimethyldianthraquinonyls of the formula



$$\mathrm{ClC_6H_3{<}\genfrac{}{}{0pt}{}{O}{O}{>}C_6H_2(CH_3).C_6H_2(CH_3){<}\genfrac{}{}{0pt}{}{O}{O}{>}C_6H_3Cl},$$

which are prepared from the corresponding β-chloro-β-methylanthraquinones according to the process described in the chief patent.—J. C. C.

Dyestuffs for wool; Process of preparation of yellow ——. Fabr. Prod. Chim. ci-dev. Sandoz. First Addition, dated May 18, 1908, to Fr. Pat. 387,245, Feb. 14, 1908 (this J., 1908, 801).

Dyestuffs resembling those described in the chief patent, but faster to light, are prepared by replacing 1-*o*-*m*-dichloro-*p*-sulphophenyl-5-pyrazolone-3-carboxylic acid by 1-*o*-*m*-dichloro-*p*-sulphophenyl-3-methyl-5-pyrazolone. This, when combined with diazotised sulphanilic acid, yields an azo dyestuff which is especially suitable for the preparation of lakes.—J. C. C.

Sulphurised dyestuffs; Manufacture of ——. A. G. Bloxam. From Act. Ges. f. Anilin-Fabr., Berlin. Eng. Pat. 22,967, Oct. 17, 1907.

By acting with the monosulphide of an alkali on a naphthalene-mono or polysulphonic acid, sulphide dyestuffs are obtained which dye cotton from a suitable bath in bronze tints. Example:—22 parts of the sodium salt of 1·3·6-naphthalenetrisulphonic acid are heated with 40 parts of pulverised anhydrous sodium monosulphide and about 20 parts of water to 350° C. for about 8—10 hours. The mass produced may be pulverised and directly used for dyeing.—P. F. C.

Polyazo-dyestuffs; Manufacture of —— with aid of para-aminophenyl arsenic acid. Act. Ges. f. Anilin-Fabr., Berlin. Eng. Pat. 10,096, May 9, 1908. Under Int. Conv., Nov. 15, 1907. Addition to Eng. Pat. 8967 of 1908.

Instead of using H-acid as the middle member in the method of production of polyazo-dyestuffs described in the main patent, other compounds, such as the mono- or di-sulphonic acids of aminonaphthol or dihydroxy-naphthalene which are capable of combining with two diazo-compounds, are employed.—P. F. C.

Vat [*thioindigo*] *dyestuffs; Manufacture of red ——.* Farbwerke vorm. Meister, Lucius, und Brüning, Hoechst on Maine, Germany. Eng. Pat. 5589, March 12, 1908. Under Int. Conv., April 25, 1907.

See U.S. Pat. 892,897 of 1908; this J., 1908, 894.—T. F. B.

Indigo dyestuffs; Production of leuco derivatives of ——. Badische Anilin und Soda Fabrik. Fr. Pat. 390,455, May 21, 1908. Under Int. Conv., Nov. 18, 1907.

See Eng. Pat. 11,141 of 1908; this J., 1908, 935.—T. F. B.

Dyestuffs containing sulphur [*Thioindigo dyestuffs*] *or their leuco-compounds; Manufacture of ——.* O. Imray, London. From Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. Eng. Pat. 4541, Feb. 28, 1908.

See Ger Pat. 198,509 of 1907; this J., 1908, 801.—T. F. B.

Thioindigo and indigo as oil colours. E. Täuber. *See* XIII*A*.

Colouring matters of the anthracene series; Manufacture of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 4141, Feb. 24, 1908. Addition to Eng. Pat. 16,775, July 22, 1907.

See Fr. Pat. 386,606 of 1908; this J., 1908, 745.—T. F. B.

Vat [*anthracene*] *dyestuff and process of making same; Orange to orange-yellow ——.* A. Schaarschmidt, Assignor to Society of Chemical Industry in Basle, Basle, Switzerland. U.S. Pat. 899,845, Sept. 29, 1908.

See Eng. Pat. 7583 of 1908; this J., 1908, 1015.—T. F. B.

Anthracene dyestuff; Manufacture of a new ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld. Germany. Eng. Pat. 28,493, Dec. 27. 1907.

See Ger. Pat. 198,024 of 1907; this J., 1908, 744.—T. F. B.

Induline colours; Process of producing ——. A. Ostrogovich, Bucharest, and T. Silbermann, Charlottenburg. U.S. Pat. 900,302, Oct. 6, 1908.

See Fr. Pat. 374,715 of 1907; this J., 1907, 865.—T. F. B.

Dyestuffs of the diphenylnaphthylmethane series; Manufacture of new ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 28,492, Dec. 27, 1907.

See Fr. Pat. 386,814 of 1908; this J., 1908, 744.—T. F. B.

Colouring matters of the gallocyanine series; Manufacture of new ——. G. B. Ellis, London. From Chem. Fabr. vorm. Sandoz, Basle, Switzerland. Eng. Pat. 21,109, Sept. 23, 1907.

See Fr. Pat. 382,335 of 1907; this J., 1908, 219.—T. F. B.

Leuco derivatives of the gallocyanine series; Manufacture of new ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 553, Jan. 9, 1908.

See Fr. Pat. 386,065 of 1908; this J., 1908, 680.—T. F. B.

Erratum:—This J., 1908, 1014, col. 2, first patent title date should read "July 28, 1908. Comprised in No. 23,026, Oct. 18, 1907."

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES YARNS, AND FIBRES.

Weighting in raw silk. H. Walder. Färber-Zeit., 1908, **19**, 331—332.

It is not usual for raw silk to be weighted, but Gnehm (this J., 1903, 415) drew attention to a case in which samples of Japanese tram had been adulterated with fat. Similar cases have been met with by the author, the silk having been weighted with fats, wax, etc. He has examined a weighting mixture which contained common salt, saponified and unsaponified fat, viscous paraffin oil, and gelatin. Raw silk weighted with such a mixture would require a drastic treatment in boiling off to remove all the weighting, and any nitrogenous matter not removed would, upon analysis of the cleaned silk, point to a higher content of real silk than that actually present. Attention is also drawn to the use in weighting of salts of the heavy metals, especially tin salt. The harmful effect of this weighting is shown in the influence of storing upon silk yarns received at different times from one source and dyed in various ways. Some deliveries had been weighted with tin, the others not, and after six years the weighted yarns had suffered such a decrease in strength that they could not even be shaken out without breaking, whereas the unweighted yarn had remained quite unaffected.
—F. M.

Steaming of coloured worsted yarns; Note on carbthiol formation during the ——. D. Paterson. J. Soc. Dyers and Col., 1908, **24**, 245—246.

During the steaming of printed carpet yarns there is a slight evolution of sulphuretted hydrogen, due to a decomposition of the wool substance, and increasing with the temperature and pressure. A colour paste containing Malachite Green without addition of acid was printed on worsted yarn and steamed; the resulting colour was pale and uneven. A duplicate colour containing a little acid was then printed, and after steaming yielded a considerably fuller and perfectly level print. When the first hank was passed, after steaming, through a dilute acid bath, it acquired a similar colour to the other. These facts are to be attributed to the formation in the first case of a colourless carbthiol within the wool fibre by the sulphuretted hydrogen produced by decomposition of the wool during steaming. (See also page 1054.)—R. B. B.

Fastness of dyestuffs to light; Researches on the ——. A. Bolis. Rev. Gen. Mat. Col., 1908, **12**, 289—292.

In order to throw light if possible on the cause of fading of dyed colours, experiments were made in the following directions:—(1) *Action of light in air and in vacuo.* The results of experiments with acid, basic, and substantive dyestuffs and Aniline Black confirmed the observations of Chevreul and others that light only causes fading in the presence of air. Some of the more fugitive colours, *e.g.*, Congo Red, which faded very badly in air, also lost a trifle in depth when exposed in a vacuum for 15 days, but this loss may be ascribed either to some action of the fibre itself or, perhaps with more probability, to the small amount of residual air contained in the exhausted vessel or even to the moisture present in this air. (2) *Action of light in dry and in moist air.* The patterns taken for these experiments were dyed with ½ per cent. of Magenta, on tannin mordant, and ¾ per cent. of Azo Violet respectively. For comparison, a scale of 10 degrees was constructed by exposing patterns for various periods ranging from 10 hours to several months, the zero of the scale being the original unexposed colour. The results of 15 days' exposure, confirmed by repeated experiments were: Magenta in dry air, 5—6°; in moist air, 8°; Azo Violet in dry air, 4°; in moist air, 7°: thus proving the considerably greater effect in moist air. (3) *Influence of variously coloured light.* In investigating this question, it must be remembered that the problem is complicated by the nature of the colour on the fibre, *i.e.*, by the fact that different rays are absorbed by dyed materials of different colours. For this reason only black colouring matters were taken for the present experiments, in which the dyed fabrics were exposed by means of a movable prism to the direct action of the solar spectrum. The result corresponded with the known chemical activity of the rays; blue and violet rays have by far the most energetic fading action, whilst red rays have the least; the green and yellow rays occupy an intermediate position. An Aniline Black exposed for 10 days was strongly faded by blue and violet light but remained unchanged under the influence of the remaining portion of the spectrum.—R. B. B.

Discharge; Diazo —— *on dyeings dischargeable with chlorate and prussiate.* Sealed note No. 1781 of November 11, 1907. E. Bourcart and A. Brand. With report by M. Battegay. Bull. Soc. Ind. Mulhouse, 1908, **78**, 241—244.

A freshly prepared chlorate-prussiate discharge paste instantly decomposes diazoparanitroanisol with evolution of nitrogen, but if the paste has been made up for some time or has been heated to about 60° C. (whereby ferrocyanide is oxidised to ferricyanide), the diazo compound may safely be incorporated with it. This permits of coloured diazo discharges being obtained on a ground of Indigo, and on many basic and other dyestuffs which can be discharged with chlorate-prussiate.

It is pointed out in the report that steam discharges containing Paranitraniline Red on Indigo ground were described some years ago by Bloch, Zeidler, and Brandenberger (this J., 1898, 576), who substituted ferricyanide for ferrocyanide in the discharge colour. The paranitroanisol proposed for use by the present authors yields a very brilliant red by the process described.—R. B. B.

Hemicelluloses; Action of certain fungi on ——. H. C. Schellenberg. *See* XIX.

Hemp and flax waste; Utilisation of ——. J. Csókás. *See* III.

Filasse produced from ramie fibre in China. Board of Trade J., Oct. 15, 1908. [T.R.]

With reference to notices in the "Board of Trade Journal," relative to a new process for the treatment of ramie fibre, a sample of the filasse produced by the new process has been received and may be seen at the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, London, E.C.

H.M. Consul-General at Shanghai states that the new process has not so far turned out a financial success. When produced in small quantities the filasse has usually proved to be of excellent quality, but the difficulty of degumming large quantities of the fibre simultaneously without producing filasse of uneven quality has not yet been solved.

Patents.

Threads, filaments, strips, or films of cellulose; Manufacture of ——. S. Courtauld and Co., Ltd., London, and L. P. Wilson, Coventry. Eng. Pats. 21,405, Sept. 26, 1907, and 5595, March 12, 1908.

In the preparation of artificial threads from viscose, glucose or other sugar, together with a mineral acid, is added to the coagulating bath. The glucose may be replaced by other organic substances which have a coagulating action on the viscose, those being preferred which produce coagulation without decomposition of the viscose into cellulose. In the second patent the further addition of ammonium sulphate or magnesium sulphate to the coagulating bath is claimed.—P. F. C.

Cellulose products ; Manufacture of new ——. Soc. Anon. Française "La Soie Artificielle." First Addition, dated April 29, 1908 (Under Int. Conv., Sept. 30, 1907), to Fr. Pat. 385,083, Dec. 16, 1907 (this J., 1908, 558).

The coagulating solution, consisting of a concentrated solution of sodium hydroxide to which has been added glucose, saccharose, lactose or glycerin, is heated to a temperature between 45—75° C.—P. F. C.

Grease and potash salts from wool ; Extracting —— and apparatus therefor. F. and C. Shuman, Assignors to F. Shuman, W. Erben, and C. H. Harding, Philadelphia, Pa.; U.S. Pats. 889,339 and 899,440, Sept. 22, 1908.

The wool, held between a pair of travelling aprons, is continuously led forward through flowing streams of solvent containing a less and less percentage of grease. These streams are produced by arranging solvent distributors above the compartments of a partitioned tank, each distributor being so mounted that the solvent falls from it into two adjoining compartments. The wool is then washed in the pure solvent, and afterwards with water at a comparatively low temperature to remove the potassium salts without discolouring the wool. The wool is finally washed with water of a temperature sufficiently high to vaporise any traces of solvent left on the material.
—P. F. C.

Spinning viscous solutions ; Machine for ——. J. P. Bemberg Akt.-Ges. Fr. Pat. 390,178, May 13, 1908. Under Int. Conv., May 15, 1907.

See Eng. Pat. 15,448 of 1908 ; this J., 1908, 977.—T. F. B.

Soda-lye rendered impure by the mercerisation process ; Process for purifying and clarifying the ——. O. Venter, Chemnitz, Saxony. Eng. Pat. 2876, Feb. 8, 1908. Under Int. Conv., Oct. 14, 1907. Addition to Eng. Pat. 993 of 1908, dated March 28, 1907.

See Fr. Pat. 387,621 of 1908, this J., 1908, 852.—T. F. B.

Wool ; Process and apparatus for extracting grease and alkali salts from ——. F. and C. Shuman. Fr. Pat. 390,438, May 20, 1908.

See U.S. Pats. 899,339 and 899,440 of 1908 ; preceding.
—T. F. B.

Colours [dyestuffs on the fibre] ; Process of fixing ——. H. Toepfer, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 900,130, Oct. 6, 1908.

See Fr. Pat. 381,279 of 1907 ; this J., 1908, 119.—T. F. B.

Zinc salt of formaldehyde-sulphoxylic acid ; Manufacture of ——. Eng. Pat. 4761. *See* VII.

VII.—ACIDS, ALKALIS, SALTS, AND NON-METALLIC ELEMENTS.

Nitric oxide and oxygen ; Reaction between ——. W. Holwech. Z. angew. Chem., 1908, 21, 2131—2135.

Russ and Mandl (this J., 1908, 333) have stated that with oxygen prepared electrolytically, or from barium peroxide, or potassium bichromate and sulphuric acid, the reaction between nitric oxide and oxygen does not proceed to completion. The author is unable to confirm this statement. Experiments were made with Linde's oxygen, ozonised oxygen, and oxygen prepared from barium peroxide and from potassium bichromate and sulphuric acid, and it was found that in all cases, the reaction between the oxygen and nitric oxide (formation of nitrogen peroxide) proceeded practically to completion and with approximately the same velocity.—A. S.

Nitric oxide formation in high-tension arcs. F. Haber and A. Koenig. *See* XIA.

Chromic and vanadic acids in the presence of one another ; Iodometric determination of ——. G. Edgar. Amer. J. Science, 1908, **26**, 333—336.

The method depends upon the reduction of chromic and vanadic acids by hydrobromic acid in accordance with the equation : $V_2O_5 + 2CrO_3 + 8HBr = V_2O_4 + Cr_2O_3 + 8Br + 4H_2O$; and the subsequent reduction of the vanadium tetroxide to trioxide by means of hydriodic acid : $V_2O_4 + 2HI = V_2O_3 + 2I + H_2O$. The solution containing the vanadic and chromic acids is placed in a flask which is connected on the one hand with a supply of hydrogen and with a funnel containing hydrochloric acid, and on the other, with an absorption apparatus containing an alkaline solution of potassium iodide. One or two grms. of potassium bromide are added to the solution in the flask, hydrogen is passed through, 15–20 c.c. of hydrochloric acid are run in, and the solution boiled for 10 minutes. The solution in the absorption apparatus is now acidified with hydrochloric acid, and the liberated iodine titrated with thiosulphate. The apparatus being again adjusted, hydrogen passed through, 1–2 grms of potassium iodide and 10–15 c.c. of hydrochloric acid and 3 c.c. of syrupy phosphoric acid introduced into the flask, and the contents of the latter boiled until the volume is reduced to from 10 to 12 c.c., the vapours evolved being as before passed through alkaline potassium iodide solution. The latter is then acidified, and the iodine titrated with thiosulphate.
—A. S.

Sodium chloride, "C.P." ; [Impurities in ——.] F. O. Taylor, J. Amer. Chem. Soc., 1908, **30**, 1631—1634.

Six samples of so-called "C.P." sodium chloride were found to be free from the usual impurities (calcium, magnesium, sulphates, etc.), but all these samples contained traces of insoluble matter, the ash from which ranged from 27 to 124 parts per million of the salt. The origin of this was traced to the vessels used in the manufacturing process. Thus, on evaporating a solution of the purest commercial sodium chloride in earthenware vessels, an insoluble residue was obtained in which silica and antimony could be detected. In other experiments, 150 c.c. of a filtered 16·67 per cent. solution of sodium chloride with an original insoluble ash of 22 parts per million, were evaporated in a tinned copper dish, in an aluminium dish, and in an iron dish coated with a special enamel. The amounts of insoluble ash respectively obtained were 209, 36·5, and 10·0 parts per million. From these experiments the author concludes that the preparation on a manufacturing scale of sodium chloride free from all insoluble matter, is practically impossible, although under the best conditions its amount may be rendered negligible.—C. A. M.

Hydrosols of metallic oxides ; Preparation of —— by peptisation of their gels. A. Müller. Z. anorg. Chem., 1908, **57**, 311—322. Chem. Zentr., 1908, **1**, 1369.

Metallic hydroxides are precipitated by a slight excess of ammonia, quickly and carefully washed, suspended in water, and small quantities of a solution of an acid or salt added from a burette, the mixture being boiled vigorously for 10 to 15 minutes after each addition, until the precipitate has been completely disintegrated into the corresponding hydrosol. Thus the sol of aluminium hydroxide is produced with the aid of solutions of hydrochloric acid, ferric chloride, thorium nitrate, or chromium nitrate ; the hydrosol of thorium oxide, prepared in a similar manner, is dark reddish-yellow, that of yttrium oxide (containing erbium) is dark yellow, that of cobalt oxide yellowish-green. The hydrosol of ferric oxide is obtained from the chloride by addition of potassium hydroxide, not in excess, followed by precipitation with ammonia and boiling for a short time ; the hydroxide thus precipitated is converted into the hydrosol by means of hydrochloric acid. These colloidal solutions are opalescent, and very stable, with the exception of the hydrosol of cobalt oxide. The colloidal particles carry a positive electric charge, and are precipitated by shaking with benzene, and by multivalent acids and their salts; they do not show the ordinary ionic reactions. On drying, they yield reversible gels, similar to organic colloids.—E. F.

Sodium thiosulphate; Action of —— on potassium permanganate in alkaline solution. Kiliani. *See* XXIII.

Potassium ferrocyanide; Volumetric determination of ——. H. Bollenbach. Z. anal. Chem., 1908, **47**, 687—690.

THE following modification of de Haën's method of determining potassium ferrocyanide gives good results:—The solution, made strongly acid with sulphuric acid, is titrated with potassium permanganate, and, when the violet colour becomes permanent, a few drops of ferric sulphate solution are added, and the slight excess of permanganate titrated by the cautious addition of *N*/20 potassium ferrocyanide solution. A cloudiness, due to the production of Prussian blue, appears as each drop of ferrocyanide enters the liquid, but this vanishes on shaking, as long as any excess of permanganate remains, a permanent greenish-blue coloration marking the completion of the reaction. The method of determining ferrocyanide iodometrically (Rupp and Schiedt, this J., 1902, 1099) has also been examined: it is reliable only when about double the calculated quantity of iodine is used, and success, therefore, depends upon knowing approximately the strength of the solution to be analysed. —F. SODN

PATENTS.

Arsenious oxide; Manufacture of ——. U. Wedge, Ardmore, Pa. U.S. Pat. 900,138, Oct. 6, 1908.

ARSENIOUS oxide is recovered from the sulphide of arsenic sludge produced in sulphuric acid manufacture, by neutralising, drying, and burning the sludge, and condensing the arsenious oxide by cooling the resulting vapours. The surfaces with which the vapours come in contact are cooled to prevent the oxide from firmly adhering to them.—W. C. H.

Zinc-salt of formaldehyde-sulphoxylic acid; Manufacture of a somewhat insoluble ——. F. Rademacher, Prag-Karolinenthal, Austria. Eng. Pat. 4761, March 2, 1908.

THE zinc salt of formaldehyde-sulphoxylic acid is produced by reducing a formaldehyde-alkali bisulphite with zinc dust in presence of a zinc salt (acetate, chloride, sulphate) other than the sulphite or formaldehyde-sulphite or reduction products thereof. It is stated that the reduction is so facilitated in the presence of the zinc salt, that a considerable yield can be obtained with a relatively small amount of zinc dust, and the degree of concentration of the liquid is immaterial.—A. S.

Tin salts; Manufacture of ——. H. Brandenburg. Kempen a/Rhine, Germany. Eng. Pat. 10,938, May 20, 1908. Addition to Eng. Pat. 1461, Jan. 21, 1908 (see Fr. Pat. 386,594 of 1908; this J., 1908, 749).

FINELY ground tin ores, tin residues, ashes, and other tin-containing substances are reduced by solid, liquid, or gaseous reducing substances at such a temperature (about 700° to 850° C.) as to avoid the formation of slag, into which tin would pass, and the whole reduction product, containing tin in a finely-divided form, is subjected to treatment with some reagent which converts the tin into tin salts.—W. C. H.

Potash; Production of ——. S. Sparling, Hammond, Ind. U.S. Pat. 896,168, Aug. 18, 1908.

THE wood of plants, vines, etc., especially that of the species of *Artemisia* known as "sage-brush," is carbonised at as low a temperature as possible, until all the volatile matter is expelled; air is now admitted to the apparatus, and the residue is allowed to burn slowly at a dull red heat. Potash is extracted from the ashes by any convenient means. It is stated that from one ton of sage-brush may be obtained 140 lb. of ashes containing 61 per cent. of potassium as oxide.—T. F. B.

Gaseous endothermic reactions [nitrogen oxides from air]; Methods of and means for conducting ——. S. Z. de Ferranti. Eng. Pat. 20,697, Sept. 17, 1907.

A MIXTURE of gases, such as air, is compressed and forced into a chamber in which it is heated in an electric arc. The gases formed and heated in the arc are then cooled by expansion in one or more nozzles. The gases issuing at high velocity from the nozzles are brought into contact with a cooled surface or cooling sprays, or preferably used to drive a suitable wheel system. Instead of an electric arc, internal combustion, or a resistance heater, or a combination of all three may be used to heat the gases.—O. F. H.

Nitric acid; Process of making ——. O. Bender, Neu-Babelsberg, Germany. U.S. Pat. 900,471, Oct. 6, 1908.

SEE Fr. Pat. 377,442 of 1907; this J., 1907, 1090.—T. F. B.

Gases containing sulphur dioxide; Process of purifying ——. G. Eschelmann, St. Petersburg, Russia. U.S. Pat. 900,500, Oct. 6, 1908.

SEE Eng. Pat. 12,213 of 1907; this J., 1907, 1138.—T. F. B.

Sulphuric acid; Process of making ——. O. Bender, Neu-Babelsberg, Germany. U.S. Pat. 900,688, Oct. 6, 1908.

SEE Fr. Pat. 377,442 of 1907; this J., 1907, 1090.—T. F. B.

Sulphur dioxide and sulphuretted hydrogen; Treatment of —— for the obtainment of sulphur therefrom. W. Feld, Zehlendorf, Germany. Eng. Pat. 2719, Feb. 6, 1908. Under Int. Conv., March 6, 1907.

SEE Fr. Pat. 387,438 of 1908; this J., 1908, 810.—T. F. B.

Filling for reaction chambers, etc. H. Petersen, Wilmersdorf, Germany. U.S. Pat. 899,898, Sept. 29, 1908.

SEE Fr. Pat. 378,454 of 1907; this J., 1907, 1130.—T. F. B.

Filling material for reaction chambers. H. Petersen, Wilmersdorf, Germany. U.S. Pat. 899,899, Sept. 29, 1908.

SEE Fr. Pat. 382,262 of 1907; this J., 1908, 151.—T. F. B.

VIII.—GLASS, POTTERY, AND ENAMELS.

Kaolin formation; Contribution to the question of ——. O. Hähnel. J. prakt. Chem., 1908, **78**, 280—284.

ANALYSES are quoted of specimens of porphyry from the same deposit in: (1), the undecomposed state; (2), after weathering; and (3), after semi-kaolinisation. The figures show that weathering and kaolinisation are quite distinct processes. In the former, the proportions of alkali and alumina remained practically unaltered, that of the iron increased slightly, and that of the silica decreased, whilst in the latter, the amount of alkali fell nearly to half the original value, the iron content decreased, and the proportions of alumina and silica increased considerably. A decomposition product of granite taken from below a layer of humus, had a composition closely approaching that of crude kaolin.—A. S.

Texas kaolin; Note on ——. A. Mayer. Trans. Amer. Ceram. Soc., 1908, **10**, 91—96.

THE clay examined was from a deposit located about 75 miles west of San Antonio. It is taken from the mine as a snow-white powder. The division of the grains is not at all fine, the surface factor being 9036 as compared to 15.000—16.000 for many English clays. The tensile strength is very great, 89 lb. per sq. in., as compared to the 15—40 lb. of other china clays. The plasticity, also, is very great; the clay requires 51 per cent. of water to convert it into a workable state. The contraction from the mould was 10 per cent., and on firing to cone 10 bending, it contracted another 12 per cent.—a total shrinkage of 22 per cent., whereas china clays usually contract 11—16 per cent. on the whole, and ball-clays 16—19 per cent. The composition of the clay is: silica, 43·75; alumina, 37·62; ferric oxide, 0·36; calcium carbonate, 1·40; loss on ignition, 15·84; alkalis, 0·96 per cent. For colour, vitrification, strength, and plasticity, the clay appears to be superior to any china clay on the market. In the discussion, Zimmer attributed the physical properties of the clay to amorphous silicic acid, and pointed out that similar effects could be obtained by adding water-glass to kaolin. Hottinger stated that ware made from this clay was full of fine cracks internally, although perfect on the surface. It was necessary to open it up for drying by introduction of some non-plastic material. Fox stated he had met a somewhat similar clay from Jerseyville, Ill., which had the enormous tensile strength of 500—560 lb. per sq. in.—H. H. S.

Kaolin; Effect of potash mica (muscovite) upon ——. R. Rieke. Sprechsaal, 1908, **41**, 577—582.

In the rational analysis of clays, the portion soluble in hot sulphuric acid is returned as "clay substance," and is regarded as consisting of hydrated aluminium disilicate, $Al_2O_3,2SiO_2,2H_2O$. Analyses of this portion, however, show that in addition to alumina, other oxides are present, namely, ferric oxide, titanium oxide, lime, magnesia, sodium oxide, and especially potassium oxide. According to Vogt the appreciable proportion of alkali is due to the presence of finely divided mica, chiefly muscovite, which is dissolved by the sulphuric acid, along with the clay substance. If present in a large proportion, the mica would affect the refractoriness, sintering temperature, contraction on burning, and other properties of a kaolin. The extent to which the properties of the kaolin are affected would depend upon the degree of fineness and uniformity of size of the mica particles. The author has investigated these points by experiments upon Zettlitz kaolin (containing 98·5 per cent. of clay substance, and 1·5 per cent. of quartz and felspar), and a pure crystalline muscovite. He found, when the muscovite was ground fine enough to pass through a 5000-mesh sieve, that 96 per cent. was dissolved by the sulphuric acid treatment in a rational analysis, and that as much as 74 per cent. was dissolved from a portion that would pass a 900-mesh sieve. The melting points of mixtures of Zettlitz kaolin and of the very finely divided muscovite were lowered as the amount of the latter was increased. The same effect is produced upon the kaolin by orthoclase felspar, but to a much greater extent, owing to the larger content of alkali in the orthoclase. Kaolin on the other hand does not act upon muscovite in the same way; but only slightly diminishes its easy fusibility. Crystallised alumina and muscovite react upon each other in the same way as mica and kaolin. Mixtures of quartz and muscovite on the other hand do not show a regular decrease in their melting points as the amount of muscovite increases. This melting point curve shows a maximum with a mixture containing 80 per cent. of muscovite, and a minimum with a mixture containing 50 per cent. of muscovite, and the trace of the curve remains practically the same when previously molten mixtures are tested again. Additions of the finely divided muscovite to Zettlitz kaolin increase the contraction on burning, but only to a small extent; above Seger cone 10, the more micaceous mixtures show a slight expansion. The effect of the mica upon the density of the burnt test-pieces is very marked with mixtures containing over 20 per cent. of mica, but at temperatures much below the melting point of the muscovite, its influence on the density is apparent (from about Seger cone 1 upwards). The effect is very much increased by increased fineness of grain of the mica. Finely ground muscovite shows on burning very little contraction, but a high porosity. Between Seger cones 6 and 10 the water absorption sinks from 20 per cent. to *nil*, so that the muscovite must begin to fuse at cone 10, without any marked alteration in form occurring. The actual fusing point is about cone 13. Judging from the tenacity of a paste of the finest washed potash mica and water, it stands intermediate between plastic and non-plastic (or diluent) materials. These results showing the effect of potash mica on kaolin were also confirmed by experiments made upon an American kaolin containing 99·7 per cent. of clay substance, and approximating even more than Zettlitz kaolin to the theoretical formula, $Al_2O_3,2SiO_2,2H_2O$.—W. C. H.

Frits; Compounding of ——. H. F. Staley. Trans. Amer. Ceram. Soc., 1908, **10**, 113—123.

The author attacks the "common and disastrous fallacy" of assuming that frits of like stoichiometrical formulæ will have like pyrometric and physical properties. The error is greatest when the frit is merely sintered in saggars; it is still grave when the frit is brought to full fluidity and quietude in a frit kiln. By simply varying the raw materials, it is stated that the same formula may be made to give a "nice clear glass" at a low temperature or an opaque porcelain-like mass at 200° C. higher. At any point between these two extremes, the mixture can be made to craze, "fit," or chip on any given body. Alumina and silica should, whenever possible, be introduced into a frit as felspar, which is the best basis for a frit, and the cheapest. Soda and soda-lime spars are cheaper than potash spars on account of their greater fusibility. Clay should be avoided, as it impairs the fusibility, thereby increasing the expense of fritting; its constituents can be better introduced as felspar. Fluorine always has the same effect, however introduced; it tends to reduce the melting point, to cause crazing and to give a milky opacity. Boric acid should be used sparingly on account of its high cost. The glass is first made as fusible as possible by keeping the alkalis high, the lime low, the metallic oxides fairly high, and using only enough alumina and silica to produce an insoluble glass. If the glass is still too refractory, boric acid is added. Since lime is kept low—because it is not an efficient flux, unless introduced as spar—zinc can be used to a considerable extent. Weight for weight, it is superior to lead as a flux, and it costs less.—H. H. S.

[*Pottery*] *Fusion curves; Notes on some* ——. A. V. Bleininger. Trans. Amer. Ceramic Soc., 1908, **10**, 259—264.

The author has studied the fusion of mixtures of felspar, ferric oxide, and "whiting." The dry constituents were ground together in various proportions from 100 per cent. of felspar to 40 per cent. of ferric oxide, 100 per cent. of felspar to 40 per cent. of whiting, and 100 per cent. of felspar to 40 per cent. of ferric oxide and whiting together, the percentages of whiting at first being small, but increasing as the felspar diminished. The mixtures were made into cones with dextrin and water, and fused in a test-kiln. In the felspar-ferric oxide series, there is an eutectic, melting at 1100° C., consisting of 91 per cent. of felspar and 9 per cent. of ferric oxide, and corresponding with the formula:—

$$0{\cdot}015\,MgO : 0{\cdot}034\,CaO : 0{\cdot}766\,K_2O : 0{\cdot}185\,Na_2O : 1{\cdot}04\,Al_2O_3 : 0{\cdot}415\,Fe_2O_3 : 6{\cdot}82\,SiO_2.$$

In the felspar-lime series, there is apparently an eutectic consisting of about 97 per cent. of felspar and 3 per cent. of whiting. In the felspar-ferric oxide-whiting series, the author concludes that the isothermal compositions are connected by some definite law; one set of mixtures within certain limits fused between 1175° and 1195° C., another set with a wider range of composition fused between 1195° and 1215° C., and so on, each set having a temperature interval of 20° C.—W. C. H.

Cornish stone versus felspar as a flux for porcelain; Use of ——. A. S. Watts. Trans. Amer. Ceram. Soc., 1908, **10**, 97—112.

A FELSPAR-FRIT was made of the same composition as the Cornish stone, *viz.*, 0·676 KNaO : 0·293 CaO : 0·030 MgO, : 1·167 Al_2O_3 : 8·93 SiO_2. The lime was introduced as fluorspar in order to derive benefit from any additional fluxing power fluorspar may have over whiting. The mixture was fritted at cone 10, and ground to pass a 120-mesh screen. After firing, no trace of fluorine could be found. The Cornish stone and its artificial substitute were then weighed out with china clay, ball clay, flint, and whiting to make two bodies of the formula—0·16 K_2O, 0·08 CaO, 1·0 Al_2O_3, 4·5 SiO_2, and the test pieces were fired under normal and reducing conditions. In the normal burn, the two bodies were about equal in vitrification. In colour, the stone body tended to a brownish-cream, and the frit body to a blue; the latter being the better colour. In the reducing burn, the stone body had a creamy translucency common to American chinas, while the frit body had the peculiar blue-white translucency of the highest quality French chinas, the frit body again being superior. In the discussion, Mayer referred to the beautiful colour of English bone china. Although this contains Cornish stone, the lime from the bone "bleaches the iron in the body." English manufacturers endeavouring to compete with American "vitreous" ware had to get their fluxes from Sweden, owing to the absorption of Cornish stone bodies. Weelans said that Cornish stone gave rise to blistering. Langenbeck stated that stone was very variable in composition. At Trenton, there was a "dark purple" and a "light buff" stone. The former is a hard rock having large crystals of felspathic material, while the latter has been considerably weathered. Analyses showed that the amount of alkalis might range from 3 to 7 per cent. Cornish stone contained fluorine, and he attributed the blistering mentioned to that ingredient. Incidentally, he mentioned that a vitreous body made of Cornish stone by itself had a shrinkage less than one of felspar, and greater than one of fireclay. Zimmer stated that the reason why American porcelain is yellowish while European ware is bluish, is that the American ware is only semi-porcelain and has to be fired in a neutral or an oxidising flame because of the lead glaze on it, while the Continental porcelain has a felspathic glaze and is fired chiefly in a reducing atmosphere, thereby keeping the iron compounds reduced. Binns stated that felspar gave a weaker body than stone, but that the spar body was less liable to spit out in the decorating kiln—an important point when underglaze printing with gold edge. He attributed the dark purple colour of some stones to fluorine, some stones containing as much as 1·6 per cent. of fluorspar.—H. H. S.

Porcelain manufacture; Action of the different forms of calcium as a flux in ——. A. S. Watts. Trans. Amer. Ceramic Soc., 1908, **10**, 265—292.

THE author has examined the effects produced upon a porcelain of the composition, $0·16K_2O : 1Al_2O_3 : 4·5SiO_2$, by additions of calcium, introduced as "whiting," pulverised marble ($CaCO_3$,$MgCO_3$), plaster of Paris, and fluorspar. With uniform firing and gradual cooling in a neutral or very slightly oxidising atmosphere, the source of the calcium does not appear to affect the qualities of the porcelain. When the bodies were burnt in either a strongly oxidising or a strongly reducing atmosphere, considerable variations appeared in the shrinkage, apparent density, and absorption (tested by 48 hours' immersion in nearly boiling water). Roughly speaking the specific gravities and shrinkages were less in the oxidising burn, and greater in the reducing burn, than under normal conditions of firing. The author concludes that greater variations occur in a body in which calcium is present than in a plain felspar body. A small addition of calcium flux may improve the colour if properly handled, but all the desirable qualities do not appear in any one body. From a discussion of the data, when corrected for real specific gravity, percentage of sealed pores, and volume changes of solid material, it appears that porcelains, like other vitrified wares, are not the solid bodies they appear to be from the ordinary absorption, porosity, and shrinkage measurements. In some cases there is molecular volume alteration. The solid material and the sealed pores increase in volume, but it is not clear whether the sealed voids are the original open pores sealed off, or new pores developed by the formation and expansion of enclosed gases. So far as can be seen at present, the strength of the porcelains does not depend upon the amount of sealed pores, neither can any conclusion be arrived at as to the effect of the molecular increase in volume of the solid portion, on the strength of the porcelain.—W. C. H.

Stoneware; A cheap enamel for ——. R. T. Stull. Trans. Amer. Ceramic Soc., 1908, **10**, 216—243.

THE author's object was to produce an enamel which was whiter and better than the commercial stoneware glaze, and should have somewhat the appearance of a tin enamel, but be cheaper to produce. The following glaze was taken as the starting point,

$$0·3K_2O\ 0·4CaO : 0·3BaO : 0·4Al_2O_3 : 3·75SiO_2.$$

The substitution of zinc oxide for baryta in this glaze increased the fusibility, brilliancy, and opacity, and reduced the tendency to craze. The crazing and refractoriness were increased by replacement of lime from "whiting" by lime from bone ash, but the bone ash required calcining with flint, otherwise the glaze flaked off after dipping. The equivalent of $0·13P_2O_5$, introduced as bone ash, with 0·3ZnO and $0·4Al_2O_3$, increased the whiteness and did not cause "beading," which is considered to be a danger arising from the use of bone ash. To reduce the refractoriness and "crazing" and at the same time retain the whiteness, dehydrated colemanite (calcium borate) was introduced, and by replacing bone ash, zinc oxide, and silica, the fusibility and brilliancy were increased, but the opacity decreased. No good commercial glazes were obtained in a series of trials in which an attempt was made to increase the content of alumina and phosphoric anhydride by the introduction of aluminium phosphate; though the whiteness and opacity were increased, the glazes were spoiled by blistering, "beading," etc. The best results were obtained with a glaze of the following formula:—

$$0·2ZnO : 0·6CaO : 0·2K_2O :$$
$$0·40—0·55Al_2O_3 : 2·5SiO_2 : 0·2P_2O_5 : 0·8B_2O_3.$$

In this the bone ash was calcined or fritted, and the alumina in excess of 0·3 equivalent was added as calcined clay. The glazes could be fired as low as cone ·01 and gave good opaque glossy enamels, with a light ivory colour and texture. There was only a very slight tendency to "crawl." The enamels also contain no raw borax or other soluble salts.—W. C. H.

Pottery plaster. H. E. Ashley. Trans. Amer. Ceram. Soc., 1908, **10**, 76—90.

ACCORDING to the author's theory, based chiefly on the work of Le Chatelier and of himself, the setting of plaster is caused by the energy of hydration, supplemented by the solvent action of water, and the difference in solubility of crystallised and uncrystallised calcium sulphate. Some of the plaster is first hydrated, a process which is accompanied by a rise of temperature. The hydrated plaster coats masses of not-hydrated plaster, and the process of hydration is brought to a stand until the excess of water has dissolved the hydrated plaster, thereby causing a fall of temperature. When the water is saturated, the dihydrate, $CaSO_4,2H_2O$, crystallises out, and setting begins and proceeds more and more rapidly till nearly complete. The temperature also rises rapidly, owing to the not-hydrated plaster becoming exposed and then hydrated. The more finely-ground the plaster, the more extensive is the initial hydration and the quicker the setting. The "ageing" of plaster moulds is a phenomenon akin to setting. In a solution, large crystals grow at the expense of smaller ones. By "ageing," the moulds become more difficultly soluble, and this explains the greater wearing power (said to be 10 per cent.), of aged moulds.

Tests for plaster for moulds.—Sieve. The residue left on a sieve, 80 meshes to the inch, is objectionable in mould-making. *Tensile strength.* The author rejects this common test, because over-burned has greater tensile strength than under-burned plaster, but is useless for mould-making owing to its lack of porosity. *Heating test.* To 75 grms. of water of known temperature, 100 grms. of plaster are added and rapidly stirred. Readings are taken of time and temperature. The initial rise in temperature is greater the finer the plaster. Then comes a retardation, or even a fall, due to the solution of the hydrated plaster, and finally another rise which indicates roughly the extent to which the plaster has been calcined. The heating curves, though they cannot be relied upon for a full description of the plaster, make a convenient basis for comparisons. *Drip test.* Moulds have often to be discarded after a short period of use through the uncovering of air-pits and consequent irregularity of surface. The quality of a mould from this standpoint can be tested by placing the formed piece under dripping water for one hour, when hard lumps appear raised above the surface, and numerous air-pits are uncovered. By blending the plaster and water in a small "blunger" and letting the bubbles of air rise to the surface, the air-pits can be reduced in number and especially in size. New moulds have more calcium sulphate dissolved out of them than old ones, thereby causing the outer surface of the ware cast in them to be vitrified during the subsequent firing, and to become harder than the inner surface.—H. H. S.

Seger-cones 022 *to* 7. M. Simonis. Tonind.-Zeit., 1908, 32, 1764—1768.

Seger first instituted cones 1—20, then 26—36, and lastly 21—25. Cones 4—35 consisted of clay, quartz, and felspar or whiting. In cones 1—3, iron oxide was used as flux. Cramer prepared cones 010—01 by the use of boric acid, and Hecht, cones 022—011 with the aid of lead oxide. These lower members, however, owing to the influence of reducing gases, were not so reliable as the cones above 4. Not merely did they swell and twist, but their melting-points were influenced by the size and nature of the muffles in which they were fired, and by the time of firing. Further, successive cones do not mark regular gradations of temperature. Between cones 016 and 011, for example, there is a difference of only 35° C. (750°—785° C.), while the next cone (010) melts at 910° C.—a rise of 125° C. To remedy this, the author prepared a series of lead-free cones by adding increasing quantities (from 2·5 to 30 per cent.) of Zettlitz kaolin to the frit—

$$0\cdot5Na_2O,0\cdot25CaO,0\cdot25MgO,1\cdot0SiO_2,1\cdot0B_2O_3$$

—for cones 021—016, and of kaolin (15 to 21·5 per cent.) and magnesite (4 to 10 per cent.) to the frit — $0\cdot5Na_2O,0\cdot5CaO,0\cdot2Al_2O_3,2\cdot0SiO_2,1\cdot0B_2O_3$ — for cones 015—011. The new cones were more regular in gradations of temperature and gave concordant results whether fired in a kiln or in a quick-firing muffle. But it was found that the new cone, 011a, had a higher melting-point than the old Seger cone, 010, which contained iron oxide and was liable to burst when quickly fired. The author therefore extended his new series of lead- and iron- free cones up to number 7 by adding to the substance of cone 7 suitable quantities (2 to 77 per cent.) of a material made by mixing 33·5 parts of kaolin and 10 parts of magnesite with 56·5 parts of the second of the above frits. These new cones gave good results as long as they contained not less than 20 per cent. of the substance of Seger cone 7. The molecular formulæ of all the new cones are given in the paper.—H. H. S.

Glaze formula ; Function of boron in the ——. C. F. Binns. Trans. Amer. Ceramic Soc., 1908, 10, 158—174.

The ratio of the basic to the acidic components in a glaze is calculated on the oxygen ratio, and the most satisfactory results are obtained with a ratio of 1 : 2 in normal raw glazes, in which silica is the acidic component, so that such glazes were often referred to as "bisilicates." When however boric acid is introduced into a glaze, instead of replacing part of the silica, it is found in practice that an increased amount of silica is required, and the oxygen ratio of 1 : 2 does not hold good. If however boric acid, or rather boron sesquioxide, in which form the boron presumably exists in a fritted glaze, be reckoned as basic, then the glaze satisfies the oxygen ratio of 1 : 2, and some explanation of the necessary increase of the silica content is afforded. According to the periodic law, and from its valency, boron might be presumed to act like aluminium, and exhibit the functions of a base with strong acids, and of an acid with strong bases. In a glaze formula it would thus fall into the R_2O_3 column, as B_2O_3. The author found experimentally that when silica and boron sesquioxide are melted together, the latter appeared to completely dissolve the former, and also that a measurable amount of heat was evolved. From the results obtained with a number of experimental glazes, boron sesquioxide appeared to exhibit basic functions. If it had acted like an acid, the members of one series would have varied from a little more than a bisilicate to considerably more than a trisilicate, which is highly improbable in face of the uniform results obtained through all the members of the series. If reckoned as a base, the oxygen ratio throughout the series was 1 : 2. In another series, one member with $0\cdot25\ B_2O_3$ was more fluid than another member with $0\cdot5\ B_2O_3$, and as this series contained no alumina, it is evident that at least in an experimental way, boron sesquioxide may replace alumina entirely, and in excess, tends to act like the latter in increasing the viscosity of a glaze. Further, from the occurrence of devitrification in the trials, boron sesquioxide appeared to exhibit basic and not acid functions. The replacement of boric acid by alumina, and *vice versa* had no effect upon crazing of the glaze. There are probably conditions under which boron does exhibit acid functions, but the author does not consider that it acts thus in the presence of silica.
—W. C. H.

Glazes ; New crystalline ——. J. Koerner. Trans. Amer. Ceram. Soc., 1908, 10, 61—64.

Whilst experimenting with uranium oxide to obtain a red colour, the author found that with lead, uranium tends to form an aventurine glaze. Attributing this phenomenon to a high lead-content, he tried to overcome the difficulty by adding fluxes high in alkali content, but without satisfactory results. He then replaced the lead fluxes by bismuth, and at once obtained crystals which appeared red from above, but glittered like gold from the side. The crystals were not so large as the well-known zinc and titanium crystals, but were effective on account of their peculiar colour. The best results were obtained with the two following glazes :—

A. $0\cdot25PbO:0\cdot20Bi_2O_3:0\cdot10CaO:0\cdot05MgO:0\cdot05Al_2O_3,$
$0\cdot75SiO_2:0\cdot25B_2O_3.$

B. $0\cdot20Bi_2O_3:0\cdot16K_2O:0\cdot08MgO:0\cdot16CaO:0\cdot05Al_2O_3,$
$0\cdot75SiO_2:0\cdot25B_2O_3.$

These crystals were obtained at as low a temperature as Seger cones 011—09.

Crystalline glazes may also be obtained with tungstic acid, WO_3, but a temperature of Seger cone 8—10 is required. Glazes containing much alumina are not suitable. The best formula is

$$1\cdot0RO,2—3SiO_2,0\cdot1Al_2O_3,1\cdot0B_2O_3,0\cdot1WO_3,$$

in which

$$RO=0\cdot5PbO,0\cdot3CaO,0\cdot1K_2O,0\cdot1Na_2O.$$

The crystals show peculiar iridescent reflexes and may be coloured.—H. H. S.

Chromium oxide in glazes containing zinc ; Action of ——. M. L. Bryan. Trans. Amer. Ceram. Soc., 1908, 10, 124—132.

A matte glaze of the composition,

$$0\cdot25K_2O,0\cdot30—0\cdot14CaO,0\cdot45—0\cdot21BaO,0\cdot00—0\cdot40ZnO,$$
$$0\cdot3Al_2O_3,2\cdot0SiO_2,$$

gave with raw chromium oxide, brown colours instead of green, when more than 0·10 equivalent of zinc oxide was present. It was at first thought that zinc chromate had been formed by the zinc oxide remaining suspended in the glaze, as it does in the glaze on Bristol ware, but on making a new glaze containing sufficient lead oxide to dissolve the zinc oxide, the brown colour still appeared. The author concludes that zinc oxide acts as an oxidising agent, changing chromic oxide into a higher oxide, which remains as such, unless it is subjected to a highly reducing atmosphere. The duration of burning seems to affect the colour; for instance, samples burnt in a trial kiln for only 24 hours may come out green. In the ordinary kiln, the colour may be green when hot, but become brown on cooling.—H. H. S.

Patent.

Glass; Apparatus for drawing ——. O. Imray, London. From Window Glass Machine Co., Pittsburg, U.S.A. Eng. Pat. 15,670, July 23, 1908.

The apparatus consists of a melting furnace and a drawing pot. The pot has two cavities for the glass, and is mounted on a horizontal axis about which it can be rotated, so that whilst glass is being drawn from the upper cavity, the lower, empty cavity is cleaned by the flame. The top stone of the furnace is made in separate parts, and a single mechanism is provided by which the pot can be turned on its axis. The separate parts or plates of the top stone can be moved radially to fit round the rim of the pot, and thus prevent the flame below from interfering with the glass which is being drawn from the upper cavity of the pot. The top may also be made in two parts which are mounted so that they may be raised slightly in being drawn back to allow for the turning of the pot.—W. C. H.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Portland cement; Effect of fine grinding on the properties of ——. J. A. Williams. Trans. Amer. Ceramic Soc., 1908, **10**, 244—258.

It is now generally agreed that only the most finely-divided particles (flour) of Portland cement are hydraulically active, within a reasonable length of time, and that the larger particles are inert, so far as the working qualities of the cement are concerned. In commercial cements the sizes of the particles range from those that just pass a 100-mesh sieve down to impalpable dust. The author has examined the effects produced upon the time of setting, tensile strength, and soundness by finer grinding of cement. A sample of Portland cement was bought in the open market, and one portion re-ground in a ball mill for 2 hours, a second for 5 hours, a third for 9 hours, and a fourth for 14 hours. The effect upon the fineness is shown in the following table:—

Sample.	Retained on 100-mesh.	Passing 100, retained on 200-mesh.	Passing 200-mesh.
Market	3·45	20·80	75·75
After 2 hours grinding	0·27	11·19	88·54
„ 5 „ „	0·15	8·75	91·10
„ 9 „ „	0·02	3·20	96·78
„ 14 „ „	0·00	1·22	98·78

Portions that passed the 200-mesh were further separated by settling in kerosene for ½, 1, and 5 mins. respectively with the following results:—

Sample.	Settling from suspension in kerosene in:			In suspension in kerosene after 5 mins.	Totals.
	30 secs.	1 min.	5 mins.		
Market ..	25·43	12·08	9·71	28·53	75·75
2-hour ..	27·39	17·42	13·77	29·96	88·54
5-hour ..	31·50	16·28	18·17	35·15	91·10
9-hour ..	25·93	15·54	17·63	37·68	96·78
14-hour ..	19·91	17·21	16·56	45·10	98·78

The times of the initial and final sets were measured, and decreased in every case with increased fineness of the particles, whilst the percentage of water required to make the pats increased. The times of the initial and final sets for the material in suspension in kerosene after 5 minutes were 2 mins., and 9 mins., and for the cement after 14 hours regrinding, 5 mins., and 17 mins. respectively. The following table shows the effect produced on the tensile strength by finer grinding.

Sample.	Neat cement. Lb. per sq. in. at end of:			1 cement: 3 sand. Lb. per sq. in. at end of:	
	24 hrs.	7 days.	28 days.	7 days.	28 days.
Market ..	135·9	555·3	657·8	167·9	242·7
2-hour ..	327·9	532·3	619·0	223·3	294·4
5-hour ..	348·8	568·3	631·3	243·0	350·5
9-hour ..	291·6	532·9	630·9	267·7	344·4
14-hour ..	365·0	596·7	598·8	283·1	380·6

At the end of 1 day, finer grinding considerably increases the tensile strength of the neat cement, but the increase is less marked as the setting period increases, and at the end of 28 days there was an actual decrease in strength. In the case of mixtures of cement and sand, there is however a uniform and fairly rapid increase in strength, in other words the larger the proportion of cement flour the stronger is the attachment between cement and aggregate. With the original cement, there is a very considerable increase in tensile strength as the period of setting increases. With the re-ground samples, the tensile strength increases as the fineness of the particles increases, but during succeeding days the increase in tensile strength is less marked with these than with the original cement. In the case of cement-sand mixtures, the increase in strength is more uniform at the end of 7 and 28 days. Hence, finer grinding appears to produce a cement which sets more quickly, and attains a greater strength in a shorter time. From this it would follow that with finer ground cement, a larger proportion of aggregate could be used to meet requirements as to strength and stability, or, if the present proportions were kept, the work could be completed in a shorter time. If the ultimate strength of the finer ground cement is greater, less cement would be required to satisfy definite conditions, and the present dimensional standards could be revised. Ultimately the question arises whether it would not be possible to grind the entire output of the kilns to such a degree of fineness that every particle became hydraulically active, and as a retarder, use some inert material which would be cheaper than the coarser particles of our present cements, which appear to serve the purpose of retarders, and constitute over 50 per cent. of the cement. —W. C. H.

Cement; New investigations on ——. E. Stern. Chem.-Zeit., 1908, **32**, 1029—1031.

To examine the action of water on cement, the author removed dust from the coarser particles by sifting, then placed these particles on microscope slides, covered them with 2 or 3 c.c. of a 2 per cent. solution of gelatin, allowed this to dry, and then immersed the slides in water or saline solutions. Microscopical examination of slides immersed in pure water showed that after one day, the cement particles had taken up some water and had slightly pushed back the skin of gelatin covering them; after 4 days' immersion, crystals of calcium hydroxide and carbonate had appeared. In solutions containing sea-salt, carbon dioxide, magnesium chloride, calcium chloride, sulphates, and especially calcium sulphate (gypsum), this crystallisation was retarded; in a solution containing bicarbonates it was accelerated. Treatment of cement with water in a dialyser showed that both aluminium and calcium hydroxides were dissolved, but that only calcium hydroxide diffused into the outer vessel; the residue obtained after some weeks contained 41 per cent. of lime, 30 of silica, and 8·3 of alumina. (See also this J., 1908, 983.)—A. G. L.

Patents.

Wood: Preserved ——. P. C. Reilly, Indianapolis, Ind. U.S. Pats. 899,904 and 899,905, Sept. 29, 1908.

Wood is impregnated with tar obtained in the manufacture of oil- and water-gas. This tar is heavier than water, begins to distil at about 150° C., and is liquid at ordinary temperatures, substantially non-volatile, practically free from suspended matter, and antiseptic to the organisms which attack wood. Creosote oil may be mixed with the tar.—A. G. L.

Wood; Process of vulcanising ——. C. Howard, Assignor to National Wood-Vulcanising Co., New York. U.S. Pat. 900,017, Sept. 29, 1908.

Wood is "vulcanised" by exposing it to a vacuum, then treating it with live steam at about 230° F., subjecting the steamed wood to a dry heat of about 380° F. in a vacuum, and finally cooling the wood gradually to a temperature below 212° F. while maintaining the vacuum. —A. G. L.

Ceramic products and other porous substances; Process for impregnating ——. Grünzweig und Hartmann G.m.b.H. Fr. Pat. 390,456, May 21, 1908. Under Int. Conv., June 6, 1907.

Porous articles are impregnated with the vapours of the "higher hydrocarbons," by heating them for one or several hours at about 250° C. in a closed vessel containing pitch, resin, etc. It is claimed that after this treatment the articles will no longer absorb water, although their weight is increased only by about 2 per cent., and their porosity remains practically undiminished.—A. G. L.

Solid hard pieces from pulverulent material of any kind; Method of producing ——. L. Weiss, Budapest, Austria-Hungary. U.S. Pat. 899,581, Sept. 29, 1908.

See Fr. Pat. 357,801 of 1905; this J., 1906, 115.—T. F. B.

Erratum:—This J., 1908, 1021. In title, l. 27 from bottom *for* "Buchler" *read* "Buehler."

X.—METALS AND METALLURGY.

Cobalt mineral output. Min. World (Chicago). Oct. 17, 1908. [T.R.]

The table below summarises the production of the Cobalt camp for the last two years, according to the report of the Ontario Bureau of Mines, just received. From 1904 to 1907 inclusive, the total production of the Cobalt mines was as follows: Ore shipped, 22,425 tons, valued at $11,674,621, containing metal values as follows:—silver, 18,083,308 oz., $11,295,332; nickel, 619 tons, $14,641; cobalt, 1194 tons, $305,090; arsenic, 5019 tons, $59,558.

Production of the Cobalt district in Ontario.

	1906.		1907.	
	Quantity.	Value.	Quantity.	Value.
		$		$
Ore shipped, tons	5,335	3,764,113	14,788	6,301,095
Silver, fine oz.	5,401,766	3,667,551	10,023,311	6,155,391
Nickel, tons ..	160	—	370	1,174
Cobalt, tons ..	321	80,704	739	104,426
Arsenic, tons ..	1,440	15,858	2,958	40,104

Manganese in Russia during 1907. I. I. Rogovin. Eng. and Min. J., Oct. 17, 1908. [T.R.]

Manganese ore is produced in the south of Russia, near the town of Nikopol and in the Caucasus, Sharopon district, Province of Kutais. The output in these two provinces, during the last three years, was in poods as follows:—

	1905.	1906.	1907.
Caucasus	20,876,487	50,170,000	40,833,000
South Russia ..	9,235,794	9,580,000	15,500,000
Total	30,112,281	59,750,000	56,333,000

The rapid increase from 1905 to 1906 was due to the increased demand for manganese ore and to the difficulty of securing supplies elsewhere. Of the total production from 60 to 70 per cent. was exported, the remainder going to supply the needs of metallurgical works in southern Russia. The first half of 1907 was marked by considerable activity. An immense demand for ore and unheard-of prices attracted to Chiatury a number of small producers. In August this boom began to subside, and when the general financial crisis arrived, there was a sudden standstill, which continues until the present time. Prices fell considerably, and output of ore ceased almost completely toward the end of the year. Owing to the inability of the Chiatury narrow-gauge railroad to meet the requirements of the industry, its high tariff and other charges, prices were so high last year that consumers found it more profitable to ship manganese ore from India. Several years ago the Sharopon ore constituted 47 to 53 per cent. of the world's supply, whereas in 1905 the proportion amounted to 31·46 per cent., and in 1906 to 36·85 per cent. The total output of manganese in all countries amounted in 1905 to 1,339,082 tons and in 1906 to 2,117,816 tons; of this quantity the Sharopon district in 1905 supplied 336,717 tons or 25·15 per cent. and 809,193 or 38·21 per cent. in 1906.

Note:—1 pood = 36·1 lb., 62·05 poods = 1 ton (avoird.).

Basic open-hearth process; Chemical control of the ——. A. Harrison and R. V. Wheeler. Iron and Steel Inst., Sept., 1908. [Advance proof.]

The authors advocate the desirability of making a series of rapid analyses of the metal during the working of basic open-hearth charges, and the keeping of systematic records of charges. Details are given of the methods for the rapid estimation of carbon, sulphur, phosphorus, and manganese, enabling a report to be given within a quarter of an hour after the drillings have been received. Carbon is determined by the ordinary Eggertz test with a few slight alterations. If the steel contain less than 0·40 per cent. of carbon, 0·2 grm. of the sample and the same weight of the standard steel are weighed out into clean, dry test-tubes (6 inches by ½ inch). When the sample is known to contain over 0·40 per cent. of carbon, 0·1 grm. only is weighed out. 4 c.c. of nitric acid (sp. gr. 1·2) are added and the test-tubes placed in a water-bath till the steel is dissolved, then heated over a small flame until all the brown flocks of carbide have dissolved, cooled, and the solutions transferred to comparison tubes. Sulphur is determined by an evolution method. Two grms are weighed out and placed in a conical flask of 300 c.c. capacity, fitted with a safety funnel and delivery tube with a catch-bulb. The delivery tube dips into 50 c.c. of a standard ammoniacal copper solution contained in a Nessler glass. 75 c.c. of boiling commercial hydrochloric acid (2 of acid to 1 of water) are poured down the thistle funnel; when the sample has dissolved, the contents of the flask are boiled to expel any sulphuretted hydrogen remaining, and the delivery tube disconnected. Two c.c. of strong ammonia are now added to the solution in the Nessler glass in case hydrochloric acid fumes have neutralised the ammonia already present, and the percentage of sulphur is estimated by the intensity of the blue colour of the ammoniacal copper sulphate, and by the quantity of copper sulphide precipitated. Phosphorus is determined as follows: 0·2 grm. of the steel is dissolved in 4 c.c. of No. 1 solution (370 grms. of ammonium nitrate and 370 c.c. of nitric acid per litre), and then 4 c.c. of No. 2 solution (125 grms. of ammonium nitrate and 100 grms. of ammonium molybdate per litre) added. The mixture is heated for exactly one minute over a

Bunsen burner, and transferred to a special measuring tube 1 inch in diameter and graduated in cubic centimetres up to 80 c.c. Distilled water is now added till a standard black spot on an illuminated screen can be distinctly seen through the solution. After each addition of water, the solution must be shaken up. The volume of the solution is now read and from the figure thus obtained, the percentage of phosphorus can be calculated, using a curve obtained by plotting the results given by a series of samples containing known percentages of phosphorus.

Manganese is determined by the following volumetric method: 0·2 grm. of the sample is dissolved in 8 c.c. of nitric acid (sp. gr. 1·2) in a test-tube of 1 inch diameter, and cooled, 10 c.c. of $N/100$ silver nitrate solution are added and about 0·75 grm. of potassium persulphate, and the test-tube placed in boiling water for exactly three minutes. It is then taken out, cooled, and the potassium permanganate that has been formed titrated with $N/100$ sodium arsenite solution. Examples are given of complete charge records. Frequent analyses made during the working of charges have shown that manganese is neither so rapidly nor so completely removed as is usually believed; in some cases as much as 0·346 per cent. has been present at the end of the heat, the lowest percentage found being 0·120. —O. F. H.

Iron-silicon-carbon alloys; Some ——. W. Gontermann. Z. anorg. Chem., 1908, **59**, 373—413. Chem. Zentr., 1908, **2**, 1157—1158.

Iron-carbon system.—With iron containing 0·07 per cent of carbon, the author observed an arrest-point at 1411° C., which was not perceptibly affected by melting the metal four times in succession in an atmosphere of nitrogen. This arrest-point, which can no longer be detected with iron containing larger proportions of carbon, is regarded as corresponding to a polymorphous transformation of δ-iron into γ-iron. The structure of chill castings ("*Hartgüsse*") is explained as being due to the fact that in the white layer, after supercooling below the eutectic temperature, the eutectic crystallisation takes place only after primary separation of martensite and cementite. With respect to the formation of kish ("*Garschaum*") in iron containing more than 4·5 per cent. of carbon, the author points out that this can be explained on the assumption that cementite, on melting, forms two non-miscible liquids. There must then be present two stable eutectics, *viz.*, martensite and cementite, and cementite and graphite, the appearance of kish being due to the latter, which separates from the liquid richer in carbon. The formation of graphite at 1100° C., observed by Heyn and Bauer (Stahl u. Eisen, 27, 1565, 1621) may be due to a change in the stability of the two phases, cementite and graphite; at 1100° C., martensite, graphite, and cementite, are present together in non-variant equilibrium. From about 900° C. downwards, the three phases, martensite, cementite, and graphite, no longer react sufficiently rapidly for equilibrium to be attained. *Iron-silicon system.*—The compound, Fe_2Si (compare Guertler and Tammann, this J., 1905, 1236) may also be regarded as saturated mixed crystals, which crystallise as a eutectic with the compound, FeSi. According to the investigations of Osmond (this J., 1890, 517, 865), Arnold (this J., 1894, 642), and Baker (this J., 1903, 1050), the heat effect of the transformation of γ- into β-iron (without appreciable alteration of the temperature of transformation) is remarkably weakened by silicon; the temperature of transformation of β- into α-iron is lowered by about 7°—8° for each 1 per cent. of silicon; and both transformations take place not at constant temperature but over an interval. On the basis of these results the author has constructed a diagrammatic representation of the polymorphous transformations of iron in presence of silicon. Both β- and α-iron form mixed crystals with silicon, the limits within which the two elements are not miscible, becoming wider as the temperature falls. The temperature of transformation of γ- into β-iron, in the author's opinion, rises with increasing content of silicon above 3 per cent., since the temperature of formation of pearlite, is considerably increased by silicon. *Iron-carbon-silicon system.*—The experiments were made on alloys in which, with constant content of silicon, the proportion of carbon was varied, and were confined to the system, Fe-Fe_3C-FeSi. The field of this system is divided into two portions by a curve of univariant equilibrium, which connects the two binary eutectic points, mixed crystals $+Fe_3C$, and mixed crystals +FeSi. In the field between this curve and the line joining the points corresponding to Fe_3C and FeSi, the primary separation consists of mixed crystals of the two compounds, Fe_3C and FeSi (silicon-cementite), and the secondary, of a mixture of the same with ternary Fe-Si-C mixed crystals (silicon-martensite). The field for the separation of silicon-martensite lies between the point for pure iron and the univariant equilibrium curve; this field is divided into two portions by the curve representing the saturated silicon-martensite, of which one corresponds to the unsaturated silicon-martensite, and the other to the secondary crystallisation of mixtures of saturated silicon-martensite with silicon-cementite. The analogy between the crystallisation of the iron-carbon-silicon alloys and of iron-carbon alloys, also extends to the transformations in the solid state. Either graphite forms owing to decomposition of silicon-martensite into carbon and silicon-ferrite (iron-silicon mixed crystals free from carbon), or the silicon-martensite splits up into silicon-ferrite and silicon-cementite, yielding silicon-pearlite. Neither β- nor α-iron, nor probably their mixed crystals with silicon, are capable of dissolving considerable quantities of carbon. From alloys rich in silicon and those of a composition approaching the univariant equilibrium curve, no kish is separated, and this is in accord with the author's view that the formation of kish is due to the production of two layers of liquid metal.—A. S.

Iron, phosphorus, carbon; The system ——. P. Goerens and W. Dobbelstein. Metallurgie, 1908, **5**, 561—566.

THE authors have continued the work of Wüst (this J., 1908, 406), and have examined both by the freezing-curve method and metallographically the iron-carbon-phosphorus alloys. The ternary eutectic, which solidifies at a temperature of 953° C., contains 1·96 per cent. of carbon, 6·89 of phosphorus, and 91·15 of iron. All the alloys behave (in regard to the phenomena of freezing) as though formed of the three components iron, iron carbide, Fe_3C, and iron phosphide, Fe_3P. The different structural constituents which are found on metallographic examination of the alloys are: Mixed crystals of the three components just mentioned ("Tannenbaumkristalle"); cementite (or sometimes graphite); iron phosphide; the three binary eutectics mixed crystals and iron phosphide, mixed crystals and cementite, cementite and iron phosphide (or graphite and iron phosphide); and the ternary eutectic, cementite, iron phosphide, mixed crystals. Numerical data, cooling curves, and photomicrographs are given in the paper.—J. T. D.

Silver extraction at silver mines in Mexico. A. E. J. Bordeaux. Amer. Inst. Mining Engineers. Chattanooga Meeting. Mining World, Chicago, Oct. 10, 1908.

THESE silver mines include deposits of three principal classes:—(1), Veins and "stock works" in eruptive rocks; (2), fissure veins crossing the crystalline schists, granite, diorite, etc., and (3), veins and replacement deposits in limestone. The true fissure veins in some districts contain, as regards value, more gold than silver. In other deposits, the silver is decreasing in depth, leaving galena and zinc blende as the principal ores. As to treatment, the old patio process with certain modern improvements, was still in use at Pachuca. But it is being replaced by the cyanide process, which having been applied to gold ores for the last 15 years, is now made available for the treatment of silver ores. The essential difference in the two cases (gold and silver), is that the gold is usually free, whereas the silver is combined with sulphur, arsenic, and antimony, and requires preliminary treatment, by means of a so-called "reduction process." This reduction is partly effected by fine crushing in tube mills, partly by agitation with compressed air by means of centrifugal pumps, etc., or by simple mechanical means. In the second stage of the process, agitation being continued, either iron or zinc is added, or lead acetate, and then potassium or sodium cyanide. The leaching power of the cyanide is increased by the presence of another metal (such as those mentioned), which tends to replace the silver in its combinations, thus permitting of its solution by the cyanide. Compressed air proves to be a powerful auxiliary agent, and the continued agitation is chiefly necessary for breaking up the clay balls of slimes, so as to bring the ore into more direct contact with the cyanide. The old patio (amalgamation) process gave an output of 95 per cent. of the silver and 84 per cent. of the gold in the ore. The cyanide treatment extracts from 90 to 98 per cent. of the gold, and as regards silver, the results, different for different kinds of ores, run from 50 to 80 per cent.—in some cases to 85 per cent. The entire process of concentration and cyaniding, yields from 70 to 90 per cent.

Silver cyaniding in Mexico. J. B. Empson. Eng. and Min. J., 1908, **86**, 667—668.

Instead of the 14 to 21 days' cyanide treatment, common in Mexico, it has been found that, on clean silver sulphide ores, a 93 to 97 per cent. extraction can be effected in 3 to 4 days by finely grinding the ore, and thoroughly agitating and aërating the pulp in the cyanide solution, by means of a Brown (or Pachuca) air lift agitation tank. The ore is ground so that all will pass a 150-mesh screen and 85 per cent. will pass a 200-mesh screen; it is then mixed with double its weight of cyanide solution and agitated and aërated in a Pachuca tank. The tank is cylindrical, of a height three times the diameter, and terminates below in a cone, the sides of which have an inclination of 60°. In the centre of the tank, from the top nearly to the bottom, is the air-lift tube, into the lower end of which compressed air is injected, causing an upward motion of the pulp. At the beginning of the agitation, a pressure of 50 to 60 lb. per sq. in. is required for a tank 45 ft. by 15 ft., but half the pressure is sufficient to maintain the agitation when once it has been well started. The pulp is finally filter-pressed and the precious metals precipitated from the solution by means of zinc, or, as the author prefers, electrolytically. A test was made on 100 kilos. of clean silver sulphide ore containing 345 oz. of silver and 1½ oz. of gold to the ton, portions of the solution being tested periodically. At the end of 6 hours, an extraction of 88·8 per cent. both of silver and gold had been obtained. This proved to be practically the maximum extraction for the gold. In 18 hours, the silver extraction was 94·7 per cent., in 36 hours 96·6, and in 48 hours, 96·9 per cent. The strength of the cyanide solution used was 0·38 per cent. and the loss during treatment only amounted to 2 lb. of potassium cyanide per ton of ore. 30 grms. of lead acetate, for the decomposition of the alkali sulphides, were used in this test, representing about 0·6 lb. per ton of ore.—F. R.

Sulphocyanides and ferrocyanides, etc., in cyanide solutions containing copper; Determination of ——. L. M. Green. *See* XXIII.

Bronze with remarkable properties. M. Escher. Metallurgie, 1908, 5, 567.

The author gives a description of "Parsons' manganese-bronze," which is largely used for the blades of turbines and centrifugal pumps, or other purposes where resistance to sea water or to water containing sand is necessary. Its percentage composition is—copper 58, zinc 38·5, tin 1, aluminium 1, iron 1, manganese 0·5. The copper and manganese (as mangan-copper) are melted together, and the iron added as fine filings or drillings. If no mangan-copper is available, ferromanganese may be added, with the iron, to the melted copper. The other metals are now added, and the metal is cast. The iron and ferromanganese will at a red heat readily alloy with tin, and this alloy, cast into blocks, can then be added to the melted copper. The alloy has a high tensile strength, is practically unacted on by 10 per cent. hydrochloric acid, and is very resistant to the friction of sand. Under similar circumstances of exposure (50 hours, 1 sq. dm. surface) to a sandblast, this metal lost less by abrasion than any other. A bronze containing 86 per cent. of copper and 14 per cent. of tin lost 55 per cent., one with 88 of copper and 12 of tin lost 26, cast iron 64, and steel sheet 79 per cent. more than the manganese bronze.—J. T. D.

Alloys of copper with cobalt, iron, manganese, and magnesium. R. Sahmen. Z. anorg. Chem., 1908, **57**, 1—33. Chem. Zentr., 1908, **1**, 805—806.

Cobalt-copper.—The metals are miscible in all proportions and form two series of mixed crystals, with 0—10 per cent. and 95·5—100 per cent. of copper, and with a corresponding hardness of 4 and 3, respectively. The transformation point of the non-magnetic β-cobalt into the magnetic α-cobalt is lowered from 1115° C. to 1050° C. by the addition of 10 per cent. of copper, and falls further as the percentage of copper is increased; the alloy with 99·5 per cent. of copper has no magnetic properties. The polished alloys first exhibit a reddish colour with 40 per cent. of copper.

Iron-copper.—The thermal diagram very much resembles that for the system, cobalt-copper. There is a break in the series of mixed crystals between 3·5 and 97·25 per cent. of copper; transformation of the saturated mixed crystal takes place at 1100° C. The transformation temperature of γ- to β-iron is lowered by 3 per cent. of copper to about 720° C., if the alloy be cooled immediately after melting; the transformation temperature between β- and α-iron is not influenced by copper. α-Iron forms no mixed crystals with copper. The polished surface of the alloy with 50 per cent. of iron is faintly red. *Manganese-copper.*—These metals form a continuous series of non-magnetic mixed crystals, with a melting point minimum at 866° C. and about 65 per cent. of copper. Micrographic examination shows that the alloys may be rendered homogeneous by prolonged heating at 800°—1050° C. The colour of the alloy with 80 per cent. of copper is grey, and that with 95 per cent. of copper is brass-yellow. The hardness of the alloy with 2 per cent. of copper is 6—7; with more than 40 per cent. of copper, it is below 3. The molten alloys rich in manganese attack porcelain. *Magnesium-copper.*—The metals are miscible in all proportions in the molten state and form two compounds, Cu_2Mg, m.pt. 797°, and $CuMg_2$, m.pt. 570° C. These compounds are both very brittle and resemble magnesium in colour. The compound, CuMg (Boudouard, this J., 1902, 1456), does not exist. Porcelain is strongly attacked by these alloys.—F. Sodn.

Alloys of nickel with tin, lead, thallium, bismuth, chromium, magnesium, zinc, and cadmium. G. Voss. Z. anorg. Chem., 1908, **57**, 34—71. Chem. Zentr., 1908, **1**, 806—808.

Nickel-tin.—Nickel forms a series of mixed crystals with tin up to 15 per cent. of the latter. The molten metals are not miscible for the intervals, 3·5—18 per cent. and 26—45 per cent. of nickel. The compounds, Ni_3Sn_2, Ni_3Sn, and probably Ni_4Sn, are formed. Down to a content of about 60 per cent. of nickel, the alloys are magnetic. *Nickel-lead.*—These metals are not completely miscible and form no compounds. A series of mixed crystals, containing up to 4 per cent. of lead, are formed. *Nickel-thallium.*—The metals resemble nickel and lead in their behaviour; mixed crystals are formed up to 3 per cent. of thallium. The alloys with 0—3 per cent. of thallium are silver-white and oxidise less readily than nickel. *Nickel-bismuth.*—The metals form mixed crystals only up to 0·5 per cent. of bismuth. They also form the compound, NiBi, and another compound, neither of which are magnetic. *Nickel-chromium.*—The two metals form an almost continuous series of mixed crystals. 10 per cent. of chromium renders the alloys non-magnetic. Magnesia vessels were used in the preparation of these alloys. *Nickel-magnesium.*—Two compounds are formed, Ni_2Mg (reddish leaflets), m.pt. 1145° C., and $NiMg_2$, which is non-magnetic. *Nickel-zinc.*—These alloys were only investigated up to 21 per cent. of nickel.

A non-magnetic compound, $NiZn_3$, m.pt. about 857° C., is formed. *Nickel-cadmium.*—The alloys were examined up to 15 per cent. of nickel; they are non-magnetic. A compound, probably $NiCd_4$, is formed. The temperature of magnetic transformation of nickel is lowered in each of the above systems as the percentage of the second metal increases, except in the system, Ni—Pb, where the reverse is true.—F. SODN.

Chromium and manganese alloys; Some ——. G. Hindrichs. Z. anorg. Chem., 1908, **59**, 414—449. Chem. Zentr., 1908, **2**, 1241—1242.

Tin-chromium alloys. The two metals are not miscible between the limits 0—87 per cent. of chromium at 1420° C. Mixed crystals containing from 0—5 per cent. of tin are produced. The melting point of chromium (1550° C.) is depressed to 1420° C. by the presence of 13 per cent. of tin, but chromium has no appreciable effect on the melting point of tin. *Copper* and *chromium* appear to be miscible only outside the limits 2—98 per cent. of chromium. 0·5 per cent. of chromium depresses the melting point of copper by about 8° C., whilst the melting point of chromium falls by about 80° C. in presence of a small proportion of copper. *Silver* and *chromium* are not miscible within the limits, less than 25 per cent. to about 92 per cent. of chromium. 8 per cent. of silver depresses the melting point of chromium to about 1464° C. *Zinc* and *cadmium* give with *chromium* no homogeneous alloys. *Lead* and *chromium* are miscible only outside the limits 10 to 73 per cent. of chromium. The melting point of chromium is depressed to about 1470° C. in presence of 27 per cent. of lead. *Aluminium* and *chromium* form a compound, probably $AlCr_3$, of high melting point; alloys containing 96 and 85·7 per cent. respectively of chromium melted above 1900° C. The compound forms mixed crystals with chromium, but is not miscible with aluminium within the limits, less than 5 to 55 per cent. of chromium. The melting point of aluminium is reduced by about 19° C. by addition of less than 5 per cent. of chromium. The alloys containing up to 70 per cent. of chromium are not stable in the air, the lower layer, rich in chromium, falling to a grey crystalline powder after a few days. *Manganese* and *silver* are not miscible within the limits, less than 2 to 87 per cent. of manganese. The melting point of manganese (1207° C. for the metal used) is reduced to 1145° C. by 12 per cent. of silver, and that of silver is depressed to 945° C. by less than 2 per cent. of manganese. *Aluminium* and *manganese* form two compounds, probably $MnAl_3$ and Mn_3Al. According to Heusler, alloys containing manganese and aluminium in atomic proportions are strongly magnetic. The author finds that the alloys containing from 25 to 100 per cent. of aluminium are non-magnetic; as the content of aluminium falls below 25 per cent., the alloys show slight magnetic susceptibility, increasing to a maximum in the alloy containing 15 per cent. of aluminium, and then falling again, the alloy containing 10 per cent. of aluminium being non-magnetic.—A. S.

Alloys of aluminium with copper, iron, nickel, cobalt, lead, and cadmium. A. G. C. Gwyer. Z. anorg. Chem., 1908, **57**, 113—153. Chem. Zentr., 1908, **1**, 1033—1035.

Copper-aluminium. The liquid metals are miscible in all proportions and form three compounds, Cu_3Al, m.pt. 1050° C., CuAl, and $CuAl_2$. Two series of mixed crystals, from 0—4 per cent. and from 91·5—100 per cent. of copper, are obtained. The supposed compound, Cu_4Al (Carpenter and Edwards, this J., 1907, 206) does not exist, but corresponds to the saturated mixed crystal with 91·5 per cent. of copper. The alloys containing 87—73 per cent. of copper may be rendered homogeneous by heating at 600° C. *Iron-aluminium.* γ-Iron forms with aluminium mixed crystals containing 100—66 per cent. of iron; with 30 per cent. of aluminium the magnetic property disappears The metals form a compound, $FeAl_3$, m.pt. 1444° C., and a second series of mixed crystals, containing 40·8—47·5 per cent. of iron. *Nickel-aluminium.* At 1300° C. the metals frequently act on each other with explosive violence. They form three compounds, NiAl, m.pt. 1640° C., $NiAl_2$, and $NiAl_3$. As the nickel content falls from 100 to 85 per cent., both the magnetic permeability and the temperature of magnetic transformation decrease. *Cobalt-aluminium.* The metals form three compounds, CoAl, m.pt. 1628° C., Co_2Al_5, and Co_3Al_{13}. With rising aluminium content, the alloys become less magnetic in a marked degree; the temperature of magnetic transformation falls from 1130° C. with 100 per cent. of cobalt to 790° C. with 85 per cent. For the preparation of some of these alloys, as also for some of the nickel and iron alloys, vessels of magnesia, in place of porcelain, were used. *Lead-aluminium. Cadmium-aluminium.* No miscibility in either solid or liquid state was observed in these systems.
—F. SODN.

Alloys of calcium with zinc, cadmium, aluminium, thallium, lead, tin, bismuth, antimony, and copper. L. Donski. Z. anorg. Chem., 1908, **57**, 185—219. Chem. Zentr., 1908, **1**, 1035—1038.

MANY of the alloys, rich in calcium, were prepared by melting the metals together *in vacuo* (10—12 mm.) in a porcelain tube protected by asbestos; molten calcium attacks Jena glass strongly. *Calcium-zinc.* These metals form five compounds, $CaZn_{10}$, m.pt. 717° C., $CaZn_4$, m.pt. about 677° C., Ca_2Zn_3, m.pt. 688° C., CaZn (probably), and Ca_4Zn. The alloys with 0—6 per cent. of calcium, have the colour of zinc and are a little harder than this metal; they are fairly inert towards air and water. Those containing 6—19 per cent. of calcium, tarnish rather quickly, and with 20—29 per cent. of calcium, they decompose water readily and, in common with the alloys richer in this metal, fall to a black powder on exposure even to dry air. Brittleness reaches a maximum at 30 per cent. of calcium. *Calcium-cadmium.* The liquid metals do not mix in all proportions; at 685° C. the compound, β-CaCd, is formed from the two layers of metal, and this is transformed into α-CaCd at 635° C. in contact with the denser layer, rich in calcium. The metals also form the compound, $CaCd_3$, m.pt. 615° C., and another, probably Ca_3Cd. Up to a content of 10 per cent. of calcium, the alloys are unaffected by air or water; their hardness is somewhat greater than that of cadmium. Those containing 10—26 per cent. of calcium tarnish in the air and decompose cold water, and the alloys with 30 per cent., or more, of calcium, fall to a black powder. Brittleness increases as the content of calcium rises from 10 to 40 per cent. *Calcium-aluminium.* The metals, as liquids, do not mix in all proportions; from the two layers at about 692° C. the compound, $CaAl_3$, is formed. The alloys containing 0—8 per cent. of calcium have the colour of aluminium and are somewhat harder than this metal; they are not affected by air. but decompose hot water. Those with 20—50 per cent. of calcium are porous and brittle; they tarnish in the air and decompose cold water. A higher percentage of calcium renders the alloys unstable in the air and less brittle. *Calcium-thallium.* Only alloys containing 0—15 per cent. of calcium have been investigated. The compounds, TlCa and Tl_3Ca, are formed. The two metals form mixed crystals, but the saturated mixed crystal contains less than 2 per cent. of calcium. The alloys are harder than thallium, and brittle; they also tarnish more readily. Those containing less than 6 per cent. of calcium decompose water only when hot. *Calcium-lead.* The alloys containing 0—12 per cent. of calcium were investigated. Calcium dissolves in molten lead with the production of sparks; the metals form the compound, Pb_3Ca. Up to a calcium content of 4 per cent., the alloys are harder than lead and not brittle; those containing above 6 per cent. decompose water, and with more than 10 per cent. they fall to a black powder on exposure. *Calcium-tin.* Calcium dissolves in molten tin with the evolution of much heat. Only the alloys up to 18 per cent. of calcium were examined. The metals form the compound, $CaSn_3$. The alloys containing more than 2 per cent. of calcium attack cold water; those with 4 per cent. are harder than tin and fairly tough: a higher percentage of calcium renders them brittle. *Calcium-bismuth.* A compound, of unknown composition, is formed between these metals; it decomposes water. and falls to a black powder on exposure. Calcium dissolves in molten bismuth at 700° C. with some violence, sparks being produced. *Calcium-antimony.* At 700° C. calcium unites explosively with antimony. As far as investigated (0—9·1 per cent. of calcium), one compound, of unknown composition, is formed. The alloy with 9 per cent. of calcium is as brittle as antimony and very porous; it decomposes hot water slowly. Those containing a smaller proportion of calcium are less brittle. *Calcium-copper.* One per cent. of calcium reduces the melting point of copper by 8° C. and the resulting alloy decomposes cold water; 5 per cent. of calcium causes a depression of 74° C. in the melting point, and at 920° C. an eutectic point is reached.—F. Sodn.

Mineral Production of the United Kingdom. Home Office, Sept. 28th, 1908. Cd. 4343. [T.R.]

Description of mineral.	1906.		1907.	
	Quantity.	Value.	Quantity.	Value.
	Tons.	£	Tons.	£
Alum shale	9,454	1,978	9,905	1,692
Arsenical pyrites	640	952	1,772	2,990
Arsenic	1,599	22,313	1,499	35,829
Barium (compounds)	35,745	35,282	41,974	38,440
Bauxite	6,654	2,728	7,537	1,884
Bog ore	5,425	1,356	6,290	1,573
Chalk	4,749,310	203,224	4,779,387	200,882
Chert and flint	68,209	14,803	53,664	12,705
Clay and shale	15,291,352	1,768,023	14,827,895	1,850,387
Coal	251,067,628	91,529,266	267,830,962	120,527,378
Copper ore	7,478	26,466	6,525	21,253
Copper precipitate	280	12,800	267	12,665
Diatomite	—	—	150	450
Fluorspar	41,849	20,023	49,462	23,311
Gold ore	17,384	5,343	12,978	5,625
Gravel and sand	2,366,985	117,996	2,400,392	183,625
Gypsum	225,027	74,563	235,517	88,629
Igneous rocks	6,165,750	1,223,611	5,674,470	1,158,951
Iron ore	15,500,406	4,085,428	15,731,604	4,433,418
Iron pyrites	11,140	4,953	10,194	4,489
Lead ore	30,795	341,405	32,533	419,247
Limestone	12,758,588	1,368,375	12,509,142	1,323,624
Manganese	22,762	22,983	16,098	16,516
Mica	11,384	4,530	14,615	5,074
Ochre, umber	14,210	14,641	14,692	14,408
Oil shale	2,546,522	657,928	2,690,028	806,323
Petroleum	10	15	—	—
Phosphate of lime	—	—	32	46
Salt	1,965,151	595,984	1,984,656	648,596
Sandstone	5,261,150	1,504,889	5,012,053	1,397,285
Silver ore	cwts. 12	42	4	348
Slate	492,663	1,232,321	443,554	1,178,609
Sulphate of strontia	14,112	13,758	10,745	8,059
Tin ore (dressed)	7,153	713,184	7,080	706,700
Uranium ore	11	no information	71	6,500
Wolfram ore	271	19,775	322	41,044
Zinc ore	22,824	142,054	20,082	100,533
Total values	—	£105,842,992	—	£135,279,088

Metals obtainable by smelting from ores in mineral production of United Kingdom. Home Office, Sept. 28, 1908. Cd. 4343. [T.R.]

Description of metal.		1906.		1907.	
		Quantity.	Value.	Quantity.	Value.
			£		£
Aluminium		Information not supplied.	Information not supplied.	Information not supplied.	Information not supplied.
Copper	tons	749	69,385	666	62,673
Gold (bar)	oz.	1,871	6,569	1,911	6,228
Iron	tons	5,040,360	17,623,966	5,126,949	19,004,413
Lead	tons	22,335	392,445	24,460	479,722
Silver	oz.	148,341	19,083	153,684	19,331
Tin	tons	4,522	819,377	4,407	769,438
Zinc	tons	8,539	235,819	7,600	186,612
Total values		—	£19,166,644	—	£20,528,417

Nickel matte; Constitution of ——. K. Bornemann. Metallurgie, 1908, **5**, 61—68.

The author has investigated by thermal and microscopic methods the properties of a series of mixtures of iron sulphide (FeS) with each of two sulphides of nickel, Ni_3S_2 and Ni_2S. The sulphide, Ni_3S_2, is a well defined compound, and is the only compound of nickel and sulphur which exists in the molten state. The compound, Ni_2S, has no existence by itself, but exists in presence of iron sulphide. The system, FeS and Ni_3S_2, is considered first. Pure iron sulphide melts at 1194° C. As the sulphide, Ni_3S_2, is added to it, the melting-point falls steadily until 880° C. is reached; at this point the proportion by weight of the nickel sulphide is 57·7 per cent. There is here a change in the direction and form of the melting-point curve, and the existence of the compound, $(FeS)_2Ni_3S_2$, is considered probable. In all mixtures up to this point there is a (second) retardation point in the cooling curve at 880° C., where a eutectic of FeS and $(FeS)_2,Ni_3S_2$ separates. If further amounts of Ni_3S_2 be added, the melting point falls until the melting point of pure Ni_3S_2 (788° C.) is reached. Along this line an unbroken series of mixed crystals separate. In the system, FeS and Ni_2S, the melting point of the nickel sulphide is 645° C., and the curve has a eutectic point at 872° C., when 44 per cent. of the sulphide, Ni_2S, are present. There is a maximum on the curve at 46 per cent. of nickel sulphide, Ni_2S, (886° C.), indicating the existence of a compound, $(FeS)_2,Ni_2S$. Between 46 per cent. and 100 per cent. of nickel sulphide, Ni_2S, the melting-point curve shows a formation of mixed crystals, with a break in the curve at 67 per cent. of nickel sulphide, Ni_2S. In both these series, the observations drawn from the melting-point curve have been supported by microscopical examination. It may be assumed that in nickel matte, the nickel does not occur as the sulphide, NiS. In mattes poor in iron, the nickel is present as the sulphide, Ni_3S_2. In mattes rich in iron, the nickel also occurs as the sulphide, Ni_3S_2, if there is sufficient sulphur present; if there is not, it may occur as the sulphide, Ni_2S.—C. E. F.

Element [*metal*) *allied to molybdenum; New* ——. M. Ogawa. J. Coll. Science, Imp. Univ., Tokyo, 1908, 25, Article 16.

In addition to nipponium (this J., 1908, 753), the author has discovered another new metal in molybdenite and thorianite. Powdered molybdenite was ignited in oxygen, extracted with ammonia, the residue heated repeatedly with concentrated nitric acid, the whole evaporated to dryness, and again extracted with ammonia. The final residue was digested with ammonium sulphide solution, and the reddish-brown solution filtered, acidified with hydrochloric acid and heated. The dark brown precipitate thus obtained was decomposed with nitric acid, the solution evaporated, and the yellowish-brown syrupy residue ignited in the air. The product was fused with potassium nitrate, extracted with water, and the solution filtered from ferric oxide, neutralised with nitric acid, concentrated, mixed with an equal volume of a saturated solution of ammonium chloride, and a quantity of 90 per cent. alcohol equal to one-third of the total volume added. After standing for some time, the crystalline precipitate was separated and washed first with ammonium chloride solution and then with dilute alcohol. It consisted of the ammonium salt of the acid of the new element, contaminated with molybdenum, the yield being about 7 grms. from 400 grms. of molybdenite. In order to obtain a product free from molybdenum, a solution of the ammonium salt was electrolysed at 60°—70° C., with a current of 1 amp. per 100 sq. cm. at 4 volts. A black substance, containing molybdenum was deposited on the cathode. This was heated repeatedly with 2-*N* hydrochloric acid, which dissolved the molybdenum compound (probably hydrated sesquioxide). The residue, probably the hydrated lower oxide of the new element, was boiled with nitric acid, and the whole evaporated to dryness and extracted with ammonia. The ammonium salt obtained by evaporation of the solution was soluble in water. The solution when treated with hydrogen sulphide in presence of hydrochloric acid, gave a brown coloration, and on heating, a dark brown precipitate, the filtrate from which was colourless (distinction from a molybdate, which gives a blue solution). The barium, lead, and silver salts, prepared from the ammonium salt, resembled the corresponding molybdates, but the mercurous salt formed golden-yellow crystals. When the solution of the ammonium salt was rendered strongly acid with nitric acid, and sodium phosphate added, a compound similar to ammonium phosphomolybdate was obtained. The oxide obtained by electrolysis had a graphitic appearance, and when heated in a current of hydrogen, yielded the new element; this had a metallic lustre and somewhat resembled magnesium powder. It burned readily in the air, and the resulting oxide when again reduced with hydrogen, yielded the metal in the form of a gray powder resembling molybdenum. The metal was non-fusible at a red heat. It was soluble with difficulty in concentrated hydrochloric acid; the chloride was soluble in water. The element differs from molybdenum in producing no colour reactions when a soluble salt of its higher oxide is reduced with zinc and hydrochloric acid, either in the presence or absence of potassium thiocyanate. The equivalent weight of the new element is 16·7. It is also present in thorianite, and is probably identical with the "new tin-group element" described by Evans (Chem. Soc. Trans., 1908, **93**, 666). The author has also found that interspersed in thorianite are small, translucent, yellow to red, prismatic crystals, consisting of a double silicate of zirconium and nipponium, which form a rich raw material for the preparation of the latter metal. In addition to nipponium and the new metal described above, thorianite appears to contain another new element, the oxide of which is radioactive and dissolves in nitric acid to form a bluish-green solution.—A. S.

Patents.

Steel; Manufacture of alloys of ——. J. R. Crawford, Bushey. Eng. Pat. 21,355, Sept. 26, 1907.

Metallic calcium is added to molten steel with the special view of obtaining a tough and strong alloy. In order to ensure accuracy of composition, the calcium may be added in the form of ferro-calcium just before pouring the metal. A steel containing 2 per cent. of calcium appears to be the most useful alloy for general purposes. —J. W. H.

Flue dust, pulverised or finely divided ores or other materials containing iron, etc.; Consolidating —— *into lumps for the manufacture of iron or steel.* W. Thomlinson, Seaton Carew, Durham. Eng. Pat. 21,428, Sept. 27, 1907.

Flue dust, finely divided ores, etc., are handled in large masses instead of being briquetted. The material after grinding or mixing is carried direct to open-topped kilns. These kilns form large moulds and are subdivided by division boards which support movable cores of wood or other material. The cores are withdrawn after each subdivision of the kiln is filled, and form air spaces and channels by means of which the mass is readily burnt. After burning, the blocks of material are removed in bulk. These blocks readily break up into lumps on account of the perforations formed by the cores.—J. W. H.

Armour plates; Manufacture of ——. S. S. Wales, Munhall, Pa., U.S.A. Eng. Pat. 9380, April 30, 1908. Under Int. Conv., Nov. 11, 1907.

The face of the plate to be hardened is heated to about 950° C., whilst a cooling medium is sprayed upon the back. On quenching, the face of the plate is hardened, while the structure of the metal in the body and back of the plate is unaffected.—J. W. H.

Steel; Method of manufacturing ——. J. W. Maxwell, Williamsport, Pa. U.S. Pat. 900,564, Oct. 6, 1908.

An open-hearth furnace is charged with pig-iron and a calcareous material such as lime or limestone; on this mixture is placed a layer of carbonaceous material covered with scrap iron or steel, so as to bring these materials into intimate contact, and yet to protect the carbonaceous material from oxidation. The charge is smelted and refined as usual.—A. G. L.

Aluminium and alloys thereof; Soldering ——. F. M. Mrazsek. Eng. Pat. 13,689, June 13, 1907.

The solder consists of an alloy of tin, zinc, aluminium, and silver in which the proportion of tin exceeds that of the zinc, that of the zinc exceeds that of the aluminium, and that of the aluminium exceeds that of the silver. For example, it may consist of 120—170 parts of tin, 30—60 parts of zinc, 2—10 parts of aluminium, and 0·5—5 parts of silver. The cleaned surfaces to be joined are heated to a temperature that does not much, if at all exceed that of the solder. The solder is then melted on the aluminium, and the melted solder rubbed by a soldering bit or wire brush until the layer of solder is uniform and the dark film on it has been removed. The surfaces are finally united by pressure.—O. F. H.

Flux; Manufacture of soldering ——. Ges.m.b.H. Classen und Co., Berlin. Eng. Pat. 11,605, May 28, 1908. Under Int. Conv., June 27, 1907.

The flux is made by heating together and thoroughly mixing substances containing fatty acids, such as stearine, zinc chloride, and resins, such as colophony, together with a suitable binding agent, such as ceresin. The flux may if necessary be mixed with a diluent, such as vaseline.
—O. F. H.

Furnaces; Regenerative —— *for heating or melting metals.* B. J. Hammersley, Tipton, Staffs., and J. McChesney, Glasgow. Eng. Pat. 23,323, Oct. 22, 1907.

The furnace can be arranged either for heating steel bars, when the axis is made horizontal, or as a crucible furnace. In the first case the front and back ends of the cylindrical interior are left open so that the bars to be heated can be passed right through. The portion of the furnace, immediately behind the front plate is enlarged in diameter, forming a heating chamber. Tangentially to this chamber, inlet openings containing blowpipe nozzles are arranged, so that by injecting a suitable gaseous mixture through these, an annular flame is obtained which plays around the article to be heated. Moreover, the gases being delivered under pressure, a continuous out-draught is caused at the front and back of the furnace, thus preventing the entry of air. Before delivery into the blowpipes, the gas and the air (or, when oil is used, the air alone) are caused to pass through zig-zag passages in a regenerative box where they are heated by the waste gases from the back of the furnace. The crucible furnace is of similar type, the flame being made to play in a whirling ring around the crucible.—C. A. W.

Crucible furnaces. C. and J. Debus, Hoechst on Maine, Germany. Eng. Pat. 5506, Mar. 11, 1908.

The furnace cover has a central hole of such dimensions as to form a preliminary heating chamber. Knee-shaped channels in this cover direct the gases from the combustion chamber surrounding the crucible into the mouth of the crucible itself. To render these knee-shaped channels effective during the preliminary heating, means are provided for raising the crucible so as to bring its mouth into close contact with the cover of the furnace.—J. W. H.

Blast-furnace. J. H. Meissner, Pittsburg, Pa. U.S. Pat. 900,291, Oct. 6, 1908.

Above the hearth of the furnace are arranged a number of independent sections, one of these being movable and capable of being rotated or subjected to an oscillatory motion. Water-boxes are provided for cooling the joints between the movable section and those which are fixed, and, by the application of air pressure to the exterior at these parts, the outflow of fluid from the furnace is prevented.—C. A. W.

Zinc and other furnaces; Means of protecting the operatives of —— *from heat, fumes, and dust.* E. Dor-Delattre, Dorplein, Holland. Eng. Pat. 15,288, July 20, 1908. Under Int. Conv., Sept. 7, 1907.

A movable screen, which can be raised or lowered by means of a hydraulic ram, is arranged in front of the retort openings of the furnace. The screen itself is made up of a number of independent panels which can either slide in vertical guides, or, by means of pegs and holes, be fixed to the framework of the furnace. Thus, by raising the screen a certain distance, securing the top panel, and lowering the remainder, any row of retorts can be left uncovered. The panels are formed of a treble thickness of sheet iron; between the first and the second plates a hard layer of asbestos is interposed, whilst an air space is provided between the second and third.—C. A. W.

Zinc oxide; Treating ——. F. P. Dewey, Washington, D.C. U.S. Pat. 900,088, Oct. 6, 1908.

Ores containing sulphides of zinc and other metals are roasted in an oxidising atmosphere, and the roasted material is introduced into water containing sulphurous acid, the latter being maintained in excess, whereby the oxide of zinc is dissolved, and separated from the other oxides.—W. C. H.

Ores; Apparatus for roasting and briquetting ——. C. F. Buck, New York, Assignor to A. Heckscher, Huntington, N.Y. U.S. Pat. 899,507, Sept. 29, 1908.

The apparatus consists of a rotating air drum provided with spaced flanges, the lower one of which forms a table for the ore. Means are provided to deflect the partly roasted ore outwardly, to charge raw ore between the centre of the drum and the partly roasted ore, and to discharge the completely roasted ore.—A. G. L.

Mineral values; Apparatus for recovering ——. J. W. Boardman, Josephine, Mont., Assignor to L. E. Phillips and M. French, Harlem, Mont. U.S. Pat. 899,710, Sept. 29, 1908.

The apparatus comprises a series of superposed separating tanks communicating with one another; means for feeding finely-divided ore particles into the highest tank; an exterior bowl into which the lowest tank discharges; means for discharging the heavier constituents of the contents of the bowl; an outlet pipe connecting a discharge pipe placed above the bowl with the bowl itself, allowing the lighter constituents to pass into a tank placed above the bowl; a shoot communicating with this tank, and means for automatically discharging the contents of the shoot from time to time; and a separate spray-box placed within each tank and in the bowl to agitate their contents. This spray-box consists of a metal box having a perforated metal top, over which is placed a cloth cover secured to the box by an internally threaded collar; water is supplied to the interior of the box by means of a pipe.—A. G. L.

Steels; Heat treatment and quenching of alloyed ——. J. Churchward, New York. U.S. Pat. 899,713, Sept. 29, 1908.

The metal is subjected to a series of "heat-waves" of successively decreasing maximum temperature, the first "heat-wave" being carried to a temperature within 100° F. of the segregation or retardation point of the alloyed metal having the highest retardation point, and each successive "heat-wave" being carried to within 100° F. of the retardation point of another of the alloying metals. The metal is quenched after each successive "heat-wave."—A. G. L.

Copper matte; Method of bessemerising ——. G. H. Benjamin, New York. U.S. Pat. 900,345, Oct. 6, 1908.

The matte is subjected to the action of an oxidising gas (air) under pressure, in a converter having a suitable lining. The iron and sulphur having been oxidised and the resulting slag removed, a reducing gas, under pressure and capable of giving a high temperature when ignited, is passed over the residual product.—C. A. W.

Copper ores; Method of smelting ——. G. H. Benjamin, New York. U.S. Pat. 900,346, Oct. 6, 1908.

The ore having been desulphurised by ignition is subjected to the action of an oxidising blast so that its iron and copper contents are completely oxidised. The product is then allowed to react at a high temperature with an ignited reducing gas delivered under pressure. The two processes, oxidation of the ignited ore and reduction of the oxidised product may take place within the same furnace structure.—C. A. W.

Ores; Method of smelting —— *and method of recovering values from flue-dust and fines.* R. Baggaley, Pittsburg, Pa. U.S. Pats. 900,466 and 900,467, Oct. 6, 1908.

(1). To a molten bath "high in fuel values" (*i.e.*, molten matte), silicious ores of valuable metals are added, for the purpose of fluxing the iron contained in the bath. The process, once started, is carried on solely by the heat produced by the oxidation of the ore constituents, without the addition of carbonaceous fuel. During the process the area of the escape-opening of the vessel in which the process is carried out is varied "conformably to the heat requirements of the bath, whereby the heat may be kept to a maximum, and yet without materially increasing the pressure within the vessel." (2). Flue-dust or "fines" are mixed with molten low-grade matte to the extent to which the matte will absorb the dust without solidifying. The still molten mixture is placed in a converter and bessemerised, silicious ores being added to remove iron. —A. G. L.

Ores ; Treatment of —— for the extraction of metals therefrom. H. Rosalt, Paris. Eng. Pat. 25,357, Nov. 15, 1907.

See Fr. Pat. 381,642 of 1906 ; this J., 1908, 231.—T. F. B.

Aluminium ; Process for the production of ——. E. A. O. Viel, Paris. Eng. Pat. 24,612, Nov. 6, 1907.

See Fr. Pat. 380,087 of 1907 ; this J., 1907, 1285.—T. F. B.

Aluminium solder. T. J. and R. Wibrin, Chaudefontaine, Belgium. U.S. Pat. 900,810, Oct. 13, 1908.

See Fr. Pat. 380,952 of 1907 ; this J., 1908, 128.—T. F. B.

Puddling furnaces. J. P. Roe, Pottstown, Pa., U.S.A. Eng. Pat. 5413, March 10, 1908.

See Fr. Pat. 388,018 of 1908 ; this J., 1908, 862.—T. F. B.

Iron ; Method of protecting ——. J. J. Bradley, Assignor to L. von Gessner, Brooklyn. U.S. Pat. 900,656, Oct. 6, 1908.

See Fr. Pat. 389,289 of 1908 ; this J., 1908, 985.—T. F. B.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(*A*.)—ELECTRO-CHEMISTRY.

Calcium and sodium amalgams as electrodes in solutions of neutral salts ; Behaviour of ——. H. G. Byers. J. Amer. Chem. Soc., 1908, 30, 1584—1586.

In determining the E.M.F. of cells in which calcium amalgam was used as one of the electrodes, it was observed that whilst normal values are obtained if the amalgam be in contact with solutions of pure calcium chloride, such is not the case if solutions of other alkali or alkaline-earth salts be added to the calcium chloride solutions. Similarly, normal values of E.M.F. are obtained with sodium amalgam in contact with pure solutions of sodium chloride, but not if other alkali or alkaline-earth salt solutions be added. These results indicate that replacement by the metal of the added salt occurs. This conclusion was shown to be correct by shaking calcium amalgam with barium chloride, washing the amalgam thoroughly, and digesting it with hydrochloric acid ; the solution was found to contain barium.—L. E.

Nitric oxide formation in high-tension arcs. F. Haber and A. Koenig. Z. Elektrochem., 1908, 14, 689—695. (See also this J., 1908, 27.)

The authors have extended their experiments on the formation of nitric oxide from mixtures of oxygen and nitrogen in a water-cooled tube, under the influence of the electric arc and diminished pressure. By subjecting nitric oxide to this treatment, the same state of equilibrium is reached, under like conditions, as by starting with a mixture of nitrogen and oxygen in equal volumes, and this at a temperature shown, by special measurements, to be not many hundred degrees above the melting point of platinum. At such temperatures the rate of the thermal decomposition of nitric oxide is relatively slow, and the authors claim to have proved that the high content of nitric oxide obtained (under the best conditions, 14·5 per cent., or 10 per cent. with air) represents a state of electrical, rather than thermal equilibrium. At much higher temperatures, such as are generally employed, electrical gives place to thermal equilibrium, the thermal reaction becoming rapid. —F. Sodn.

Selenium ; Influence of moisture on the electrical properties of ——. C. Ries. Physik. Zeits., 1908, 9, 569—582. Chem. Zentr., 1908, 2, 1230—1231. (See this J., 1906, 1173 ; also 1902, 989 ; 1903, 760.)

If a selenium cell be heated for a long time to above 200° C., the electrical resistance frequently rises gradually to a maximum. This has been attributed to defects in the contacts caused by the high temperature, but the author shows that it is due to expulsion of moisture from the selenium. If amorphous selenium be heated to near its melting point, and kept at 200° C. for a long time and then cooled very slowly, it gradually absorbs moisture, and its conductivity increases up to a maximum value. If it be very rapidly cooled, however, it is practically unaffected by moisture. It was further observed that the specimens of selenium most sensitive to light had the highest electrical resistance, and *vice versa*.—A. S.

Patents.

Electric resistance material. British Thomson-Houston Co., London. From General Electric Co., Schenectady, N.Y., U.S.A. Eng. Pat. 22,869, Oct. 16, 1907.

The important ingredient in the composition of the material is a hard, crystalline and very pure alumina, produced in the electric furnace from bauxite and known commercially as alundum. This substance is mixed in various proportions with clay and graphite according to the properties desired in the finished product. For the preparation of a resistance unit, the proportions taken would be : 20 parts of alundum, 20 parts of a high-grade fireclay (mixed if desired with suitable amounts of felspar and flint), and such a proportion of graphite as will give the conductivity desired, say 1½ to 2 parts. The wet mixture, squirted into shape, is dried and baked at a temperature of 1100 to 1300° C. The sticks having been enamelled to keep out moisture, are provided at the ends with contact surfaces, either by carbonisation or by any other process. Since the conductivity (and coefficient of expansion) of the alundum is practically zero, the resistance of a rod of any given size depends solely on the proportion of graphite it contains, and remains constant after heating.—C. A. W.

Wood for use in electric batteries and electrolytic cells ; Treatment of ——. The Chloride Electrical Storage Co., Ltd., and B. Heap, Manchester. Eng. Pat. 1420, Jan. 21, 1908.

Wood to be employed for separators, packings, etc., in secondary batteries is digested for a number of hours in a solution of caustic soda, caustic potash, or ammonia in alcohol or other spirit, with or without the addition of water. The wood is then washed with alcohol or other spirit, until practically free from water, and dried in a current of warm or dry air.—J. W. H.

Storage battery plates ; Process for producing positive ——. J. R. d'Várad and A. Meislinger-Meszlényi, Budapest. Eng. Pat. 4940, March 4, 1908.

A mixture containing 70 per cent. of red lead and 30 per cent. of litharge is mixed with an equal amount of sulphuric acid (18° B.) in which are dissolved 20 grms. of caustic soda per litre. The plastic mass is filled into the grid, which is then covered on both sides with a very thin layer of charcoal powder, and pressed under very high pressure, washed, and quickly dried. The plates are then placed in sulphuric acid (18° B.) containing 5 grms. of potassium bichromate per litre, dried again, and put into pure sulphuric acid (21—22° B.).—O. F. H.

Ozone; Production of ——. J. Steynis, New York, U.S.A., and H. J. E. Chaumat, Paris. Eng. Pat. 18,184, Jan. 7, 1908. Under Int. Conv., Jan. 25, 1907.

Air or oxygen, previously compressed, is cooled to a very low temperature by its adiabatic expansion in a compressed air motor, working under a load, and the cooled exhaust air from the motor is passed into silent discharge or effluvia ozonisers. The temperature of the air entering the ozoniser is maintained constant by the load and speed of the motor. The power of the motor may be used for any purpose, but in particular for the preliminary compression of the air or oxygen. The compressor and the alternator are controlled in such a manner that if the latter for any reason rotates more rapidly, the compressor also rotates more quickly, and thus maintains an air pressure which is sufficient to prevent the production of an arc.—W. C. H.

Ozone; Process for the preparation of ——. E. Briner and E. Durand. Fr. Pat. 390,408, July 26, 1907.

High yields of ozone are obtained by the action of the electric discharge on oxygen or air in an apparatus cooled to —90° C., for example by means of liquid air. The ozone is recovered in the form of a liquid.—A. S.

Primary battery. W. A. F. Bleeck, Brisbane, Queensland. U.S. Pat. 899,823, Sept. 29, 1908.

See Eng. Pat. 5297 of 1908; this J., 1908, 1025.—T. F. B.

Electric furnace. J. H. Reid, Cornwall, Assignor to S. L. Tingley, Ottawa, Canada. U.S. Pat. 900,207, Oct. 6, 1908.

See Fr. Pat. 379,566 of 1907; this J., 1907, 1242.—T. F. B.

Electric furnace. E. Cornelius, Trolhättan, Sweden. U.S. Pat. 900,486, Oct. 6, 1908.

See Fr. Pat. 390,220 of 1908; this J., 1908, 1026.—T. F. B.

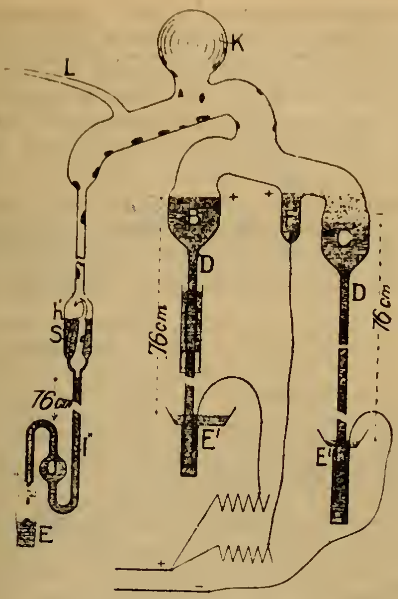
Electrode for electrolytic purposes. P. Ferchland, Berlin, and J. Nussbaum, Charlottenburg, Germany. U.S. Pat. 900,502, Oct. 6, 1908.

See Eng. Pat. 24,806 of 1906; this J., 1907, 261.—T. F. B.

(*B.*)—ELECTRO-METALLURGY.

Metals [*mercury*]; *Process and apparatus for purifying* —— *by electrical heating.* C. T. Knipp. Ger. Pat. 201,017, Sept. 5, 1907.

The process consists in volatilising the metal by means of an electric arc produced between two separate portions of the metal, in a space from which the air has been removed. The level of the two portions of metal between which the arc is struck, is kept practically constant by the barometric pressure of the atmospheric air. The apparatus used is shown in the figure. The metal to be purified is contained in the bulbs, B and C, from which extend the tubes, D, the open ends of the latter dipping into the metal contained in the receptacles, E′. An auxiliary bulb, F, is provided, also containing metal, for the purpose of producing the arc at the beginning of the process. The apparatus is exhausted by means of a pump connected to the tube, L. On passing a current through the wires shown, an arc is produced between B and C, the metal is volatilised, and condenses in K. The condensed metal collects in S, and flows through the siphon, *h*, and the capillary tube, I″, into the receptacle, E, any impurities collecting on the surface of the metal in S.—A. S.



Steel; Desulphurising of ——, *in the electric induction furnace.* T. Geilenkirchen. Stahl u. Eisen, 1908, 28, 1507—1508.

Referring to his former communication (this J., 1908, 691) and that of Osann (*ibid.*, 817), the author agrees that for successful desulphurising:—(1). The slag must be free from metallic oxides, especially iron oxide. (2). The sulphur must finally be combined with calcium, not with manganese. (3). The transference of the sulphur from iron or manganese to calcium can only be effected by the aid of a powerful reducing agent. The process in the induction furnace differs from that in the Héroult furnace in that:—(1). Work has to be specially directed towards desulphurising in the induction furnace, whereas in the Héroult process it occurs as it were automatically. (2). The reducer used in the induction furnace is ferrosilicon, in the Héroult furnace, calcium carbide. Both appear to effect their object; but ferrosilicon is a costly reagent, whilst calcium carbide, formed as it is in sufficient quantity in the furnace itself, costs very little. The difference in cost would seem to be about 5s. per ton of metal. Ferrosilicon has the additional disadvantage that through its use, the amount of silicon in the metal may be raised to an injurious extent.—J. T. D

Iron sheets and tubes: Production of finished —— *in one operation.* S. Cowper-Coles. Iron and Steel Inst., Sept., 1908. [Advance proof.]

Crude iron, finely-divided impure iron ore, "blue billy," or other source of iron unsuitable for smelting, may be dissolved electrolytically and a high grade iron deposited from the solution upon moving mandrels, in the form of finished tubes or sheets. (See Eng. Pats. 21,081 and 28,897 of 1906: this J., 1907, 699, 1147.) The electrolyte found most suitable consists of a 20 per cent. solution of sulpho-cresylic acid saturated with iron; the solution is kept charged with iron oxide which is maintained in suspension by agitation. A sheet of metal of the required surface is wrapped round the cathode and held in place by wedges, or for the production of tubes, the mandrel is electrolytically coated with lead, upon which the iron is deposited. When the deposit is thick enough, the mandrel is heated until the lead melts, which allows of the ready withdrawal of the tube. The voltage across the cell must be low and the current density per sq. ft. of cathode surface, high. The author used 100 amperes per sq. ft. and a temperature of 70° C. The iron contains a large volume of occluded hydrogen, which is given up on annealing. The amount present, which varies with the current density, etc., has a marked effect on the physical properties of the iron, causing it to become hard and brittle and comparatively inert to acids. The paper contains many illustrations and a number of tables of electrical data.—F. R.

Chromium; Process for making electrolytic deposits of ——. F. Salzer, Dresden, Germany. Eng. Pat. 1344, Jan. 20, 1908. Under Int. Conv., Jan. 21, 1907.

SEE Fr. Pat. 386,258 of 1908; this J., 1908, 692.—T. F. B.

Chromium; Process for producing an electrolytic deposit of metallic ——. F. Salzer, Dresden, Germany. U.S. Pat. 900,597, Oct. 6, 1908.

SEE Fr. Pat. 386,258 of 1908; this J., 1908, 692.—T. F. B.

Copper and other metals; Process for the precipitation of electrolytic —— *in the form of sheets or cylinders, with soluble iron or other metal anodes.* M. J. L. Wenger, Paris. Eng. Pat. 3504, Feb. 15, 1908. Under Int. Conv., Sept. 9, 1907.

SEE Fr. Pat. 381,659 of 1907; this J., 1908, 168.—T. F. B.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

Oils from certain expressed seeds; Characteristics of ——. J. Kochs. Mitt. der Kgl. Gärtner Lehranstalt zu Dahlem. Chem. Rev. Fett- u. Harz-Ind., 1908, **15**, 256—257.

THE oils, the analytical values of which are given in the table below, were obtained from the dried and crushed seeds by extraction with ether. *Red currant seeds*, when air-dried, contained 16·9 per cent. of a thin, yellowish-brown oil, with a pleasant odour. It dried well, yielding a hard, colourless, elastic film after exposure for 7 hours in a thin layer at 70° C., and could be used as a substitute for linseed oil in the manufacture of paints and varnishes. *Oil of hips.*—The seeds of the berries, termed "hips," contained 9·63 per cent. of a thin, yellow or orange-yellow oil of pleasant odour. It had good drying properties, but the yield would be too small to repay the cost of extraction. *Tomato-seed oil* (yield from the seeds 17·3 per cent.) was a thin reddish-brown oil, which from its behaviour in film tests might be classed among the semi-drying oils. It could probably be used as an edible oil. *Raspberry-seed oil* (yield 13·5 per cent.) was a thin oil of greenish-yellow colour, which dried well, and where obtainable in large quantities, might be used as a substitute for linseed oil. *Strawberry-seed oil* (yield 16·35 per cent.) was a thick, yellow oil, which became darker and more viscid after some weeks. It had excellent drying properties equal to those of good linseed oil. The low iodine value obtained was attributed by the author to oxidation during the crushing of the seeds. *Oil of Euonymus europæus.*—The non-drying oil from the seeds of this plant, which is common throughout Germany, and especially in the South, was a moderately thin, reddish-brown fluid, with a characteristic sharp odour. The seeds yielded 35·2 per cent. of oil, and in the author's opinion might be profitably extracted for the soap industry. The high Reichert-Meissl value and high percentage of unsaponifiable matter, the latter attributable to the orange colouring matter, are characteristic.

Values.	Red-currant seed oil.	Hip oil.	Tomato seed oil.	Raspberry seed oil.	Strawberry seed oil.	*Euonymus europæus* oil.
Sp. gr. at 15° C.	0·9120	0·9161	0·9200	0·9151	0·974	0·939
Saponification value	171·3	172·8	183·6	180·3	184·6	230·1
Iodine value	152·5	152·8	117·8	162·2	72·8	—
Reichert-Meissl value	0·77	0·44	0·22	0·11	13·42	35·31
Butyro-refractometer "degrees" at 40° C.	62°	67°	63°	65°	82°	52°
Solidification point	Semi-solid at −17·5° C.	Viscous at —17·5° C.	Viscous at — 9° C. Semi-solid at —12° C.	Semi-solid at — 17·5° C.	—	- 10° C.
Fatty acids—						
Melting point	20° C.	31° C.	26°—29° C.	30° C.	21°	38° C. (begin) 70° C. (end)
Iodine value	169·5	174·3	129·6	170·3	66·3	105·3
Mean molecular weight	266·2	276·8	281·5	281·5	241·0	251·2
Unsaponifiable matter, per cent.	2·31	2·62	2·68	1·86	2·42	5·83

—C. A. M.

Sesamé oil; Colour reactions of —— *with aromatic aldehydes and sugars.* C. Fleig. Bull. Soc. Chim., 1908, **3**, 984—999.

SESAMÉ oil gives reactions with aromatic aldehydes analogous to those obtained in the reaction with furfural in the Baudouin test. From 0·2 to 0·4 c.c. of a 2 to 4 per cent. solution of the aldehyde in 90 to 95 per cent. alcohol are mixed with 10 c.c. of hydrochloric acid (sp. gr. 1·17 to 1·18) and 10 c.c. of the oil under examination in a tube which is then corked and shaken for 1½ minutes. The colour of the acid layer which separates on standing, varies in intensity with the proportion of sesamé oil in the oil and with the nature of the aldehyde. If necessary, the reaction may be accelerated and intensified by heating the oil before shaking, and allowing the tube to stand in hot water afterwards. The sensitiveness of the reactions in the case of several aldehydes is about the same as that with furfural. The aldehydes tried gave the following colorations:—Benzaldehyde, orange; salicylaldehyde, intense gooseberry red; *p*-hydroxybenzaldehyde, intense gooseberry red; anisic aldehyde, bright gooseberry or cherry red; protocatechuic aldehyde and vanillin, peach red changing to deep violet; piperonal, colour as with vanillin; *o*-nitrobenzaldehyde, intense orange; *p*-nitrobenzaldehyde (added as powder), faint orange; *m*-nitrobenzaldehyde, colour intermediate to the last two; *p*-dimethylaminobenzaldehyde, orange; cinnamic aldehyde, immediate very intense cherry red; and cuminic aldehyde, faint orange. An alcoholic extract obtained by shaking the sesamé oil with its own volume of 95 per cent. alcohol gives the same reactions as the oil itself, but the colorations are more intense and more stable. This might possibly be made the basis of a colorimetric method of determining sesamé oil in admixture with other oils. Comparative tests were also made as in the Baudouin test by treating 5 c.c. of sesamé oil with 0·05 grm. of different sugars and 5 c.c. of hydrochloric acid (sp. gr. 1·17 to 1·18) and observing the intensity of the colorations produced in the cold. It was found that the sugars tried could be grouped in the following descending scale of intensity: (1), Lævulose, invert sugar, sucrose, sorbose; (2), raffinose; (3), xylose and arabinose; (4), galactose, mannose, mannitol, dextrose; (5), *iso*dulcitol, erythritol, sorbitol, dulcitol, lactose, and maltose. If heat be applied, all the reactions are accelerated, and certain sugars (*e.g.*, lactose and maltose) which give no coloration in the cold, then give positive reactions. Intense colorations are also given by many sugars when hydrochloric acid is substituted for sulphuric acid in Pettenkofer's test. In the author's opinion this Pettenkofer reaction like the sesamé oil reaction, probably depends upon a formation of furfural, for the sugars that give the most pronounced reactions in both tests, are those which most readily yield furfural on hydrolysis.—C. A. M.

Triolein-ozonide and its decomposition products. E. Molinari and P. Fenaroli. Ber., 1908, **41**, 2789—2794.

Triolein combines with ozone to form a characteristic ozonide analogous to that given by oleic acid (this J., 1906, 1055, 1158). Ozone values of 16·45 and 16·41 were obtained (theory = 16·27) by dissolving olein in hexane, admitting a current of ozone, and evaporating the solvent in a current of hot air. The resulting product was a light yellow, gelatinous, transparent mass, which was purified by treatment with a 1 per cent. solution of potassium hydroxide, followed by extraction with ether. When dried *in vacuo*, it was a viscous, almost gelatinous, colourless oil, which was soluble in ether, acetic acid, benzene, and chloroform, and decomposed at 136° C. Its composition agreed with the formula, $C_{57}H_{104}O_{15}$, and its molecular weight determined by the freezing-point method was (1) 936 and (2) 1036 (theory = 1029). When heated for 30 minutes on the water-bath with 30 per cent. alcoholic potassium hydroxide solution, it was decomposed, and on evaporating the alcohol and acidifying the liquid, an oily layer rose to the surface. From this could be separated by distillation with steam, nonylic acid, $C_9H_{18}O_2$, whilst the residue in the distillation flask consisted of the two fatty acids described by Molinari and Soncini (this J., 1906, 1055). One of these, which formed an insoluble calcium salt, was a white hydroxy-acid, $C_{18}H_{36}O_3$, whilst the other was an oily liquid ($C_{18}H_{32}O_6$) which formed a soluble calcium salt and was quantitatively oxidised by potassium permanganate into azelaic acid. Contrary to the experience of Harries (this J., 1906, 1158), the authors find that hydrogen peroxide is not produced in the decomposition of the ozonides of olein and oleic acid by boiling with water. Arnold and Mentzel's benzidine test (this J., 1902, 640, 1297) gave negative results, and the colour reactions obtained by Harries in the test with ether and bichromate were probably due, not to hydrogen peroxide, but to other substances. *Iodine values of ozonides of olein and oleic and claïdic acids*:—If one of these ozonides be dissolved in alcohol containing a few drops of chloroform, and a cold alcoholic solution of potassium iodide be added, iodine is liberated, and it may eventually be found possible to determine in this way the amount of oleic acid or olein in a mixture. The chief difficulty is that the iodine first liberated is partially re-absorbed, and if the solutions be hot, the reaction goes so far that the whole of the iodine is again absorbed. In experiments with cold solutions, oleic acid ozonide liberated 39·03 per cent. of iodine in 30 minutes, and 39·49 per cent. in 24 hours. In other experiments 38·77 per cent. of iodine were liberated in 6½ hours, and 37·15 per cent. in 24 hours. Assuming that one atom of iodine is liberated for each mol. of ozone, the calculated iodine value of the ozonide is 38·45. Olein-ozonide behaves in the same way, though more irregularly. When the ozonides of olive oil fatty acids are treated with potassium iodide, the proportion of iodine liberated varies with the age of the ozonide, the concentration of the solution, and the temperature. *Saponification value of ozonides*:—Triolein-ozonide gave a saponification value of 276·5, and an ozonide of pure olive oil a value of 223·7. Since the saponification values of ozonised oils differ considerably from those of non-ozonised oils, the test may be found of practical value in analysis.—C. A. M.

Oleic acid ozonide; Decomposition products of ——. E. Molinari and C. Barosi. Ber., 1908, **41**, 2794—2799.

According to Molinari and Soncini (this J., 1906, 1055) and Molinari and Fenaroli (see preceding abstract), no hydrogen peroxide is formed in the decomposition of oleic acid ozonide by hot water. Aldehydes are produced in small quantity, whilst the main products are azelaic and nonylic acids and two other acids (loc. cit.), one of which is here shown to be a hydroxystearic acid, $C_{18}H_{36}O_3$, and the other a dihydroxydiazelaic acid, $C_{18}H_{32}O_6$. Experiments on the decomposition of the ozonide in the presence of potassium bisulphite (to fix any aldehydes), showed that in addition to these four acids, there were also formed several condensation products of aldehydes and semi-aldehydes. It is suggested that this may throw light upon syntheses that occur in the animal and vegetable kingdom, as well as upon changes which take place in fats.—C. A. M.

Cholesterol and phytosterol; Proof of double bonds in the constitutional formula of ——. E. Molinari and P. Fenaroli. Ber., 1908, **41**, 2785—2789.

The ozone value of anhydrous phytosterol from Calabar beans was determined by treating a solution of a weighed quantity of the substance in chloroform with ozonised air, and then evaporating the solvent first in a current of ozonised air, and finally *in vacuo*, until, after some weeks, the residue became constant in weight. The ozone value (24·84) corresponded with the theoretical value for an addition of 2 mols. of ozone. The ozonide ($C_{27}H_{46}O_7$) was a white crystalline mass which decomposed when heated above 100° C. It liberated iodine from a solution of potassium iodide, and gave only slight reactions for aldehydes. *Rapid determination of the ozone value*:—By heating the weighed vessel containing the ozonide *in vacuo* on a water-bath at 60° C., the weight becomes constant within about 30 minutes. This method may be used in the determination of the ozone value of any substance which yields an ozonide stable at 50° to 60° C. The ozone value of the phytosterol from walnut oil (24·84) also corresponded with the formula, $C_{27}H_{46}O + 2O_3$. Two specimens of cholesterol from gall-stones gave ozone values of 25·00 and 24·70 per cent. respectively, whilst *bombyxcesterol* from the chrysalides of the silkworm gave a value of 24·84. Hence the author concludes that both cholesterol and phytosterol contain double bonds. In his opinion the ozone value is the best test for determining the number of such true double bonds in organic compounds. (See also this J., 1906, 1055, 1158.) —C. A. M.

Patents.

Soaps containing pumice and the like; Composition and process for making ——. E. T. C. Firth, Auckland, New Zealand. Eng. Pat. 9744, May 5, 1908. Under Int. Conv., June 14, 1907.

Claim is made for soap blocks composed of a mixture of, say, 36 lb. of ground pumice, silica, alumina, or the like, with about 5 lb. of soap, and about 8 lb. of water, with the addition, if desired, of carbolic acid or other disinfectant. In the process claimed, the abrasive material is mixed with an aqueous solution of the soap, and the mixture reduced to a semi-granular or nearly dry state by means of a disintegrating machine, and then compressed into blocks in a moulding machine.—C. A. M.

Oils, fats, etc.; Composition for decolouring ——, *and process of making the same.* T. Macherski and E. Koperski, Brest-Litovsk, Russia. U.S. Pat. 899,879, Sept. 29, 1908.

See Eng. Pat. 22,942 of 1905; this J., 1907, 159.—T. F. B

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(A.)—PIGMENTS, PAINTS.

Thioindigo and indigo as oil colours. E. Täuber. Chem.-Zeit., 1908, 32, 1032.

Comparative tests were made with thioindigo, indigo, and with alizarin and madder colours used as oil-paints. It was found that although the first two colours were as stable as the last two when used by themselves, they faded in a few days, even in the dark, when mixed with aluminium hydroxide, lead white, zinc white, or barium sulphate. The nature of the oil used as vehicle had no influence on the result, similar effects being obtained with linseed oil, boiled linseed oil, and poppy-seed oil. The colour could not be restored by treatment with oxidising agents.—A. G. L.

Naphthenic acids and their metallic salts ; Practical importance of ——. [*Paints and varnishes*]. E. Pyhälä. *See* III.

Patents.

Zinc sulphate ; Manufacture of —— *from complex zinc ores, and its employment for the preparation of a lithopone having barium sulphite as its base.* L. Brunet. First Addition, dated July 22, 1907, to Fr. Pat. 360,517, Feb. 28, 1905 (this J., 1906, 486).

The claim is for pigments of good covering power composed of mixtures of barium sulphite or hyposulphite with zinc oxide or sulphide. These pigments may be used with dark-coloured oils, the sulphite or hyposulphite exercising a bleaching effect.—A. S.

Pigments from antimony and arsenic, lithopone from white antimony or cerussite, yellow and red antimony sulphides, or antimony minium ; Process of making ——. L. Brunet. First Addition, dated July 22, 1907, to Fr. Pat. 361,380, April 15, 1905 (see Eng. Pat. 16,490A of 1905 ; this J., 1906, 32).

Products similar to those described in the chief patent are prepared by mixing barium sulphite or hyposulphite with white or coloured pigments of arsenic or antimony compounds.—A. S.

(*B.*)—RESINS, VARNISHES.

Colophony ; Determination of —— *in shellac.* C. Ahrens. Chem.-Zeit., 1908, **32**, 996.

The determination of the iodine value must still be regarded as the best method of determining colophony in admixture with shellac. The calculations are usually based upon the assumption that the iodine value of shellac is 10 and that of colophony 125. The author, however, finds that the iodine value of colophony may vary, according to the quality of the substance, between 110 and 164. The time usually allowed for the iodine absorption (6 hours) is also insufficient, but the reaction appears to be complete after 30 hours. Account must be taken of the natural variation of the iodine value in making a determination. Thus an iodine value of 35 may indicate from 16 to 25 per cent. of colophony in a mixture.—C. A. M.

Naphthenic acids and their metallic salts ; Practical importance of ——. [*Paints and varnishes*]. E. Pyhälä. *See* III.

Lac trade of India. India Office, Sept., 1908. [T.R.]

Lac factories are almost confined to Bengal and the United Provinces, where there are 62 large ones employing nearly 6000 persons, besides many smaller. The hand-labour factories hold their own, and for some grades produce qualities hardly, if at all, attainable by machinery. Although there seems no likelihood of India losing her place as the main source for the supply of lac, the more scientific cultivation and collection of the crop has for some time been engaging the attention of the Forest Department. Lac is produced over wide areas in the provinces and States of North-Eastern India, but statistics of the area and yield are lacking. Unfortunately much of it comes from forests in the Native States, where no agency exists for conservancy and development, and where wasteful methods of collection are said to prevail. Whatever the conditions of production, the industry has been able to respond to the greatly increased demand that has manifested itself in recent years. The following statistics of exports speak for themselves :—

	Cwt.	£
1901–2	157,071	640,352
1902–3	239,013	1,233,859
1903–4	235,620	1,815,931
1904–5	240,131	2,050,941
1905–6	270,448	2,111,645
1906–7	257,778	2,313,847
1907–8	340,590	2,665,224

Lac of all sorts is included in the above figures, but the bulk of the trade is in shellac. The United States is the principal buyer of lac, and bought £896,000 in 1907–8. The market is a sensitive one, and prices varied in that year from a maximum of £10 8s. 8d. for shellac in April, 1907, to a maximum of £4 10s. 8d. in 1907, when the effect of the American financial crisis made itself felt.

Patents.

Turpentine still. E. E. Quinker. Valdosta, Ga. U.S. Pat. 900,203, Oct. 6, 1908.

The apparatus claimed consists of a closed vessel with an inner chamber secured at the top to an annular ring in the upper part of the vessel, and having a tapering lower end opening into a discharge pipe controlled by means of a perforated damper. The pulp is heated in the inner chamber by means of steam, *e.g.*, from a perforated coil within the tapering portion, whilst the vapour is carried through an outlet tube in the exterior vessel above the inner chamber.—C. A. M.

Varnish composition. C. Ellis, White Plains, N.Y., Assignor to Ellis-Chalmers Co., West Virginia. U.S. Pat. 900,687, Oct. 6, 1908.

This consists of a mixture of rubber resin with Chinese wood (tung) oil, with or without the addition of a thinning agent and a drier. Or, it may consist of a mixture of pontianac resin and tung oil, to which may also be added other resinous substances.—C. A. M.

Resinous products ; Apparatus for purifying and filtering crude ——. G. Col. First Addition, dated May 20, 1908, to Fr. Pat. 378,965, June 18, 1907.

The present addition relates to an improvement in the apparatus described in the main patent (this J., 1907, 1207). The funnel through which the material is charged into the melting vessel, is provided with a screen of perforated metal, having two lateral gutters, together with a wire brush, worked by means of a reciprocating rod, which brushes the impurities collecting on the screen, into the gutters.—A. S.

Shellac ; Process for preparing substitutes for ——. J. Meyer, Berlin. Eng. Pat. 4546, Feb. 28, 1908.

See U.S. Pat. 898,382 of 1908 ; this J., 1908, 988.—T. F. B.

(*C.*)—INDIA-RUBBER, &c.

Rubber ; Coagulation of —— *by means of "purub"* [*hydrofluoric acid*]. F. Frank. Gummi-Zeit., 1908, 23, 64.

The author endorses the opinion which has been expressed (see India-Rubber J., 1908, 36, 320), that planters should indicate in some way to manufacturers, rubbers which have been coagulated by means of "purub" (this J., 1908, 1029), on account of the facility with which such rubbers vulcanise, as compared with rubbers not so prepared. At the same time he insists upon the importance of allowing large scale experiments with processes such as this to be freely carried out, in order that the best possible methods of preparation of the latex may be arrived at and qualities of plantation rubber standardised with as little delay as possible. The adoption of trade-marks would probably meet the case, and such a system of identification would, moreover, assist in bringing about greater co-operation between manufacturers and growers, for the purpose of determining the most suitable methods of preparation.—E. W. L.

Antimony and lead compounds containing oxygen ; Analysis of ——. F. Jacobson. Chem.-Zeit., 1908, 32, 984—985.

The compounds referred to in particular are the " golden " sulphide of antimony and " black hypo " as used in rubber manufacture. The analysis of the former has been dealt with previously (this J., 1908, 169). " Black hypo " is an impure thiosulphate of lead, prepared by heating lead carbonate with sulphur. In the analysis of this product, the determinations of sulphur in the free and combined state are the points of essential importance. The *free sulphur* is best determined by boiling the substance with a solvent such as chloroform. The *sulphur combined with lead as sulphide* is estimated as in the case of the antimony compound (*loc. cit.*). *Total sulphur* is estimated by fusing the substance with sodium carbonate and potassium nitrate, and subsequently precipitating as barium sulphate. Other elements are determined by the ordinary methods of inorganic analysis.—E. W. L.

Patents.

India-rubber ; Process for the synthetic production of ——. A. Heinemann, London. Eng. Pat. 21,772, Oct. 2, 1907.

A mixture of acetylene and ethylene is heated at a dull red heat, and the resulting divinyl converted into methyl-divinyl or isoprene by the action of methyl chloride. Caoutchouc condensed from the isoprene thus obtained is stated to be equal in every respect to the natural product.—C. A. M.

Elastic or resilient material [*rubber substitute*] *; Manufacture and production of a new* —— *for various uses in the arts.* W. H. Perkin and Whipp Bros. and Tod, Ltd., Manchester. Eng. Pat. 23,031, Oct. 18, 1907.

Two parts by weight of gelatin or glue are dissolved in 3 parts, or more, by weight of creosote ; the latter should, preferably, contain a considerable amount of phenol or cresol, and boil at a temperature of about 200° C., or the cresol separated from coal tar creosote, and boiling at 190°—205° C., may be used. One hundred parts of the solution are then well mixed with from 15 to 30 parts of a cold saturated solution of potassium bichromate and the product is allowed to set ; it is afterwards rendered firmer by steeping it in acetone. Or, 100 parts of the solution, 5 parts of amber oil, and 5 parts of acetone are mixed with from 15 to 30 parts of the solution of potassium bichromate, and the mixture allowed to set. Formaldehyde, tanning materials, tannin, etc., may be employed in place of the potassium bichromate.—W. P. S.

XIV.—TANNING, LEATHER, GLUE, SIZE.

Patents.

Inks for polishing leather in the cold ; Process for the manufacture of solid ——. Chem. Fabr. " Electro " G.m.b.H. Fr. Pat. 390,437, May 20, 1908.

An alkaline emulsion of a wax is mixed with a suitable colouring matter and with a soluble carbohydrate or protein, or both, and the mixture evaporated to dryness, preferably in a vacuum, at a temperature below 80° C. The powder thus obtained can be easily emulsified even with cold water.—A. S.

Tanning extract from peat. E. E. M. Payne, Aylesbury, Assignor to W. H. Staynes, J. H. Smith, and W. H Sturges, Leicester. U.S. Pat. 899,800, Sept. 29, 1908.

See Fr. Pat. 346,406 of 1904 ; this J., 1905, 143.—T. F. B.

Extracts of quebracho ; Process of treating ——. L. Pollak, Assignor to A. Redlich, Wilsdorf, Austria-Hungary. U.S. Pat. 900,038, Sept. 29, 1908.

See Eng. Pat. 4358 of 1908 ; this J., 1908, 696.—T. F. B.

XV.—MANURES, &c.

Dihydroxystearic acid ; Isolation of —— *from soils.* O. Schreiner and E. C. Shorey. J. Amer. Chem. Soc., 1908, 30, 1599—1607.

The small proportion of picoline-carboxylic acid isolated from a poor soil (this J., 1908, 912) and its relatively slight toxicity suggested the probability of the presence of other toxic substances. In experiments to isolate these, the soil was treated with 2 per cent. sodium hydroxide solution, and the alkaline extract acidified with a slight excess of acetic acid and filtered. The filtrate was extracted with ether, and the ethereal extract evaporated at a low temperature. The residue, after recrystallisation from hot water to separate resinous substances, formed radiating clusters of flat crystals of m.pt. 98°—99° C., and agreed in all other properties with the dihydroxystearic acid prepared from elaidic acid. Both the acid isolated from the soil and that prepared from elaidic acid had a pronounced toxic action upon wheat seedlings, even in a solution containing only 20 parts per million. In the case of solutions containing 100 or 200 parts per million, the wheat seedlings showed but little transpiration ; the weight of the plants was only about half that of the plants used in control experiments, and death resulted in 12 to 15 days. The resinous substance had the composition : C., 63·84 ; H, 9·65 per cent. It was very insoluble in water, and when quite free from dihydroxystearic acid did not impart any toxic properties to boiling distilled water. The soil from which the dihydroxystearic acid was isolated was a good medium for the growth of fungi, and the rootlets of oak trees growing in it were infested with mould. The possibility of the formation of the acid from oleic acid derived from decomposed lecithins in plants is therefore suggested. —C. A. M.

Calcium cyanamide [" *nitrolime* "] *as a manure ; Experiences with crude* ——. A. Stutzer. Z. angew. Chem., 1908, 21, 2122.

For rye and wheat, application of moderate quantities of crude calcium cyanamide at about the end of February have proved very advantageous, but the fertiliser is not so satisfactorily utilised when applied to the soil in autumn. With oats, crude calcium cyanamide produces an increased yield of grain equal to that produced by the same quantity of nitrogen in the form of sodium nitrate. For all plants of which the seeds are sown in spring, the crude calcium cyanamide should be applied to the soil at least 8 days before sowing the seed. Up to the present, this fertiliser has not proved so useful with spring barley and beets, but gives very good results in the case of potatoes. —A. S.

Hemicelluloses ; Action of certain fungi on ——. H. C. Schellenberg. *See* XIX.

Patents.

Fertilizer. L. R. Coates, Baltimore, Md., Assignor to The American Bacteria-ized Fertilizer Co. U.S. Pat. 900,056, Sept. 29, 1908.

The dry roots of leguminous plants, with their bacteria-bearing nodules, are ground to form a bacteria-carrying material suitable for mixing with other materials for use as a fertilizer.—A. T. L.

Brewers' and other by-products, etc. ; Apparatus for drying ——. Eng. Pat. 13,013. *See* XVII.

Potatoes; Utilisation of the juice of ——. Fr. Pat. 390,018. *See* XVI.

XVI.—SUGAR, STARCH, GUM, &c.

Cane sugar [*sucrose*]; *Inversion of* —— *by invertase. II.* C. S. Hudson. J. Amer. Chem. Soc., 1908, **30**, 1564—1583. (See also this J., 1908, 822.)

O'Sullivan and Tompson (this J., 1890, 1049) showed that the inversion of sucrose by invertase is a reaction of the first order, but other workers, neglecting the error caused by mutarotation (this J., 1908, 822), have disputed this. The author has now made further experiments which confirm the conclusions of O'Sullivan and Tompson. The invertase employed was prepared from brewer's yeast: (1), by autodigestion; (2), by grinding a mixture of yeast, coarse sand, and ground glass, and extracting the mass with water. To stop inversion at any given time, and to accelerate mutarotation, 10 c.c. of a 0·2 molal [molal = 1 grm. mol. per litre] sodium carbonate solution were added to each 100 c.c. withdrawn from the solution undergoing inversion; the mixture was left longer than 7 minutes but not longer than 2 hours before reading the rotation, thereby insuring that mutarotation was complete, and that the inversion products were not appreciably attacked at the time of reading. It was found that though the action of invertase is much accelerated by addition of traces of acid to the neutral solution, further small additions of acid have no further effect; hence, in the experiments, 5 drops of glacial acetic acid were added to each litre of the sugar solutions, this acidity being insufficient to cause appreciable inversion by its own action, and rendering the activity of the invertase independent of the very small amounts of acid or alkaline impurities that often get into the solutions by accident. The author has shown that whilst acids accelerate mutarotation, invertase does not do this, and hence, the rate of inversion of sucrose by invertase is apparently irregular in comparison with the action of acids. If, however, alkali (sodium carbonate in preference to caustic alkali) is added to the invertase-sucrose solution before reading the rotation, mutarotation is accelerated, and the inversion, like that with acids, proves to be a catalytic reaction of the first order. The acceleration of the mutarotation of dextrose at 30° C. by hydrochloric acid, is such that the rate is a linear function of the concentration of the hydrogen ions, but with lævulose, the relation is more complicated. The author has also shown that the inversion of sucrose by invertase is proportional to the concentration of the invertase in both dilute and concentrated sucrose solutions, and has deduced a specific rotation of 100°—125° for the dextrose liberated from sucrose by invertase, which must therefore be *a*-glucose.—L. E.

Sugar; Density of ——. G. Fouquet. Bull. Assoc. Chim. Sucr. et Dist., 1908, **26**, 176—177.

The author has observed that the density of refined sugar crystals varies according to the mode of crystallisation. Thus, in one case, the density of the crystals varied from 1·550 to 1·575, whilst in another, it ranged between 1·580 and 1·610. The author has not yet been able to ascertain definitely why these differences occur. Variation in the densities of crystalline substances has been previously observed, and, according to Filhol, the density of crystals increases with their regularity.—L. E.

Maple products; Lead value of ——. A. P. Sy. J. Amer. Chem. Soc., 1908, **30**, 1611—1616. (See also this J., 1908, 992.)

The "*lead value*" of a maple product is the amount of lead precipitated on adding a solution of lead acetate to 100 grms. of sugar or 100 c.c. of syrup, and it forms a valuable criterion of the purity of such products. The author has made experiments on the use of lead acetate and basic lead acetate, and concludes that the former is the more suitable reagent. He has also made experiments on the solubility of lead malate (of which the precipitate chiefly consists), and on the effect of fermentation of the sample on the analysis. On the basis of his results, he has adopted the following method for determining the "*lead value*":—50 c.c. of syrup or 50 grms. of sugar are heated to boiling with 200 c.c. of water (thus eliminating any fermentation products which might influence the result), treated with 20 c.c. of 10 per cent. solution of normal lead acetate, and again heated to boiling. The solution is allowed to stand till cold, and the precipitate washed with water (20° C.). The filter and precipitate are treated with 15 c.c. of concentrated nitric acid and 10 c.c. of concentrated hydrochloric acid, the whole is heated until the filter is disintegrated, cooled, treated with 10 c.c. of concentrated sulphuric acid, and heated to expel all nitric acid. If the blackening does not disappear in a few minutes, 5 c.c. more of nitric acid are carefully added after cooling a little, and the whole is heated again to expel all nitric acid. The cooled solution is treated with 50 c.c. of water, cooled again, and treated with 100 c.c. of alcohol. After standing for 6 hours or longer, the lead sulphate is filtered off and determined. The weight of lead sulphate multiplied by 1·366 (2×0·683) gives the weight of lead precipitated by 100 c.c. or 100 grms. of sample. The lead value of a pure product should not be less than 0·250 and is usually over 0·300.—L. E.

Patents.

Sugar refinery products, juices, syrups, etc.; Process and apparatus for the purification of ——. S. Kugler. First Addition, dated May 7, 1908, to Fr. Pat. 386,534, Jan. 24, 1908 (this J., 1908, 700).

In order to separate iron and calcium compounds from the juice, etc., after it has been subjected to the electrolytic process described in the main patent (*loc. cit.*), it is treated with carbon dioxide at about 55° C., or with sodium carbonate, sodium bicarbonate, or ammonium bicarbonate, and the precipitated carbonates of calcium and iron are removed by filtration.—A. S.

Molasses; Treating ——. R. D. Pike, Berkeley, Cal. U.S. Pat. 900,584, Oct. 6, 1908.

The molasses is rapidly "osmosed," the osmose syrup is concentrated to supersaturation, and then crystallised until the coefficient of purity of the resulting molasses is approximately that of the molasses previously osmosed. Fresh molasses is then added and the process repeated. The syrup is crystallised in a closed chamber with the aid of exciting crystals, being passed through the crystalliser in such a way that the velocity is greater at the inlet than at the outlet. The crystalliser may be subjected to a temperature sufficient to maintain the supersaturation of the syrup.—C. J. G.

Molasses; Removal of potassium compounds from —— and utilisation of the products. L. Rivière. Third Addition, dated July 1, 1907, to Fr. Pat. 385,139, Feb. 28, 1907 (this J., 1908, 584, 702, 869).

The additional points claimed are:—(1) The neutralisation of the resulting juices by lime, followed by carbon dioxide, preferably obtained by fermentation. The neutralisation and carbonation may be varied to any degree of alkalinity to suit the liquid under treatment. (2). The substitution of soluble fluosilicates, such as magnesium fluosilicate, for the hydrofluosilicic acid previously used, and their addition in the form of highly concentrated solutions or in the solid state. (3). The utilisation of the volatile products of cane molasses when subjected to distillation in the autoclave. (4). The preparation of concentrated juices from sound or damaged beets, previously dried, for making worts free from potash, before or after extraction of the ammonia in the autoclave. (5). The regeneration of hydrofluosilicic acid or of soluble fluosilicates from the precipitated salts by the use of superheated steam.—J. F. B.

Potatoes; Utilisation of the juice of ——. R. Goldschmidt. Fr. Pat. 390,018, April 22, 1908.

Potatoes are deprived of their juice according to the process described in Fr. Pat. 331,061 of 1903 (this J., 1903, 1142), by draining the rasped pulp in a centrifugal machine. The juice, which must be fresh, undiluted, and free from starch, is evaporated to dryness *in vacuo*, for the preparation of a yeast-food. Or else the albumin may be precipitated by acids, the salts may be precipitated from the filtrate for use as fertilisers and the residual liquid may be evaporated for the recovery of the sugar.—J. F. B.

Sugar juices; Process for the purification of ——. C. H. Bertels, Brussels, Assignor to Standard Sugar Process Co., Ltd., London. U.S. Pat. 901,147, Oct. 13, 1908.

See Eng. Pat. 17,554 of 1905; this J., 1906, 859.—T. F. B.

Gum: Process for the production of a soluble ——. F. Fritsche, Assignor to Stolle und Kopke, Rumburg, Austria Hungary. U.S. Pat. 900,274, Oct. 6, 1908.

See Eng. Pat. 1353 of 1908; this J., 1908, 822.—T. F. B.

XVII.—BREWING, WINES, SPIRITS, &c.

Barley; The enzymes of ungerminated ——. Jalowetz. Brau- und Malzind., 1908; Woch. für Brau., 1908, **25**, 557—559.

In view of the somewhat contradictory observations of previous authors as to the distribution and properties of the diastatic enzyme of raw barley, the author has re-investigated this question. By cutting the corns into three portions by transverse sections, the author confirms the observation of Brown and Morris (this J., 1890, 530) that the diastatic enzyme is localised mainly in the embryo-end of the corn, and that the point-end is practically devoid of action on starch paste. He disagrees with these authors and confirms Baker's results (this J., 1902, 1087) in the observation that the diastatic enzyme of raw barley is possessed of both liquefying and saccharifying activity towards starch paste. The action takes place not only at 50° C. but also at the ordinary temperature. The author also agrees with Baker in the observation that saccharification is never complete, but that the products always show a blue coloration with iodine, indicating the presence of amylodextrin. The diastatic power of meal from the embryo-ends of raw barley is much feebler than that of malt meal, and the action is very much slower. The diastase of the raw grain most probably begins to play its part at the very earliest stages of germination, attacking the starch granules and supplying soluble carbohydrates to the embryo. Raw barley also contains invertase, which likewise is concentrated at the embryo-end of the corn. This enzyme is also active both at 50° C. and at the ordinary temperature. The activity of aqueous extracts of the corn is very much lower than that of an equivalent quantity of the meal. The invertase remains confined to the proximal end of the corn during germination, and is found chiefly in the rootlets; it is generally destroyed during the curing of the malt. It must be assumed that, like the diastase, the invertase of raw barley plays an important part during the earliest stages of the germination.—J. F. B.

Beer yeasts; Hereditary and acquired characteristics of top-fermentation ——. F. Schönfeld and H. Rossmann. Woch. für Brau., 1908, **25**, 525—530, 541—546, 553—556.

The authors have continued their studies on the fixity of the specific characters of top-fermentation yeasts (this J., 1908, 636). These characters were defined (this J., 1908, 462) as:—spar-like growth in vaseline ring cultures, only partial fermentation of melitriose, the milky character of their suspensions in water, and the rising of the yeast in the form of a top-fermentation "head." This rising of the yeast is described as the formation of a froth composed of bubbles of a small size, the bubbles gradually becoming more and more turbid. When the froth begins to fall, there remains a convex coherent yeast-skin, which often possesses a brilliant surface, underneath which the froth is still loose and free. The yeast-skin is characterised by great toughness. Good, medium, and weak degrees of "head"-formation are recognised. When this character was only feebly marked, it could generally be developed in a normal degree by repeated sub-cultivation in a mixture of wort with an equal quantity of a 10 per cent. sugar solution. Hansen has shown that top-fermentation forms can be evolved comparatively readily from certain bottom-fermentation yeasts, but that the converse transformation is of very rare occurrence, and even in the few cases observed, the present authors are not satisfied that the aberrations recorded, (relating only to the formation of "head"), were really permanent. Dealing with certain top-fermentation German brewery yeasts, the authors have sub-cultivated them through three generations, and, selecting 30 cells from each, have observed whether their descendants possessed all the characters of the originals. They have established the fact that in some species the character of "head" production is very liable to variation, probably as the result of conditions of nutrition, but it may also be varied by purely mechanical circumstances. It also shows a tendency to remain latent through several generations, but it can generally be re-developed by special treatments. In those varieties of yeast which show a pronounced capacity for producing a top-fermentation head, the specific characters, *viz.*, the form of budding, the behaviour when stirred with water, the rising of the yeasty "head," and the behaviour towards melitriose, are transmitted constantly and regularly to the descendants. In the case of yeasts which do not show a very pronounced "head," the only character which is transmitted constantly and regularly is the behaviour on stirring with water; the other characters are transmitted irregularly. As regards the behaviour towards melitriose, it is not contended that in any case the extent of the irregularities observed, approached the complete fermentation effected by true bottom yeasts; they might merely have been experimental irregularities. As regards the form of budding and the production of "head," these may be developed by special treatment. Thus no true conversion of a top yeast into a bottom yeast has been obtained.—J. F. B.

Yeasts; Biological analysis and sampling of brewery ——. F. Stockhausen and W. Coblitz. Woch. f. Brau., 1908, **25**, 637—641.

The authors have developed the biological analysis of yeast and the preparation of pure pitching yeast so as to render them accessible to small and medium-sized breweries not in a position to employ either large pure culture apparatus or a permanent analyst. (1). *Biological analysis of brewery yeasts.* (*a*). The yeast is mixed with sterile water and Lindner drop-cultures are prepared (see this J., 1908, 462). (*b*). A trace of the yeast is inoculated into sterile beer-wort, from which drop-cultures are then prepared. Study of these drop-cultures gives indications concerning the vitality and reproducing power of the yeast, and also the physiological condition of the cells. (*c*) Bettges and Heller's method is used for the detection of sarcinæ (this J., 1906, 227; 1907, 427). (*d*) A general view of the condition of the yeast is obtained by means of an ordinary vaseline closed-chamber preparation and the dead cells are detected by aqueous "methylene blue" solution. (2). *Sampling yeast for biological analysis.* For this purpose a sterilised oval tin, capable of containing about 180 grms. of solid yeast, is used. Into this tin the yeast is introduced by means of a tin or enamelled spoon sterilised by passing through a flame. The amount of yeast to be sampled, the size of the sample, and the quantity of sterile water with which the sample is mixed (*vide supra*) must stand in certain definite relations to one another, which relations the authors give in tabular form. In order to avoid the sending of large samples, and the consequent loss of yeast to the brewer, in cases where large quantities of yeast are to be sampled, it is recommended that the brewer mix the yeast with the requisite proportion of sterile water and send a sample of the latter in a sterile bottle for examination. (3). *Cultivation of pure pitching yeast.* For this purpose the authors use two cylindrical copper vessels, of 40 and 140 litres content respectively, provided with closely-fitting covers, the carbon dioxide escaping by means of a double wall with lateral perforations. The vessels are sterilised by rinsing with sodium carbonate solution and formalin, and, after thorough washing with warm water, are charged with hot wort collected in covered, sterilised cans at the pump in the copper house. The yeast from about 10 litres of wort (two Carlsberg vessels) is introduced into the cooled wort in the smaller copper vessel and allowed to grow for about 4 days, after which time the whole of the contents of the vessel are emptied into the larger one containing 100 litres of wort. In this way sufficient yeast is obtained to pitch about 6 hectolitres of wort in an ordinary fermenting vessel. If carried out with the usual precautions, this procedure yields pure yeast.—T. H. P.

Yeast; Continuous pure culture of ——. W. Coblitz. Woch. f. Brau., 1908, **25**, 641—643.

The apparatus devised by the author consists principally of a flask of about 1 litre content provided with a side-tube on either side and another tube at the top. By the two side-tubes the flask is connected with a Carlsberg vessel and a Lindner's drum holding about 50 litres of wort. The third tube of the flask is closed by means of an air-filter. The wort itself, the flask, the Carlsberg vessel, and all the connections are sterilised by boiling the wort in the drum and allowing the steam to pass through the various vessels. When the wort is cool, about half a litre of it is driven into the flask and there inoculated with the yeast to be cultivated. After sufficient growth of the yeast has taken place, the fermenting wort is shaken up and then passed over into the Carlsberg vessel together with the requisite quantity of wort from the Lindner drum. The amount of yeast obtained in the Carlsberg vessel may be increased by carefully pouring off the wort from the yeast at the end of the fermentation and then re-charging with fresh wort from the drum. By using two or more flasks connected with the same Lindner drum, two or more different yeasts can be cultivated at the same time. The drum may be replaced when empty and the Carlsberg vessel when the fermentation is complete. By this method only one inoculation of the yeast is required, the risk of infection and trouble being thus considerably diminished.—T. H. P.

Succinic acid; Determination of —— *in fermented liquids, in presence of other fixed and volatile acids.* M. E. Pozzi-Escot. Bull. Assoc. Chim. Sucr. et Dist., 1908, **26**, 185—186.

The author recommends the following process as being rapid and fairly accurate:—A known volume of the solution is treated with a small quantity of gelatin, neutralised with ammonia, acidified with a large excess of acetic acid, and treated with barium chloride. The solution is allowed to stand for a short time to allow of complete precipitation, and then filtered, the filter being subsequently well washed. The filtrate is heated to boiling, and treated with considerable excess of lead acetate, whereby any albuminoid substances and tannins, not precipitated by the gelatin, are thrown down as well as phosphates and tartaric and citric acids; provided that a sufficient excess of the lead salt has been added, malic and succinic acids, if present, pass into solution. The solution is now filtered, the filter being washed with water slightly acidified with acetic acid. The filtrate is treated with sulphuretted hydrogen to remove lead, filtered again, and then heated to boiling in order to expel excess of sulphuretted hydrogen. The solution, which now contains free malic and succinic acids, is acidified fairly strongly with sulphuric acid, and treated, at the boiling temperature, with such an excess of potassium permanganate that at the end of the operation the liquid remains at least 5 minutes without becoming decolorised. Under these conditions, malic acid and any trace of tartaric acid are completely oxidised. The boiling solution is now decolorised with a small quantity of potassium bisulphite, the sulphuric acid being removed by a slight excess of barium chloride. The filtered solution is concentrated, rendered slightly ammoniacal, and treated with excess of alcoholic barium bromide and with 3 volumes of 95 per cent. alcohol. The precipitated barium succinate is collected on a filter, washed with alcohol of at least 60 per cent. strength, and ignited in a muffle. The amount of barium carbonate thus obtained is then determined with N/10 hydrochloric acid.—L. E.

Thujone; Detecting —— *in liqueurs* [*or essential oils*]. L. Duperc and A. Monnier. *See* XX.

Patents.

Brewers' and other by-products and other moisture laden substances; Apparatus for drying or similarly treating ——. J. B. Watson, Burton-on-Trent. Eng. Pat. 13,013, June 18, 1908.

The apparatus consists of a cylindrical tower containing a number of superposed trays arranged round a central spindle. The substance to be dried is automatically delivered, through an opening in the cover of the tower, on to the uppermost tray and is spread over the latter and lower trays by means of rakes attached to the central spindle; openings are provided in the upper trays at the inner and outer edges alternately, and the substance is caused to pass through these openings from tray to tray by the action of the rakes. During its passage, the substance is subjected to the action of a current of hot air introduced into the upper half of the tower. The lower trays in the tower are of a different construction; a separate supply of heated air or steam, at a moderate temperature, is circulated through circuitous jackets beneath the trays, so that the partially dried substance is not submitted to the direct action of the air or steam. After leaving the bottom tray, the dry substance is collected in a conveyor of sufficient length to ensure the substance being cold before it is discharged into sacks, etc. The apparatus may be employed for drying the by-products of breweries, distilleries, and starch factories, peat, blood, sewage, fish, chemical manures, etc.—W. P. S.

Fermentation industries; Application of mineral salts and their colloidal solutions in the ——. G. E. Jacquemin. Fr. Pat. 389,938, July 12, 1907.

The inventor specifies the use in all fermentation industries, but particularly in the distillery, of salts of tin or bismuth, stannous chloride being specially suitable. These salts or their colloidal solutions are either used in the cultivation of the yeast or are added to the pitching yeast or to the main body of wort. By the use of these salts the yield of alcohol is claimed to be increased and the production of by-products diminished; the yeast is brought more rapidly into an active condition and the attenuation is accelerated. The most favourable proportion is 0·2—0·3 grm. of stannous chloride per litre.—J. F. B.

Brewing beer; Process of ——. L. Nathan, Zürich, Switzerland, and H. Bolze, Mannheim, Germany. U.S. Pat. 899,756, Sept. 29, 1908.

See Eng. Pat. 8526 of 1901; this J., 1902, 491.—T. F. B.

Filters. Eng. Pat. 9207, April 28, 1908. See I.

Potatoes; Utilisation of the juice of ——. Fr. Pat. 390,018. *See* XVI.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, AND DISINFECTANTS.

(*A.*)—FOODS.

Milk; Chemical evidence of peptonisation in raw and pasteurised ——. R. H. Colwell and H. C. Sherman. J. Biolog. Chem., 1908, **5**, 247—251.

The determination of ammonia in milk does not serve as an exact measure of the extent of protein decomposition.

In a series of experiments, milk was tested for peptone both when fresh and after standing. The coagulable protein was first removed, the proteoses precipitated by zinc sulphate, and an aliquot part of the filtrate treated with sodium hydroxide, until the zinc was precipitated and redissolved, and then submitted to the biuret test. Pasteurisation of the milk at 60° C. restrained peptonisation and souring to about the same extent. It did not render the milk either more or less liable to the development of offensive odours. Pasteurisation at higher temperatures (75° and 90° C.) restrained souring to a greater extent but had less effect on peptonisation. The samples developed more offensive odours than unpasteurised milk, indicating the predominance of an objectionable type of change. The results emphasise the desirability of low temperatures in pasteurising milk as a safeguard against disease and the objectionableness of pasteurisation as a preservative measure.—E. F. A.

Casein; Influence of temperature upon the solubility of —— in alkaline solutions. T. B. Robertson. J. Biolog. Chem., 1908, **5**, 147—154.

The solubility of casein in dilute alkaline solutions is considerably augmented at temperatures above 40° C., a fact which is not in harmony with the view that an increase in temperature increases the degreee of hydrolytic dissociation of the caseinates in solution. Caseinate solutions also increase in alkalinity and electrical conductivity upon heating (see Osborne, J. of Physiol. Chem., 1901, **27**, 398). The author considers a solution of a protein to be a system of polymeric modifications of the amphoteric electrolyte, HXOH, and suggests that the influence of heat consists, among other effects, in displacing equilibria of the type,

$$\mathrm{HXOH + HXOH \rightleftarrows HXXOH + H_2O},$$

towards the right hand in the direction of higher complexes. Coagulation by heat is the result of repeated condensations of this type. The paper contains solubility determinations of casein in solutions of potassium, lithium, and calcium hydroxides at temperatures from 21 to 88° C.—E. F. A.

Vegetable coagulating juices; Effect of dialysis on ——. C. Gerber. Compt. rend., 1908, **147**, 601—603. (See also this J., 1907, 1106).

It has already been shown that in the coagulation of milk by vegetable agents, the salts in the expressed plant juice, as well as in the milk itself, play an important part. The author has now studied the coagulating activity of two plant juices (from *Ficus Carica* L., and *Broussonetia papyrifera* L.), freed from the greater part of their mineral constituents by dialysis. It was found that during dialysis, the liquids increase in volume and that a precipitate separates; the dialysed and filtered liquids are much less active than the original juices; the precipitates, however, when made up to volumes corresponding to those of the dialysed liquids, with 5 per cent. solution of sodium chloride, yield solutions of much greater coagulating activity than the dialysed liquids treated with an equal quantity of sodium chloride. On submitting a liquid, already dialysed for 24 hours, to a second dialysis of the same duration, changes, similar to those observed in the first dialysis but smaller in amount, take place, thus indicating an approach to a state of equilibrium. On merely standing, also, coagulating juices undergo these alterations; it was found that a juice (from *Maclura aurantiaca* L.), which by standing had attained a state of equilibrium, suffered changes on dialysis similar to those observed in dialysing fresh juice. The results of the experiments indicate that the precipitate formed during the dialysis of vegetable juices consists chiefly of globulins, held in solution in the original juice by mineral salts; the decreased activity of the juice on dialysis, and the great activity of the precipitate when dissolved in sodium chloride solution, are explained by a precipitation of the enzyme, which may either be carried down with the globulins, or may be itself of a globulin character. The author considers that the precipitation which occurs spontaneously in active juices is due to mixture of juices from different cellular tissues, some of these juices containing sufficient mineral matter to hold the globulins in solution, whilst others contain much less mineral matter or contain particular electrolytes, whereby the former juices are diluted or undergo some chemical change.—L. E.

Apple-juice; Sterilisation of unfermented ——. H. C. Gore. U.S. Dept. of Agric., Bureau of Chemistry, Bull. No. 118, 1908.

The results are given of an investigation which was carried out with the view of ascertaining whether it was possible to sterilise apple-juice and keep the same in wooden, metal, or glass vessels for a reasonable length of time without any changes taking place. It is shown conclusively that apple-juice may be sterilised in wooden barrels, and that the product will remain sound for at least six months. The process consists in first of all coating the barrels on the outside with paraffin, then sterilising them by means of steam and sulphur dioxide, and removing the latter by a further application of steam. The juice, before being run into the barrels, is passed through a steriliser where it is heated to a temperature of from 65° to 70° C. When the barrel has been filled, it is closed by means of a paraffined and sterilised bung which has a hole through its centre plugged with cotton-wool. The barrel is completely closed, when the contents are cold, by driving a sterilised wooden plug into the centre hole. Tin and glass receptacles may also be employed, the juice in this case being filled into the receptacle and then subjected to a temperature 70° C. for from 30 minutes to 1 hour. The flavour of the juice is scarcely affected by the treatment, and slight carbonation was found to improve the taste, hide any cooked flavour, and to lessen the danger of contamination by moulds.—W. P. S.

Iron; Amount of —— in certain foodstuffs. E. Robert. Pharm. Zentr., 1908, **49**, 773.

Examination of various articles of diet gave the following results, the figures indicating the quantity of iron (in mgrms.) in 100 grms. of dry substance. Raspberries, 3·9; shelled hazel-nuts, 4·3, shelled almonds, 4·9; strawberries, 5·7; potatoes, 6·4; peas, 6·5, white beans, 8·3; carrots, 8·6; wheat-bran, 8·8; lentils, 9·5; red cherries, stoned, 10; apples, 13·2; cabbages, 16·5; asparagus, 20; spinach, at least 32·7; beef, 245; venison, 105; veal, 91; poultry, 91; pork, 56; shell fish, 56; eels, 56; pike, 42; horse blood, 580; human blood, 512; bullock's blood, 381; cow's milk, per litre, 1 to 2·5; human milk, 2·5 to 3·9; bitch's milk, 4·0; mare's milk, 15; egg yolk, 20; one egg only contains 1 mgrm. of iron.—J. O. B.

Patents.

Lactalbumin; Processes for obtaining a pure, neutral, sodium salt of —— soluble in water. J. A. Wülfing and E. Fischer, Berlin. Eng. Pat. 6179, March 19, 1908.

Ten kilos. of dry lactalbumin free from fat are mixed with 200 kilos. of water and dissolved by the addition of 600 grms. of sodium hydroxide. The lactalbumin is then precipitated by the addition of 20 per cent. hydrochloric acid, an excess, amounting to 130 grms. of hydrochloric acid, being added, beyond the quantity needed to neutralise the 600 grms. of sodium hydroxide. The precipitate is collected, washed with water, and, while still moist, treated with a solution containing 260 grms. of sodium hydroxide. The solution is then evaporated under reduced pressure at a temperature below 60° C. An alternative method is to treat the precipitated and washed lactalbumin with 90 per cent. alcohol; 260 grms. of sodium hydroxide, in the form of a concentrated aqueous solution, are then added to the magma and the whole is well mixed At the end of about 2 hours, the mixture is filtered, the residue is pressed, washed with ether, and dried at a low temperature.
—W. P. S.

Dehydrating apparatus [*for foodstuffs*]. F. T. Stare. Fr. Pat. 390,426, May 20, 1908. Under Int. Conv., May 21, 1907.

See Eng. Pat. 11,019 of 1908; this J., 1908, 1036.—T. F. B.

Potatoes: Utilisation of the juice of ——. Fr. Pat. 390,018. *See* XVI.

Brewer's and other by-products, etc.; Apparatus for drying ——. Eng. Pat. 13,013. *See* XVII.

(*B.*)—*SANITATION; WATER PURIFICATION.*

Vanillism; Industrial ——. Claverie. *See* XX.

Patent.

Sewage; Method and apparatus for the treatment of [*deodorising*] ——. A. B. Thomson and Oxychlorides (1907) Ltd., London. Eng. Pat. 21,566, Sept. 28, 1907.

The treatment consists in adding to the sewage oxychlorides prepared as described in Eng. Pats. 5596 of 1901, 21,021 of 1902, 11,470 of 1904, and 9706 of 1906 (this J., 1901, 815; 1903, 1297; 1905, 446; 1907, 417). The required proportion of the oxychloride is admitted to the sewage through a valve operated by means of a float, the rise or fall of which is regulated by the level of the sewage passing over a weir. Arrangements by this means may be provided for supplying the deodoriser to the liquor passing from the settling tanks, septic tanks, or precipitation tanks to the contact beds, or to the filters themselves.—W. P. S.

(*C.*)—*DISINFECTANTS.*

Antiformin; a new germicide. U.S. Cons. Reps., Sept., 1908. [T.R.]

U.S. Consul at Chemnitz states that Prof. Uhlenhut and Dr. Xylander, in the "Klinische Wochenschrift," find that successful results in the prevention of disease are obtained by the use of antiformin, a trade name given to the alkaline liquid prepared by the addition of caustic soda to solution of sodium hypochlorite.

Antiformin is a clear, yellow liquid, with a strong but not repulsive odour. On account of the impossibility of isolating alkali hypochlorites, solutions only can be prepared and used. For some time past antiformin has been used as a disinfectant, especially in breweries.

The bacteria of dysentery, cholera, typhoid fever, diphtheria, and bubonic plague are killed when brought in contact for a few minutes with 5 per cent. and even weaker solutions of antiformin. When a small amount of it is added to water containing these germs they gradually disappear into solution.

This property of antiformin adapts it for the purification of water, and for the disinfection of sewage. Experiments with the latter show that not only are all germs present destroyed, but that also every trace of odour is removed.

But the bacteria of tuberculosis show great power of resistance against its action.

Solutions of sodium hypochlorite are now prepared in Germany by the electrolytic decomposition of 5 per cent. salt solutions in platinum troughs. A current of 110 volts and 100 ampères furnishes in such an apparatus nearly 6,000 litres daily of a bleaching solution containing 1 per cent. of available chlorine.

Patent.

Tobacco extract; Manufacture of concentrated ——. C. F. Gloystein, Henderson, Ky. U.S. Pat. 899,865, Sept. 29, 1908.

Tobacco extract is heated to about 160° C. under a pressure of about 100 lb. per sq. in. for an hour, in order to transform the albumins present into peptones for the purpose of preventing sediment.—A. T. L.

XIX.—PAPER, PASTEBOARD, &c.

Paper-making; New raw material [*marsh-mallow*] *for* ——. E. Belani. Papierfabrikant, 1908, 6, 2305.

Large stretches of the Hungarian swamp-country, particularly around Szakolcza, are covered with growths of wild mallow. The stems, when scraped free from pith and boiled with sodium hydroxide, yield a pulp consisting, to the extent of about 80 per cent., of fine bast fibres, with thick walls and uniform lumen. Their average dimensions are 2·5 mm. in length and 7—10μ. in diameter. They are coloured wine-red to yellowish-red by zinc chloride-iodine reagent, and their form indicates a pliability which appears in favourable contrast with the stiff fibres obtained from rushes from the same district (see this J., 1908, 707). The other elements of the pulp include chains of parenchyma cells marked with characteristic crosses; broad net-like vessels with fine pores, and spiral and ring vessels; sclerenchyma cells are not present. The microscopic appearance of the pulp suggests that it should be a very suitable material for paper-making. —J. F. B.

Copying tissues and cigarette papers; Manufacture of ——. J. P. Korschilgen. Papierfabrikant, 1908, 6, 2185—2187, 2245—2247, 2301—2303.

The first condition for the manufacture of cigarette papers is a plentiful supply of soft and pure water. Ordinary rag papers are estimated to require 1500 times their weight of water in the course of their manufacture, but cigarette papers require considerably more. Any foreign matters dissolved in the water will tend to be absorbed by the paper and to influence the flavour of the smoke. For copying tissues any reasonably pure supply of water will suffice, even if it has a considerable degree of hardness. For copying tissues, suitable mixtures of linen, hemp, and cotton may be used, but cotton is not suitable for the thinnest sorts; cheap tissues may contain 70—80 per cent. of well bleached Ritter-Kellner sulphite wood pulp. Rags for cigarette papers require far more careful selection and purification. Hemp is the best material. The rags must be perfectly sound and strong; they must not be mouldy nor contain the slightest traces of tar, grease, etc. Fine, new canvas cuttings and twine-ends are the best, preferably free from "sheavy," although this can be dealt with if necessary. For coarse materials containing "sheavy," a double boiling process is desirable, first with 18–20 per cent. of lime for 5—6 hours under 6—8 atmos. pressure, and subsequently with 5—7 per cent. of soda ash for 3—4 hours under 5—6 atmos. pressure. After thorough washing with hot and cold water, the rags are broken-in, mixed with bleach, and the half-stuff placed in bleaching vats and drained for 4—5 days. By this maturing process, certain resistant impurities are rendered susceptible to attack, and the half-stuff is returned to the breakers, washed, further broken-in and treated with a second small quantity of bleach, which may be followed by a little dilute acid. The beating of cigarette papers is a very special art, the aim being to effect a complete longitudinal splitting of the fibres into fibrillæ with a minimum production of gelatinous cellulose.—J. F. B.

Pine wood; Chemical composition of ——. P. Klason and O. Fagerlind. Arkiv för Kemi, Min., och Geol., 1908, 3, [5], 1—20, [6], 1—10. Chem. Zentr., 1908, 2, 1302—1304.

Pine wood contains besides cellulose, about 3 per cent. of lignin and 12 per cent. of other carbohydrates; the dried wood contains 26—30 per cent. of lignin. Lignin probably contains a propylene or oxypropylene group. According to earlier experiments of Klason, the lignin contained in sulphite-cellulose waste lyes is combined with about 36 per cent. of sulphurous acid. By fractional precipitation with alcohol, the calcium lignosulphonate can be separated to some extent from the carbohydrates present with it in the waste lyes. The lyes are concentrated, neutralised with calcium carbonate, saturated with crystallised calcium chloride, and the resulting precipitate is agglomerated by boiling, freed from mother-liquor by pressing, and washed with alcohol. In this way about one-half of the calcium salt present in the lye is obtained. It is freed from calcium sulphate by conversion into the barium salt, which can also be precipitated from its solution by alcohol. Barium lignosulphonate is easily soluble in water, giving a clear, yellowish-brown, faintly acid solution. It has the composition, $C_{40}H_{44}O_{17}S_2Ba$, from which the formula, $C_{40}H_{42}O_{11}$, is derived for lignin. Determinations of the molecular weight of the barium salt by the cryoscopic method and of the degree of dissociation of its solution, indicate that the lignin molecule contains six C_{40}-aggregates. Calcium lignosulphonate gives the usual colour reactions of lignin, with the exception of those with hydrochloric acid and phenol and with phenylhydrazine. The failure of these two reactions with the calcium salt is due to the fact that in the latter, the oxypropylene group is combined with sulphurous acid. The other colour reactions, common to the calcium salt and to lignin, are caused by a free carbonyl group. The calcium salt appears to contain four methoxyl groups, one hydroxyl group, and a free carbonyl group. It will absorb two atomic proportions of iodine and hence contains an ethylenic linkage. In the authors' opinion, lignin is a condensation product of coniferyl and hydroxyconiferyl alcohols. The calcium lignosulphonate which is not precipitated by calcium chloride appears to contain less methoxyl than the less soluble salt. Lignin exhibits such a close resemblance to tannin, that it may be classed as an "insoluble tannin." It is present in the wood in combination with carbohydrates. Dried pine wood contains about 12 per cent. of matter soluble in warm water; of this, 10 per cent. consists of "wood gum" and 2 per cent. of a substance closely resembling lignin. Pine wood gum is only slightly soluble in alkali. It yields 25 per cent. of xylose, 6 per cent. of mannose, and traces of galactose, but consists chiefly of unknown carbohydrates.—A. S.

Cellulose; Action of cold solutions of sodium hydroxide on ——. W. Vieweg. Ber. 1908, **41**, 3269—3275.

In continuation of his previous work (this J., 1907, 1157), the author has studied comparatively the absorption of sodium hydroxide by cotton cellulose and "crinol," which is cellulose re-precipitated from its solution in cuprammonium. He confirms the observation that between the concentrations of 11 and 24 grms. of sodium hydroxide per 100 c.c., the proportion of sodium hydroxide removed from solution by the cellulose approximates to a constant and corresponds with a definite compound, $C_{12}H_{19}O_{10}Na$. The formation of this compound is indicated by a horizontal portion in the absorption-concentration curve; this horizontal portion occurs both in the case of cotton and of "crinol," indicating the same stoïchiometrical ratio, but the concentration of sodium hydroxide necessary for the formation of this compound varies. The necessary concentration is lower, the lower the temperature of the solution; it is also lower, the higher the original "degree of mercerisation" (see *loc. cit.*) of the cellulose. "Crinol" possesses a very high original "degree of mercerisation." Before the horizontal portion is reached, the absorption-concentration curve takes a somewhat irregular course, particularly in the case of cotton, owing to the alterations which the degree of mercerisation of the cellulose undergoes; these irregularities disappear as soon as Gladstone's compound, $C_{12}H_{19}O_{10}Na$, is formed, and the curve then runs horizontally. Saturation of the sodium hydroxide solutions with sodium chloride causes an increased absorption of the hydroxide by the cellulose in solutions of equal alkali concentration. Thus the formation of Gladstone's compound is reached at a lower concentration of sodium hydroxide than when the sodium chloride is absent. Saturation with sodium chloride, however, complicates the simple stoïchiometrical ratio mentioned above, and the curve continues to rise gradually instead of running horizontally. This is attributed to a physical influence of the salt, which superimposes an "adsorption" of alkali by the cellulose, in addition to the simple chemical combination.—J. F. B.

Hemicelluloses; Action of certain fungi on ——. H. C. Schellenberg. Flora, 1908, **98**, 257—308. Woch. für Brau., 1908, **25**, 539.

As typical hemicelluloses the author selected the cotyledons of *Lupinus hirsutus*, *Impatiens balsamina*, *Cyclamen europaeum* and *Tropæolum majus*, also the endosperms of the seeds of *Phœnix dactylifera* and young seedlings of *Molinia cœrulea*. The mycelia of various fungi were placed on sections of the above plant-tissues, and the erosion of the latter and the development of the fungi were studied. The results showed that the relations between fungus and plant-tissue were strictly specific. For instance, *Mucor racemosus* could only dissolve the hemicellulose of *Molinia cœrulea*; it had no effect upon the other types of hemicellulose, nor on cotton or flax fibres. This fungus is therefore considered to be specifically adapted for the disintegration of the hemicellulose tissues of the grass family, hence its natural occurrence in rotting straw and manure. *Mucor neglectus*, *M piriforme*, and *Rhizopus nigricans* are specifically adapted to dissolve the hemicellulose of lupin seeds, whilst *Trichoterium roseum* has a powerful solvent action on the date kernel. *Penicillium glaucum* dissolves the amyloid from the membranous tissues of the endosperms of *Impatiens*, *Cyclamen* and *Tropæolum*, leaving the ground-substance of the membranes unattacked. None of the fungi had any solvent effect on the true cellulose of cotton or flax. Many of the fungi possessed the property of dissolving the middle lamellæ of the plant tissues, which is supposed to be of a pectic nature, but which the author regards rather as a hemicellulose. The solvent action of the fungi is clearly shown to be due to the action of enzymes secreted by them. An intense blue coloration is produced with guaiacum and hydrogen peroxide, especially around the points of the hyphæ. No sugars could be isolated as the result of the action, and it is probable that the sugars produced are immediately absorbed by the living fungus, which becomes rich in glycogen and fat. The specific character of the enzymes secreted by the different fungi forces the author to conclude that there are at least four distinct cyto-hydrolytic enzymes, which he names according to the kind of hemicellulose susceptible to their attack: molinia-cytase, lupinus-cytase, phœnix-cytase and impatiens-cytase. These cytases are, however, quite distinct from the enzyme "cellulase," which is supposed to dissolve true cellulose and to be secreted by the various fungi which attack and destroy the tissues of wood.—J. F. B.

Patents.

Celluloid or the like; Manufacture of ——. Self-Developing Plate Co., London, and T. Bolas, Chiswick. Eng. Pat. 21,880, Oct. 3, 1907.

Uniformly nitrated pyroxylin in sheet form (*e.g.*, nitrated paper) is made evenly transparent by treatment with a "high" solvent in quantity insufficient to produce complete solution. The prepared sheet is supported (*e.g.*, by a glass plate) until it is dry. Several sheets may be superposed before or during gelatinisation. Various materials or articles may be covered or coated with gelatinised sheets of pyroxylin in the manner described. The position of the sheet on the support may be reversed for the purpose of obtaining two smooth surfaces, or the upper surface may be covered with a stratum of gelatin.—J. F. B.

Celluloid; Manufacture of films of ——. Soc. Civile des Pellicules Nouvelles pour Cinématographes et Autres Usages. First Addition, dated July 6, 1907, to Fr. Pat. 384,112, Jan. 25, 1907 (this J., 1908, 471).

Films of celluloid or cellulose, produced by discharging special collodions from suitable orifices, are dried flat under tension by fixing their edges on frames during the drying process.—J. F. B.

Plastic material [*celluloid substitute*] *for the manufacture of combs and moulded objects of all kinds.* L. Desvaux and H. Allaire. First Addition, dated May 9, 1908, to Fr. Pat. 388,097, March 11, 1908 (this J., 1908, 873).

According to the present addition, plastic materials are obtained by substituting "maisin" (this J., 1902, 1464, 1548; 1903, 816, 960; 1905, 853) for the whole of one of the usual components of celluloid. The mixture of "maisin" with nitrocellulose or camphor is kneaded to a plastic mass with the addition of a liquid which is a solvent of both substances.—A. S.

Celluloid; Chemical product resembling —— and process for producing the same. F. Raschig, Ludwigshafen on Rhine, Germany. U.S. Pat. 900,204, Oct. 6, 1908.

See Ger. Pat. 174,914 of 1905; this J., 1907, 340.—T. F. B.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

Poppy culture [*in Germany*] *for opium production.* Thoms. Z. angew. Chem., 1908, **21**, 2208.

Experiments have been carried out on the cultivation of poppies for opium production in the gardens of the Pharmaceutical Institute of the Berlin University. The amount of opium obtainable from poppies in this latitude is satisfactory, but the cost of collecting it is too high. In one working hour only 250 poppy-heads can be cut and the opium collected. After three separate cuttings, one poppy-head yields on an average 0·059 grm. of dry opium. The alkaloid content depends upon the quality of the manure. A good yield is obtained from a highly nitrogenous porous soil. Attempts to obtain the alkaloids directly from the unripe poppy-heads were not encouraging. It seems that the alkaloids are already formed in the plant. In the young plant the percentage of narcotine is increased, whilst that of morphine is low. Morphine, narcotine, and codeine are present in the fully-ripe capsules. —F. Shdn.

Belladonna and hyoscyamus extracts; Determination of alkaloids in ——. E. Rupp and A. Zinnius. Pharm. Zeit., 1908, **53**, 737—738.

Three grms. of belladonna extract or 6 grms. of hyoscyamus extract are dissolved in 5 or 8 c.c. of hot water, treated with 90 grms. of ether and 1 grm. of ammonia solution, and shaken frequently for 15 minutes, then allowed to stand for the same period. Sixty grms. of the ether solution (=2 or 3 grms. of the respective extracts) are then decanted through a cotton plug and the solvent is distilled off. The residue is treated with 3 successive 5 c.c. of ether, which are evaporated each time separately. The final residue is re-dissolved in a little alcohol, and treated with 20 c.c. of $N/_{100}$ acid and 20 c.c. of water. If this solution is colourless, it may be titrated back directly with $N/_{100}$ alkali; but if coloured, it must be transferred to a separator, and shaken out with 5 c.c. of ether. The aqueous portion is then run into a flask of alkali-free glass, sufficient ether added to form a layer 1 cm. deep, and titrated back with $N/_{100}$ alkali with iodeosin indicator.—J. O. B.

Vanillism; Industrial ——. Claverie. J. Méd. et Chirurg. pract., 1908, **79**, 111. J. Pharm. Chim., Append., 1908, **28**, 27.

Those who habitually handle vanilla "beans" are more or less subject to a cutaneous affection either general or local, in the form of a papulo-erythematous eruption of the hands, face or neck, sometimes having the appearance of erysipelas, and causing intense itching. Acute forms may be accompanied by headache or migraine. This affection has been attributed to a species of *Acarus* parasitic on vanilla, or to formol used as a preservative. The author however considers the oily juice which exudes from the beans to be the irritant cause. As prophylactics, thorough washing of the hands after handling vanilla, and efficient ventilation of the factory, are suggested. —J. O. B.

Benzaldehyde; Colorimetric determination of —— in almond extracts. A. G. Woodman and E. F. Lyford. J. Amer. Chem. Soc., 1908, **30**, 1607—1611.

The method is based upon the reaction of aldehydes with fuchsin (magenta) decolorised with sulphurous acid, and is similar to Chace's method of determining citral in lemon oils (this J., 1906, 1116). The reagent is prepared by dissolving 0·5 grm. of the dyestuff in 100 c.c. of water, adding a freshly-prepared solution of sulphur dioxide (20 grms. per litre) and diluting the whole with water to a litre. The best method of obtaining alcohol free from aldehydes was found to be treatment of commercial "cologne spirits" with silver oxide, as suggested by Dunlap, followed by distillation. The distillate was then treated with 25 grms. of metaphenylenediamine hydrochloride per litre, and a rapid current of air passed through the solution for 3 hours, after which it was distilled, and the first 100 c.c. of distillate rejected. The remainder of the distillate will remain suitable for use for some weeks if kept in the dark and at a low temperature. For determination three standard solutions are prepared containing respectively 2, 4, and 6 mgrms. of freshly-distilled benzaldehyde in the aldehyde-free alcohol, and placed in Hehner's Nesslerising tubes. Ten grms. of the extract under examination are diluted with the alcohol to 50 c.c., and 2 c.c. of this solution made up to 20 c.c. with the same alcohol, and also placed in a Hehner's tube. All the cylinders are now allowed to stand in water at 15° C., and an addition of 20 c.c. of Schiff's reagent at the same temperature rapidly made to each. After thorough mixing of their contents, the tubes are allowed to stand for 10 minutes, and the colour of the unknown solution then matched against that nearest to it. Test experiments have shown that within the limits mentioned, the depth of colour is proportional to the concentration of the benzaldehyde. —C. A. M.

Adrenine (adrenaline); Some specific reactions for ——. G. Comessatti. Muench. Med. Woch., 1908, 1296. Apoth.-Zeit., 1908, **23**, 715.

If 3 or 4 drops of a fresh adrenine solution (1 : 1000) diluted with 6 to 8 c.c. of distilled water, be shaken with a few drops of mercuric chloride solution (1 or 2 : 1000), a diffused reddish colour appears in from 1 to 3 mins. and is persistent. Aqueous solution of adrenine alone, without the addition of mercuric chloride, remains colourless, when exposed for from half an hour to two hours to the air, then slowly acquires a reddish tint probably due to the formation of oxyadrenine. When 1 or 2 drops of a pyrocatechol solution (1 : 1000), diluted with 8 c.c. of water are treated with mercuric chloride solution, a greenish colour is at length developed. If one or two drops of adrenine solution (1 : 1000) are added to the same reagents mixed under like conditions, a reddish permanent colour appears in 1 to 3 mins. Salicylates and resorcinol solutions also give colour reactions with mercuric chloride, but these are distinguishable from the colour given by adrenine.—J. O. B.

Pinonic and pinic acids; Active ——. P. Barbier and V. Grignard. Compt. rend., 1908, **147**, 597—600.

Hitherto, only racemic pinonic acid and an oily, feebly active acid have been obtained by the oxidation of pinene with permanganate. Considering that this result was due, at least in part, to the fact that the samples of pinene used were only slightly optically active, the authors have studied the oxidation of highly active preparations. *l-Pinene* ($[\alpha]_D$ = about − 37°), on oxidation with potassium permanganate in the cold, was found to yield racemic and *l*-pinonic acids, separable by fractional crystallisation. *l*-Pinonic acid, $C_{10}H_{16}O_3$, melts at 67°—69° C., is easily soluble in water and ether, fairly soluble in chloroform, nearly insoluble in ligroïn (petroleum spirit); its rotation in chloroform solution is $[\alpha]_D^{22^\circ} = -90^\circ{\cdot}5$; it forms two oximes, a lævorotatory β-oxime (m. pt. 128° C.) and a dextrorotatory γ-oxime (m. pt. 189°—191° C.). These oximes only differ from those obtained by Baeyer from dextrorotatory, oily pinonic acid, in possessing opposite optical activities. On oxidation with sodium hypochlorite or hypobromite, *l*-pinonic acid yields *d*-pinic acid, $C_9H_{14}O_4$, which melts at 135°—136° C., and, in acetone solution, has a rotation of $[\alpha]_D^{25^\circ} = +7{\cdot}1^\circ$. *d-Pinene* ($[\alpha]_D = +39{\cdot}4^\circ$), oxidised in the same way as the lævo-compound, yielded a mixture of racemic and *d*-pinonic acids, separable by fractional crystallisation. *d*-Pinonic acid has a rotatory power of $[\alpha]_D^{25^\circ} = +89{\cdot}0^\circ$; in other respects it resembles the *l*- acid closely. It forms β- and γ-oximes identical with those obtained by Baeyer. By melting equal quantities of *d*- and *l*-pinonic acids together, the racemic acid (m. pt. 104° C.) is at once obtained. The author's work shows that the acid obtained by Tiemann by oxidising sodium α-campholenate and by distilling α-dihydroxydihydrocampholenic acid, and described as *l*-pinonic acid, is not identical with the acid obtained from *l*-pinene, since it melts at 98°—99° C., forms only one oxime (m. pt. 147° C.), and yields racemic pinic acid on oxidation. It is possible, however, that these two lævo-acids are the *cis*- and *cis-trans*-isomerides theoretically possible.—L. E.

Thujone; New method for detecting —— in liqueurs [or essential oils]. L. Duparc and A. Monnier. Ann. Chim. analyt., 1908, **13**, 378—381.

The nitroprusside reaction for thujone gives more definite and distinctive results than those obtained by the methods of Cuniasse or Rocques (this J., 1907, 269; 1908, 702). Ten c.c. of a solution of an essential oil in 60 per cent. alcohol, or a similar volume of the distillate from a liqueur, are treated with 2 c.c. of a 10 per cent. solution of zinc sulphate, then with 0·5 c.c. of 10 per cent. sodium nitroprusside solution; after agitation, 4 c.c. of 5 per cent. sodium hydroxide solution, free from carbonate, are added; after agitating and allowing to stand for a minute, 2 or 3 c.c. of glacial acetic acid are added. In the presence of thujone and tansy oil, a copious deep currant-red precipitate is formed; the same is given by the thujone-containing oils of absinthe, thuja, sage, and *Artemisia barrelieri*. All other essential oils examined give yellow or whitish precipitates, except citral, which affords an orange-red precipitate. It is readily distinguished from the thujone precipitate by treatment with ether, which removes the colour from the former, and itself becomes yellow; whereas the thujone precipitate forms a red deposit at the bottom of the ether. If definite results are not obtained directly from the distillate, the liquid may be shaken with ether; after separating and distilling off that solvent, the residue, dissolved in alcohol, may be tested as above.—J. O. B.

Helkomen, basic bismuth dibromohydroxynaphthoate [Iodoform substitute]. G. Richter. Apoth.-Zeit., 1908, **23**, 600.

β-Hydroxynaphthoic acid in acetic acid solution is brominated, and the resulting dibromohydroxynaphthoic acid converted into the basic bismuth salt by heating with bismuth hydroxide. It forms a fine, yellow, odourless, insoluble powder, unaffected by heating to 110° C. It is introduced as a substitute for iodoform.—J. O. B.

Indoform, so-called salicylic acid-methylene acetate. G. Frerichs. Apoth.-Zeit., 1908, **23**, 641—643.

"Indoform" which has been introduced as a definite compound, salicylic acid-methylene acetate, is found to be merely a mixture of 1 part of salicylic acid with 2 parts of acetylsalicylic acid, moistened with a little formaldehyde solution, dried, and then perfumed with a faint trace of methyl salicylate.—J. O. B.

Dimethylglyoxime; Preparation of —— [for use in the determination of nickel]. A. Gandarin. J. prakt. Chem., 1908, **77**, 414—416.

In view of the use of dimethylglyoxime for the detection and determination of nickel (this J., 1907, 1217), the author has devised a method for its preparation. 850 grms. of commercial methylethyl ketone are mixed with 30 c.c. of hydrochloric acid of sp. gr. 1·19, and 1 litre of amyl nitrite is allowed to run in slowly with vigorous stirring. This takes about 1½ hours and the temperature should be kept below 40°—50° C. When the reaction is over, 800 grms. of ice are added, followed by 878 grms. of sodium hydroxide in 800 c.c. of water, and the mixture shaken for half-an-hour. After standing, the layer of amyl alcohol is removed, and the aqueous liquid extracted twice with ether. 100 c.c. of the alkaline liquid are treated with the calculated amount of hydroxylamine hydrochloride, and the dimethylglyoxime collected and weighed. If the original volume of the alkaline liquid is *v* c.c., *a* grms. the weight of dimethylglyoxime obtained from the 100 c.c., the amount of hydroxylamine hydrochloride in grms. required for the remaining liquid, is given by the expression $\frac{656\cdot(v-100)\ a.}{109500}$ This weight of hydroxylamine hydrochloride is dissolved in a little water, added to the alkaline liquid, and the whole warmed on the water-bath for an hour. The liquid is acidified with acetic acid, and the dimethylglyoxime separated at the pump, washed, and dried. As thus produced it is sufficiently pure, but if necessary, can be recrystallised from alcohol. About 650—700 grms. can be obtained from the quantities of raw materials given above. Dimethylglyoxime will show the presence of 0·0025 mgrm. of nickel (5 c.c. of a solution of strength 1 : 2,000,000). It will also detect 0·1 mgrm. of nickel in the presence of 5000 times this amount of cobalt.—F. Shdn.

Benzoic and cinnamic acids; Separation of ——. A. W. K. de Jong. Pharm. Weekblad, 1908, **45**, 1115—1116. Chem. Zentr., 1908, **2**, 1293.

The author states that the method proposed by Scheringa (this J., 1907, 1069) cannot yield satisfactory quantitative results, as by the oxidation of cinnamic acid with permanganate, considerable quantities of benzoic acid are formed in addition to benzaldehyde.—A. S.

Hydrogenation; Equilibria of ——. M. Padoa and U. Fabris. Atti R. Accad. dei Lincei Roma, 1908, [5], **17**, I., 111—115; II., 125—132. Chem. Zentr., 1908, **1**, 1395; **2**, 1103—1104.

From a study of the action of nickel and hydrogen on various hydrocarbons at different temperatures, the following conclusions are drawn:—(1). In the dehydrogenation of monocyclic and polycyclic hydrogenised hydrocarbons, gaseous hydrocarbons are formed to some extent. If a hydrocarbon yields several hydrogenation products, the most highly hydrogenised one is most readily decomposed in this manner. Of the hydrocarbons examined, tetra- and di-hydrophenanthrene yielded no hydrocarbon decomposition products even under increased pressure, and tetrahydronaphthalene did not under atmospheric pressure. (2). The decomposing action of nickel is influenced by pressure. For instance, at atmospheric pressure, tetrahydronaphthalene is simply de-hydrogenised with liberation of hydrogen, whereas under a pressure of 3 atmos., gaseous hydrocarbons are formed. (3). The several hydrogenation products of a hydrocarbon can each be obtained from the most highly hydrogenised product by the action of nickel at a definite temperature, but it is not possible to effect a gradual progressive splitting-off of hydrogen. In almost all cases de-hydrogenation begins at a higher temperature than hydrogenation. Under atmospheric pressure, hydrogenation and de-hydrogenation are distinct processes; in most cases nickel can effect either reaction, but on certain compounds, the nickel acts only in one way. Under increased pressure, the two limits of temperature, *viz.*, the highest at which hydrogenation is possible, and the lowest at which de-hydrogenation takes place, are closer together, and under certain conditions. the two processes may proceed simultaneously until equilibrium is attained.—A. S.

Oxalates of the rare-earth metals; Solubility of —— in solutions of uranyl salts. O. Hauser. Z. anal. Chem., 1908. **47**. 677—680.

Solutions of uranyl salts dissolve the oxalates of the rare-earth metals, even in the cold, and, on standing, sparingly soluble complex uranyloxalates, such as $3[UO_2(COO)_4]Ce_2,5H_2O$, separate. In the presence of large quantities of uranyl salts, therefore, the quantity of oxalic acid (or ammonium oxalate) used for the separation of the rare-earth metals as oxalates must be sufficient to provide for the reaction: $UO_2^{\cdot\cdot}+2(COO)_2'' = UO_2(COO)_4''$. In order to prevent complications, due to reduction of sexavalent to quadrivalent uranium, the reacting mixture should not be exposed for long to full daylight.—F. Sodn.

Gases of the atmosphere non-liquefiable in liquid air; Analysis of ——. F. Bordas and Touplain. Compt. rend., 1908, **147**, 591—594.

The residual gases obtained by cooling atmospheric air in liquid air, were purified by passage through tubes containing charcoal and immersed in liquid air. The residue thus obtained, was found to consist of neon and helium. A number of new lines was discovered in the spectrum of neon.—L. E.

Origanum oil in Cyprus. Bd. of Tr. J., Oct. 29, 1908. [T.R.]

The annual report of the Director of Agriculture for the year 1907–8 states that the former contract for the distillation of origanum oil having terminated, a new agreement was entered into for five years with another contractor. The forest area in which the collection of the origanum plant may be made has been increased, and there is a prospect of a correspondingly larger yield of oil. The total quantity distilled in 1907 was 636 okes, or about 1766 lb. Owing to some delay in starting work, the quantity of oil extracted fell short of what might otherwise have been obtained. It is pointed out that the Cyprus origanum oil contains a good percentage of carvacrol, a valuable constituent which is not difficult to extract. Efforts will be made during the year to put a small quantity of this on the market.

Vacuum sublimation; Practical studies on ——. See I.

Patents.

Secretions from the thyroid or other organs; Preparation of ——. E. Hoennicke, Dresden, Germany. Eng. Pat. 27,023, Dec. 6, 1907. Under Int. Conv., Dec. 17, 1906.

The patent relates to the obtainment of the inner secretions of the thyroid glands, etc., in a pure state, free from cellular albumin, the methods used being based on the difference between the colloidal properties of the contents of the vesicle on the one hand and the cellular albumin on the other hand. The methods proposed are described in detail. They consist briefly in:—(1). Subjecting macerations of the organs in "physiological" common salt solution to treatment with certain mediums having a coagulating effect on the cellular albumin only. (2). Heating macerations of the organs gradually almost to the boiling point, and then allowing them to cool slowly. (3). Heating macerations of the organs to blood temperature after subjecting them to a treatment favourable to the coagulation of cellular albumin, *e.g.*, adding suitable colloids, agitating, or passing carbon dioxide or an electric current through them. (4). Filtering the macerations through precipitated cellular colloids of the organs being treated or similar colloids having the same effect. (5). Effecting the coagulation of the cellular colloid in the organ itself and especially in the outer layers of the same, by treating the organs with hot water, alcohol, etc., and subsequently extracting the inner secretions by placing the organs in a "physiological" common salt solution. —A. S.

Colloidal elements; Process of peptisating ——. H. Kuzel, Baden, Austria. U.S. Pat. 899,875, Sept. 29, 1908.

See addition of March 8, 1907, to Fr. Pat. 371,799; this J., 1907. 1029.—T. F. B.

Chloracetic ether [ester]; Process of making ——. G. Imbert, Nuremberg, Germany. U.S. Pat. 901,009, Oct. 13, 1908.

See Eng. Pat. 5013 of 1907; this J., 1907, 637.—T. F. B.

Diformin; Process of producing ——. S. von Kapff, Boxgraben-Aachen, Germany. U.S. Pat. 901,298, Oct. 13, 1908.

See Eng. Pat. 28,723 of 1907; this J., 1908, 356.—T. F. B.

Terpene esters; Process of making ——. A. A. Shukoff, St. Petersburg. U.S. Pat. 900,316, Oct. 6, 1908.

See Fr. Pat. 369,794 of 1906; this J., 1907, 223.—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Selenium; Influence of moisture on the electrical properties of ——. C. Ries. *See* XI*A*.

Patent.

Pictures and photographic printing plates; Process of producing ——. W. Triepel, Berlin. U.S. Pat. 901,218, Oct. 13, 1908.

See Eng. Pat. 19,889 of 1907; this J., 1908, 140.—T. F. B.

XXII.—EXPLOSIVES, MATCHES, &c.

Patents.

Nitrocellulose explosives; Art of producing gelatinised ——. G. H. Wadsworth, Lyndhurst. U.S. Pat. 899,577, Sept. 29, 1908.

See Eng. Pat. 16,492 of 1907; this J., 1908, 297.—T. F. B.

Explosive; Smokeless ——. M. Abelli, Turin, Assignor to Dinamite Nobel Soc. Anon. U.S. Pat. 899,855. Sept. 29, 1908.

See Eng. Pat. 21,529 of 1905; this J., 1906, 1119.—T. F. B.

XXIII.—ANALYTICAL CHEMISTRY.

APPARATUS.

Patents.

Combustible gases; Apparatus for detecting the presence of ——. H. Sefton-Jones, London. From Hartmann und Braun Akt. Ges., Frankfurt a/Main, Germany, and E. A. della Santa, Brussels. Eng. Pat. 16,670, Aug. 8, 1908.

The apparatus for detecting the presence of combustible gases in the atmosphere comprises a source of heat, varying in intensity with the nature of the surrounding atmosphere, and a resistance subjected to the action of this source of heat, together with means for indicating changes in the magnitude of the resistance. The source of heat may be either a flame or a catalytic agent, the former responding not only to combustible gases but to inert gases in the atmosphere, whilst the catalytic agent indicates only combustible gases. The flame is covered by a mantle or chimney provided with laterally extending vanes to assist radiation. It is connected with a mantle above it which is wound with wire and which, in combination with a galvanometer, constitutes a resistance-thermometer. The flame varies in height according to the composition of the atmosphere and thus varies the temperature of the resistance-coil. A compensating-resistance may be included to allow for changes in temperature of the outside air.—J. F. B.

Gases ; Apparatus for analysing ——. H. J. Westover, New York. U.S. Pat. 899,774, Sept. 29, 1908.

The gas is withdrawn from the furnace flue by a partial vacuum created in a measuring chamber. When the latter is filled, the connection to the flue is shut off and the gas is forced into an absorbing chamber. The liquid in the latter is in connection with a displacement chamber in which a float is arranged which rises to a greater or lesser extent, depending upon the proportion of gas absorbed. A pen attached to the float records the percentage of gas absorbed as soon as the whole of the gas from the measuring chamber has been forced into the absorbing chamber.

—W. H. C.

Gases ; Process and apparatus for the determination of the calorific power of ——. Salau und Birkholz. Fr. Pat. 389.633. April 25, 1908.

The temperature of the flame of a gas is a function of its calorific power and of the quantity and temperature of the air supplied to support combustion. The process claimed consists in heating a metallic body by means of a flame fed by the gas, and measuring the elongation of the body, the air necessary for combustion being aspirated by the draught produced in the chimney and being heated by contact with the walls of the chimney. The apparatus comprises a chamber in which the flame burns below the measuring body, the lower part of the chamber being swept by fresh air and the upper part by the products of combustion which escape by a special chimney. The indicating and registering devices rest on a pillar and are raised above their supports at a low temperature, but are free to swing on their supports when the temperature rises above a certain point.—J. F. B.

INORGANIC—QUALITATIVE.

Uranium and cadmium ; New differential reaction for ——. P. Lemaire. Rép. Pharm., 1908, **20**, 433—434.

A reagent is prepared, immediately before use, by mixing 5 c.c. of caustic soda solution of sp. gr. 1·332, with 95 c.c. of 5 per cent. thiosinamine solution. Two or three drops of the solution to be tested are boiled with 3 or 4 c.c. of this reagent. In the presence of salts of either cadmium or uranium, a yellow, permanent precipitate will be obtained. Under similar conditions, the commoner metals, alkaline-earths, and alkalis, give no reaction. When a positive reaction is thus obtained, cadmium may be precipitated, in the usual manner, from hydrochloric acid solution by means of hydrogen sulphide, and uranium by ammonium sulphydrate reagent.—J. O. B.

INORGANIC—QUANTITATIVE.

Sodium thiosulphate ; Action of —— *on potassium permanganate in alkaline solution.* Kiliani. Chem.-Zeit., 1908, **32**, 1018.

Reinige (Z. anal. Chem., **9**, 39) described a method of titrating permanganate in alkaline solution based on the following equation :—

$$2KMnO_4 + 6Na_2S_2O_3 + 4H_2O = 3Na_2S_4O_6 + 2MnO_2 + 2KOH + 6NaOH.$$

It was found by Herm that, in practice, only one-eighth of the amount of thiosulphate required by the above equation was necessary for the decolorisation of alkaline potassium permanganate. The author's experimental investigations have confirmed Herm's statement. The thiosulphate is not converted into tetrathionate, but is oxidised to sulphate, as in the equation :

$$8KMnO_4 + 3Na_2S_2O_3 + H_2O = 3Na_2SO_4 + 3K_2SO_4 + 2KOH + 8MnO_2$$

—C. A. M.

Sulphocyanides [thiocyanates] and ferrocyanides, etc., in cyanide solutions containing copper ; Determination of ——. L. M. Green. Trans. Inst. Min. and Met., Oct., 1908. [Advance proof.]

In the cyanide treatment of silver and gold ores, the determination of ferrocyanides and sulphocyanides in the working solutions is complicated by the presence of copper compounds. As cupric and cuprous double cyanides reduce potassium permanganate, the titration of the cyanide solution by this reagent indicates the reducing power of ferrocyanides and sulphocyanides *plus* that of the copper compounds. Copper also interferes with the separation of sulphocyanides and ferrocyanides, some cuprous sulphocyanide being precipitated with the Prussian blue. The following solutions for determining sulpho- and ferrocyanides, etc., in cyanide solutions containing copper, are required. *Standard solutions :*—Silver nitrate—13·05 grms. of the salt in 1 litre of water. Mercuric chloride—20·846 grms. of $HgCl_2$ in 1 litre. $N/10$ permanganate. *Approximate solutions :*—Sulphocyanide to approximately equal permanganate. Zinc sulphate solution—10 per cent. $ZnSO_4,7H_2O$. $N/10$ ferrocyanide—42·2 grms. $K_4FeCy_6,3H_2O$ in the litre. The scheme suggested for the separate estimation of these various double cyanides is as follows. (1). Take 10 c.c. of the solution, add a small crystal of potassium iodide and a little sodium hydrate solution and titrate with a 1·305 per cent. silver nitrate solution, till there is a permanent yellowish cloudiness ; the result called "a" c.c. represents the alkali cyanide plus the zinc potassium cyanide, in terms of potassium cyanide. (2). Dissolve a small crystal of potassium iodide in a few c.c. of water, and add 5 c.c. of an approximately $N/10$ solution of potassium ferrocyanide and a pinch of sodium bicarbonate. Add a 2·0846 per cent. solution of mercuric chloride, drop by drop, till there is just a permanent red precipitate. To this add 10 c.c. of the cyanide solution and titrate with the mercuric chloride until there is a permanent red colour. The result, called "b" c.c., represents potassium cyanide equivalent to the alkali cyanide plus the zinc-potassium cyanide, plus the cuprous-potassium cyanide, plus $\frac{3}{4}$ of the cupric-potassium cyanide. If silver be present in large amount, the cyanide combined with it must be calculated and deducted from "b." (3). Take 10 c.c. of the cyanide solution, add 20 c.c. of a solution of potassium sulphocyanide, approximately equivalent to $N/10$ permanganate, and 5 c.c. of a 10 per cent. zinc sulphate solution. Titrate with the standard mercuric chloride solution until the precipitate becomes permanently but faintly yellow. The result, called "c" c.c., represents potassium cyanide equivalent to the alkali cyanide, plus the zinc-potassium cyanide, plus half of the cupric-potassium cyanide. (4). Acidify about 10 c.c. of water very strongly with sulphuric acid, cool, and add 10 c.c. of $N/10$ potassium permanganate solution. Titrate with the cyanide solution and calculate the reducing power of 10 c.c. in terms of permanganate. The result, called "d" c.c., gives the amount of permanganate reduced by the sulphocyanide, plus the ferrocyanide, plus the whole of the copper. Sulphides or organic matter, when present, must be removed before testing or must be estimated and allowed for. (5). To 25 c.c. of the solution, add 5 c.c. of the ferrocyanide solution and acidify with sulphuric acid ; add 5 c.c. of the zinc sulphate solution and make up to 50 c.c. Shake up and filter through a dry filter. Titrate 20 c.c. of the filtrate with the permanganate ; the result, called "e," gives the amount of permanganate reduced by the sulphocyanide alone. Then the percentage of alkali and zinc double cyanide, estimated as potassium cyanide is "a"$\div 10$. The percentage of cupric double cyanide as potassium cyanide is $(c - a) \div 5$. The percentage of cuprous double cyanide as potassium cyanide is $(a + 2b - 3c) \div 20$. The percentage of potassium sulphocyanide is "e"$i \times 0{\cdot}0162$. The percentage of potassium ferrocyanide is

$$\left\{ d - \left[(2b - a - c) \div 2{\cdot}6 \right] - e \right\} \times 0{\cdot}422.$$

The percentage of total copper is $(2b - a - c) \div 40{\cdot}9$. The author gives equations and explanations of the various reactions.—F. R.

Chromic and vanadic acids in the presence of one another; Iodometric determination of ——. G. Edgar. *See* VII.

Potassium ferrocyanide; Volumetric determination of ——. H. Bollenbach. *See* VII.

Antimony or lead compounds containing oxygen; Analysis of ——. F. Jacobson. *See* XIII*C*.

Dimethylglyoxime; Preparation of —— [*for use in the determination of nickel*]. A. Gandarin. *See* XX.

ORGANIC—QUALITATIVE.

Sesamé oil; Colour reactions of —— *with aromatic aldehydes and sugars.* C. Fleig. *See* XII.

Adrenine (*adrenaline*)*; Some specific reactions for* ——. G. Comessatti. *See* XX.

Thujone; Detecting —— *in liqueurs* [*or essential oils*]. L. Duparc and A. Monnier. *See* XX.

ORGANIC—QUANTITATIVE.

Mineral oils; New values in the analysis of ——. R. Kissling. *See* III.

Colophony; Determination of —— *in shellac.* C. Ahrens. *See* XIII*B*.

Maple products; Lead value of ——. A. P. Sy. *See* XVI.

Yeasts; Biological analysis and sampling of brewery ——. F. Stockhausen and W. Coblitz. *See* XVII.

Succinic acid; Determination of —— *in fermented liquids in presence of other fixed and volatile acids.* E. Pozzi-Escot. *See* XVII.

Belladonna and hyoscyamus extracts; Determination of alkaloids in ——. E. Rupp and A. Zinnius. *See* XX.

Benzaldehyde; Colorimetric determination of —— *in almond extracts.* A. G. Woodman and E. F. Lyford. *See* XX.

Benzoic and cinnamic acids; Separation of ——. A. W. K. de Jong. *See* XX.

New Books.

The Structure of the Wool Fibre, and its Relation to the Use of Wool for Technical Purposes. By F. H. Bowman, D.Sc., etc. Macmillan & Co., Ltd., St. Martin's Street, London. 1908. Price 8s. 6d. net.

Small 8vo volume, containing 467 pages of subject-matter, with a frontispiece and 78 illustrations, some of which are coloured. There are also a glossary of terms used in the work, and an alphabetical index. The text is classified as follows:—I, French and British methods of treating wool. Attention to breed in sheep. Importance in selection of raw material, etc. II, Classification of fibres. III, Structure of the skin. IV, Origin and development of the hair. V, Variations in hair structure. VI, History, classification, and varieties of sheep and goats. VII, Classification and description of foreign sheep. VIII, Sheep and wool culture. IX, Mechanical structure of the wool fibre. X, Chemical composition of wool. XI, Action of reagents upon wool. XII, Qualities and varieties of wool and their distinctions. XIII, Strength and testing of worsted yarns. XIV, Theory of dyeing and colour. XV, Method of analysis and detection of various fibres.

Les densités des Solutions Sucrées a Differentes Températures. Calculees par D. Sidersky. Friedr. Vieweg et fils, 18, Vor der Burg, Brunswick. 1908. Price 3 fr. 50. H. Dunod et E. Pinat, 49, Quai des Grands-Augustins, Paris.

Large 8vo volume, containing 21 pages of subject-matter, followed by 25 pages entirely devoted to specific gravity tables, and classified as Part I, and Part II. The contents of the book are written both in French and German and arranged in alternate pages or columns, the subject-matter consisting of explanatory matter referring to the tables, which give the percentages of pure sugar contained in solutions of given specific gravities, and under varying temperatures.

Jahresbericht über die Untersuchungen und Fortschritte auf dem Gesamtgebiete der Zuckerfabrikation. Begründet von Dr. K. Stammer. Herausgegeben von Dr. Joh. Bock. 47, Jahrgang, 1907. Friedrich Vieweg und Sohn, Braunschweig. 1908. Price M.16.

8vo volume, containing 334 pages of subject-matter, and alphabetical indexes of subjects and names of authors etc. The subject-matter is classified as follows:—I, Agricultural.—(*a*), Soils, manures, beet-roots, etc. (*b*), Beetroot pests and maladies. II, Technical.—(*a*), Preparation of the crude sugar. (*b*), Preparation of refined sugar. (*c*), Desaccharifying the molasses. (*d*), Steam raising and utilising to best advantage. (*e*), Purification of effluents, waste waters, etc. III, Chemical.—(*a*), Scientific and technical methods of investigation. IV, Patent Rights in the Sugar Industry. V, Statistical and Legal.

Cyanide Processes. By E. B. Wilson. Fourth Edition, revised and enlarged. John Wiley and Sons, New York. 1908. Price $1.50. Chapman and Hall, Limited, London.

12mo volume, containing 238 pages of subject-matter, and the alphabetical index. There are 26 illustrations. The text is subdivided and classified as follows:—I, Ores suitable for cyanide processes. II, Potassium cyanide and oxygen. III, Chemistry of the process. IV, Laboratory tests. V. Plants for cyaniding. VI, Leaching the ore. VII. Precipitating gold from cyanide solutions. VIII, Treatment of bullion. IX, Treatment of concentrates and slimes. X, Electricity applied to cyaniding. XI. Electrodes. XII, The current. XIII, Anodes. XIV, Cathodes. XV, Siemens-Halske and Peletan-Clerici processes. XVI, Cyaniding slimes. Appendix. Instructions how to proceed with a case of cyanide poisoning in the absence of medical treatment.

Metallurgy. A Condensed Treatise for the Use of College Students and any desiring a General Knowledge of the Subject. By Henry Wysor. Assistant Professor of Analytical Chemistry and Metallurgy in Lafayette College. The Chemical Publishing Co., Easton, Pa. Williams and Norgate, 14, Henrietta Street, Covent Garden, London, W.C. 1908. Price 12s.6d net.

8vo volume, containing 294 pages of subject-matter, with 88 illustrations, and an alphabetical index. The subject-matter is classified as follows:—I, Physical properties of the metals. II, Refractory materials and fluxes. III, Acid materials. IV, Basic materials. V, Neutral materials. VI, Fluxes. VII, Theory of combustion and thermal measurements. VIII, Natural fuels. IX, Prepared fuels. X, Ore dressing. XI, Furnaces. XII, Iron. Ores and properties. XIII, Iron smelting. Cast and wrought iron, etc. XIV, Steel. Cementation and crucible process, etc. Methods of treatment. XV, Copper. Ores, properties. Smelting, etc. XVI, Extraction by wet method. XVII, Copper refining. Electrolytic process. XVIII, Lead. Ores, etc. Smelting and refining. XIX, Zinc. Ores. Smelting, etc. XX, Tin and mercury. XXI, Silver. Ores. Extraction, etc. XXII, Gold. Extraction and refining. XXIII, Nickel, aluminium, manganese, and rarer metals XXIV, Alloys. Preparation and manufacture. XXV, Welding. Plating.

Trade Records Committee. Report. [Cd. 4,345.] Price 1d.

This is the report of the Committee appointed by the Board of Trade to consider and report how far any change is desirable in the form in which the trade accounts of the United Kingdom are published as regards the countries from which imports are received and to which exports are sent.

The committee recommend:—

1. That legislative power be sought to require importers to declare upon their entries, in addition to the place of shipment of imported goods, the places whence the goods were first consigned to the United Kingdom; and to require exporters to declare upon their specifications the places of final destination of exported goods, so far as they know them.

2. That Clause 41 of the Customs Consolidation Act, 1876, should be expressly repealed, and that legislative sanction be sought to a provision empowering the Commissioners of Customs to vary the forms of entry and specification, and the nature of the information required in regard to imports and exports as they may deem necessary from time to time.

3. That, from and after the beginning of 1909, the scope of the Monthly Accounts of Trade and Navigation be altered so that they may show the imports into this country according to the countries from which they were first consigned to the United Kingdom, instead of according to the countries from which they were shipped direct to the United Kingdom, as hitherto, and the exports from this country according to the countries of final destination (so far as known) without regard to whether such final destination be an inland country or not.

4. That the import sections of Vols. I. and II. of the Annual Statement of Trade for 1908 and subsequent years be based in the same way upon the countries whence the imported goods were consigned to the United Kingdom, and the export sections (both of United Kingdom produce and of Foreign and Colonial produce) upon the countries of final destination, so far as known, whether or not they have a seaboard.

5. That, commencing with the Annual Statement of Trade for 1908, a Supplementary Volume be compiled and published showing the imports into the United Kingdom according to the old method of countries of shipment, and the changes which would have been introduced into the export records had they continued to be compiled in the old form, *i.e.*, of leaving countries without seaboard out of account

6. That the preparation and publication of such Supplementary Volumes be continued for a period of six years, *i.e.*, up to and including 1913, and then cease.

7. That the requisite changes be introduced into the tables in the Statistical Abstract for the United Kingdom relating to imports and exports as early and as completely as practicable.

Mines and Quarries. General Report and Statistics for 1907. Part III., Output. Home Office, Sept., 1908, Cd. 4343.

The total value of the minerals raised during the year amounted to £135,279,088, an increase of £29,436,096 as compared with 1906. This increase is accounted for by the increased output of coal, and a rise in the average price of coal, viz., from 7s. 3·49d. per ton in 1906 to 9s. in 1907. The total output of coal, 267,830,962 tons, which was the highest hitherto recorded, and the value, £120,527,378, show increases of 16,763,334 tons and £28,998,112 respectively on the figures for 1906. The quantity of coal exported, exclusive of coke and patent fuel and of coal shipped for the use of steamers engaged in foreign trade, was 63,600,947 tons, an increase of more than eight million tons on the exports for 1906. France received over 10 2-3 million tons, Germany over 10 million tons, Italy over 8¼ million tons, the Netherlands over 3¾ million tons, Sweden over 3 2-3 million tons, and Russia, Spain, Denmark, Egypt, and the Argentine Republic each over two million tons. Adding the 2,968,501 tons exported in the form of coke and patent fuel, and the 18,618,828 tons shipped for the use of British and foreign steamers engaged in foreign trade, the total quantity of coal which left the country was 85,188,276 tons. The amount of coal remaining for home consumption was 182,642,686 tons, or 4·142 tons per head of the population; 21,119,547 tons were used in the blast furnaces for the manufacture of pig iron, as against 20,836,795 tons in the previous year. Particulars relating to the manufacture of coke and briquettes for the past year are being obtained by the Board of Trade as part of the census that is being taken under the Census of Production Act, and will be published later by that Department. Of the metallic minerals raised in the United Kingdom, iron ore is by far the most important. During the year the output of ores of this metal was 15,731,604 tons, valued at £4,433,418. The ore yielded 5,126,949 tons of iron, or more than one-half of the total quantity of pig iron made in this country.

Journal of the Municipal School of Technology, Manchester. Vol. I., Part 2.

This book, which is printed in the Photography and Printing Crafts Department of the school, contains a record of investigations carried out in its various departments. The following is a list:—"Rapid cutting steel," by J. T. Nicholson. "Some experiments for determining the elastic and ultimate strength of brickwork pillars and pillars of Portland cement concrete," by W. C. Popplewell. "The electrical discharge in air and its commercial application," by W. Cramp and S. Leetham. "Influence of certain reagents on the tensile strength and on the dyeing properties of cotton yarn," by J. Hübner and W. J. Pope. "The jointing of pipes for drains and sewers," by J. Radcliffe. "Asymmetric optically active selenium compounds, and the sexavalency of selenium and sulphur: *d*- and *l*-phenylmethyl-selenetine salts," by W. J. Pope and A. Neville. "Volumetric estimation of azo dyes, nitro compounds, etc.," "Volumetric estimation of indigo, some basic colours, and eosins," and "Estimation of methylene blue," by E. Knecht. "Convective equilibrium of a spherical mass of gas subject only to the mutual gravitation of its parts," by J. Prescott.

Patent List.

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

Applications.

21,623. Brearley. Indicator for determining the temperature of heated objects. Oct. 13.

21,767. Cudlipp. Hydro-extractors. Oct. 15.

21,904. Kayser. Utilising exhaust steam and waste heat, especially in drying and evaporating processes.* Oct. 16.

22,207. Lennox, and Fraser and Co., Ltd. Purification of gases. Oct. 20.

22,524. Candy. Filters. Oct. 23.

22,738. Diederichs. *See under* V.

23,001. Challis. Filtration. Oct. 29.

23,099. Hoyle and Brearley. Means for determining the temperature of salt bath furnaces. Oct. 30.

23,189. Wilfley Mining Machinery Co., Ltd., and Roudebusch. Apparatus for separating solid material from liquids. Oct. 30.

Complete Specifications Accepted.

23,362 (1907). Macfarlane and Williamson. Centrifugal drying machines. Oct. 28.

23,524 (1907). Lang. *See under* II.

27,645 (1907). Venter. Device for concentrating lyes. Oct. 28.

5038 (1908). Heinz. Regenerative retort furnaces. Nov. 4.

8956 (1908). Benkö. Production of a vacuum. Nov. 4.

10,314 (1908). Aktiebolaget Separator, and Harje. Centrifugal machines for separating solids from liquids. Oct. 21.

11,385 (1908). Barker (Albaugh-Dover Co.). Centrifugal liquid separators. Nov. 4.

11,546 (1908). Mazza and de Murrieta. Separating the components of gaseous mixtures. Oct. 28.

14,686 (1908). Ados Ges., and Matzerath. Mixing liquids. Oct. 21.

16,917 (1908). Persoons and Persoons. Centrifugal separators. Oct. 21.

17,609 (1908). Schmatolla. *See under* VII.

II.—FUEL, GAS, AND LIGHT.

Applications.

21,597. Barnes. *See under* III.

21,658. Thomas. Incandescent gas mantles. Oct. 13.

21,660. Schimming. Gas generators. [Ger. Appl., Oct. 14, 1907.]* Oct. 13.

21,763. Burkheiser. Purifying and obtaining by-products from gases obtained by dry distillation or gasification. [Addition to No. 20,920 of 1908.]* Oct. 14.

22,033. Zindler. Utilising bituminous brown coal and peat in making fuel briquettes and briquettes for smelting purposes.* Oct. 17.

22,049. Roberts. Manufacture of illuminating gas. Oct. 19.

22,114. Keeble. Treatment of certain gases. Oct. 19.

22,207. Lennox, and Fraser and Co., Ltd. *See under* I.

22,851. Tully. Apparatus for making heating and illuminating gas. Oct. 27.

23,042. Wilton. Washing and forcing gases. Oct. 29.

23,043. Wilton. Purifying gas obtained from the distillation of carbonaceous materials and recovery of by-products. Oct. 29.

23,044. Wilton. Gas generators, producers, or refuse destructors. Oct. 29.

23,263. Meunier. Gas manufacture. Oct. 31.

23,279. Wilton. Purification of gases and recovery of by-products. Oct. 31.

Complete Specifications Accepted.

18,118 (1907). Parker. *See under* III.

18,856 (1907). Parker. Fuel. Oct. 28.

22,274 (1907). Johnston. Apparatus for making coal gas. Oct. 21.

23,524 (1907). Lang. Production of heat and gas under pressure. Nov. 4.

25,279 (1907). Schulthorpe. Production of inflammable gas. Oct. 21.

28,280 (1907). Bauke. Removing sulphur compounds from the refuse water of gas generators. Oct. 21.

138 (1908). Sheldon. Distilling and coking coal. Oct. 21.

5038 (1908). Heinz. *See under* I.

7703 (1908). Medberg and Medberger. Fuel for internal combustion engines. Nov. 4.

8104 (1908). Michaud and Delasson. Manufacture of filaments for illuminating and heating. Nov. 4.

8416 (1908). Wolfram-Lampen A.-G. Incandescent filaments for electric lamps. Nov. 4.

11,533 (1908). Thomas. Gas producer. Oct. 28.

11,603 (1908). Siemens und Halske A.-G. Manufacture of tungsten incandescence filaments. Oct. 21.

15,079 (1908). Aron and Geiger. Decarbonising filaments for electric metal-filament lamps. Oct. 28.

15,086 (1908). Nelson. Manufacture of briquettes for fuel. Oct. 21.

16,534 (1908). Coolidge. Manufacture of refractory electric conductors. Oct. 28.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

Applications.

21,597. Barnes. Treating petrol or other liquid fuel for internal combustion engines. Oct. 12.

21,763. Burkheiser. *See under* II.

21,800. Gutensohn. Treating tar to recover certain light constituents and to facilitate distillation. Oct. 15.

21,853. Reilly. Methods of separating coal tar.* Oct. 27.

23,043. Wilton. *See under* II.

23,136. Noad, and Patent Hydrocarbon, Ltd. Manufacture of volatile spirit. Oct. 30.

Complete Specifications Accepted.

18,118 (1907). Parker. Distillation of carbonaceous substances. Oct. 21.

18,706 (1907). Rutgerswerke A.-G. Increasing the explosiveness of hydrocarbons having a high boiling-point and also of ethyl alcohol. Oct. 28.

342 (1908) Gehre. Nitrifying schist oil and similar oils. Nov. 4.

IV.—COLOURING MATTERS AND DYESTUFFS.

Applications.

21,585. Newton (Bayer und Co.). Manufacture of basic dyestuffs. [Addition to No. 20,367 of 1908.] Oct. 12.

21,911. Newton (Bayer und Co.). Manufacture of basic dyestuffs. [Addition to No. 20,367 of 1908.] Oct. 16.

22,425. Ransford (Cassella und Co.). Production of dyestuffs. Oct. 22.

23,142. Newton (Bayer und Co.). Manufacture of azo dyestuffs. Oct. 30.

23,190. Merz. *See under* XIII.A.

Complete Specifications Accepted.

27,609 (1907). Ris and Haager. Manufacture of blue disazo colouring matters, dyeing cotton and wool. Nov. 4.

1678 (1908). Newton (Bayer und Co.). Manufacture of anthraquinone derivatives. Oct. 28.

1840 (1908). Johnson (Badische Anilin und Soda Fabrik.) Manufacture of colouring matters of the anthracene series. Oct. 21.

3155 (1908). Johnson (Badische Anilin und Soda Fabrik). Manufacture of dithiosalicylic acid compounds. Oct. 28.

3875 (1908). Bloxam (Act.-Ges. f. Anilinfabr.). Manufacture of *p*-phenylenediamine, its homologues and derivatives. Nov. 4.

3966 (1908). Bloxam (Act.-Ges. f. Anilinfabr.). Manufacture of aniline, its homologues and derivatives. Nov. 4.

4044 (1908). Bloxam (Act.-Ges. f. Anilinfabr.). Manufacture of *p*-aminophenol, its homologues and substitution products. Nov. 4.

5299 (1908). Imray (Meister, Lucius, und Brüning). Manufacture of bromo substitution products of β-naphthylindigo. Oct. 28.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

Applications.

21,621. Balme and Ashton. Machines for dyeing, bleaching, etc., fabrics or other materials. Oct. 13.

21,829. Gminder. Treating fabrics in spread out form with liquids.* Oct. 15.

21,839 and 21,840. Verein. Kunstseidefabr. Making multi-coloured surfaces. [Ger. Appls., July 13 and 23, 1908.]* Oct. 15.

21,871. Ellis. Production of Aniline Black or other colours on vegetable or animal fibres. Oct. 16.

21,872. Dreaper. Manufacture of machinery for artificial silk, etc. [Addition to No. 13,868 of 1907.]* Oct. 16.

22,097. Ransford (Cassella und Co.). Dyeing with chrome colours. Oct. 19.

22,214. Lake (Cell Drier Machine Co.). Apparatus for drying fabrics. Oct. 20.

22,504. Mellor. Apparatus for treating fabrics with liquids. Oct. 23.

22,549. Bloxam (Chem. Fabr. Griesheim-Elektron). Reserving woollen threads in dyeing union goods with sulphurised dyestuffs.* Oct. 23.

22,690. Newton (Bayer und Co.). Dyeing half-wool. Oct. 26.

22,738. Diederichs. Apparatus for treating textile material and for mixing liquids with chemicals, dyeing materials, oils, and gases. [Addition to No. 8821 of 1908.]* Oct. 26.

23,084. Warburton and Longbottom. Appliance for bleaching and dyeing yarn. Oct. 30.

23,171. Corron. Machines for dyeing yarns, fabrics, &c. Oct. 30.

Complete Specifications Accepted.

27,963 (1907). Yates. Apparatus for mercerising, bleaching, dyeing, and like treatment of yarns. Oct. 21.

7126 (1908). Crumière. Manufacture of artificial horsehair and ribbons of cellulose. Oct. 28.

11,611 (1908). St.-Germain and St.-Germain. Manufacture of fibrous compositions. Oct. 28.

13,933 (1908). British Cotton and Wool Dyers' Assoc., and Hoegger. Cop dyeing machines. Oct. 28.

15,034 (1908). Ryerson. Production of ornamental fabrics. Nov. 4.

17,681 (1908). Weinzirl. Producing designs on sealskin and all kinds of plush and velvets. Oct. 21.

VII.—ACID, ALKALIS, AND SALTS.

Applications.

21,778. Whyte. Nitre and like extracting plant. Oct. 15.

21,959. Moscicki. Producing oxides of nitrogen by means of a rotary flame. [Ger. Appl., Oct. 17, 1907.]* Oct. 16.

22,029. Berry. Process of obtaining tartaric acid. Oct. 17.

22,116. Keeble. Manufacture of nitrogen compounds. Oct. 19.

22,118. Lang. Heating solid, fluid, and gaseous materials by the heat developed on formation of sulphur compounds, especially metallic sulphides. [Ger. Appl., Oct. 21, 1907.]* Oct. 19.

22,434. De Briailles. Manufacture, concentration, and purification of sulphuric acid.* Oct. 22

Complete Specifications Accepted.

22,894 (1907). Middleton. Repurifying spent lime. Oct. 21.

575 (1908). De Stucklé. *See under* XIII*A*.

1352 (1908). Fritsche. Manufacture of sodium perborate containing borax. Oct. 21.

1639 (1908). Robeson. Manufacture of briquettes of sulphur-bearing material. Oct. 21.

6218 (1908). British Cyanides Co., and Chance. Manufacture of sulphocyanides. Oct. 21.

9773 (1908). Weyer. Obtaining barium and strontium nitrates. Oct. 21.

11,590 (1908). Loiseau. Manufacture of carbonic oxide. Oct. 21.

14,863 (1908). Menter and Sedlitzky. Compositions for generating carbonic acid. Oct. 28.

17,609 (1908). Schmatolla. Kilns for burning limestone, dolomite, &c. Nov. 4.

VIII.—GLASS, POTTERY, AND ENAMELS

Application.

22,613. Grünzweig und Hartmann. Manufacture of porous ceramic objects. [Ger. Appl., May 9, 1908.]* Oct. 24.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Applications.

22,126. Reich. Production of clay tiles resembling natural sandstone. Oct. 19.

22,854. Reilly. Impregnating wood.* Oct. 27.

Complete Specifications Accepted.

25,969 (1907). Potter. Manufacture of hydraulic cement. Oct. 21.

28,355 (1907). Whitehead. Treatment of timber with liquids or gases. Oct. 21.

19,070 (1908). Lessing. Manufacture of cement from blast furnace slag, etc. Oct. 28.

X.—METALS AND METALLURGY.

Applications.

21,759. Hommel. and Metals Extraction Corporation. Extraction of zinc from its ores or compounds. Oct. 14.

21,837 and 21,921. Junquera. Treatment of minerals of any kind to extract the mineral they contain. [Span. Appl., Feb. 8, 1908.]* Oct. 15 and 16.

22,082. Soc. Anon. d'Exploit. des Brev. Cubilot A. Baillot. Smelting furnaces. [Fr. Appl., Jan. 6, 1908.]* Oct. 19.

22,092. Richford. Producing lead or other metals or alloy in a thread-like or finely divided form. Oct. 19.

22,337. Von Schutz. Detinning tin plate by means of chlorine. [Ger. Appl., Nov. 15, 1907.]* Oct. 21.

22,412. Fennell and Sackett. Furnaces for the treatment of metals, ores, and alloys.* Oct. 22.

22,455. Baum. Production of a coating of platinum on base metals not easily fusible.* Oct. 22.

22,461. Parnell. The cyanide process of treating ores. Oct. 22.

22,531. Cowper-Coles. Case-hardening iron and steel. Oct. 23.

22,838. Cowper-Coles. Rendering iron surfaces non-corrosive. Oct. 27.

22,873. Siemens und Halske A.-G. Production of tantalum. [Ger. Appl., Nov. 16, 1907.]* Oct. 27.

22,948. Johnson. Melting and refining iron. Oct. 28.

23,068. Higgins. Extraction of tin from tin scrap.* Oct. 29.

23,179. De Saint Seine, and Thwaites Bros., Ltd. Smelting ores, residues, etc., for obtaining copper or other metals. Oct. 30.

23,239. Galbraith. Furnaces for treating ores. Oct. 31.

23,240. Galbraith. Rotary kilns for treating ores. Oct. 31.

Complete Specifications Accepted.

23,997 (1907). Hövcler. Smelting furnaces. Nov. 4.

24,096 (1907). Schoop. Welding aluminium. Oct. 28.

24,396 (1907). Cowper-Coles. Manufacture of calcium. Nov. 4.

24,517 (1907). Herrenschmidt. *See under* XI.

25,496 (1907). Sperry. Detinning process. Oct. 28.

26,932 (1907). Harden, and Amalgaline, Ltd. Soldering aluminium. Oct. 28.

26,940 (1907). British Thomson-Houston Co. (General Electric Co.). *See under* XI.

4647 (1908). Goldschmidt. Manufacture of products containing calcium, barium, or strontium, and silicon. Oct. 21.

5055 (1908). Nielsen. Soldering aluminium. Oct. 21.

11,971 (1908). Demaret. Apparatus for the volumetric classification of ores. Oct. 28.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

Applications.

21,687. Smith and Deakin. Apparatus for the electrodeposition of metals. Oct. 14.

21,741. Keller. Electric furnaces.* Oct. 14.

21,743. Deckert. Furnace electrically heated, for melting and boiling, and especially for determining melting and boiling points. Oct. 14.

21,823. Chloride Electrical Storage Co., Ltd., and Heap. Storage battery electrodes. Oct. 15.

22,236. Basset. Electric batteries. [Fr. Appl., Oct. 31, 1907.]* Oct. 20.

22,824. Soc. d'Electro-Chimie. Electrolytic production of sodium and the like. [Fr. Appl., Nov. 2, 1907.]* Oct. 27.

23,007. MacGahan. Manufacture of electric conductors. [U.S. Appl., Nov. 8, 1907.]* Oct. 29.

23,071. British Thomson-Houston Co. (General Electric Co.). Electric furnaces.* Oct. 29.

23,132. Szek. Insulating acid- and damp-proof materials for use in galvanic batteries, etc. Oct. 30.

23,193. Brachmann. Electrodeposition of metals.* Oct 30.

Complete Specifications Accepted.

23,145 (1907). Cowper-Coles. Apparatus for purifying electrolytes. Oct. 28.

24,517 (1907). Herrenschmidt. Processes of melting in electric furnaces and their application to the extraction of easily volatilisable metals. Nov. 4.

25,324 (1907). Hartnell. Electro-depositing apparatus. Nov. 4.

26,940 (1907), and 12,183 (1908). British Thomson-Houston Co. (General Electric Co.). Alloys useful as electric resistance conductors. Nov. 4.

28,619 (1907). Ekstromer and Ekstromer. Production of a substance from albuminoids, applicable for use with secondary batteries. Nov. 4.

7188 (1908). Nathusius, and Westdeutsche Thomasphosphatwerke. Electric furnaces. Oct. 21.

15,362 (1908). Edison. Preparation of metallic films for use with storage battery electrodes. Oct. 21.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

Applications.

21,690. Valentine and Bolton. Apparatus for the recovery of fatty matters. Oct. 14.

21,822. Bloxam (Jacobi). Soap frames. [Addition to No. 18,253 of 1907.] Oct. 15.

22,122. Thompson (Lingner). Making odourless and non-irritant tar soaps.* Oct. 19.

22,174. Robertson and Budde. Manufacture of soap, candles, lubricants, etc. Oct. 20.

22,441. Runge. Manufacture of albumose soap. [Ger. Appl., Sept. 24, 1908.]* Oct. 22.

22,738. Diederichs. *See under* I.

23,210. Prusz. Cleansing compound. [U.S. Appl., Nov. 2, 1907.] Oct. 31.

Complete Specification Accepted.

5817 (1908). Oyler. Manufacture of soap. Oct. 28.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc.

(*A.*)—Pigments, Paints.

Application.

23,190. Merz. Preparation of azo pigments insoluble in oil. [Addition to No. 20,990 of 1907.]* Oct. 30.

Complete Specifications Accepted.

28,424 (1907). Winter. Manufacture of pigmental lakes. Oct. 28.

575 (1908). De Stucklé. Production of zinc pigments or mixtures containing zinc sulphide. Oct. 21.

9083 (1908). Meurant. Production of colours. Nov. 4.

19,588 (1908). Elam. Copying ink. Oct. 28.

(*B.*)—Resins, Varnishes.

Applications.

23,039. Terrisse. Treatment of hard and semi-hard copals for the preparation of varnishes. [U.S. Appl., Oct. 29, 1907.]* Oct. 29.

23,047. Crow. Manufacture of driers for varnishes, etc. Oct. 29.

Complete Specifications Accepted.

26,317 (1907). Newton (Bayer und Co.). Manufacture of resin-like products. Oct. 28.

28,282 (1907). Barbieri. Manufacture of linoleum. Nov. 4.

(*C.*)—India-Rubber.

Application.

21,718. Stuart. Rubber compositions. Oct. 14.

Complete Specification Accepted.

13,599 (1908). Hyatt and Penn. Reclamation of waste rubber and vulcanite. Nov. 4.

XIV.—TANNING, LEATHER, GLUE, SIZE, Etc.

Applications.

22,368. Leconte. Preparing hides for the manufacture of leather.* Oct. 21.

22,869. Silberrad. The dressing of leather. Oct. 27.

23,186. Tillberg. Treatment of organic extracts of tannin. [Swed. Appl., April 27, 1908.]* Oct. 30.

Complete Specifications Accepted.

23,030 (1907). Perkin, and Whipp Bros. and Todd, Ltd. Preparation of gelatine. Oct. 28.

12,174 (1908). Lake (Schuhfabr. Bonndorf Gebr. Kriechle). Manufacture of a leather substitute. Oct. 28.

XV.—MANURES, Etc.

Applications.

21,590. Carlson. Production of fertilisers. [Swed. Appl., Nov. 9, 1907.]* Oct. 12.

21,630. Lehbauer, Mear, Hollinshead, and Moody. Manufacture of artificial manure from offal, etc. Oct. 13.

Complete Specification Accepted.

23,399 (1907). Colburn and Broadbent. Treating animal and vegetable matter for the production of manure. Oct. 28.

XVI.—SUGAR, STARCH, GUM, Etc.

Complete Specification Accepted.

5501 (1908). Eastick. Purification of sugar. Oct. 28.

XVII.—BREWING, WINES, SPIRITS, Etc.

Applications.

21,820. Ascoli. Yeast preparation and process of making the same.* Oct. 15.

22,695. Mackeson. Treatment of malt liquors. Oct. 26.

Complete Specifications Accepted.

18,706 (1907). Rutgerswerke A.-G. *See under* III

348 (1908). Waterkeyn. Manufacture of alcohol from grain. Nov. 4.

4231 (1908). Bendle, Smith, and Thorne. Preparation of a nourishing wine or other alcoholic liquid. Oct. 28.

XVIII.—FOODS; SANITATION, WATER PURIFICATION; AND DISINFECTANTS.

(*A.*)—Foods.

Applications.

22,221. Goetz and Jones. Processes of pasteurisation. Oct. 20.

22,879. Staley. Manufacture of cocoa and chocolate. Oct. 28.

22,942. Trufood, Ltd. (Gere). Desiccation of milk.* Oct. 28.

23,191. Stewart. Products of casein and like substances. Oct. 30.

(*B.*)—Sanitation; Water Purification.

Application.

22,140. Grossmann. Method and apparatus for desiccating sewage sludge. Oct. 20.

Complete Specifications Accepted.

28,221 (1907). Dales. Softening and purifying water, primarily for steam generating and manufacturing purposes. Nov. 4.

6949 (1908). Boult (Patin). Apparatus for purifying water. Nov. 4.

16,725 (1908). Linden. Purifying or clarifying water or effluent. Nov. 4.

(*C.*)—Disinfectants.

Application.

22,339. South American Improved Chilling Co., and Leaver. Disinfecting and sterilising. Oct. 21.

Complete Specification Accepted.

23,954 (1907). Lehmann. Disinfecting process. Nov. 4.

XIX.—PAPER, PASTEBOARD, Etc.

Application.

23,192. Hollins and Taylor. Manufacture of cellulose.* Oct. 30.

Complete Specifications Accepted.

22,840 (1907). Mitchell. Decorative treatment of paper, etc. Oct. 28.

413 (1908). Dubosc. *See under* XX.

7126 (1908). Crumière. *See under* V.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

Applications.

21,566. Baekeland. Condensation product. [U.S. Appl., Oct. 15, 1907.]* Oct. 12.

22,085. Newton (Bayer und Co.). Manufacture of alkyl esters of methylenecitric acid. Oct. 19.

22,132. Justice (Boehringer). Salts of the sulpho acids of guaiacol carbonate.* Oct. 19.

22,874. Meister, Lucius, und Brüning. Manufacture of reduction products from derivatives of *p*-aminophenylarsenic acid. [Ger. Appl., Feb. 4, 1908. Addition to No. 17,619 of 1907.]* Oct. 27.

23,143. Newton (Bayer und Co.). Manufacture of aminoacidylpyrocatechins. Oct. 30.

COMPLETE SPECIFICATIONS ACCEPTED.

28,028 (1907). Schmitz und Co. Manufacture of isoborneol. Oct. 28.

413 (1908). Dubosc. Preparation of an organic ether and its use in preparing nitrocellulose solutions and celluloid. Oct. 28.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

APPLICATIONS.

23,020. Burnett. Manufacture of gelatin photographic papers containing silver salts. Oct. 29.

23,146. Gillard. Manufacture of photographic transfer films. Oct. 30.

23,273. Clifton and Wells. Carbon tissues for use in colour photography. Oct. 31.

COMPLETE SPECIFICATION ACCEPTED.

28,614 (1907). Schwarz. Colour photography. Oct. 21.

XXII.—EXPLOSIVES, MATCHES, ETC.

APPLICATION.

22,555. Lezinsky. Explosive compounds and manufacture of the same. [U.S. Appl., Nov. 1, 1907.]* Oct. 23.

COMPLETE SPECIFICATIONS ACCEPTED.

23,250. (1907) Schaefer. Manufacture of matches. Oct. 21.

24,025 (1907). Anglo-French F. and S., Ltd., and Edwards. Explosives. Nov. 4.

XXIII.—GENERAL ANALYTICAL CHEMISTRY.

APPLICATION.

21,743. Deckert. *See under* XI.

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London Section.

Meeting held at Burlington House on Monday, Nov. 2nd.

DR. J. LEWKOWITSCH IN THE CHAIR.

The Chairman, in opening the proceedings, referred to the loss by death, since the last meeting, of Sir Thomas Stevenson, a prominent member of the London Section.

He also drew the attention of members to the Decennial Index, just published, which had entailed a great deal of time, labour, and expenditure of money; he hoped that members who had not yet obtained a copy would send in their applications.

This session would be, in more than one respect, a memorable one; at the close of it would come the International Congress of Applied Chemistry, which would meet in London, and in which the Society would take a very prominent part with regard to the arrangements. In a few days details would be sent out; but he desired now to appeal to all the members of the Section loyally to support the Congress by preparing papers or announcing their desire to take part in the discussions.

Another important event would mark the close of the Session, namely, the annual meeting of their own Society, which would commence in London one day before the opening of the Congress, and then be held concurrently with it for three days until the end of the week. That would entail a great deal of preparatory work, which would be undertaken by committeees which had been appointed; and he appealed to the generosity of the members to furnish their committees with the necessary financial support.

Lastly, he had to mention that the committee of the London Section had taken in hand the arrangement of general papers to be given by the foremost specialists in their subjects. To put it briefly, it was intended to collect in a series of rounded-off papers, a "Chemical Technology," as it were, on all the subjects with which Chemical Industry and Chemical Engineering dealt. These papers were to be contributed by the most prominent specialists, who would deal, in the first instance, with groups of subjects from a general point of view, then with the individual industries belonging to these groups, and descend finally to the latest details in their particular branches. All sections of the Society would be invited through the Council of this Society to take part in this scheme, which no doubt would keep all the Sections busy for a good many years to come.

The first paper of that kind was the one to be brought forward that evening; and he very much regretted that its author, Professor Adolf Frank, could not be present. Professor Frank had not only consented most readily to prepare this paper, but had offered to come himself to read it; after the paper had been sent in, he was unfortunately struck down by illness, and was unable to be present. He had, however, urgently insisted that no alteration in the programme of the Section be made.

CHEMICAL INDUSTRY IN RELATION TO AGRICULTURE.

BY PROF. ADOLF FRANK, PH.D.

Between agriculture and industry, both members of the same family and both supporters of the welfare of a State, a certain antagonism of interest has long existed. The gulf which threatened to separate them would have become still wider owing to the more rapid extension and the greater mobility of industry, had not science and technical practice fortunately come between them as mediators at the opportune moment. A large share of this beneficent action was taken by chemistry. By a happy concatenation of circumstances I have been working for more than 50 years on the borderland between agriculture and applied chemistry, and I am therefore very pleased to accede to your chairman's invitation to communicate some details and relate some incidents that I have seen and taken part in during that period.

In order to mark the connection between chemical research and agricultural practice, it is sufficient to recall the name of Liebig. In his works published about 1840, among which may be mentioned "On the chemical process of the nourishment of the plants and the natural laws of agriculture" and the "Chemical Letters," he clearly and correctly defined the lines upon which the development of modern agriculture has taken place and which alone offered the possibility of giving and securing bread with peace to a rapidly increasing population living on a restricted area. With reference to Liebig's principles, which form the foundation of a new era in the political as well as in the social life of nations, another great chemist, Hermann Kolbe, has expressed himself as follows:—"It seems marvellous and almost incredible to the uninitiated that, after a pursuit of agriculture for thousands of years, and after the establishment of the general belief that agriculture was being rationally carried out on the basis of a thousand years of experience, a chemist, who had never been a farmer, had never held the plough, never tilled the ground, should from his desk teach the agriculturists how to treat the soil, in order to impart to it constant productivity; and that only through Liebig's doctrine of the treatment of the soil and of the natural laws governing the cultivation of the ground a truly rational system of agriculture has been inaugurated."

Not only did Liebig enunciate new views upon agriculture, but he also devised processes for the production of artificial manures; and when chemical industry took possession of the ground thus prepared, most things were ready and there only remained to be carried out what the mind of the great master had devised and foreseen. In the seventh edition of his "Agricultural Chemistry," published shortly before his death, Liebig restated his doctrine, as follows:—

1. The nourishment of all green plants consists of inorganic and mineral substances;
2. Plants require carbonic acid, ammonia, nitric acid, water, phosphoric acid, sulphuric acid, silicic acid, lime, magnesia, potash, soda, and iron; in addition, some also require common salt;
3. Between all the component parts of the soil, water, and air, which participate in the life of the plant, between all parts of animals and plants, there is a connection in the sense that, if but one single link is missing in the chain of phenomena which bring about the conversion of inorganic matter into supporters of organic activity, the plant or the animal cannot thrive;
4. Manure, the excrements of man and animals, does not influence vegetable life by its organic elements, but acts on it indirectly through the products of its decomposition, in consequence of the transformation of its carbon into carbonic acid and of its nitrogen into ammonia or nitric acid. Organic manure, which is composed of parts or remnants of plants or animals, may therefore be replaced by the inorganic compounds into which it is decomposed in the soil.

When, by numerous analyses of the ashes of cultivated plants, Liebig had shown which mineral substances were required, and when it had been ascertained that soil suitable for certain plants contained a sufficiency of these substances in a condition suitable for absorption by the plants, the conclusion followed that the incapacity of the tilled ground to produce satisfactory crops, or, in other words, the decrease of the products harvested under normal climatic conditions, could only be attributed to the deficiency of one or more of the mineral substances required for the nourishment of the plants. It thus became easy to understand the effect of manure and of the rotation of crops and fallow, the latter serving to give the soil a rest, *i.e.*, time for a sufficient decomposition of insoluble mineral matter. All these expedients were, however, insufficient and thus furnished proof that the soil was deprived by the crops of more mineral substances than could be supplied by means of the time-honoured procedure, or, in other words, that the soil had become exhausted. Where the entire residue of the crop was almost wholly returned to the soil in the shape of manure, as in the case of small agricultural holdings which consume their products themselves, the soil, with the assistance of the natural processes of decomposition, retained its fertility. Where, however, part of the crop, as for instance, grain, or large quantities of animal products, were carried away for other purposes, without suitable substitutes being procured, the fertility of the soil gradually lessened. Practical proof for the correctness of this theory was supplied by Liebig not only by reference to the barrenness of those countries which had formerly supplied Rome with corn, but also by showing that the present system of agriculture, by which many important plant-nourishing substances were permanently lost to the soil, could but bring about a similar disastrous state of affairs. But as the development of our commercial life does not admit of a return to primitive conditions of agriculture, the only rational course left is to replace the vegetable and animal manure withdrawn from the soil by natural or artificial manures from fresh sources. It is hardly necessary to point out that a supply of that kind, expensive as it is rendered by freight, can only pay in the case of those plant-nourishing substances which are really deficient in the soil and which—unlike lime, silicic acid, etc.—cannot be procured in the immediate neighbourhood. Through the investigations of Liebig and his followers it was shown that two mineral substances, indispensable for the cultivation of plants, viz., phosphoric acid and potash, are not, in most cases, rendered available rapidly enough, by the decomposition of the soil, to replace the loss which the soil had suffered through the crop. A third indispensable requisite of the soil in addition to the above two substances, is nitrogenous manure, as represented by ammonia and nitric acid.

In the widespread alarm produced by Liebig's proof of the exhaustion of the soil and of the consequent and unavoidable decrease of agricultural production, over-zealous disciples of the new theory arrived at conclusions and made proposals which called for a complete revolution in our economical and social conditions. The immense value of plant-nourishing substances constantly withdrawn from agriculture in the waste products of the inhabitants of towns was calculated and it was concluded that only the extreme care shown by the Chinese in the conservation of excrements might be a means of rescue. The number of projects worked out for the utilisation of town refuse and even of sewage by transformation into manures, was legion, and much capital was spent in carrying out such ideas. But others, better informed, on calmly examining Liebig's principles, soon recognised that, to replace the mineral nourishing substances of plants, less complicated means might be found by using mineral deposits, which, like coal, might have accumulated in some spots of the earth. The correctness of this view was confirmed first through the discovery of rich deposits of phosphates, then through the opening up of the nitrate fields of Chili, followed just at the right time, by the discovery of enormous deposits of potash salts and, finally, in the last decade, by the technical utilisation of the immeasurable quantity of nitrogen stored up in our atmosphere.

I shall now proceed to discuss briefly the production of the raw materials thus found, and of their working up, as this represents one of the most important branches of chemical industry, and I shall begin with the oldest manufacture, that of phosphates, first founded in Great Britain.

The advantage obtained by manuring fields with bone meal had long been known in Great Britain, and large quantities of bones were imported from other countries for the requirements of British agriculture. It was, however, left to Liebig, whose theories Great Britain was the first to appreciate fully, to prove that the efficacy of this manure was mainly due to its contents of easily soluble phosphates (*i.e.*, phosphates easily absorbed by plants), like the readily soluble phosphates in guano. To render the mineral phosphates then known, such as the coprolites of Norfolk and Suffolk, equally effective, Liebig recommended converting them into the soluble monophosphate by treatment with acid. This operation, which soon proved to be attended with success by practical experiments in the field, formed the basis of the superphosphate industry, which in its turn reacted beneficially on the expansion of the manufacture of sulphuric acid. Starting from Great Britain, the superphosphate industry rapidly spread over all civilised countries. As the known deposits of phosphates did not suffice for the rapidly increasing demand, all parts of the world were searched for phosphates, in order to procure the raw material required for the manure works at present existing in Europe and in the United States. The statistics of the world's production of native phosphates show with what energy this search has been carried out. The production was in 1900, 2,800,000 tons (in round figures), and had risen to 3,800,000 tons in 1905. Of these the United States produced 1,515,000 tons in 1900, and 2,000,000 tons in 1905, 620,000 and 935,000 tons respectively being exported. Algeria and Tunis together shipped abroad 440,000 tons of phosphates in 1900, and 800,000 tons in 1905. To these native phosphates (the conversion of which into superphosphate requires 3,000,000 tons of chamber acid) must be added the valuable source of supply which has been thrown open during the last decades, in the shape of the so-called Thomas, or basic slags.

It is well known that the production of ingot steel in the Bessemer converter from pig-iron containing a high percentage of phosphorus has only become possible through the process, invented by Thomas and Gilchrist in 1878, whereby the phosphorus contained in the iron ore is transformed into phosphoric acid, which combines with the lime added to the liquid iron, to form basic quadriphosphate. Whilst native phosphates are as a rule composed of triphosphates which are not readily soluble, the quadriphosphate is not only soluble in weak organic acids, such as citric acid, but also, if sufficiently finely divided, in those weaker acids formed by the slow chemical changes which take place in the soil. Hence quadriphosphate may be used directly as a manure with success.

Germany being very poor in iron ores free from phosphorus which alone were suitable for the old Bessemer process, but owning enormous deposits of ores containing more or less phosphorus (*minette*), which formerly were considered of very low value, quickly adopted the Thomas-Gilchrist process, which was somewhat improved by German metallurgists. When the basic process was introduced in Germany in 1879, the production of German iron ore amounted to 7,240,000 tons and that of pig-iron to 2,730,000 tons. In 1906 the output of iron ore had risen to 26,700,000 tons, of which 21,000,000 tons were phosphoric minette ores, and the pig-iron production had increased to 12,478,000 tons, of which 8,000,000 tons were worked up by the Thomas-Gilchrist process. The 1,500,000 tons of basic slag, containing from 18 to 20 per cent. of phosphoric acid, have been used in Germany as a cheap and efficient phosphatic fertiliser, especially in admixture with potash salts, and the income derived from this by-product represents a valuable item in the balance sheets of German steel makers. The total quantity of Thomas phosphate produced in the world in 1907 is estimated at 2,700,000 tons. The phosphorus contained in 400 kilos. of Thomas iron can supply sufficient phosphoric acid to restore to 1 hectare (2½ acres) of soil what has been taken away from it by one crop of wheat or rye.

I now pass to the production of potash, the second important mineral foodstuff of plants. The advantages of manuring with wood ashes were known in practice long before Liebig's time, but it was impossible to obtain sufficient material for agricultural purposes on account of the steady diminution of forests and the increasing requirement of potash for industrial purposes. Trials made by Ward, in Great Britain, to obtain potash from felspar did not lead to commercially successful results. True, some muriate and sulphate of potash was obtained in France and in Scotland as a by-product in the treatment of seaweed (kelp, varech) for the production of iodine and bromine, but those quantities were very small. The most abundant source of potash was found in beet-root, which extracts from the soil large quantities of potash, which is then found in the sugar molasses. From these molasses, which still contain much sugar, but are unfit for consumption on account of their salty taste, alcohol was produced by fermentation, and, after distilling off the alcohol, potash was obtained by evaporating and charring the residual liquors. As much as 250 kilos. of potash per hectare (2½ acres) may be extracted from the soil by a good beet-root crop. Hence it is clear that considerable quantities of potash could be obtained by growing beet, and as a matter of fact, the quantity of potash so produced towards the end of the 'fifties in the beet-root district of Magdeburg alone amounted to 4500 tons per annum. But this apparently easily gained profit was followed by large losses, as owing to the withdrawal of the potash salts necessary for the growth of the beet-roots, the fertility of the soil, notwithstanding abundant manuring with guano and superphosphate, decreased so rapidly, that the very existence of the beet-root sugar industry was jeopardised. Here there was direct proof, obvious even to the practical farmer, of the correctness of Liebig's theories. At this critical moment and precisely at the time when Balard and Merle had concluded their protracted studies on the production of potash salts from the mother liquors of the "salt gardens," came the opening up of the Stassfurt Salt Mines in 1857. It is well known that in 1852, in the course of sinking a shaft for the mining of rock-salt at Stassfurt, enormous layers of impure salts were found overlaying the true rock-salt. These "overburdens" contained large proportions of potassium chloride, magnesium chloride, and magnesium sulphate. These coloured "bitter salts," unfit to be used as rock-salt, were at first termed "waste salts" (*Abraumsalze*) and their whole quantity, which had to be removed before the rock-salt was reached, was thrown on the waste heap as so much refuse.

At that time I was working as chemist in a beet-root factory at Stassfurt and, being a zealous disciple of Liebig, my mind was full of thoughts regarding the decrease—both as regards quality and quantity—of the crops, which then made itself felt on the beet-root fields. I therefore took up the study of these waste salts, the composition of which had already been ascertained by Heinrich Rose and Marchand, and I soon found that they represented suitable material for the production of potash salts for industrial as well as for agricultural purposes. After having overcome a great number of difficulties and obstacles, I succeeded, in 1861, in establishing the first potash salts factory, which was designed to work up no more than 5 tons of waste salts per day. This factory supplied potash manures, in addition to potassium chloride, for the manufacture of potassium nitrate. Whereas before the practical execution of my plans I had found but little support, the successful working of my factory, soon became known, and brought me more credit than I desired, in the shape of a number of rapidly constructed competing works. At the end of 1862, four potash works had been erected at Stassfurt, among which were those of Vorster and Grüneberg and of Leissler-Townsend. These manufacturers being possessed of larger capital and of greater experience in the manufacture of saltpetre and potash, considerably advanced the new industry. The number of new works rose to 18 in 1864, and worked up a total quantity of 139,000 tons of material. In the course of that year the neighbouring salt mine of Leopoldshall, belonging to the Duke of Anhalt, was also opened up. In 1872 a total of 500,000 tons of crude salts was worked up in 33 potash works.

The salt mining industry proper was at first a monopoly of the Governments, but after it became free by virtue of the Mines Act of 1865, private capital began to take an interest in it, and the great financial success obtained therein at the beginning gave rise to extended experimental boring and to opening out of new deposits. It was supposed at first that the deposits of potash salts were restricted to the relatively small district of the so-called Magdeburg-Halberstadt Valley; it was then found that they extended to Hanover, Mecklenburg, and Thuringia, and when it was ascertained recently that they also stretched towards the south, Germany passed through a period of speculation and company-promotion in many respects like the gold-mining fever in other countries. Partly in consequence of this over-speculation, and partly with a view to check ruinous over-production, free mining of potash salts was again abolished in Prussia last year, and the Prussian Government has reserved to itself all salt deposits which have, so far, not passed into private hands, as also all coal fields not opened at that time. The number of private potash mines started in the years 1872 to 1907 has risen to 50, while 26 more concerns have begun to sink shafts and 500 new potash companies have carried out experimental boring with more or less success.

The production and sale of raw potash salts increased from 514,000 tons in 1872 to 5,129,000 tons in 1905, representing a value of £4,250,000. The salts raised are partly worked up into refined products, such as potassium chloride, sulphate and carbonate, magnesium salts, bromine, etc.—the work being carried out mostly in the factories belonging and adjacent to the mines—and partly sold in the crude state, as manure. Almost all potash mines have combined to form a syndicate which fixes the production, allots to each member a certain quota, determines the price of the various products, and also attends to the propaganda for introducing potash manures, and increasing their consumption by the encouragement of scientific investigations and the establishment of agencies in various countries.

Of the total potash salt production 16 per cent. are used in chemical industry and 84 per cent. in agriculture. The far larger portion of the latter quantity is, of course, consumed by German farmers. This consumption amounted to 43,000 tons in 1879, 803,000 tons in 1899, and 1,685,000 tons in 1905. As the use of potash manures began in 1862 with the cultivation of beet-root, I may mention here the respective output of the years 1862 and 1907, as a measure of the effect of rational manuring. The quantity of beet-root worked up in Germany in 1862 amounted to 1,580,000 tons, yielding 125,000 tons of sugar, so that 12·5 tons of beet-root were required to produce one ton of sugar. At that time no sugar was exported; on the contrary, a small quantity, about 9000 tons, was imported. In 1907, 14,186,000 tons of beet-root were worked up, yielding 1 ton of sugar per 6·66 tons of beet-root, or a total yield of 2,242,000 tons of raw sugar, of which 1,103,000 tons were exported.

Among other countries where potash manures are employed on a large scale, the United States takes the first place. England and Scotland also use large quantities, while Ireland might largely increase her consumption, for she would derive the greatest advantage from the utilisation of potash manure for the cultivation of flax and for the reclamation of her large bogs. Potash manures have also obtained a footing on the tea and cocoa plantations of Ceylon and on the sugar cane fields of Australia.

From the figures I have given regarding the extension of the German potash deposits and the large number of potash mines already in existence, you will gather that, even if no large deposits should be found in any other part of the world, those so far discovered are sufficient to satisfy every requirement.

Less favourable are, or at least have been up to recently, the conditions for supplying nitrogenous substances, that third class of manure which the farmer quite as urgently requires as the foregoing ones. The two important sources available hitherto were ammonium sulphate, obtained as a by-product from coal on coking it, or making gas from it, and the sodium nitrate deposits occurring on the high plateau of Chili. The production of ammonium sulphate from gas liquor was commenced in Great Britain about 1850, and amounted to 9700 tons in 1860. Later on, ammonia was also obtained as a by-product in the dry distillation of shale, the recovery of waste gases from blast furnaces, coke ovens, and gas generators, so that the British production rose to 293,000 tons in 1906. Germany takes the second place among the countries producing ammonium sulphate, its output having been 235,000 tons in 1906, mostly from coke ovens. All the other industrial countries together produced only 19,000 tons. Although the successful process of Mond, by which power gas and ammonia are obtained simultaneously, is securing a steady increase in the production of sulphate, it must not be overlooked that ammonia is in every case but a by-product of other manufactures. Hence, unfavourable business conjunctures, such as occurred last year, must bring about a decrease in the production of ammonia, so that agriculture cannot depend, with certainty, upon obtaining a sufficient supply. As the demand for nitrogenous manures increased more rapidly than the production of ammonium salts, assistance was sought in the extensive deposits of nitrate of soda. Although these had been opened up on the West Coast of South America, on the high plateau of Chili, as far back as 1830, the nitrate had, up to 1860, been used for chemical purposes only. The export of nitrate of soda from Chili was 68,000 tons in 1860; it rose to 1,023,000 tons in 1890, and to 1,600,000 tons in 1906. Of this latter quantity, about 1,200,000 tons came to Europe, 20 per cent. of it being used in industry for the production of chemical products, explosives, etc., whilst the remainder was absorbed by agriculture. Germany, on account of its climate, as well as on account of its extensive cultivation of beet-root, uses the largest quantity of Chili saltpetre. In 1906, Germany imported about 590,000 tons. Next comes France, whilst the consumption of British agriculture is but small. The demand for saltpetre in the United States is rapidly increasing, the import figure having risen from 177,000 tons in 1901 to 364,000 tons in 1906. The price of Chili saltpetre, which stood at £7 to £8 per ton in Europe at the beginning of the present century, has been raised to £10 per ton, not only on account of higher cost of production, but also in consequence of the formation of a syndicate of producers. European industry and agriculture have, therefore, to pay about £12,000,000 a year for their present import of nitrate of soda. Since the cost of Chili saltpetre serves as a standard by which the price of the other nitrogenous manures is regulated, ammonium salts have also risen in value at a corresponding rate, namely, from £10 to £12 10s. per ton. This tribute, heavy and steadily increasing with the growing requirements, and mainly borne by agriculture, was indeed felt as an oppressive burden. Yet over and above there had to be faced the danger that the Chili deposits might be advancing towards exhaustion, just as was the case with the Peruvian guano deposits. Although the opinions given by experts on the available stock of Chili saltpetre vary widely, the exhaustion of the supply of saltpetre, whether it occur in 30 or in 50 years, must be reckoned with, apart from the fact that the increase in price is already beginning to prove burdensome. The probability that other saltpetre deposits may be discovered is slight, because the special climatic and geological conditions which combined to build up the large masses of saltpetre in Chili, are hardly met with elsewhere.

In the presence of these facts it is easy to understand why one of our greatest authorities, Sir William Crookes, has sounded a warning note, just as Liebig did in his time, as to the danger threatening the whole human race through the want of nitrogenous manure, that indispensable agent in the fertilisation of the soil. As far back as 1897, Sir William Crookes showed that the food—as measured by the consumption of wheat—which will be required by mankind at the present rate of increase 30 to 40 years hence, can only be produced if the fertility of the soil is improved in a corresponding degree. For this purpose more abundant manuring with nitrogenous substances is necessary. Even before Sir William Crookes had pointed out the necessity of solving the problem, numerous investigators had been searching for means of warding off the threatened danger.

Since Rutherford in 1772 had ascertained the fact that the largest part of our atmosphere consists of nitrogen, attempts have not been wanting to utilise this inexhaustible store which, taking the weight of the air resting on 1 hectare (2½ acres) as 100,000 tons, represents a total quantity of about 4 trillion tons of nitrogen. Priestley in 1775 discovered that the nitrogen of the atmosphere, under the action of the electric spark combines with oxygen to form nitric acid, and he also ascertained that the amount of nitric acid in the air increased through a thunder-storm. Berthelot in 1869 observed the formation of hydrocyanic acid when a mixture of acetylene and nitrogen was submitted to the action of the electric spark. Fownes and Young, as well as Bunsen and Playfair, ascertained afterwards that cyanogen and ammonia were formed on passing nitrogen over a highly heated mixture of coal and alkalis. Marguerite and Sourdeval, and later on Solvay, and especially Ludwig Mond, carried out extensive experiments on the technical utilisation of this reaction, by passing nitrogen over mixtures of caustic baryta and coal, but all these attempts were thwarted by the impossibility of constructing apparatus capable of resisting the necessary high temperature. The great improvements made in the course of the last decades in the realm of electricity have been instrumental in solving this problem. The advent of the dynamo supplied the means of generating electric currents approaching in their effect the electric discharges of the atmosphere, and the electric furnace constructed by Werner Siemens and Sir William Siemens made it possible to obtain degrees of temperature as had been unattainable before. Attempts were made at first, by means of electric discharges in various forms, to effect the direct combination of the elements of the air, oxygen and nitrogen, so as to form nitric acid. But the expectations aroused by the experiments carried out at Niagara Falls by the Atmospheric Products Company, and elsewhere, were not realised. Only the process invented about five years ago by Birkeland and Eyde, in continuance of earlier experiments made by Siemens and Halske, and since then further developed by Schönherr in conjunction with the Badische Anilin und Sodafabrik, has opened up a practicable road towards the solution of the problem. However, as happens so often in industry, an apparently longer and more tedious way ultimately proved to be a successful one.

In 1894 the technical world was astounded by the invention of Moissan and Willson which lead to the manufacture of calcium carbide in the electric furnace on a large scale. The product thus obtained was first used for the manufacture of acetylene. Careful studies which I made immediately after the publication of Moissan's work with calcium carbide and barium carbide, showed that both were possessed of qualities rendering them suitable also for purposes other than illumination. Reviewing the earlier experiments of Marguerite and Sourdeval, and especially those made by Mond, I considered it likely that also in those newer experiments the combination of nitrogen and the production of cyanogen and of other nitrogen compounds might be preceded by the formation of carbides. Contrary to Moissan's views, who had not found carbides to be capable of absorbing nitrogen, I pointed out as far back as in 1895, in a paper published in the Proceedings of the Verein für Gewerbefleiss, the possibility of producing cyanides, amides, and eventually also more complicated nitrogen compounds, starting with carbides as raw material. Experiments which I carried out in conjunction with Dr. N. Caro, in the beginning of 1895, on calcium carbide and barium carbide, especially on the latter, yielded results so favourable that at the end of March, 1895, we were in a position to apply for patents claiming the combination of atmospheric nitrogen with carbides of the alkalis and alkaline earths. But rapid and satisfactory as was the first success, the further development was troublesome and wearisome. For the purpose of carrying out he work on a technical scale we combined with the well-known firm of Siemens und Halske which for some time past had directed its attention to the problem of the fixation of nitrogen. With the assistance of third parties a company was then formed to find the by no means small capital required for our work. The new concern took the name of "Cyanidgesellschaft," and all patents obtained previously and later on were transferred to this Company.

In the middle of the "-90's" the demand for, and the price of potassium cyanide had become considerably enhanced through the introduction of the MacArthur-Forest cyanide process of gold extraction. We therefore kept in view the production of cyanides and ferrocyanides, they being the most valuable compounds of nitrogen. For our purposes barium carbide appeared to be most suitable, as the fixation of nitrogen took place easily, BaC_2+N_2 combining readily to yield $Ba(CN)_2$. Moreover, the barium cyanide so obtained could be transformed, by simple methods, into potassium ferrocyanide and cyanide. The behaviour of calcium carbide to nitrogen at first appeared to be less favourable, for, in spite of apparently strong absorption, only very small quantities of cyanides were found. But a closer examination of the products of the reaction afterwards revealed the interesting fact, that whilst only very small quantities of calcium cyanide resulted from the absorption of nitrogen by calcium carbide, calcium cyanamide had been formed, with the separation of one atom of carbon, thus:—$CaC_2 + N_2 = CaCN_2 + C$. Now, although the conversion of calcium cyanamide into cyanide is technically quite feasible, and is indeed carried out by us on a large scale, the low atomic weight of calcium as compared with that of barium pointed to the advisability of producing directly from atmospheric nitrogen with the aid of the calcium compound cheap nitrogen products, such as ammonia, etc., which would therefore be available for manuring purposes. Our anticipations were confirmed by further experiments, when it was found that the whole amount of nitrogen contained in calcium cyanamide, as also that contained in the pure cyanamide, produced therefrom, could be easily converted into ammonia, by heating with water under high pressure; this is expressed by the following equations:—

$$CaCN_2+3H_2O=CaCO_3+2NH_3$$
$$CN_2H_2+3H_2O=(NH_4)_2CO_3.$$

Thus the long looked-for method for the production of ammonia and ammonium salts from atmospheric nitrogen had been found.

The consideration of this simple reaction led my son, Dr. Albert Frank, to the conclusion that, under suitable conditions, crude calcium cyanamide might in itself represent a suitable fertiliser that could be used directly for the nutrition of plants. As this supposition was only based on theoretical observations, it became necessary to prove its correctness by practical tests. These were carried out first in 1901 and 1902 by Prof. Wagner of Darmstadt and Prof. Gerlach of Posen. A great number of tests were made, under varying conditions, in pots, as well as in the open field, and the results proved that crude calcium cyanamide containing 20 per cent. of nitrogen could be considered equivalent to ammonium sulphate and therefore, if used in the right place, might serve as a suitable fertiliser for plants. These trials having been successfully repeated in the following year in numerous agricultural testing stations as also in agricultural practice, we had to develop and improve the manufacture of the product—which we termed "Kalkstickstoff," "nitrolime"—so as to enable it to enter into successful competition with ammonium sulphate and Chili saltpetre. The raw materials required, viz., lime, coal, and atmospheric nitrogen, are easily obtainable everywhere, but the production of pure nitrogen in such large quantities required further investigations. The process first used by us to separate oxygen from nitrogen by leading the air over heated copper turnings proved to have many drawbacks, because, in consequence of the necessary reduction of the oxide formed, work could only be carried on intermittently. We therefore turned our attention to the Linde method of separating the two constituents of our atmosphere by liquefaction and fractional distillation. This method also presented difficulties, for we had to devise first an expensive plant for the supply of the large quantity of pure nitrogen (300 cub. metres per hour) which we required.

In the course of the last years we have, however, successfully developed both methods of producing nitrogen on a large scale, so that both are applicable, the choice of the method depending in each case on local circumstances.

The second raw material required for the manufacture of calcium cyanamide is calcium carbide. 100 kilos. of commercial calcium carbide—of 80 per cent. purity—can, theoretically, absorb 35 kilos. of nitrogen. In practical working, the absorption amounts to 25 kilos. only, so that the resulting product is 125 kilos. of "nitrolime" containing 20 per cent. of nitrogen. Thus, in order to fix one ton of nitrogen, four tons of calcium carbide are required. The production of this quantity of calcium carbide forms, of course, the basis of the subsequent manufacturing operations. Carbide factories now produce two tons of carbide per kilowatt-year; consequently we require 2 kilowatts-year equalling 2·66 h.p.-year for the 4 tons of carbide necessary to fix 1 ton of nitrogen. Adding to this amount 0·34 h.p.-year for other mechanical work, etc., we require a total of 3 h.p.-year. It is, therefore, evident that the cost of electric energy represents an important factor in the competitive struggle of the new product with the old nitrogenous manures, ammonia and saltpetre. In order to introduce nitrolime into agricultural practice with success, it is necessary to supply the unit of nitrogen at a price at least equal to, and if possible lower than that of the unit contained in ammonia and saltpetre.

Since water power, necessary for the production of energy at a low price, is very scarce and hence can only be obtained at a high cost in Germany, the Cyanidgesellschaft combined with the largest Italian carbide works to found the "Società Generale per la Cianamide" in Rome, to whom all patents were transferred. The first plant equipped for production on a large scale was, at the end of 1905, started at Piano d'Orta, utilising the large hydraulic power of the Pescara River; the production of this plant, laid out first for 4000 tons a year, has already been increased to 10,000 tons a year. Further large plants in Italy have since been erected at Terni, in connection with the carbide works which already existed there, and near San Michele in the Aosta Valley. On the other side of the Adriatic, at Sebenico in Dalmatia, at Fiume, and especially at Almissa, where water power of 50,000 h.p. is available, some factories are being constructed, whilst others are already working. Licences for France have been granted to the "Société Française des Produits Azotés," which has erected a plant for 4000 tons a year, at Notre Dame de Briançon. In Switzerland, the "Société Suisse des Produits Azotés" has begun manufacturing in works situated in the Rhone Valley. In the United States, the "American Cyanamid Company" has erected, on the Canadian side of the Niagara Falls, a factory for an output of 5000 to 6000 tons, which, when the installation is complete, will be increased to 10,000 tons a year. I may also mention that a plant is now in course of construction on the Kiuskzu Islands, in Japan; it is designed to produce, for the present, 4000 tons a year. In Great Britain, "The North Western Cyanamide Company, Ltd.," was founded in 1906. This Company acquired from the Birkeland-Eyde concern water power, to the extent of 50,000 h.p., near Odde on the Hardanger Fjord in Norway and established there a plant for the production of 12,500 tons of nitrolime to begin with, an extension to 50,000 tons a year being provided for. In Germany, owing to the want of cheap water power, only two small factories, for a production of 2000 tons and 6000 tons respectively, have been started; there will, however, soon be added a third plant for 15,000 tons a year, now in the course of erection in Bavaria, which will utilise the water power of the Alz. When all the above plants are at work, their total production will correspond to the nitrogen contained in 250,000 tons of Chili saltpetre.

The thought that Germany, the largest consumer of nitrogenous manure, would have to import nitrogenous manure, as she is now importing Chili saltpetre, acted as a strong stimulus to discover other hitherto unused sources of power. The solution of this problem, so important in many respects from the economic standpoint, has now been found, by utilising the large stores of energy accumulated in the German bog areas. About the middle of the 'sixties I paid attention to the investigation of those districts, whilst endeavouring to introduce there potash manures and whilst interested in a plant for the utilisation of meadow-ore (bog-iron ore) which was being raised there. At that time I fully recognised the difficulties which had to be overcome to utilise successfully those extensive deposits of peat. When, in the 'nineties, the improvement in the construction of electric generators offered the possibility of an easy transport of the energy produced, and since, as mentioned before, large quantities of energy are required for the production of nitrogen, I resumed my former studies. As I knew from my own experience, and as I had also learned from the failure of others that the physical properties of the peat, especially its large proportion of water, made it absolutely impossible to convert the material into a fuel easy of transport and fit to compete with coal, I recommended the erection of large electric power stations in the middle of the bog district so as to utilise the heating power of the peat for the production of steam with the least possible expenditure of labour. The improvement of the gas engine and the work of Mond on the simultaneous production of power gas and ammonium salts in the gas generator helped to mature further plans. If it was possible to gasify in a generator the raw peat, first dried to a certain extent, and to obtain thereby not only power gas, but also to extract at the same time, in the shape of ammonium salts, a large portion of the frequently high percentage of nitrogen contained in the peat, then the problem of cheap production of power was solved. Experiments which my collaborator, Dr. Caro, made with the assistance of Dr. Mond, at the works of the " Power Gas Corporation " at Stockton and Winnington, and, later on, at the works of the " Deutsche Mondgas Gesellschaft " in Westphalia, furnished the very favourable result that peat containing 50 to 55 per cent. of water could be gasified without difficulty. It was found that in addition to a power gas, yielding 1400 kilo.-calories per cub. metre, a quantity of ammonium sulphate was obtained which corresponded to 75—80 per cent. of the nitrogen originally contained in the peat. At a lengthy trial carried out last May at the works of the German Mond Gas Company at Sodingen in Westphalia, when 40 tons of wet peat were worked up per day, 2 tons of peat containing 50 per cent. of water furnished 2400 cub. metres of power gas and 38 kilos. of ammonium sulphate. As the nitrogen contents of the dry peat amounted to 1·05 per cent., this yield of ammonia represents about 75 per cent. of the total nitrogen. On using the power gas in a large Deutz gas engine, the consumption per h.p.-hour was 2·4 cub. metres. Hence, not taking into account the production of steam required for working the generator, the above 2400 cub. metres of power gas are capable of supplying 1000 h.p.-hours.

Thus, a source of power has been found for the production of calcium carbide and of nitrolime, which can compete even with the cheapest water power of mountainous countries. As Germany owns an area of 22,000 square kilometres (=8500 English sq. miles) of bogs, she can not only produce the nitrogenous manure required for her agricultural requirements, but she can, in addition, supply large quantities of power for other industrial and agricultural purposes, as, for instance, for railway and canal traffic, whilst the land from which the peat has been removed, is suitable for cultivation, as long experience in Holland has demonstrated. Similar conditions obtain in Great Britain, especially in the Irish bogs. Ireland, for her area, owns more peat deposits than any other country in the world ; almost one-seventh of her surface, viz., 4250 sq. miles, is covered with peat deposits of a quality rarely found elsewhere in Europe, and the percentage of nitrogen in the peat is often very considerable. The zealous endeavours made for years to improve Irish agriculture and industry, can therefore be assisted to a great extent by the rational utilisation of the bogs.

More important still than the fixation of nitrogen in the shape of calcium cyanamide, is the application of large and cheap sources of energy for the production of nitric acid and nitrates direct from the atmospheric nitrogen by means of the electric arc. This process is a thermal one, but whilst the combination of nitrogen with calcium carbide represents an exothermic process (*i.e.*, heat is set free), the combustion of nitrogen with oxygen is an endothermic process. Consequently, the consumption of energy is considerably larger in the latter process, amounting theoretically to nearly 2·8 times the consumption of the former process per unit of nitrogen fixed. In practice, according to Eyde's own statement, the consumption is even higher. The product obtained by the Birkeland-Eyde process, namely, nitrate of lime, has proved itself to be, for the same percentage of nitrogen, a manure fully equal to nitrate of soda. The employment of neutral nitrate of lime is, however, attended with some difficulty on account of the hygroscopic property of this salt. Hence, it became necessary to manufacture the less hygroscopic basic nitrate, which in its commercial form contains only 11 to 12 per cent. of nitrogen. Other methods for the production of nitric acid, by combustion of ammonia with oxygen, wherein the necessary heat is produced by the oxydation of the hydrogen, have lately been worked out by Prof. Ostwald of Leipzig, as also by Dr. Caro and myself. Ostwald's process is based upon the catalytic action of platinum, whilst Caro and myself obtain the same effect by using a mixture of thorium and cerium oxides, the incandescent bodies of the Auer burners. The products obtained in the experiments we have carried out so far, on a small scale, have utilised as much as 85 per cent. of the nitrogen contained in the ammonia. Large plants are said to have been erected to work Ostwald's process, but reports on their practical results are, so far, wanting. Considering that, as mentioned already, by treating nitrolime with steam under high pressure, pure ammonia can be easily produced with a yield of 98 per cent., it is quite within the limits of possibility that our process may also become a useful one for the production of nitric acid. Meanwhile the production of ammonia on a large scale with the aid of nitrolime is only carried out in the Piano d'Orta works for the manufacture of ammonium sulphate. As a matter of fact, the fertilising effect is only brought about by the transformation in the soil of the amide into nitric acid, this process of nitrification being effected, as has been ascertained by Löhnis and Perotti, by certain bacteria which abound in all soils that are rich in humus.

The calcium cyanamide supplied for agricultural purposes contains on an average 20—21 per cent. of nitrogen and 40—42 per cent. of calcium, corresponding to 56—59 per cent. of caustic lime, further 17—18 per cent. of carbon and some impurities consisting of mixtures of silicic acid, clay, traces of phosphoric acid, etc., originally contained in the crude carbide. When this material is mixed with the cultivated soil, the calcium cyanamide under the influence of the carbonic acid and of the moisture contained in the soil, is decomposed first into calcium carbonate and free cyanamide. The latter then, with absorption of moisture, is probably transformed into urea :

$$CN_2H_2+H_2O=(NH_2)_2CO,$$

from which ammonia, and by subsequent nitrification nitric acid, is formed. The chemistry of this process of transformation has not yet been fully worked out, but the formation of nitric acid is acknowledged by all investigators to be the final product. Thus, while nitrate of soda and nitrate of lime offer the nitric acid to the plant ready for absorption, nitrolime must first be transformed into nitric acid in the soil, in the same manner as are the ammonia salts and nitrogenous manures of animal origin. This feature constitutes a guarantee that both kinds of nitrogen manures, nitrates, as well as amides, will be used in future side by side. Saltpetre will always be used, especially as top dressing, in all cases where vegetation must be rapidly assisted, *i.e.*, especially in spring, while nitrolime must be introduced into the soil before the seed is sown in order to enable it to show an effect equal to that produced by ammonium sulphate. Moreover, it offers the advantage that its decomposition products are absorbed and retained by the soil, whereas in moist years the nitrates are washed out and carried away. Only prolonged practical experience can supply a knowledge of the most favourable conditions for the use of this new manure in different soils and for the different plants cultivated. The same thing occurred in connection with the introduction of potash manures, when their high chlorine content at first gave rise to apprehensions.

I will now mention a few other developments which have arisen from the fixation of atmospheric nitrogen.

There is the production of potassium and sodium cyanides, for the manufacture of which a large plant has now been erected near Charlottenburg. The use of the cyanide process has now greatly extended, for it can be employed in the extraction of silver from refractory ores, thus replacing the old Mexican Patio process. It was this fact which induced our chemists to produce crude cyanide of soda by simply melting nitrolime with common salt, as in this process cyanamide is transformed into cyanide together with absorption of carbon. The mass so produced, which we term "surrogate," contains about 25 per cent. of sodium cyanide, and, according to experiments made in England, has proved useful in the extraction of gold and silver. The production of this "surrogate" can be effected without difficulty in an installation near the mines. Similarly, by smelting nitrolime with fluxes, a material may be prepared which serves as a substitute for ferrocyanide of potassium and other hardening substances for tempering iron and steel. This material, sold under the name of "ferrodur," has already found extensive application in the tool industry. Crude calcium cyanamide further serves for the technical production of a large number of organic compounds. The transformation of cyanamide into urea, which I have mentioned already, forms the basis for the technical production of this substance as also of thiourea on a large scale.

Further products are dicyandiamide, resulting through the polymerisation of cyanamide, and dicyandiamidine and its salts. The salts and nitroderivatives of guanidine can also be obtained from nitrolime. In addition to the use of these substances in the colour industry, I may mention, as of special interest, that they are used as "cooling material," *i.e.*, to reduce the temperature of combustion, in the case of explosives and of gunpowder. Owing to its high contents of inert nitrogen, gunpowders manufactured with the additions of this "cooling material" produce a high pressure in ordnance, whereas in contradistinction to the other components of the explosive, which mostly consist of carbon and hydrogen, they only develop a low degree of heat. This is of special importance for ordnance powder which contains large quantities of nitrocellulose and which rapidly destroys the rifling of the pieces.

Among other organic preparations obtainable from calcium cyanamide, which is produced by the heat of the electric furnace, I will, in conclusion, only mention the efficient component of Liebig's extract of meat, namely Creatine, which can be artificially produced by the combination of sarcosine with cyanamide.

Chemical science having succeeded in producing artificially such compounds as alizarin, indigo, and similar complex substances, which not only replace, but even supplant the natural products, the opinion has often been expressed, that we shall be able to build up, artificially, from their elements the substances necessary for the nourishment of man, namely, carbohydrates, and even proteins, and thus render ourselves independent of the fluctuating production of the soil. Although I, as a chemist, believe in the possibility of such syntheses in the chemical laboratory—proved, already, in the case of sugar—I greatly doubt whether we shall ever compete successfully with the natural production of the soil. True, agricultural production ultimately rests upon the same chemical laws and processes which we employ in laboratories and works, but the energy which is required to bring about these processes and which sun, atmosphere, and soil furnish directly to the farmer, can only be supplied to industry indirectly and hence at far greater cost, quite apart from the fact that the utilisation of energy is far more perfect in the organism of plants and animals than in the apparatus of the chemist.

From the economical point of view we shall, consequently, fare best, if we are careful to further and increase the growth of our food plants, by supplying them with the substances which the soil cannot offer to them in sufficient quantity.

The old utterance of Dean Swift: "The man who makes two ears of corn or two blades of grass to grow, where only one grew before, is a great benefactor to his country," supplemented by that of the late Marquis of Salisbury: "If farmers would only manure their land with brains, as the painter mixes his paints, there would be much less heard about agricultural depression," are and will remain the practical principles guiding the relation of chemical industry to agriculture.

Discussion.

Professor **Meldola** said one could not help feeling struck at the extremely harsh way in which this country had been dealt with by nature in the way of necessary materials for agricultural purposes. John Bull was always represented as a typical farmer; but it appeared that he had to rely either on natural or manufactured products from other parts of the world. Not the least interesting part of this paper was the historical introduction to the various sections. Dr. Frank, of course, had touched lightly on the early steps in the utilisation of those different materials. As to the influence exercised by Liebig on agricultural procedure, it should not be forgotten that the late Lord Playfair was really the intermediary between this great chemist and English agriculturists. It was he who first realised the importance of Liebig's work, translated his books, invited him over to England, and himself went about the country lecturing to farmers and making them see the importance of those discoveries. In writing the history of this chapter, therefore, English chemists and agriculturists should never forget to associate with it the name of Lord Playfair.

Another point which he wished to bring forward had reference to the utilisation of the potash from beet-sugar waste. Everyone now recognised the importance, and in fact the necessity for potash for certain crops; and the question of beet-sugar cultivation had been raised over and over again in England. In his younger days, about 1869 or 1870, the late James Duncan endeavoured to introduce beet cultivation into Suffolk; but, apparently it did not succeed, nor, he understood, had later efforts in that direction. A point which might profitably be considered in connection with this paper, was the question whether beet could be grown in this country, and if so, why was it not undertaken?

With respect to the nitrogen question, one could not help feeling from the purely chemical point of view that, although the author had proved, theoretically and practically, that atmospheric nitrogen was fixable in the form of cyanamide, still it was a long cry from cyanamide to nitrate, which was the only form in which the plant could use it. The question, therefore, still remained: What was the fertilising value of cyanamide as compared with Chili saltpetre? On that point he believed experiments had been made at various stations; and it would be well to have some definite statement of results.

Lastly, he would cordially endorse the opinion expressed in the paper, that it would be a very long time, if ever, before a chemical process could compete with living organisms in the synthesis of proteids.

But even from the biological point of view, the living organism had already solved the question of the fixation of nitrogen. As they were all now aware, leguminous crops got their nitrogen through the intervention of an organism, by a sort of symbiotic arrangement. The so-called nodules of leguminous plants were composed of organisms which were in some way able to fix the atmospheric nitrogen directly and pass it on to the leguminous crops. So that that problem had been solved by some of the very lowest organisms in Nature.

Sir **William Ramsay** said there was one point which had already been brought before the Society by Professor Guye some years ago, which ought to be mentioned. Obviously, the manufacture of calcium cyanamide should be undertaken concurrently with the combination of nitrogen and oxygen. As they had heard from Dr. Frank, in his process a great quantity of pure nitrogen was required; and he understood that the oxygen was thrown away—which was a very uneconomical process. On the other hand, for the combination of nitrogen with oxygen, as carried on in the Birkeland-Eyde process, it was greatly to the advantage of the latter that the gases which entered the arc should be richer in oxygen than air; so that if those two processes were worked together. each would utilise the by-products of the other.

The only other remark which struck him was one in which he should have to refer to the results of an investigation which was still in progress, and which had not gone far enough to allow him to say much. They had heard from the Chairman that this process of Dr. Frank's was one in which energy was evolved; and that the Birkeland-Eyde process was one which absorbed energy from end to end. It looked absurd to speak of experiments made with quantities consisting of only milligrams; but he had made some experiments recently, with a very curious result. It was known that nitrogen and hydrogen would combine above a certain temperature; and every young chemist knew that if a spark were passed through a mixture of nitrogen and hydrogen, a little ammonia was formed, and that if water of sulphuric acid was present to absorb it, the combination went on until the whole of the mixture was converted into ammonia; but at any given moment the amount of ammonia present was excessively small compared with the amount of nitrogen and hydrogen which remained uncombined. Experiments had been lately made at Karlsruhe, at various temperatures, and it turned out that at a high temperature the decomposition was at its greatest; and that as the temperature was lowered, a greater and greater amount of ammonia formed in proportion to the constituent gases; but that below a certain temperature, about 500°, the nitrogen and hydrogen ceased to act on each other, or acted so slowly that practically it was not worth considering. In the presence of radium emanation, which was a source of energy, not merely ammonia rapidly decomposed, but hydrogen and nitrogen rapidly combined. Whether the radium emanation really acted as a catalyser and greased the wheels, or whether the energy it evolved contributed to the operation, he did not know; but the combination of nitrogen and hydrogen was an exothermic operation. One did not want to put extra energy in. As far as they had yet gone, the combination of nitrogen and hydrogen took place just as rapidly as the decomposition of ammonia. Now if that occurred with such a substance as radium emanation, it suggested the question whether there were no other substances which could do it; and if there were the problem would be solved. There was no trouble in producing hydrogen in any quantity; and the combination should be merely a question of applying the right means.

After some remarks by Mr. F. J. Lloyd,

Mr. A. H. Lymn said there was one process which had been touched upon in which England was undoubtedly pre-eminent, namely, the recovery of nitrogen in the shape of sulphate of ammonia from coal and combustible matters generally. It was well known that Dr. Mond, 15 years ago, was recovering sulphate of ammonia from coal at the rate of 80 lb. of sulphate per ton. That had gradually developed, and the latest phase in the utilisation of the Mond process was that of recovering ammonia from peat. And in this connection he should like to correct an evident misapprehension in this paper, viz., that it was Dr. Caro who, with Dr. Mond, worked out the Mond process in its application to peat. It was true that Dr. Caro gave assistance in the working out of that process as applied to the utilisation of waste colliery products, and also of a certain material from Germany called "Seeschlick" (Lake slime), which contained a large amount of nitrogen and which was very successfully treated. But as regards peat, he wished to make it clear that a year or two before either Dr. Mond or himself met Dr. Caro, peat was already being gasified by the Power-Gas Corporation of London, and as a fact by himself, under ammonia-recovery conditions, at Stockton-on-Tees in 1903; and it was this Company who had built and supervised the operation of the plant in Germany, whereof the results had been stated by Professor Frank, indeed two further plants to gasify peat were now being built by this Company, one of them for a new Electricity Supply Station in Italy. At the same time he must draw attention to the eminently valuable work of Prof. Frank and Dr. Caro in Germany, in recognising the "Mond" process as the best adapted for making use of the peat bogs which cover so large an area there. It was probably not generally known that in many places there were peat bogs, at all events in this country and in Ireland, so rich in nitrogen that they could be profitably gasified, for ammonia only, the gas being looked upon as a by-product which for lack of power users might in some cases have to be treated as a waste product. The sulphate of ammonia obtainable from a ton of theoretically-dry peat varied naturally according to the nitrogen; but in his experience it ranged from 80 to 160 lb. per ton. That showed the enormous total value of the peat in the United Kingdom as a source of nitrogenous fertilisers. Peat could be produced in a suitable condition for gas-producers at a cost of from 2s. 6d. to 3s. 6d. per theoretically-dry ton. Of course, the theoretically-dry ton was simply mentioned as a standard; it naturally contained in its air-dried condition from 25 to 30 per cent. of moisture.

The conditions he had just mentioned might also apply to waste small coal, a very large plant being now under construction in the Midlands to gasify this fuel for ammonia only, the gas being temporarily a by-product.

Mr. C. Revis said since the discovery of the nodule bacteria, a company had been started for the purpose of producing cultures of these bacteria; but it had not been very successful, as no good effects resulted from the use of such cultures; further work had, however, elucidated the difficulties, and enabled the cultures to be used quite successfully in parts of Canada and America. They could now be supplied to the farmer in such a condition that he could use them, and remarkable results in the increase of crops had followed. He did not think the cultures had been tried on any commercial scale in England. But they must not forget the work of Professor Bottomley; it was thought for a long time that the use of these nodule bacteria was limited to the leguminous plants; but he had now shown that they were not specific in their character and could be trained for use with other species.

Journal and Patent Literature.

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I.—PLANT, APPARATUS, AND MACHINERY.

Patents.

Compressing air or gases and apparatus therefor. H. A. Humphrey, London. Eng. Pat. 22,646, Oct. 14, 1907.

The energy of expansion of an ignited combustible mixture is utilised to effect the compression of air or other elastic fluids. A mass of liquid propelled out of the combustion chamber compresses the fluid, some of the energy thus developed being used to compress a fresh charge in the chamber by a return flow of the liquid. Various methods and combinations for the regulation of the air supply and energy are claimed.—C. J. G.

Compressed-gas containers; Safety device for ——. Soc. pour l'Utilisation de l'Air et de ses Dérivés, Paris. Eng. Pat. 15,491, July 21, 1908. Under Int. Conv., July 22, 1907.

In high-pressure apparatus and particularly in cylinders containing compressed oxygen or other gas, where an ebonite washer as well as a valve regulates the supply, the sudden rise of pressure and therefore of temperature in the *cul de sac* formed when the valve is opened, may lead to ignition, especially if the ebonite be rough, or the passages covered with impurities. In order to avoid the dangers arising from this cause, an auxiliary air space is formed close to the washer, and its volume made greater than the volume of the passage on the side nearer the washer. Any rise in pressure and temperature would thus occur in the auxiliary air space, and thus be rendered innocuous.—C. J. G.

Regulating or controlling the flow of liquids; New or improved apparatus for ——. J. Fieldhouse, Guildford, and Oxychlorides (1907) Ltd., London. Eng. Pat. 8548, Apr. 16, 1908.

The patent relates to an apparatus for mixing one liquid or solution with another in definite proportions, *e.g.* for adding deodorising or antiseptic solution to sewage liquor, or for softening water by means of lime-water or chemical solutions. The flow of chemical is regulated by means of a slide-valve of special shape working over a corresponding port. A float in the sewage liquor or other sump rises or falls according to the volume passing through, and opens or closes the slide to a corresponding extent by means of a system of links and levers. The volumes of liquid passing through the apparatus may be recorded on suitably calibrated scales, by means of pointers adjustably connected with the links and levers. —C. J. G.

Centrifugal machines for separating solids from liquids. Aktiebolaget Separator and P. B. Harje, Stockholm, Sweden. Eng. Pat. 10,314, May 12, 1908.

A regulating substance independent of the liquid to be separated, is passed, together with the solids separated in the machine, through discharge openings, thus keeping the latter always filled with solids, and allowing the openings to be made sufficiently wide to avoid obstruction. The regulating substance may be introduced through a separate pipe within the feed pipe, and issue through a series of radiating pipes at the bottom of the bowl, the outlets from these pipes being placed between the discharge openings in the wall of the bowl.—C. J. G.

Centrifugal pump; Multistage ——. H. Keller, Berlin, Germany, Assignor to General Electric Co., New York. U.S. Pat. 901,450, Oct. 20, 1908.

Several centrifugal pumps are connected in series and driven from one shaft. An active fluid and a fluid to be acted on, compressed, or condensed, are separately supplied to the first pump of the series. The two fluids are separately conducted from the delivery chamber of the first, to the inlet chamber of the second pump and so on throughout the series, so that the same portion of active fluid acts on the same portion of fluid undergoing compression, in successive stages.—W. H. C.

Dryer; Recuperative ——. P. Turlur. First Addition dated May 30, 1908, to Fr. Pat. 378,247, May 30, 1907, (this J., 1907, 1136.)

In the improved apparatus, a single air-distribution box only is used.—W. H. C.

Rotary kiln; Process for the production of the highest temperatures in a gas heated ——. M. G. Semper and Portland Cementfabrik Drachenberg A.-G. Fr. Pat. 390,586, May 26, 1908.

A constriction is formed within the kiln so that the flame strikes the shoulder of the constriction and eddies are formed which allow time for the attainment of the highest temperature.—W. H. C.

Drawing off a liquid simultaneously with a gas which has reacted chemically therewith; Arrangement for ——. J. Steynis. Fr. Pat. 390,598, Aug. 1, 1907.

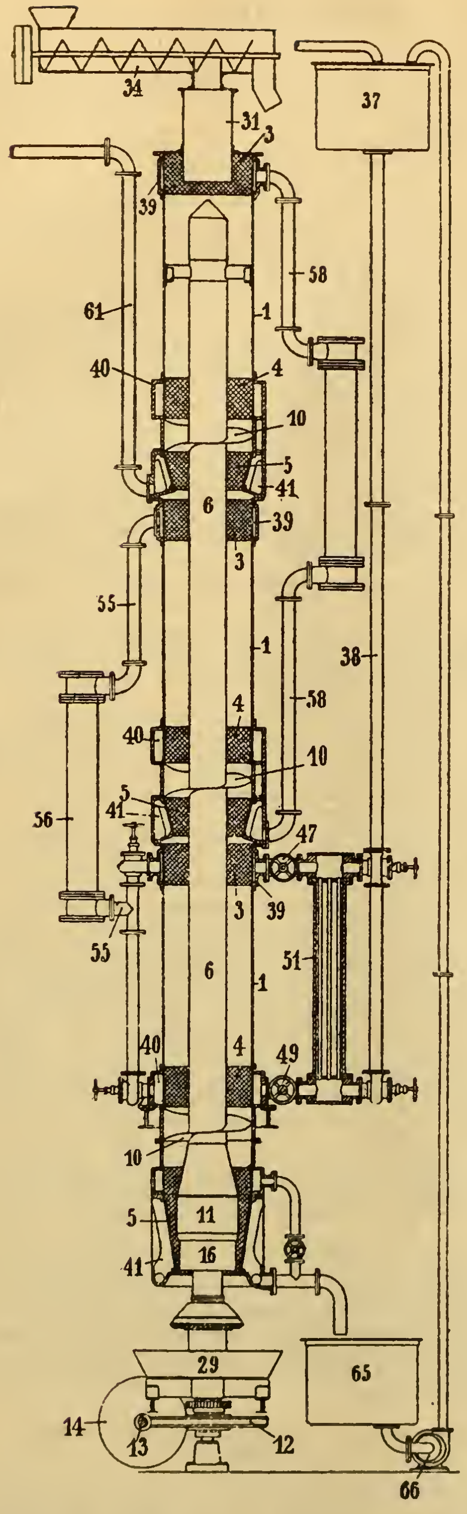
The apparatus consists of two cylinders, the second of which contains an inner chamber closed at the bottom and open near the top. A vacuum pump is connected to the bottom of the inner chamber and draws liquid through a perforated funnel into the first cylinder and into the outer chamber of the second cylinder until it overflows into the inner chamber. At this moment the gas is admitted through a number of similarly perforated funnels into the first cylinder, in a direction opposite to that of the liquid spray. The vacuum and delivery of gas and liquid are regulated by means of cocks.—C. J. G.

Separating solids from liquids by freezing, and a refrigerator for this purpose. P. Porgès and R. Neumann. Fr. Pat. 390,816, June 1, 1908.

A number of hollow chambers, through which a refrigerating agent is circulated, are arranged close together on a central spindle, which is rotated in the liquid to be cooled. The surfaces of the chambers are swept by scrapers or rakes to remove the deposit, and keep the liquid moving. Suitable subdivisions and connecting ducts for the better utilisation and circulation of the refrigerating agent are provided.—C. J. G.

Diffusion apparatus. W. Bock. Fr. Pat. 390,629, May 27, 1908.

The apparatus consists of three or more superposed cylinders, 1. Each vessel has an upper and lower perforated portion or band, 3, 4, surrounded by a jacket, 39, 40, and a perforated conical portion, 5, also surrounded by a jacket, 41. A central hollow shaft, 6, extends through the vessels and is rotated by the gearing, 12, 13, 14. The shaft carries the screw-blades, 10, in the position shown. The material to be treated is fed by the conveyor, 34, into the cylinder, 31, falls into the upper part of the top cylinder, 1, and passes downwards, the exhausted residue being discharged from the bottom of the lowest vessel into the



trough, 29. The water or other liquid flows from the tank, 37, by the pipe, 38, into the cylinder, 51, and thence either by the valve, 47, into the jacket, 39, or by the valve, 49, into the jacket, 40, of the lowest diffuser, 1. If downward extraction is desired in the lowest vessel, the liquid passes from the jacket, 39, through the perforated portion, 3, into the vessel, and after passing through the material is discharged through the perforated portion, 4, into the jacket, 40, whence it rises to the cylinder, 56. From this cylinder it passes through the next vessel by the pipes, 55, 58, to the next cylinder and thence through the upper vessel, being finally discharged as a saturated solution by the pipe, 61. The material in that portion of each diffuser which lies between the perforated bands, 3 and 4, is only slightly compacted and is therefore easily permeated by the liquid, but as it comes within the sphere of action of the screw, 10, it is compressed and driven forward into the conical perforated portion, 5. Here the liquid is squeezed out through the perforations and a comparatively solid mass of material passes on to the next vessel where the process is repeated. The vessels are only separated from one another by the compressed material, which acts as an efficient partition, and prevents the passage of the liquid. The liquid expressed from the lowest cone, 5, in which the shaft, 6, is expanded as shown at 11, and 16, flows into the tank, 65, and is returned by a pump, 66, to the tank, 37.—W. H. C.

Hydrosilicates of aluminium, animal charcoal, and other fine-grained substances; Process and apparatus for treating —— with volatile solvents. H. Hirzel. Fr. Pat. 391,169, June 13, 1908.

The process is for treating clays or hydrosilicates of aluminium (such as fuller's earth), animal charcoal, and other fine-grained substances with volatile solvents, by mixing them into a paste with the solvent, and agitating the mixture. A horizontal vessel, provided with a steam jacket, is employed, and the ends serve as filters against which the mixture is thrown by the agitator, so that the extract passes through the filters and is drawn off from end chambers; the material is thus subjected to the regular action of the solvent until exhausted, fresh solvent being added as required.—F. Sodn.

Evaporating installation. J. Prugne. Fr. Pat. 391,260, June 16, 1908.

The claim is for a system of evaporation in which a tubular steam generator is employed, which admits of the rapid production of steam. The condensed water and low-pressure steam escaping from the coils of the evaporator are collected and injected into the feed pipe of the steam generator. Air under pressure is blown into the lower part of the evaporator to stir up the deposited salts and so facilitate their removal.—W. H. C.

Cleaning or washing smoke, evaporating or cooling liquid, or condensing vapours; Apparatus for ——. J. Black, and A. H. and H. Lennox. Fr. Pat. 391,419, May 29, 1908. Under Int. Conv., June 25, 1907.

See Eng. Pat. 14,675 of 1907; this J., 1908, 617.—T. F. B.

Smoke or gases; Apparatus for washing or purifying ——. J. Black, and A. H. and H. Lennox. Fr. Pat. 391,420, May 29, 1908. Under Int. Conv., July 1, 1907.

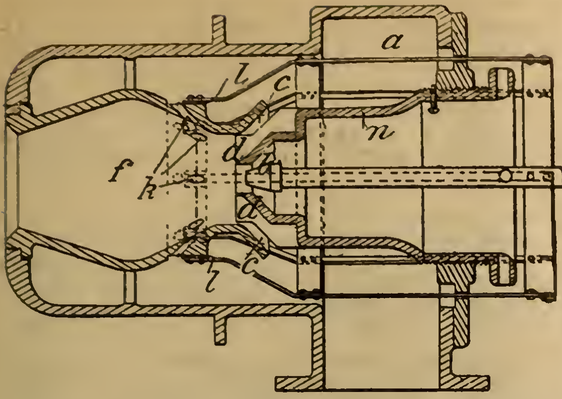
See Eng. Pat. 15,172 of 1907; this J., 1908, 742.—T. F. B.

II.—FUEL, GAS, AND LIGHT.

Patents.

Liquid fuel; Process and apparatus for the combustion of ——. A. Koch. Hanover-List, Germany. Eng. Pat. 26,816, Dec. 4, 1907.

The patent relates to a burner for heavy oils, in which an eddying current of air is produced in front of the oil-nozzle by two oppositely directed currents. Air from the outer chamber, *a*, of the burner passes into the chamber, *f*, through two series of openings, *c* and *k*. The openings, *c*, are provided with spiral vanes, *d*, which give the air a whirling motion in front of the oil-nozzle, *b*, and the openings, *k*, are directed against the direction of axial flow, or against the direction of rotation, of the air from



the openings, *c*, so as to produce a strong eddying motion. The openings, *c*, may be adjusted by turning the threaded part, *n*, and the passages, *k*, are controlled by the sleeve, *l*.
—A. T. L.

Gas furnaces or coke ovens. H. Koppers, Essen-Ruhr, Germany. Eng. Pat. 2145, Jan. 30, 1908. Addition to Eng. Pat. 28,811, Dec. 29, 1904 (this J., 1905, 1102).

The regenerator flues arranged as in the principal patent and connected directly to the heating walls, are used for preheating the air, and dampers are arranged so that the currents of air and of heating gases flow in opposite directions, in consecutive regenerators and heating walls. The regenerator flues, instead of being divided by the central arch, may run undivided along the length of each oven. Air and flue-gases then pass through alternate regenerator flues, and these flues are connected for one-half of their length with the heating wall to the left, and for the other half of their length with the heating wall to the right.
—A. T. L.

Coke-ovens. T. von Bauer. Fr. Pat. 390,720, March 26, 1908. Under Int. Conv., Oct. 2 and Dec. 2, 1907, and March 5, 1908.

The distribution of the return or heating gas takes place above the heating flues. The gas is either conveyed by a main placed above and parallel to the battery along the centre line and is distributed to groups of heating flues by inclined flues formed in the brickwork above the ovens, and radiating from the centre line to the sides, or it may be conveyed by two flues, one at each side of the battery and distributed towards the centre by a number of inclined or horizontal flues. In either case the gas enters the upper portion of the heating flues. The air for combustion is preheated by being caused to pass from a flue situated beneath the battery, through narrow channels formed in the walls, which separate the heating flues.—W. H. C.

Coke-oven; Regenerative —— without reversal of current within the oven. J. G. Kros. Fr. Pat. 391,228, June 15, 1908.

Two regenerative chambers are constructed beneath and parallel with each oven. By means of two pairs of dampers, each of the regenerators is placed alternately in connection with the air and the combustion chamber, or with the downtake from the combustion chamber and the main flue. The direction of the gases is thus reversed in the regenerators, but always remains the same in the heating flues.—W. H. C.

Gas retort. E. Gennotte. Fr. Pat. 390,563, May 25, 1908.

The upper wall of a gas retort is inclined towards the horizontal at the angle of the natural slope of the charge of coal, whilst the inclination of the bottom is steeper. At the same time the width of the lateral walls increases progressively towards the lower end of the retort. By this means the discharge of the coke is facilitated.—R. L.

Retorts; Vertical —— for the manufacture of coal gas, with intermittent working. Comp. pour la Fabr. des Compteurs et Matériel d'Usines à Gas. Fr. Pat. 390,638, Aug. 3, 1907.

The disadvantages of vertical retorts of the Appolt type are the longer period of carbonisation, high gas pressure at the base during the earlier period of distillation, and low illuminating power of the gas. The first drawback is caused by the necessary taper of the retort walls, which is usually more than 25 mm. per metre height and which consequently increases the thickness of the charge in the lower part. To avoid this drawback, one of the lateral walls only is inclined, the three remaining walls being vertical. The high pressure at the base which is due to a softening and caking of the freshly-charged coal and the consequent resistance offered to gas rising from the lower parts, may be overcome by withdrawing the gas from bottom and top simultaneously. By this means decomposition of the gas during its passage over a tall column of incandescent coke, which is responsible for the decrease in illuminating value, is also prevented.—R. L.

Retort; Vertical ——. P. de Lachomette, Williers et Cie. Fr. Pat. 390,707, May 30, 1908. (Under Int. Conv., to H. W. Woodall and A. D. MacDuckham, June 22, 1907.)

The retort charge is supported by an inclined surface placed under the retort at an angle, in such a manner that, although bearing the greater part of the weight of the charge, it does not prevent the free discharge of the coke by gravitation. At the lower end of this inclined surface an extracting device is fitted by means of which the discharge can be regulated. This device may be in the form of a roller, or of a plate over which a rotating or pushing arm moves. The inclined surface may be plane or cylindrical, and may be part of the retort or of the discharge hopper. However, it should be so arranged that the free movement of the coke over it is not impeded and that the regulating device does not carry any coke back to the incline.—R. L.

Gas producers. Masons Gas Power Co., Ltd., and T. Wright, Manchester. Eng. Pat. 21,838, Oct. 3, 1907.

The patent relates to plant comprising two or more producers arranged side by side and formed integral with one another, as described in Eng. Pat. 16,218 of 1906. Each producer is oval in plan, and the grates are arranged in the direction of the longer axes, which are inclined to the line joining the centres of the producers, so that both ends of the grates are accessible. Blowers are provided at both ends of the grates, and there are two feeding hoppers for each producer.—A. T. L.

Gas producers. B. Talbot, Middlesbrough. Eng. Pat. 1764, Jan. 25, 1908.

In the process described in Eng. Pat. 19,993 of 1901 (this J., 1902, 1183), for obtaining ammonia as well as producer gas, the fuel is stirred in the upper part of the producer where distillation takes place. The patent is for an arrangement in which this is effected by rotating arms suspended from the top of the producer. To prevent clinker from adhering to the walls, the lower part of the producer is formed of unlined metal, cooled externally by jets of water.—A. T. L.

Gas-producer. H. I. Lea, Pittsburg, Pa., Assignor to The Westinghouse Machine Co. U.S. Pat. 900,862, Oct. 13, 1908.

The producer is built up in sections to form updraft and downdraft gas-generating sections, the latter being provided with a number of outlet ports between the heat-conducting lining and the outer shell of the producer. A number of "wing walls" form independent flues between the lining and outer shell.—C. J. G.

Gas; Process of producing ——. B. F. Eldred, Bronxville, N.Y. U.S. Pat. 901,232, Oct. 13, 1908.

A NUMBER of jet flames of finely divided fuel are produced in a closed chamber, sufficient air is introduced underneath to complete combustion and keep the fuel in suspension, and subsequently sufficient fine fuel is distributed through the hot flame gases to reduce the carbon dioxide to carbon monoxide.—C. J. G.

Gas producer. R. L. Morgan, Worcester, Mass. U.S. Pat. 901,359, Oct. 20, 1908.

A HOLLOW vertical spindle passes up the centre of the producer chamber into the zone of combustion and is provided at the top with openings for the escape of air, a horizontal movement being conveyed to the current by means of a hood fixed above the apertures. A radial fan of peculiar shape is arranged above the hood, so that, on rotating the spindle, the particles of coal receive a vertical motion and come into contact with the current of air as they drop from the blades.—C. A. W.

Gas-producer. L. C. Parker, Hamilton, Ohio. U.S. Pat. 901,823, Oct. 20, 1908.

THE gas producer is of the under-feed type. The fuel is fed into the lower end of a curved tube leading to the centre of the grate and "flared" at its upper end, and is forced through the tube by a plunger. The grate consists of rocking bars arranged within a grate-ring, and an annular space is left for the passage of ashes between the grate-ring and the shell of the producer.—A. T. L.

Gas; Production of a combustible ——. H. Dingler. Fr. Pat. 390,573, May 26, 1908. Under Int. Conv., Sept. 5, 1907.

IF "air-gas," *i.e.*, air carburetted with light hydrocarbons, is compressed in bottles and a supply drawn from these, its composition varies considerably with the temperature, owing to the great difference in the densities of the air and the hydrocarbons employed. To overcome this difficulty, carbon dioxide is used in the place of air; this gas, when liquefied at ordinary temperatures, can take up large quantities of benzine, gasoline, etc., and forms constant mixtures with these. The carbon dioxide is passed through a carburettor where it is mixed with a definite percentage of hydrocarbons and is then compressed in steel bottles.—R. L.

Tar-removing box for use with gas washing plant. Masons Gas Power Co., Ltd., T. Wright, and A. Hollis, Manchester. Eng. Pat. 21,693, Oct. 1, 1907.

THE patent relates to a tar-removing box with an adjustable water-seal, for use with power gas or producer gas. The box contains water up to the level of an overflow pipe, and is divided into inlet and outlet chambers by a vertical partition with a large opening below the water level. A plate having a serrated lower edge is arranged adjacent to the partition, and is adjusted vertically to vary the depth of the water seal and to shut off the gas entirely when desired.—A. T. L.

Purifier for illuminating gas. J. L. Vinay. Fr. Pat. 390,649, May 27, 1908.

INSTEAD of the usual horizontal purifier box, an inclined receptacle is employed. A series of inclined superimposed grids support the purifying material. This is introduced at the upper end of each layer of grids, through apertures which can be closed with gas-tight horizontal lids. The discharging is effected through vertical doors at the lower end of the grids. This arrangement allows of a charging and discharging by gravity, thus saving much labour, and at the same time doing away with the lifting of a bulky cover and with the hydraulic seal.—R. L.

Gas from blast-furnaces; Centrifugal purifier for ——. Soc. Anon. J. Cockerill. Fr. Pat. 391,201, June 13, 1908.

THE apparatus is designed to remove dust from blast-furnace gas. It consists essentially of a solid disc, provided with blades on both sides, and revolving in a containing chamber at right angles to the current of gas. In order to equalise the pressure on both sides of the disc, the blades are made slightly longer on the side on which the gas approaches the disc. A small quantity of water may be injected into the apparatus. The dust contained in the gas is thrown violently against the containing walls, falls into a receptacle, and is removed periodically. —A. G. L.

Plastic mass [for electric lamp filaments]; Process of preparing a —— *with compounds of tungsten.* Siemens und Halske A.-G. First Addition, dated June 2, 1908 (under Int. Conv., June 8, 1907), and Second Addition, dated June 3, 1908 (under Int. Conv., Aug. 3, 1907), to Fr. Pat. 378,743, June 13, 1907 (this J., 1907, 1192).

(1). FILAMENTS formed from a plastic mass obtained as described in the principal patent, with or without the addition of metallic tungsten, or filaments in which this plastic mass forms the binding agent, are heated to 300°—500° C. in an atmosphere free from oxygen, in order to render them electrically conductive. The filaments are then finished in the usual manner. (2). The product obtained by heating the acid tungstate *in vacuo* at 270° C. is added in small quantities to boiling water, the precipitate is allowed to settle, and the clear solution is decanted. The solution is evaporated to a syrup *in vacuo*, and the syrup is heated to dryness over a water-bath.—A. T. L.

Naphthalene and similar substances as motor medium in internal combustion engines; Process and apparatus for using ——. Rütgerswerke Akt.-Ges. Fr. Pat. 391,651, March 28, 1908.

SEE Eng. Pat. 7594 of 1908; this J., 1908, 972.—T. F. B.

Coal; Distilling and coking ——. S. B. Sheldon, Buffalo, N.Y., U.S.A. Eng. Pat. 138, Jan. 2, 1908. Under Int. Conv., Jan. 2, 1907.

SEE U.S. Pat. 846,958 of 1907; this J., 1907, 462.—T. F. B.

Gas furnace or coke oven. H. Koppers, Essen on Ruhr, Germany. U.S. Pat. 901,351, Oct. 20, 1908.

SEE Eng. Pat. 2415 of 1908; preceding.—T. F. B.

Coal; Treatment of —— *for the manufacture of coke and superior illuminating gas.* J. Jowett. Fr. Pat. 390,509, May 23, 1908.

SEE Eng. Pat. 14,893 of 1907; this J., 1908, 495.—T. F. B.

Filaments for illuminating and heating purposes; Process of and means for manufacturing ——. W. E. Lake, London. From G. Michaud and E. Delasson, Montreuil, France. Eng. Pat. 22,036, Oct. 5, 1907.

SEE Addition of Sept. 25, 1907, to Fr. Pat. 378,665 of 1907; this J., 1908, 216.—T. F. B.

Electric incandescent lamps; Manufacture of a conducting connection for use in ——. H. W. Lake, London. From Elektrische Gluhlampenfabrik, Watt Scharf, Loti und Latzko, Vienna. Eng. Pat. 4760, March 2, 1908.

SEE Fr. Pat. 388,000 of 1908; this J., 1908, 849.—T. F. B.

Electric incandescent lamps; Manufacture of ——. A. G. Bloxam, London. From Siemens und Halske A.-G. Berlin. Eng. Pat. 5387, March 10, 1908.

SEE Fr. Pat. 387,993 of 1908; this J., 1908, 849.—T. F. B.

Tungsten incandescence filaments; Manufacture of ——. Siemens und Halske A.-G., Berlin. Eng. Pat. 11,603, May 28, 1908. Under Int. Conv., June 8, 1907. Addition to Eng. Pat. 16,489 of 1907.

SEE First Addition to Fr. Pat. 378,743 of 1907; preceding. —T. F. B.

Electrode for arc lamps. W. R. Whitney, Boston, Assignor to General Electric Co., New York. U.S. Pat. 902,354, Oct. 27, 1908.

See Eng. Pat. 26,917 of 1904; this J., 1905, 429.—T. F. B.

Metallic filaments free from carbon for electric incandescence lighting; Manufacture of ——. Siemens und Halske A.-G. Fr. Pat. 390,578, May 26, 1908.

See Eng. Pat. 11,524 of 1908; this J., 1908, 849.—T. F. B.

Sulphocyanides [*thiocyanates*]*; Manufacture of* —— [*from cyanogen compounds in coal gas*]. Eng. Pat. 6218. *See* VII.

Spent lime [*from gas-works, etc.*]*; Repurifying* ——. Eng. Pat. 22,894. *See* VII.

Sulphur from gas-purifying material; Purification of extracts containing ——. Fr. Pat. 391,109. *See* VII.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

Crude petroleum fractionation, by means of capillary filtration. J. E. Gilpin and M. P. Cram. (Production of Petroleum in 1907. D. T. Day.) U.S. Geolog. Survey.

This investigation is summarised as follows:—(I). When petroleum is allowed to rise in a tube packed with fuller's earth, there is a decided fractionation of the oil, the fraction at the top of the tube being of lower specific gravity than that at the bottom. (II). When water is added to fuller's earth which contains petroleum, the oil which is displaced first differs in specific gravity from that which is displaced afterwards when more water is added. (III). When petroleum is allowed to rise in a tube packed with fuller's earth, the paraffin hydrocarbons tend to collect in the lightest fraction at the top of the tube and the unsaturated hydrocarbons at the bottom. (IV). Whenever oil is mixed with fuller's earth and then displaced with water, about one-third of the oil remains in the earth. (The fuller's earth was the Florida product. It was ground, and passed through a sieve with 150 meshes to the inch, and then heated till perfectly dry. (See also this J., 1900, 890, 1005.)

Petroleum in Argentina. Engineering, Oct. 30, 1908. [T.R.]

Whilst boring for water near Comodoro Rivadina, on the East Coast of Patagonia, the Argentine Department of Mines, Geology, and Hydrography recently struck a stratum of petroliferous substance of recent (cretaceous) formation. The first stratum was found at a depth of 1770 ft., and the daily production has averaged 13 to 14 tons, without the aid of pumping machinery. The oil is heavy, and of a dark brown colour; representative samples contain benzine, 2·5 per cent.; kerosene, 4·7; gasoline, 9·95; heavy lubricating oils, 27·45; and asphaltum, 55·4 per cent. The soil consists of a layer of sandstone over clay.

Patents.

Distillation of wood and similar materials; Process and apparatus for the recovery of the various products contained in the gases from the ——. R. Strobach. First Addition, dated June 10, 1908, to Fr. Pat. 386,424, Jan. 21, 1908 (this J., 1908, 679).

A continuous scrubber is substituted for the intermittent apparatus described in the original patent in order to absorb the pyroligneous vapours contained in the gases after the separation of the tar. Claim is also made for the direct recovery of methyl alcohol of high strength by passing the vapours from the still, after the separation of the tar and acetic acid, directly through a continuous plate column rectifying apparatus without the application of additional heat.—W. H. C.

Mineral oil stills; Recovering gases and the lighter distillates from ——. N. M. Henderson, Broxburn, N.B. Eng. Pat. 517, Jan. 9, 1908.

The condenser outlet is trapped, and is fitted with an ascending branch provided with a two-way tap. This connects the condenser with, on the one hand, an upcast pipe (by means of which communication is established with the atmosphere when the apparatus is not working), and on the other with a pipe leading into a hydraulic main which also serves as a seal for this pipe. By means of an air-pump a slight vacuum is produced, which draws the hydrocarbon gases and light distillates from the condenser into the hydraulic main, the latter delivering them to a separating plant. Means are provided for maintaining the water in the hydraulic main at the desired level. The condenser outlet is provided with a tap, for drawing off the heavy final distillates before they reach the trap.—C. S.

"Cracking" still for liquid industrial residues, combined with continuous rectification of the products of dissociation. E. A. Barbet. Fr. Pat. 390,558, July 31, 1907.

The ordinary "black pot" cracking still is replaced by a still charged with molten lead (or lead and tin), maintained at a uniform temperature, which is controlled by a pyrometer. The liquid residue, *e.g.*, heavy petroleum oil, is admitted into a hood at the bottom of the still, where it is at once vaporised. The vapours issue in bubbles through orifices in the hood, and ascend through the molten metal, so that none of the particles can escape dissociation. The carbon formed by the dissociation process collects on the surface of the molten metal, and can be removed at intervals without interrupting the cracking process for more than a short time. The distillate is condensed in the ordinary way, and the uncondensed gases are utilised as fuel for heating the lead bath. The apparatus may be used in connection with a still for crude oil, the distillates from which are fractionated in a continuous rectifying column. It may also be employed to crack ordinary lamp oil fractions for the production of petroleum spirit, as well as for the distillation of vaseline, the cracking of heavy coal-tar oils, etc.—C. S.

"Cracking" still for liquid industrial residues combined with continuous rectification of the products of dissociation. E. A. Barbet. First Addition, dated Aug. 20, 1907, to Fr. Pat. 390,558, July 31, 1907 (see preceding abstract).

The claim is for the use of the "cracking" apparatus heated by a bath of molten lead described in the original patent as an addition to, as well as instead of, the "black-pot." Claim is also made for the use of any suitable neutral fusible salt in the place of the molten lead in the bath.—W. H. C.

Petroleum oils; Purifying ——. E. W. Wynne, Liverpool. U.S. Pat. 901,411, Oct. 20, 1908.

See Eng. Pat. 2314 of 1907; this J., 1907, 863.—T. F. B.

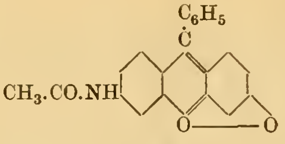
Petroleum, or its derivatives or distillates; Process for refining crude ——. L. Edeleanu. Fr. Pat. 391,405, May 22, 1908.

See Eng. Pat. 11,140 of 1908; this J., 1908, 974.—T. F. B.

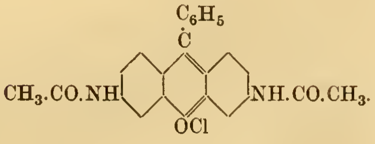
IV.—COLOURING MATTERS AND DYESTUFFS.

Fluorescein; Chromogen of —— *and the simplest Rosamine. I. Preliminary communication on carboxonium dyestuffs.* F. Kehrmann and O. Dengler. Ber., 1908, **41**, 3440—3447.

By the action of benzotrichloride on acetyl-*m*-aminophenol, two compounds are obtained having the constitution

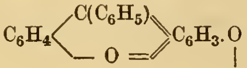


I.

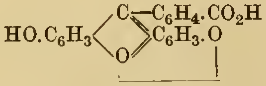


II.

From (I.) by removing first the acetyl group and then the amino-group, a substance of formula,



is formed, which is to be regarded as the chromogen of fluorescein and other cyclic phthaleïns. This substance, phenylfluorone, gives golden yellow solutions in organic solvents, which exhibit a weak green fluorescence. It is insoluble in alkalis. Aminophenylfluorone, prepared by removing the acetyl group from (I.), fluoresces very strongly. It is a dark red substance giving orange-red salts and dyes tannin-mordanted cotton similarly to Phosphine. On diazotising and boiling with water, the corresponding hydroxyphenylfluorone is obtained; ; this is identical with Doebner's "Resorcin-benzein." Silk is dyed yellowish-rose with a green fluorescence. From the resemblance of this substance to Fluorescein, the authors regard the latter as having the constitution :



The substance of formula (II.) is the chloride of the simplest (acetylated) Rosamine ; it dissolves in hot water with a yellow colour and is converted by alkalis into a Magenta-red unstable base which changes spontaneously into a colourless, stable form. The latter regenerates the yellow salt with acids. On removing the acetyl groups, the simplest Rosamine is obtained : this is a yellowish-red, strongly fluorescing dyestuff which gives bluish orange-red shades on tannin-mordanted cotton.—J. C. C.

Stilbene group ; Colouring matters [dyestuffs] of the ——. *V. Action of caustic alkalis on derivatives of* p-*nitrotoluene.* A. G. Green and J. Baddiley. Chem. Soc. Trans., 1907, **93**, 1721—1726. (Compare this J., 1908, 69.)

Previous work has shown that the action of caustic alkalis in presence of air on the methyl, methoxyl, and carboxyl derivatives of *p*-nitrotoluene leads to the formation of dibenzyl derivatives. It has since been found that by carrying the reaction further, stilbene compounds are produced. 2 : 4-Dinitrotoluene yields tetranitrostilbene when an alkaline alcoholic solution of iodine is used as the oxidising agent. 4 : 4′-Dinitro-2 : 2′-dimethylstilbene, $NO_2.C_6H_3(CH_3).CH : CH.C_6H_3(CH_3).NO_2$ prepared from *p*-nitro-*o*-xylene, forms yellow needles, m. pt. 288—290° C. 4 : 4′-Dinitro-2 : 2′-dimethoxystilbene, crystallises in bright orange needles, m. pt. 268—269° C. 4 : 4′-Dinitrostilbene-2 : 2′-dicarboxylic acid, prepared from nitro-*o*-toluic acid using sodium hypochlorite as oxidising agent, forms yellow crystals, m. pt. 288—291° C. 2 : 4 : 2′ : 4′-Tetra-aminostilbene, obtained by reducing tetranitrostilbene with tin and hydrochloric acid, gives brown azo-dyestuffs when combined with diazo-compounds.—J. C. C.

Dyestuffs in solution. L. Pelet-Jolivet and A. Wild. Z. Chem. Ind. Kolloide, 1908, **3**, 174—177.

In order to determine whether dyestuffs dissolve in the colloidal or crystalline condition, the conductivity of dyestuff solutions and their appearance under the ultramicroscope were studied. All the dyestuffs examined, which included both basic and acid dyestuffs, and also Congo Red as a representative direct cotton dyestuff, showed conductivities in solution which pointed to complete electrolytic dissociation at a sufficient dilution. As it has often been suggested that solutions of dyestuffs, and especially of basic dyestuffs, may be hydrolysed, solutions of basic dyestuffs were tested by Bredig's diazoacetic ester method. They proved to be without action on this reagent, showing the absence of hydrogen ions, and therefore the absence of hydrolysis. The blue compound obtained by the action of hydrochloric acid on Congo Red solution, which is generally considered to be the colour acid of that dyestuff, was found to be insoluble in water in the presence of electrolytes but to dissolve to a colloidal solution on continued washing with pure water; the colloidal solution so obtained showed practically no electric conductivity, indicating the absence of dissociation. Strong solutions of Congo Red show comparatively small dissociation by the conductivity method. According to their appearance under the ultramicroscope at a dilution of 0·5 per cent., the dyestuffs were divided into three classes, namely : non-colloidal solutions, showing no micellæ, slightly colloidal solutions, showing very few micellæ, and colloidal solutions, showing many. Non-colloidal solutions were yielded by Methylene Blue, Eosin, Malachite Green, Fluorescëin and Alkali Blue. Slightly colloidal solutions were yielded by Safranine, Night Blue, Rhodamine 6G, Anisolin 3B, Crystal Violet, Crystal Ponceau, Bluish Light Green SF, Helvetian Blue, and Orange II. ; and colloidal solutions by Magenta, Rocellin, and the direct cotton dyestuffs, Congo Red, Benzopurpurin, Carbazol Yellow, Oriol Yellow, etc. Special attention is directed to the results with Alkali Blue, which all previous investigators have classed as a very decided colloid. The authors do not consider that the presence of micellæ has much effect on the colour of the solution. They also are inclined to consider as a characteristic of dyestuffs in solution a tendency to be transformed into the colloidal condition under the influence of electrolytes and adsorbents. They have observed the action of electrolytes on dyestuff solutions under the ultramicroscope, and found that the results are in accordance with those governing colloidal coagulation. Negative ions precipitate the basic dyestuffs and positive ions the acid dyestuffs. According to the concentration, either amorphous precipitates, micellæ, or crystals are thrown down.—E. F.

Patents.

Red dyestuffs ; Manufacture of ——. Farbwerke vorm. Meister, Lucius, und Brüning, Hoechst on the Maine, Germany. Eng. Pat. 16,017, July 28, 1908. Under Int. Conv., Oct. 23, 1907.

When 4-dialkyloxythioindigos are treated with halogens or with agents which part with halogen, vat dyestuffs are obtained which give pure red shades on wool and cotton. For example, 1 part of 4-diethoxythioindigo is stirred with 3 parts of bromine or with 4 parts of sulphuryl chloride and allowed to stand for some time. The product is diluted with carbon tetrachloride, filtered, and the solid residue treated with a solution of bisulphite and washed with alcohol.—J. C. C.

Dyestuffs of the quinoline group ; Process for preparing blue ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 200,207, Nov. 19, 1907. Addition to Ger. Pat. 172,118, July 29, 1905.

In the process described in the original patent (see Eng. Pat. 16,227 of 1905 ; this J., 1906, 368) formaldehyde may be replaced by chloroform, bromoform, or iodoform, or by a mixture of these substances.—T. F. B.

Dianthraquinoneimines; Preparation of ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 201,327, Nov. 7, 1907.

Dianthraquinoneimines may be obtained by the condensation of α-nitroanthraquinones with aminoanthraquinones in presence of alkali carbonates, and without the aid of a catalytic agent. The condensation is usually effected in presence of a solvent, such as nitrobenzene. —T. F. B.

Orange lake-dyestuff; Manufacture of an ——. R. Lauch, Berlin. Eng. Pat. 18,736, Sept. 7, 1908. Under Int. Conv., Oct. 8, 1907.

2:4-Dinitroaniline is diazotised and combined with β-naphthol, whereby an orange, insoluble azo-dyestuff is produced which is very fast to light and may be used as a lake, either alone or with substrata.—J. C. C.

Vat dyestuffs; Production of red ——. Badische Anilin und Soda Fabrik. 3rd Addition, dated May 29, 1908 (under Int. Conv., April 20, 1908), to Fr. Pat. 365,920, May 4, 1906 (this J., 1906, 979; 1907, 960; 1908, 1015).

Dyestuffs resembling those described in the chief patent and its additions are obtained by condensing ββ-dihalogenated anthraquinones with derivatives of 1-aminoanthraquinone containing one of the groups, NHR, NR_2, OH, OR, in the ring other than that containing the amino-group or with similar derivatives formed by the coalescence of a new ring, for example a pyridine nucleus. An alternative process is to condense αα-diaminoanthraquinones with derivatives of β-halogenated anthraquinones other than the 1-amino-6- (or-7-) halogenated anthraquinones, for example, derivatives containing one of the groups, NHR, NR_2, OH, NO_2, NH(Acyl), OR, etc. Examples are given of the condensation of 2:6-dichloroanthraquinone with 1-amino-6-methylaminoanthraquinone and of 1:5-diaminoanthraquinone with 2-chloro-5-methylaminoanthraquinone by the same process as formerly described.—J. C. C.

Vat dyestuffs of the anthracene series; Production of ——. Badische Anilin und Soda Fabrik. Fr. Pat. 390,677, May 29 1908. Under Int. Conv., April 15, 1908.

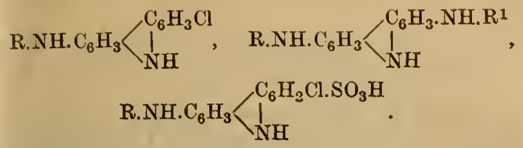
Red, vat dyestuffs are obtained by condensing 1-aminoanthraquinone with derivatives of 2-halogenated anthraquinones or derivatives of 1-aminoanthraquinone with 2-halogenated anthraquinones or their derivatives. Such compounds as the aminoanthraquinone quinoleines may be considered as derivatives of 1-amino- or 2-halogenated anthraquinones. The condensations are effected in nitrobenzene solution with the addition of copper oxide and sodium carbonate: the former may be replaced by other indifferent solvents of high boiling point, and copper salts or metallic copper together with sodium acetate, calcium carbonate, or potassium carbonate may also be used instead of copper oxide and sodium carbonate respectively.—J. C. C.

Dyestuffs dyeing vegetable fibres without mordants. L. Haas. Fr. Pat. 390,715, Aug. 5, 1907.

o-o-Dinitro-*m*-*m*-dichlorodiphenyl, m.pt. 170–171° C., is converted into the mono- and di-sulphonic acids, which are condensed with one or two molecules of aromatic bases or aminophenols. Derivatives of diphenylamine are thus obtained corresponding with the general formulæ:

$R.NH.C_6H_2(NO_2)(SO_3H).C_6H_3Cl.NO_2$,
$R.NH.C_6H_2(NO_2)(SO_3H).C_6H_2(NO_2)(SO_3H).NH.R^1$, and
$R.NH.C_6H_2(NO_2)(SO_3H).C_6H_2Cl(NO_2).SO_3H$,

where R and R^1 represent an aromatic base or an aminophenol. When these compounds are treated with polysulphides, they are converted into dyestuffs which give shades varying from green to blue and from violet-blue to black on unmordanted vegetable fibres. Further, the above diphenylamine compounds can be reduced and treated with boiling dilute mineral acids, whereby a series of compounds is obtained corresponding with one or other of the general formulæ:



$$R.NH.C_6H_3{<}\begin{array}{l}C_6H_3Cl\\ |\\ NH\end{array},\quad R.NH.C_6H_3{<}\begin{array}{l}C_6H_3.NH.R^1\\ |\\ NH\end{array},\quad R.NH.C_6H_3{<}\begin{array}{l}C_6H_2Cl.SO_3H\\ |\\ NH\end{array}.$$

When these products are treated with polysulphides between 100° C. and 250° C., dyestuffs resembling those already described are obtained. Examples are given of the condensation of the mono- and the di-sulphonic acid with *p*-aminophenol in the presence of sodium carbonate, the subsequent operations being carried out in the usual manner.—J. C. C.

Triphenylmethane dyestuffs capable of being chromed on the fibre; Production of ——. Soc. pour l'Ind. Chim. à Bâle. Fr. Pat. 391,221, Aug. 23, 1907.

By the condensation of sodium *p*-nitrobenzaldehyde-*o*-sulphonate (25·5 parts) with *o*-cresotinic acid (30 parts) in the presence of concentrated sulphuric acid (170 parts) at 40°—80° C., a dyestuff is obtained giving red shades on wool which on chroming become violet-blue, very fast to fulling and light. When printed on cotton with chromium acetate, indigo-blue shades are produced. If the condensation is effected in presence of oxidising agents such as nitrites, persulphates, etc., the shade of the chromed dyestuff becomes greenish-blue and if reducing agents are used in the condensation, the shade is violet-red. These effects are also produced if the finished dyestuff is treated with oxidising or reducing agents.—J. C. C.

Dyestuff of the oxazine series; Production of a new ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 391,241, June 15, 1908. Under Int. Conv., July 2, 1907.

A sulphonic acid of Celestine Blue is obtained by heating the dyestuff (25 kilos.) with chlorosulphonic acid (100 kilos.) at 90° C. for 4 hours. It gives pure blue shades on a chromium mordant.—J. C. C.

Alizarin preparations completely soluble in hard water: Process for preparing ——. F. Erban. Ger. Pat. 200,682, March 22, 1904.

Preparations of alizarin dyestuffs, soluble in hard waters to clear solutions, are obtained by heating the dyestuffs in aqueous solutions with gelatinous materials (*e.g.*, glue) and suitable alkaline substances (borax, etc.), and concentrating the products or evaporating to dryness. The solutions of these preparations precipitate the dyestuff slowly and evenly, so that they are available for dyeing on mordants. They can also be precipitated by addition of dilute acids, when the dyestuff is obtained in a very fine state of division.—T. F. B.

Phenoxazine derivatives; Process for preparing ——. Act.-Ges. f. Anilinfabr. Ger. Pat. 200,736, Feb. 2, 1906.

2-Nitro-2′-hydroxydiphenylamine derivatives, which are also substituted in the 6-position (with the exception of trinitrohydroxydiphenylamines) are converted into phenoxazines by treatment with alkalis. The initial materials are obtained by the condensation of *o*-aminophenol or its derivatives with 6-substituted 2-chloronitrobenzene. —T. F. B.

o-Hydroxydisazo dyestuffs; Process for preparing chrome ——. Anilinfarben- und Extraktfabr. vorm. J. R. Geigy. Ger. Pat. 201,377, Dec. 7, 1907.

Diazo compounds are combined with *m*-amino-*p*-cresolarylsulphonic esters, and the compounds thus obtained are further diazotised and combined with the usual azo components. By removing the arylsulpho group, chrome *o*-hydroxydisazo dyestuffs which dye fast green shades are produced.—T. F. B.

Laundry blue; Manufacture of consolidated ——. N. Hochsinger and Brüder Hochsinger, Budapest. Eng. Pat. 8903, April 23, 1908.

A laundry blue dissolving in water with effervescence is made by mixing Indigo Carmine, Ultramarine, Paris Blue or any blue aniline dyestuff with sodium bicarbonate, tartaric acid, talc, and stearine. A little alcohol is added to render the mixture uniform and some salicylic acid to render it antiseptic.—A. B. S.

Azo dyestuffs; Manufacture of new ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 23,183, Oct. 21, 1907.

See Fr. Pat. 383,169 of 1907; this J., 1908, 329.—T. F. B.

Anthracene derivatives: Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 1165, Jan. 17, 1908. Addition to Eng. Pat. 28,765, Dec. 17, 1906.

See Addition of Jan. 16, 1908, to Fr. Pat. 372,676 of 1906; this J., 1908, 744.—T. F. B.

p-Aminoacetyl-m-toluidine. C. Heidenreich, Vohwinkel, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 902,150, Oct. 27, 1908.

See Fr. Pat. 388,454 of 1908; this J., 1908, 894.—T. F. B.

Celestine-blue sulphonic acid. W. Lommel, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 902,154, Oct. 27, 1908.

See Fr. Pat. 391,241 of 1908; preceding.—T. F. B.

Colouring matters [dyestuffs] of the anthracene series; Manufacture of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 1840, Jan. 27, 1908.

See Fifth Addition, of Feb. 8, 1908, to Fr. Pat. 309,503 of 1901; this J., 1908, 851.—T. F. B.

Gallocyanine dyestuff and process of making same. A. Steiner, Assignor to Chemical Works formerly Sandoz, Basle, Switzerland. U.S. Pat. 901,657, Oct. 20, 1908.

See Fr. Pat. 382,335 of 1907; this J., 1908, 219.—T. F. B.

Azo dyestuff; Yellow —— *and process of making same.* M. Böniger, Assignor to Chemical Works formerly Sandoz, Basle, Switzerland. U.S. Pat. 901,675, Oct. 20, 1908.

See Fr. Pat. 387,245 of 1908; this J., 1908, 801.—T. F. B.

[Sulphide] dyestuffs; Process of making concentrated liquid ——. A. Schmidt and O. Schwab, Assignors to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on the Maine, Germany. U.S. Pat. 901,746, Oct. 20, 1908.

See Eng. Pat. 9883 of 1905; this J., 1906, 584.—T. F. B.

Sulphur [sulphide] dyestuff and process of making same; Black ——. G. E. Junius, Hagen, Germany, Assignor to R. E. B. Sanderson, New York. U.S. Pat. 901,970, Oct. 27, 1908.

See Fr. Pat. 371,119 of 1906; this J., 1907, 251.—T. F. B.

Azo dyestuffs containing fatty acid radicals. N. Sulzberger, New York. U.S. Pat. 902,021, Oct. 27, 1908.

See Ger. Pat. 193,451 of 1906; this J., 1908, 399.—T. F. B.

Dyestuff dyeing from a vat, like indigo; Production of a violet ——. Fabr. Bâloise de Prod. Chimiques. Fr. Pat. 391,199, June 13, 1908.

See Eng. Pat. 12,810 of 1908; this J., 1908, 894.—T. F. B.

Dyestuffs for cotton; Process for producing direct —— *derived from aminoazo compounds and dinitrostilbenedisulphonic acids or dinitrodibenzyldisulphonic acids.* L. Cassella und Co. Fr. Pat. 391,475, Aug. 30, 1907.

See Eng. Pat. 19,807 of 1907; this J., 1908, 975.—T. F. B.

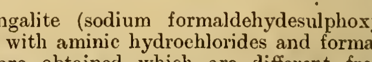
V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

Turkey Red dyeing; Application of different oils and soaps in ——. F. Erban and A. Mebus. Z. Farben-Ind., 1908, **7**, 317—320.

The authors have compared the properties of different oils and soaps used in the dyeing of Turkey Red and have given their results in tabular form. The oils were used at different degrees of sulphonation. The conclusion is drawn that none of the other oils and fats experimented with can compare with castor oil (and the many preparations therefrom), for the production of Turkey Red, even taking into account the cost of the oils. The dyeings obtained in the other cases (*e.g.*, on using train oil, cocoanut oil, etc.), are inferior to those obtained from castor oil either as regards purity of shade, evenness of shade, or the fastness of the dyeing to rubbing.
—S. H. H.

Rongalite (free acid), bases, and formaldehyde. A. Binz and E. Isaac. Ber., 1908, **41**, 3381—3387.

When rongalite (sodium formaldehydesulphoxylate) is condensed with aminic hydrochlorides and formaldehyde, products are obtained which are different from those prepared by Reinking, Dehnel and Labhardt (this J., 1905, 330) by condensing rongalite with bases. *Rongalite, formaldehyde, and ammonium chloride.* A mixture of 5·4 grms. of ammonium chloride in 15 c.c. of water with 17 grms. of rongalite in 10 c.c. of water and 10 c.c. of technical formaldehyde solution forms, after a few minutes, a white substance which decomposes between 135° C. and 140° C. and reduces Indigo Carmine on warming. It is completely decomposed when dissolved in warm water and when the substance is suspended in boiling alcohol and water added, aminomethylsulphurous acid is produced. *Rongalite, formaldehyde, and aniline hydrochloride.* By the similar interaction of these substances, a white compound, $C_{25}H_{26}O_4N_4S_2$, m.pt. 138—142° C. is obtained, which also reduces Indigo Carmine. It is also produced by treating the hydrochloride of anhydro-*p*-aminobenzyl alcohol (formed from formaldehyde and aniline hydrochloride) with rongalite. When rongalite (25 grms.) and aniline salt (19 grms.) are dissolved in water (60 c.c.) and the solution heated, a substance, $C_{27}H_{32}O_6N_4S_2$, m.pt. 159—160° C., is obtained, which does not reduce Indigo Carmine. When warmed with bichromate and sulphuric acid a brown dyestuff is formed, and with acetic anhydride and water, diacetyldiaminodiphenylmethane is produced. *o*-Toluidine hydrochloride behaves similarly, whilst *p*-toluidine hydrochloride gives a red coloration and, after 12 hours, a precipitate which cannot be acetylated. Tetramethyldiaminodiphenylmethanesulphone,



$$(CH_3)_2N.C_6H_3<\genfrac{}{}{0pt}{}{SO_2}{CH_2}>C_6H_3.N(CH_3)_2$$

is formed when a solution of dimethylaniline (48·4 grms.), in concentrated hydrochloric acid (42 c.c.), and a little water, is treated with rongalite (35 grms.) in formaldehyde solution (16 c.c.) and water (50 c.c.). A nitronitroso-derivative is obtained from this by the action of nitrous acid.—J. C. C.

Cellulose; Action of ammonium persulphate on ——. II. New test for oxycellulose. H. Ditz. *See* XIX.

Patents.

Textile and fibrous materials; Process and apparatus for the treatment of —— preparatory to spinning. J. Bendel. Fr. Pat. 390,842, June 2, 1908.

The raw material such as flax, ramie, or hemp is tied in bundles and soaked for 24 hours in water containing a ferment such as yeast. The material is then placed on metal trays and these are disposed one above the other in a suitable carrier and immersed for about one hour at 80°—100° C. in a softening bath composed of a solution of sodium carbonate, potassium carbonate, or soap, etc. The product can be then sorted into qualities according to its colour. The soaked material is spread out on inclined plates, well washed with a spray of water to remove bark, gum, etc., bleached in a bath of bleaching liquor or other suitable bleaching material, and then squeezed and dried.—A. B. S.

Bleaching; Electro-chemical method of ——. E. A. Pouzenc. Fr. Pat. 390,891, June 5, 1908.

The bleaching is effected in a rectangular vat in the bottom of which is placed the anode, under a protecting false bottom. The cathode is placed in the upper part of the vat. A solution containing from 30 to 60 parts per 1000 of an alkali borate, metaborate, orthoborate, biborate, or perborate is placed in the vat and heated to 50° C. The material is placed in the vat and an electric current from a dynamo is passed through of such a strength that there is a brisk evolution of gas at the cathode. After about one hour the material is removed, squeezed, and treated for 10 minutes in a bath containing 1 litre of sulphuric acid and 1—4 grms. of Acid Violet per 1000 litres of water. It is then squeezed and dried. —A. B. S.

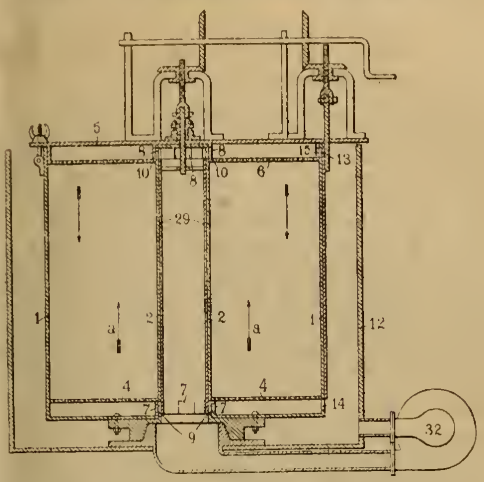
Cop dyeing machines. The British Cotton and Wool Dyers Assoc., Ltd., and A. Hoegger, Manchester. Eng. Pat. 25,696, Nov. 20, 1907.

The bobbins are placed on one or more horizontal perforated plates carried on a frame which can be raised out of the dye-bath by means of a hydraulic ram. The lower sides of the perforated plates are connected with a circulating pump by means of which the dye-liquor can be drawn or forced through the cops. The space below the plates is also connected with an exhaust cylinder, so that the liquor can be removed from the cops and air drawn through them after the carrier has been raised out of the bath by means of the ram.—A. B. S.

Textile materials by means of circulating liquids; Machine for the treatment of ——. G. de Keukelaere. Fr. Pat. 390,663, May 29, 1908. Under Int. Conv., May 16, 1908.

In the bottom of a dye vat are two openings which are in connection with a circulating pump. By a special arrangement of valves the connections between the vat and the pump can be reversed so as to make the liquid circulate in the reverse direction. Over the central opening in the vat is placed a movable vertical column composed of a number of short vertical sections fitting one above the other. Each of these sections is fitted with horizontal perforated arms to carry the bobbins, etc. The top of the column is closed and fitted with a ring for lifting out the central pipe with its arms and bobbins. The liquor from the pump is forced up the central column, passes through the material, and returns to the pump through the other opening. By reversing the valves, the liquor passes in the opposite direction. For small quantities of material, some of the sections of the vertical column are removed.—A. B. S.

Preparing, washing, or dyeing textile substances by an alternating current of the solution; Apparatus for ——. F. Deshayes. Fr. Pat. 390,895, June 4, 1908.



A movable vat, 1, is provided with a distributor, 2, a perforated false bottom, 4, a movable cover, 5, and a perforated false cover, 6. The distributor, 2, is provided at its top and bottom with openings, 7, and 8, which correspond with openings 9, and 10, in the inner walls between the false and true bottoms, and the false and true covers respectively. Inside the distributor, 2, is arranged a sliding cylinder, 29, which can be raised or lowered so as to cover the openings, 8 and 9, alternately. The periphery of the vat, 1, is also provided with openings, 13 and 14, the former corresponding with an opening, 15, in the outer wall between the true and false covers, 5 and 6. In practice, the material to be treated is put inside the vat, 1, the cover is screwed down so as to make the apparatus air-tight, and the cylinder, 29, is raised. The solution for the treatment is forced by the pump, 32, through the holes, 7 and 9, through the material in the vat, in the direction shown by the arrows, *a*. It then passes through the perforations in the false cover, 6, through the holes, 13 and 15, into the tank, 12, inside which the vat, 1, is mounted. From this tank the solution is again taken by the pump, 32. To reverse the direction of the current, the holes, 14, 8, and 10, are opened, and 13, 15, 7, and 9 are closed.—P. F. C.

Dyeing of wound bobbins by forcing the dye-liquor through them. J. B. Jacob et fils. Fr. Pat. 390,950, May 4, 1908.

A vat provided with a perforated false bottom is divided into two compartments by a vertical partition. The false bottom is provided with a number of regularly arranged cup-shaped depressions, around each of which a number of holes are pierced. In practice, the wound bobbins, each arranged with its core resting above one of these depressions, are covered by two screens (one for each compartment), which are screwed down tightly. Each bobbin is protected by a separate hat-shaped cover from becoming damaged by the pressure of the screen. The dye-liquor is forced into the lower part of one compartment, through the holes surrounding each depression in the false bottom, through the wound bobbins and into the upper part of the compartment. It then flows over the partition into the other compartment and is aspirated through the bobbins contained therein and finally returned to the reservoir.—P. F. C.

Dyeing Ryo, Soleil, or similar bobbins; Machines for ——. H. Krantz. Fr. Pat. 391,008, June 6, 1908.

The perforated tubes for carrying the bobbins are closed at one end by a plate, from the centre of which projects a cylindrical metallic portion of such a size as to fit into the ordinary bobbin mandril. When placing a bobbin on the perforated tube, this projection fits into the mandril of the bobbin and so allows the bobbin to be slipped on to the tube without disturbing the thread.—A. B. S.

Printing on fabrics ; Process for ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 390,979, May 23, 1908. Under Int. Conv., June 28, 1907.

It has hitherto been impossible to produce coloured reserves under Aniline Black with dyestuffs which are dyed with a chromium mordant, because the alkaline medium, necessary for the production of the reserve, precipitates the chromium from the printing colour, causing it to harden and become unworkable. This difficulty is avoided by adding glycerin, glucose, cane sugar, or some other such substance to the printing colour. Chromium compounds are produced which are soluble in ammonia, and can therefore be employed for the production of coloured Aniline Black reserves. Example :—Mix 8 parts of Alizarin Yellow GG in paste, 8 parts of glycerin, 4 parts of ammonia solution (25 per cent.), 40 parts of gum tragacanth solution (6 per cent.), 20—30 parts of finely divided chalk, and 10—15 parts of chromium acetate solution (20° B.). This mixture is printed on to the fabric, which is then steamed for 1 hour and padded with a liquor for producing Aniline Black, which is finally developed in the ordinary manner.—P. F. C.

Coating fabrics, wood, and other material to preserve and render same waterproof ; Liquid composition for ——. J. R. Morison, London. Eng. Pat. 22,371, Oct. 10, 1907.

Petroleum residue, pitch, or bitumen is treated with a volatile liquid, such as naphtha or carbon bisulphide, in a closed vessel until the mixture is quite fluid. Viscose is then gradually added, the mixture being thoroughly stirred in the meantime. The composition thus obtained is applied to the article which it is desired to protect.
—P. F. C.

"Benzine" and other hydrocarbons that have been used in cleaning or dyeing ; Regenerating and clarifying ——. J. Toby. Fr. Pat. 391,172, June 13, 1908. Under Int. Conv., May 11, 1908.

The liquid is drawn off from the dry-cleaning apparatus, or the like, in which it has been used, and is passed through a small centrifugal turbine. This treatment separates the solid particles (dust) and leaves the liquid in a clarified state, ready for use over again.—C. S.

Dyeing thoroughly closely woven webs or felts ; Process for ——. S. von Kapff, Aachen, Germany. Eng. Pat. 22,171, Oct. 8, 1907.

See Fr. Pat. 382,658 of 1907 ; this J., 1908, 222.—T. F. B.

Dyeing machine. J. M. Payne and G. G. Wallace. Fr. Pat. 390,733, April 16, 1908.

See U.S. Pat. 887,511 of 1908 ; this J., 1908, 625.—T. F. B.

Dyeing machines. Hussong Dyeing Machine Co. Fr. Pat. 390,885, June 3, 1908.

See Reissue, dated April 28, 1908, of U.S. Pat. 661,343 of 1900 ; this J., 1908, 559.—T. F. B.

Sulphurised [sulphide] dyestuffs ; Printing ——. M. Grünbaum, Berne, Assignor to Soc. Chem. Ind. in Basle, Basle, Switzerland. U.S. Pat. 901,705, Oct. 20, 1908.

See Eng. Pat. 24,987 of 1907 ; this J., 1908, 332.—T. F. B.

Felt and analogous fabrics ; Decorative treatment of ——. R. J. C. Mitchell. Fr. Pat. 391,093, June 10, 1908. Under Int. Conv., Sept. 18, 1907.

See Eng. Pat. 20,747 of 1907 ; this J., 1908, 683.—T. F. B.

VII.—ACIDS, ALKALIS, SALTS, AND NON-METALLIC ELEMENTS.

Nitrous gases and oxygen ; Action of —— *on water.* F. Foerster and M. Koch. Z. angew. Chem., 1908, **21**, 2161—2172, 2209—2219.

After a discussion of previous work on the subject, the authors give a detailed account of experiments on the action of mixtures of nitrogen peroxide and oxygen or air, in different proportions, on water, and on the oxidation of nitrogen peroxide to pentoxide by means of ozone, with a view of obtaining nitric acid of higher strength than is otherwise possible. The results obtained show that when a mixture of nitrogen peroxide and oxygen, prepared from 1 vol. of nitric oxide and 2 vols. of oxygen, is led into water, formation of nitric acid takes place very rapidly, until an acid of about 40 per cent. concentration is obtained. The absorption of nitrogen peroxide then slackens gradually at first, but more quickly so soon as the concentration of the nitric acid exceeds 50 per cent. At the ordinary temperature it is not possible to obtain nitric acid of a greater concentration than 68—69 per cent. by the combined action of nitrogen peroxide and oxygen ; at higher temperatures the increase of the concentration of the nitric acid proceeds still more slowly. As the strength of the acid approaches the limiting value, the greater is the proportion of the nitrogen peroxide which is simply dissolved and hence can be removed again by a current of air. From a mixture of steam, nitrogen peroxide, and oxygen, also, it is not possible to obtain, at the ordinary temperature, nitric acid of a strength higher than 68—69 per cent. As the concentration of nitric acid increases, the formation of further quantities by the interaction of nitrogen peroxide and water ($2NO_2+H_2O \rightarrow HNO_3+HNO_2$) is retarded, owing to deficiency of free water (due to the formation of hydrates of nitric acid), whilst at the same time, increasing quantities of nitric acid vapour are carried over by the current of gas passing through the solution. The acid of highest concentration attainable by the interaction of nitrogen peroxide, oxygen, and water is of approximately the same composition as the mixture of nitric acid and water of minimum vapour pressure. As the rate of evaporation of the acid solution is increased by the presence of a large excess of foreign gases, whilst the velocity of reaction of nitrogen peroxide with water is diminished, the concentration of nitric acid attainable, falls, as the percentage of nitrogen peroxide in the gaseous mixture is reduced. In the case of mixtures with air, the limiting concentrations at the ordinary temperature are :—with 1 per cent. of nitrogen peroxide, about 46 per cent. of nitric acid, with 2 per cent., 52 ; and with 5 per cent., more than 55 per cent. of nitric acid. The nitrous acid produced in the primary reaction between nitrogen peroxide and water, decomposes completely in the course of time into nitric acid and nitric oxide : $3HNO_2=HNO_3+2NO+H_2O$, and the nitric oxide is oxidised to nitrogen peroxide by excess of oxygen. With a large excess of air, however, the nitric oxide carried over from the absorption apparatus, is not completely oxidised to peroxide if the distance to the next absorption vessel is short, and if the latter be charged with alkali solution, alkali nitrite is produced ($NO+NO_2 \rightarrow N_2O_3$). The amount of nitrite thus formed is greater, the greater the dilution of the nitrogen peroxide mixture with air. By the action of ozone, nitrogen peroxide is very rapidly oxidised to nitrogen pentoxide, even when mixed with large proportions of air, and by leading the resulting gas-mixture into water or aqueous nitric acid, acid of more than 80 per cent. strength can be easily obtained.—A. S.

Phosphorous acid ; Oxidation of —— *by iodine.* B. D. Steele. Chem. Soc. Proc., 1908, **24**, 193.

The velocity of interaction of iodine and phosphorous acid has been studied. It has been found that two reactions of essentially different character occur between these reagents, one of which preponderates in more strongly acid solution, and the other, in the presence of feeble acids, such as acetic and boric acids. The former of these reactions is catalytically accelerated by the presence of hydrogen ions, and the velocity is proportional to the concentration of phosphorous acid (or of the phosphorous ion) and to the square root of the concentration of the iodine. The second reaction, which occurs in the presence of salts, such as sodium acetate, bicarbonate, or biborate, is accelerated by the presence of phosphorus acid and of sodium acetate, and retarded by the presence of iodine and of potassium iodide.

Lime in water; Solubility of ——. G. T. Moody and L. T. Leyson. Chem. Soc. Proc., 1908, **24**, 202.

The observed difference in the solubility of lime obtained from different sources is not ascribable to any peculiarity of the lime itself, but is due to the presence of impurities which either affect the solubility of the lime or are capable of neutralising acids, thereby causing an error wherever the lime present in solution is estimated by titration with acid. It is found that the curve of solubility of lime in water, between 25° and 80° C., is practically represented by a straight line.

Silica; Precipitated ——. H. Le Chatelier. Compt. rend., 1908, **147**, 660—662.

Gelatinous silica, completely freed from hydrochloric acid and sodium chloride, by washing, was heated in a sealed tube at 320° C. for six hours. No alteration in the appearance of the silica occurred, which remained gelatinous. The author concludes that no hydrate of silica exists, but that precipitated silica, however formed, is anhydrous, and merely associated mechanically with water. The other properties of the substance—formation of jelly and state of permanent suspension in water, ease of reaction with alkalis as compared with quartz, etc.—are considered to be due to the extremely fine state of division in which the silica exists. That it possesses the hardness of ordinary "anhydrous" silica is shown by the fact that metals can be polished by friction with gelatinous silica.—J. T. D.

Colloidal phosphorus; Formation of ——. A. Lottermoser. J. prakt. Chem., 1907, **78**, 367—368.

When a clear and colourless solution of white phosphorus in ether is allowed to stand in a closed vessel containing a small piece of undissolved phosphorus in excess, and exposed to diffused daylight, the solution gradually acquires an orange-yellow opalescence in reflected light, whilst appearing clear yellowish-red by transmitted light. This phenomenon is due to the formation of red phosphorus, which is practically insoluble in ether, but which, when produced in this way, remains in the form of a colloidal sol. After a time, the walls of the vessel become covered with a pale red crust of allotropic phosphorus, and the colloidal sol is destroyed, all the red phosphorus being deposited on the crust as fast as it is formed.—J. F. B.

Silver sulphide and sulphate; Reaction between ——. *Production of dark-coloured glass.* O. Sackur. *See* VIII.

Graphite production of the United States. U.S. Geol. Survey, 1908. [T.R.]

The production of graphite in the United States in 1907 included 4,947,800 pounds of the flake variety, valued at $171,149, and 26,803 short tons of the amorphous variety valued at $125,821. The output of 1906 included 5,887,982 pounds of flake graphite and 16,853 tons of amorphous graphite. During the year a small output was made by one company in Alaska. Considerable deposits exist 40 miles northwest of Nome, which appear to be much purer than most, if not all, of those at present worked in the United States. These deposits are not far from comparatively cheap transportation. In New Jersey a graphite mine was started at High Bridge in a graphite-bearing gneiss. A tunnel was driven along the strike for a distance of 400 feet. About 3½ carloads of graphite, divided into four grades, were mined and shipped.

The imports of graphite of all kinds in 1907 amounted to 22,939 short tons, valued at $1,777,389, as compared with 25,487 short tons, valued at $1,554,212 in 1906. The high value per ton of the imported product indicates that it was chiefly of the flake or crystalline variety.

The production of artificial graphite, which was first put on the market in 1897, has increased in wonderful measure. The output in 1907 was 6,590,000 lb., valued at $481,239, as compared with 5,074,757 lb., valued at $337,204, in 1906.

The world's production of graphite is valued at about $4,300,000, of which about $3,400,000 is credited to Ceylon. The volume of the world's output is about 128,000 short tons, of which Ceylon produces only about 40,000 tons, but owing to its superior quality the value of this output is approximately 80 per cent. of the value of the world's production. Austria is credited with the largest output in point of volume, amounting to about 42,000 tons, but owing to its low grade its value is only about $293,000.

Patents.

Furnace for burning pyrites and other substances; Mechanical ——. E. Bracq-Laurent and R. Moritz. Fr. Pat. 390,838, June 3, 1908.

The invention relates to a mechanical furnace for the roasting of pyrites or other substances, which possesses the following special features:—(1). The material is made to pass into the furnace, and from stage to stage of the superposed hearths, down suitable slopes, so that the ascending gases come into contact with the surface of the material only and little dust is raised. (2). The central vertical shaft passing through the furnace, and its arms and rabbles, are made hollow and are cooled by a current of air or air mixed with atomised water, the destructive action of sulphur at the high temperature of the furnace being thus retarded. An inner tube runs through the centre of the shaft and the interior of each arm is furnished with a horizontal partition, so that the air may circulate and finally, when heated, pass out through the central tube. The inner and outer tube of the shaft may be cast together in sections, or the outer tube may be cast in one piece and the other adjusted afterwards. To ensure more thorough rabbling, each compartment of the furnace may be provided with four arms, instead of two as is usual, or the extra arms may be confined to the upper stages. An examination of the step at the base of the shaft is rendered easy by the insertion of a block which may be removed for this purpose by very slightly raising the shaft.—F. Sodn.

Spent lime [from gas-works, etc.]; Repurifying ——. R. Middleton, Leeds. Eng. Pat. 22,894, Oct. 17, 1907.

Spent lime is mixed with about 5 to 10 per cent. of its volume of sawdust, or similar absorbent, finely divided fuel, made into briquettes weighing not more than about one pound each, and burnt in a reverberatory or suitable gas furnace. Fresh lime may be added as a binding agent before briquetting, if desired.—O. R.

Sulphocyanides [thiocyanates]; Manufacture of —— *[from cyanogen compounds in coal gas].* The British Cyanides Co., Ltd., and K. M. Chance, London. Eng. Pat. 6218, Mar. 20, 1908.

Coal gas is first washed in a liquor containing an alkali polysulphide in solution, which reacts with a portion of the cyanogen contained in the gas, with formation of thiocyanate and hydrogen sulphide. The latter is then passed together with the gas into a second washing compartment, which contains ammoniacal or "gas" liquor, in which free sulphur is kept agitated by means of some simple stirring appliance. The ammonia, hydrogen sulphide, and sulphur, combine to form ammonium polysulphide, which removes the remainder of the cyanogen from the gas—a portion of the polysulphide being led back into the first vessel to bring about the preliminary decomposition, as described.—O. R.

Barium and strontium nitrates ; Manufacture of ——. H. Weyer, Dellbrück, Germany. Eng. Pat. 9773, May 5, 1908.

Barium or strontium sulphide, obtained by heating the corresponding sulphate to incandescence with coal, is treated with molten calcium nitrate, or with a heated solution of the latter in water, preferably under pressure. Barium or strontium nitrate goes into solution, while sulphur, calcium sulphide, and calcium hydrosulphide, are deposited. Carbon dioxide is then passed into the heated liquid, and the escaping hydrogen sulphide "treated to form sulphur, sulphurous acid, or sulphuric acid." After filtering, the solution is evaporated to recover pure barium or strontium nitrate.—O. R.

Hydrated magnesia ; Process of preparing concentrated ——. W. S. Morrison, San Francisco, Cal. U.S. Pat. 900,868, Oct. 13, 1908.

Magnesium oxide is boiled with water for a long time, and the mixture is passed repeatedly through a strainer until the liquid runs through clear. The residual hydrated magnesia is allowed to drain for about six days, then squeezed through a fine strainer, and finally dried at about 100° F., being thoroughly stirred during the drying process.—A. S.

Alkaline deposits ; Process of treating —— for recovering soda, etc. J. C. W. Stanley, Assignor to Pacific Coast Soda Co., Los Angeles, Cal. U.S. Pat. 900,892, Oct. 13, 1908.

Natural earthy deposits containing sodium sulphate and other salts are treated with water, the solution is separated from suspended matter, and again used for extracting the soluble salts from the raw material, these operations being repeated until a clear saturated solution is obtained. This is cooled to 44°—50° F. to cause crystallisation of the sodium sulphate, and the mother liquor is decanted and evaporated, these operations being repeated until practically the whole of the sodium sulphate has been recovered. The solution is then evaporated to a greater density, and sodium carbonate recovered by repeated fractional crystallisation at 33° F., and finally the residual mother liquor is evaporated in order to precipitate sodium chloride.—A. S.

Alumina ; Furnace for calcining ——. Soc. d'Electro-Chimie. Fr. Pat. 390,822, Aug. 8, 1907.

The calcination of alumina is carried out continuously in a furnace comprising a series of vertical or inclined retorts, preferably glazed on the inside, and perforated for the discharge of steam, or having vertical perforated pipes running through the interior. The temperature of the furnace is maintained at 1200°—1500° C. and the retorts are so arranged that they may be charged and discharged automatically, at a rate which is governed by that of the calcination. The chief advantages claimed are : (1), the fuel (*e.g.*, gas) does not come in contact with the charge, and hence little dust gets into the flues ; (2), contact with foreign substances being avoided, very pure alumina, suitable for the preparation of aluminium, is obtained ; (3), great economy of fuel and ease of manipulation are effected.—F. Sodn.

Oxygen ; Solid product, soluble in water, containing "condensed" ——. P. Dame. Fr. Pat. 390,520, July 30, 1907.

Hydrogen peroxide is mixed with 1 or 2 parts by weight of anhydrous borax or other anhydrous soluble salt capable of taking up its water of crystallisation from the hydrogen peroxide ; a solid mass is thus formed, which may be moulded into a suitable form and preserved unchanged for a long period. The products are claimed as new, and form a convenient source of nascent oxygen, when dissolved in water ; they find many applications, notably as disinfectants.—F. Sodn.

Mixtures of air, rich in oxygen ; Process and apparatus for the production of ——. O. H. U. Brünler. Fr. Pat. 391,213, June 15, 1908.

The invention is based on the fact that water absorbs relatively more oxygen than nitrogen from a mixture of these gases. In the process water, from any natural source, is caused to pass continuously through a siphon ; the air is removed by suction at the highest point, or, it may be forced into solution again and pumped out alternately, so that each suction operation removes a gas containing a larger proportion of oxygen, some of the nitrogen each time remaining unabsorbed. By resaturating only a portion of the water, the relative proportion of oxygen absorbed is further increased, and a mixture containing 65—75 per cent. of oxygen may be obtained in two operations, or, by repeating several times, a mixture containing 99 per cent. of oxygen. Instead of using a supply of natural water, a closed system may be adopted and air continuously aspirated or pumped in, the water being circulated. For saturating the water, the gas is led in under pressure from a number of small pipes dipping into the descending liquid.—F. Sodn.

Carbon monoxide ; Manufacture of practically pure ——. O. Loiseau. Fr. Pat. 390,673, May 29, 1908.

Carbon monoxide is manufactured practically pure by bringing a mixture of oxygen and carbon dioxide into contact with incandescent graphite, coke, anthracite, etc., the amount of carbon dioxide being reduced in proportion to the elevation of temperature required. The gas, thus obtained, may be used for the manufacture of special steels (such as tungsten steel), the reduction of refractory oxides, the treatment of iron ores in the blast-furnace, and other purposes. In some of its applications carbon monoxide is again formed as a final product, though at a lower temperature, and it may be reheated by mixing with the oxygen or mixture of oxygen and carbon dioxide employed in the manufacture. (See under X, page 1117.)—F. Sodn.

Sulphur obtained from gas-purifying material ; Purification of the extracts containing ——. Soc. Anon. d'Exploitation des Proc. Bécigneul and E. Berger. Fr. Pat. 391,109, Aug. 19, 1907.

The object of the invention is the purification of the solution of sulphur obtained by extracting, with carbon bisulphide or other solvent, spent gas-purifying material, before or after de-cyaniding. The solution is agitated with sulphuric acid (50°—60° B.) which dissolves the carbides, which are thus extracted from the solution, and further yields with these carbides, insoluble sulpho-conjugated compounds, which ultimately become resinified and carbonised. It also resinifies and carbonises the tars, rendering them insoluble. The resulting black deposit and the excess of acid are removed by filtering through powdered gypsum, and the filtered solution is completely decolorised by a further filtration through clay or animal charcoal ; it is then evaporated. The extraction and purification are carried out in a series of vessels which communicate directly with each other, in order to avoid loss of solvent, and are also connected to a gasometer to ensure equalisation of pressure. When the solution of sulphur becomes super-saturated by evaporation, steam is passed through it, so as to cause the deposition of sulphur as small crystals free from enclosed solvent.—F. Sodn.

Sulphuric acid ; Manufacture of —— in lead chambers. A. Gaillard. Fr. Pat. 390,807, May 30, 1908. Under Int. Conv., June 7, 1907.

See Eng. Pat. 11,732 of 1908 ; this J., 1908, 1018.—T. F. B.

Perborate of sodium containing borax; Process for the production of ——. F. Fritsche, Rumburg, Austria. Eng. Pat. 1352, Jan. 20, 1908.

See Fr. Pat. 384,967 of 1907 ; this J., 1908, 503.—T. F. B.

Sulphur-bearing material [pyrites, etc.]; Manufacture of briquettes and the like of ——. J. S. Robeson, Camden, N.J., U.S.A. Eng. Pat. 1639, Jan. 23, 1908.

See Fr. Pat. 386,695 of 1908 ; this J., 1908, 750.—T. F. B.

Products [silicides] containing calcium, barium, or strontium and silicon; Process of manufacturing ——. Th. Goldschmidt, Essen on Ruhr, Germany. Eng. Pat. 4647, Feb. 29, 1908. Under Int. Conv., May 18, 1907.

See Ger. Pat. 199,193 of 1907 ; this J., 1908, 948.—T. F. B.

Salt for domestic and other uses; Process for the preparation of common ——. G. T. Holloway, London. U.S. Pat. 902,403, Oct. 27, 1908.

See Eng. Pat. 16,279 of 1905 ; this J., 1906, 758.—T. F. B.

Salt; Process and apparatus for fusing ——. E. R. Royston, and New Salt Synd., Ltd. Fr. Pat. 390,510, May 23, 1908. Under Int. Conv., May 25, 1907.

See Eng. Pat. 12,110 of 1907 ; this J., 1908, 809.—T. F. B.

Sodium nitrite; Preparation of pure —— from a solution of nitrite containing sodium bicarbonate. Norsk Hydro-Elektrisk Kvaelstofkompagni. Fr. Pat. 390,666, May 29, 1908. Under Int. Conv., June 1, 1907.

See Eng. Pat. 11,415 of 1908 ; this J., 1908, 1019.—T. F. B.

Sodium or potassium silicate; Manufacture of ——. W. Gossage and Sons, Ltd. Fr. Pat. 390,886, June 3, 1908.

See Eng. Pat. 23,794 of 1907 ; this J., 1908, 1018.—T. F. B.

Aluminium oxide; Process for the production of ——. F. W. Morris. Fr. Pat. 391,398, May 21, 1908.

See U.S. Pat. 890,084 of 1908 ; this J., 1908, 750.—T. F. B.

Carbonic oxide; Manufacture of ——. O. Loiseau, Sclaigneaux, Belgium. Eng. Pat. 11,590, May 28, 1908.

See Fr. Pat. 390,673 of 1908 ; preceding.—T. F. B.

Ebullioscopic determinations and fractional distillation; Electrical heating in ——, *[and preparation of sulphur dichloride]*. E. Beckmann. *See* XXIII.

VIII.—GLASS, POTTERY, AND ENAMELS.

Silver sulphide and sulphate; Reaction between ——. *Production of dark-coloured glass.* O. Sackur. Ber., 1908, **41**, 3356—3359.

A mixture in molecular proportions of silver sulphide and sulphate melts at 365° C. to a viscous, dark red-brown fluid; on addition of silver chloride (which does not affect any chemical reaction that occurs), the mass becomes extremely mobile at about 400° C. The author endeavoured to ascertain the conditions of equilibrium, under varying concentrations of the reacting substances, and varying temperatures, of the reaction, $Ag_2S + Ag_2SO_4 \rightleftarrows 4Ag + 2SO_2$. No trustworthy results could be obtained, however; the final pressure of sulphur dioxide in the apparatus always reached a limiting value in any experiment, but the limiting values differed greatly in successive experiments at the same temperature. The cause of this was not ascertained. The glass apparatus used, and other glass apparatus dipped in the melted mixture, becomes coloured dark brown, the depth of tint depending on the time of immersion. Notable quantities of silver are absorbed by the surface layer of the glass. This coloured glass is extremely opaque towards the blue and ultraviolet rays, and may be of use for photographic purposes.
—J. T. D.

Kaolin deposit in Natal. Board of Trade J., Nov. 5, 1908. [T.R.]

A lode containing millions of tons of kaolin is stated to exist at Padley's Station. A shaft has been sunk to a depth of about 55 ft., and this discloses several classes of clay. That on the top is more or less impregnated with iron, but lower down, the deposit becomes chalk-like in appearance; it is smooth, and takes a beautiful polish when rubbed. It is said to compare favourably with the French and other qualities, and to be suitable for pottery and the best work. The facilities for working the area are good, as the railway practically cuts into the side of the deposit and water is plentiful. The earthworks have been completed for a tram-line of about 300 yards in length, which will transport the clay from the mine to the machinery site.

Patents.

Glass sheets or plates; Apparatus for the manufacture of ——. E. Fourcault, Lodelinsart, Belgium. U.S. Pat. 901,800, Oct. 20, 1908.

See Eng. Pat. 28,790 of 1903 ; this J., 1904, 823.—T. F. B.

Ceramic mass; Method of producing a new —— and of manufacturing pottery. H. Eisenlohr, Karlsruhe, Germany. U.S. Pat. 901,599, Oct. 20, 1908.

See Ger. Pat. 182,108 of 1905; this J., 1907, 1093.—T. F. B.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Patents.

Wood (1), (2), (5), (6); Art of colouring ——. *Wood (3); Art of treating —— for lumber. Wood (4). ; Artificially grained or figured —— and process of producing the same.* W. A. Hall, New York, Assignor of the first four patents to American Mahogany Co., Maine. U.S. Pats. 901,094 to 901,099, Oct. 13, 1908.

(1). Wood is heated for several hours in a closed vessel, at a temperature exceeding 240° F., with water containing dissolved salts which permanently darken and stain the wood by their action on the resinous and gelatinous constituents. (2). At the end of the foregoing process, the liquid is sucked out of the wood as far as possible, by producing a vacuum in the containing vessel, and the wood is then impregnated under pressure with a liquid colouring matter, which intensifies the grain of the wood. (3). Wood is first subjected to the action of a moderate heat and a vacuum in a closed vessel. It is next impregnated with a colouring liquid under high pressure, and is finally "boiled" under considerable pressure and at a high temperature to diffuse the colouring matter evenly throughout the wood. (4). An artificially grained wood is produced by depositing from a single colouring solution, through the action of substances naturally present in the wood, a colouring matter in the more porous portions of the wood, and then causing the more liquid portions of the colouring solution to permeate the entire body of the wood, so as to stain the denser portions of the wood, but to leave them lighter in colour than the more porous portions. (5). The process is similar to that described in (3), but the wood is finally "boiled" in an open vessel at a temperature not exceeding 212° F. instead of under pressure. (6). The wood is first "boiled" under atmospheric pressure, at a temperature of about 212° F., in a "ferrous pyrolignite" solution, so as to darken the body of the wood throughout. The wood, while still hot, is then placed in a cold aqueous alkaline colouring solution, and is finally "boiled" in this second solution until the desired shade is attained.—A. G. L.

Wood; Liquid for preserving —— by impregnation. B. Malenkovic and Landau und Co. Fr. Pat. 391,023, June 6, 1908.

Wood is impregnated with a liquid consisting of a mixture of an aqueous solution of a salt of a base metal and an aqueous solution of an alkali fluoride, containing at least as much fluoride as is necessary to form the normal fluoride of the base metal. On heating the wood in the liquid, and afterwards drying it, the fluoride of the base metal is deposited in the wood.—A. G. L.

Portland cement; White non-staining —— and process of making same. S. B. Newberry, Sandusky, Ohio. U.S. Pat. 900,874, Oct. 13, 1908.

The cement is made by burning a mixture of white limestone, silicious clay, and a small proportion of cryolite, all the materials used being substantially free from iron. —A. G. L.

Slag cement and process of making same. H. Kühl, Blankenese, Germany, Assignor to The Atlas Portland Cement Co., New York. U.S. Pat. 900,939, Oct. 13, 1908.

Vitreous blast-furnace slag is mixed with not more than a few per cent. of non-hygroscopic "accelerating material," *e.g.*, sodium carbonate and sodium sulphate, and not more than a few per cent. of a basic "developing" material, *e.g.*, calcium hydroxide, in order that free caustic alkali may be formed in the mixture when the cement is moistened for use.—A. G. L.

Wood; Transformation of —— by coloration. W. A. Hall. Fr. Pat. 391,178, June 13, 1908

See U.S. Pats. 901,097 and 901,098 of 1908; preceding. —T. F. B.

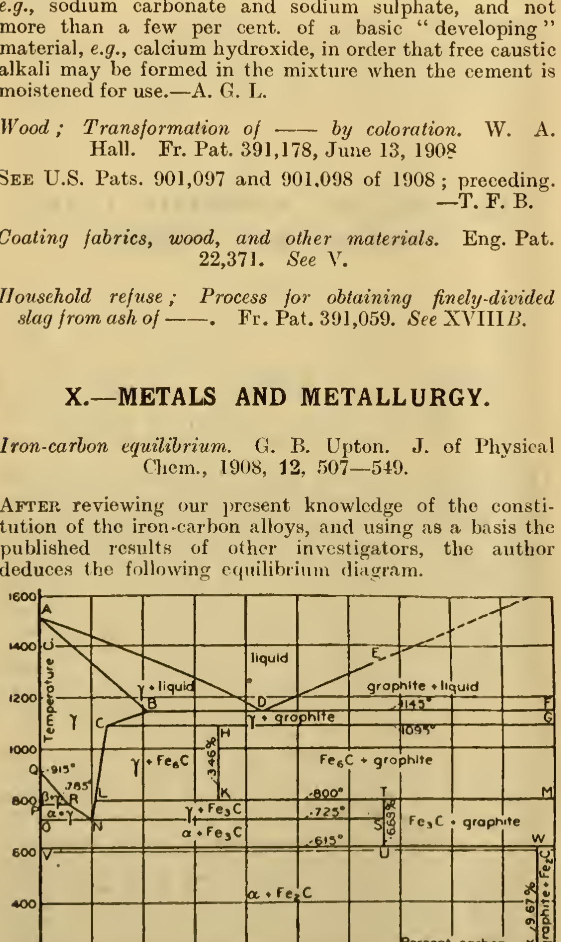
Coating fabrics, wood, and other materials. Eng. Pat. 22,371. *See* V.

Household refuse; Process for obtaining finely-divided slag from ash of ——. Fr. Pat. 391,059. *See* XVIII*B*.

X.—METALS AND METALLURGY.

Iron-carbon equilibrium. G. B. Upton. J. of Physical Chem., 1908, 12, 507—549.

After reviewing our present knowledge of the constitution of the iron-carbon alloys, and using as a basis the published results of other investigators, the author deduces the following equilibrium diagram.



The author considers that the facts do not support the assumption of Heyn, Benedicks and others of the metastable equilibrium of iron-iron carbide, quoting in support of his views the work of Goerens and Gutowski, who showed that irons quenched in ice water from the eutectic temperature (1140° C.), at various stages of the freezing, always contained graphite. The chief evidence for the existence of the compound, Fe_6C, is provided by the fact that the furnace-cooled pure irons used by Wüst, and Carpenter and Keeling (this J., 1904, 608), in their experiments, contain practically no graphite unless the total carbon exceeds 3·5 per cent. It is also shown that, allowing for the carbon-displacing power of other elements (equivalent total carbon = total carbon + 0·45Si + 0·10P + 0·05S—0·03Mn), a similar conclusion may be reached in the case of commercial cast-irons. In addition it is pointed out that when the total carbon or its equivalent exceeds 3·5 per cent., the amount of combined carbon quickly approximates to a constant value of 1·4 per cent., which is the amount normal to the γ + graphite field. In this case the larger amount of liquid eutectic and consequently longer halt at a temperature of 1140° C. favours the formation of graphite, which in irons containing more than 3·5 per cent. of carbon is a stable phase down to 800° C. or even lower. The existence of the compound, Fe_2C, is indicated principally by cooling curves, and by the work of Campbell and Kennedy (this J., 1902, 1398), who showed that the carbides recovered from a piece of white charcoal iron which had been slowly heated to 950° C., maintained at that temperature for two hours, and slowly cooled, consisted of a mixture of fine particles containing 9·33 per cent. of carbon (Fe_2C), and coarse particles containing 7·74 (Fe_3C) per cent. of carbon. The failure of steel under vibratory stress, and the ageing of steel, are explained by the increase in amount of this brittle phase, Fe_2C. The author suggests that the phases, Fe_6C, Fe_3C, and Fe_2C, are undistinguishable from one another in ordinary microscopic work. The formation of temper carbon in malleable cast iron is explained on the assumption that the original white iron had been cooled sufficiently quickly to prevent almost, if not entirely, the separation of graphite during solidification, and that the iron consists largely of a supersaturated solid solution. On annealing, this supersaturated solid solution yields the graphite which should have been formed during solidification and immediately after.—O. F. H.

Iron-phosphorus; Experimental thermal and metallographic investigation of the system ——. E. Gercke. Metallurgie, 1908, 5, 604—609.

Iron dissolves up to 1·7 per cent. of phosphorus. From mixtures containing 1·7—10·2 per cent. of phosphorus a eutectic compound containing 10·2 per cent. of phosphorus separates out; the temperature at which this body solidifies should be 980° C. in all cases, but, owing to supercooling, it may fall as low as 880°. The temperature at which the ferrite solidifies falls gradually from 1420° for the nearly pure iron used to 1108° C. for the mixture containing 9·55 per cent. of phosphorus. For the mixtures containing upwards of 1·7 per cent. of phosphorus, this ferrite contains 1·7 per cent. of phosphorus; for mixtures containing 1·7—3·5 per cent. of phosphorus, it separates out in the form of grains; for mixtures containing 3·5—10·2 per cent. of phosphorus, it forms fern-leaf shaped crystals. The paper is accompanied by a number of microphotographs.—A. G. L.

Cyanide process; Notes on the solutions used in the ——. K. Nugel. Metallurgie, 1908, 5, 611—621.

When neutral solutions of potassium-zinc cyanide are titrated with silver nitrate, potassium iodide being used as indicator, exactly half the cyanide present reacts with the silver nitrate. The solution to be titrated must be very dilute, as otherwise zinc cyanide may separate out and obscure the end-point. In alkaline solutions, on the other hand, the whole of the cyanide present reacts with the silver nitrate. Potassium cyanide solutions dissolve gold more rapidly than neutral solutions of potassium-zinc cyanide containing the same amount of potassium cyanide, and alkaline solutions of the double cyanide are even less effective, the differences increasing with increasing strength of solution. An increase in the strength of the cyanide solution, beyond 5 per cent. of potassium cyanide in the case of the potassium cyanide solutions, and 4 per cent. of potassium cyanide in the case of the double cyanide solutions, increased the time necessary for solution, probably owing to the diminished solubility of oxygen in the stronger solutions. On passing air through the solutions, the action was hastened in all cases, but considerable quantities of cyanide were lost from the neutral solutions, unless the air used was previously freed from carbon dioxide. On a large scale, at the Abbontiakoon Block I. Gold Mine, Ltd., West Africa, it was found that considerable economy of working was effected by adding potassium hydroxide to old cyanide solutions, so as to render the cyanide existing as zinc cyanide, available. With the same time of extraction as previously, the gold in the tailings dropped from 0·95 to 0·55 dwt. per ton, the daily consumption of cyanide from 150—250 to 75—125 lb., and considerably less zinc was used for precipitation. To determine the caustic alkali in cyanide solutions containing potassium-zinc cyanide, a measured quantity of standard sodium hydroxide solution (in excess of that equivalent to the zinc present) is first added; the total cyanide is then titrated with silver nitrate solution, using potassium iodide as indicator: and finally the total alkali hydroxide is titrated with standard sulphuric acid, after adding phenolphthalein. To obtain the best results in gold extraction, the caustic alkali present in the solution should be as nearly as possible equivalent to the zinc present.—A. G. L.

Zinc-blende as a constituent of matte. K. Friedrich. Metallurgie, 1908, 5, 114—128.

In order to throw light on the fact, well known to smelters, that the presence of much zinc sulphide in matte renders it refractory, the author has made a thermal and micrographic study of the binary sulphide systems, PbS—ZnS, Cu_2S—ZnS, Ag_2S—ZnS, and FeS—ZnS. Zinc-blende, galena, and magnetic pyrites were used in the investigation, but it is shown that the results may be regarded as true for systems of the pure sulphides. It was found impossible to prepare melts very rich in zinc sulphide, because the melting and boiling points of such lie very near together. The freezing-point diagrams, although really sections through the surfaces corresponding to ternary systems of two metals and sulphur, are plane, because the proportion of sulphur is almost exactly that required to combine with the respective metals. For the systems, PbS—ZnS, Ag_2S—ZnS, or FeS—ZnS, the diagram consists of a curve with two branches meeting on the eutectic line, but for the system, Cu_2S—ZnS, the curve has but one branch, no maxima being observed. It is probable that pure or nearly pure zinc sulphide crystallises from all the melts rich in this constituent, and by extrapolation the freezing-point of the pure sulphide was found to lie between 1600° and 1700° C.; at high temperatures zinc sulphide seems to be distinctly volatile. As a result of the investigation it would appear then, that a small proportion of zinc sulphide in a matte, as is shown also by practical experience, may lead to a lowering of the freezing-point, but when the zinc sulphide content passes the eutectic limit (6 per cent. for the system, PbS—ZnS, 3 per cent. for Ag_2S—ZnS, and 5 per cent. for FeS—ZnS), the freezing-point rises rapidly, especially for the system, FeS—ZnS.—F. Sodn.

Metallographic and metallurgical notes. [*Loss of silver on distilling zinc-silver alloys.*] K. Freidrich. Metallurgie, 1908, 5, 593—604.

The loss of silver on distilling zinc from zinc-silver alloys containing 1—0·01 per cent. of silver at 1165°—1392° C. in a muffle amounted to 0·4—5·8 per cent. of the silver present, and was largely mechanical. A comparison of the dry assays for cobalt and nickel according to the methods of Fritzsche (reducing atmosphere) and Plattner (oxidising atmosphere) showed that the latter method gives the most concordant and also the best results. In spite of the fact that the process consistently yields bodies of the composition, Ni_2As and Co_2As, the author, as the result of micrographic and thermal investigations, doubts the actual existence of chemical compounds possessing these formulæ, but is inclined to believe that a compound, Ni_3As_2, exists.—A. G. L.

Mineral and metal production of the United States in 1907. U.S. Geol. Survey, 1908. [T.R.]

The following are the revised figures for the mineral and metal production in 1907 (see this J., 1908, 79):—

Product.	1907.	
	Quantity.	Value.
Metallic—		$
Pig iron .... long tons	25,781,361	529,958,000
Silver............ troy ounces	56,514,700	37,299,700
Gold .... do.	4,374,827	90,435,700
Copper .... pounds	868,996,491	173,799,300
Lead ....short tons	365,166	38,707,596
Zinc .... do.	223,745	26,401,910
Mercury .... flasks	21,567	828,931
Aluminium .... pounds	17,211,039	4,926,948
Antimony ....short tons	2,022	622,046
Nickel .... pounds	—	(*a*)
Tin............ do.	—	33,285
Platinum .... troy ounces	357	10,589
Total value of metallic products	—	903,024,005
Non-metallic—		
Bituminous coal ......short tons	394,759,112	451,214,842
Pennsylvania anthracite, long tons	76,432,421	163,584,056
Natural gas	—	52,866,835
Petroleum............ barrels	166,095,335	120,106,749
Clay products	—	158,942,369
Cement .... barrels	52,230,342	55,903,851
Lime ....short tons	3,084,799	12,640,512
Sand-lime brick	—	1,225,769
Slate	—	6,019,220
Stone	—	71,105,805
Corundum and emery .short tons	1,069	12,294
Abrasive quartz and felspar .... do.	17,435	126,582
Garnet for abrasive purposes .... do.	7,058	211,686
Grindstones	—	896,022
Infusorial earth and tripoli ....short tons	—	104,406
Millstones	—	31,741
Oilstones, etc.	—	264,188
Arsenious oxide .... pounds	3,502,000	163,000
Borax (crude) ....short tons	52,850	1,121,520
Bromine .... pounds	1,379,496	195,281
Fluorspar ....short tons	49,486	287,282
Gypsum .... do.	1,751,748	4,942,264
Lithium minerals ..... do.	530	11,000
Marls .... do.	14,091	8,429
Phosphate rock ...... long tons	2,265,343	10,653,558
Pyrites .... do.	247,387	794,949
Sulphur .... do.	293,106	5,142,850
Salt .... barrels	29,704,128	7,439,551
Barytes (crude) ......short tons	89,621	291,777
Cobalt oxide .... pounds	—	(*a*)
Mineral paints ....short tons	71,973	2,979,158
Zinc white .... do.	71,784	6,490,660
Asbestos .... do.	653	11,899
Asphaltum .... do.	223,861	2,826,489
Bauxite .... long tons	97,776	480,330
Chromic iron ore ..... do.	290	5,640
Felspar ....short tons	84,544	499,069
Fibrous talc .... do.	67,800	626,000
Fuller's earth .... do.	32,851	291,773
Glass sand .... do.	1,187,296	1,250,067
Graphite {crystalline ... pounds	4,947,840	171,149
Graphite {amorphous . short tons	26,803	125,821
Magnesite .... do.	7,561	22,683
Manganese ores ...... long tons	5,604	63,369
Manganiferous ores ... do.	103,844	259,473
Mica {sheet .... pounds	1,060,182	349,311
Mica {scrap .... short tons	3,025	42,800
Mineral waters ..... gallons sold	52,060,520	7,331,503
Monazite and zircon .... pounds	548,152	65,800
Precious stones	—	*b*735,800
Pumice stone............short tons	8,112	33,818
Quartz............ do.	22,977	157,094
Rutile .... pounds	—	(*a*)
Sand, moulding, etc., and gravel ....short tons	40,664,622	13,242,002
Talc and soapstone ... do.	72,010	905,047
Tungsten .... do.	1,640	890,048
Uranium and vanadium do.	—	(*a*)
Total value of non-metallic mineral products	—	1,166,165,191
Total value of metallic products	—	903,024,005
Estimated value of mineral products unspecified	—	100,000
Grand total	—	2,069,289,196

a Included under unspecified.
b Includes pearls valued at $264,500.

"*Tin pest*"; *A new form of* ——. R. v. Hasslinger. Monatsh. f. Chem., 1908, **29**, 787—790.

A SAMPLE of tin-plate was kept by the author for two years at a temperature of 16°—45° C.; after this time the tin coating was found to have become dull and granular. Polished cast tin and also tinfoil were successfully inoculated, it is stated, from this grey tin and exhibited dull patches spreading to the extent of several mm. per day. The rate of spreading was apparently not affected by the temperature, but is said to have decreased as the distance from the centre of inoculation became greater. Melting is said to restore the normal properties of the tin, the melting-point of the changed tin being about 205° C., as compared with 231°—232° C. for the unaltered tin.—F. SODN.

Alloys; Hardness of metallic ——. *III.* A. Saposhnikow. J. Russ. Phys.-Chem. Ges., 1908, **40**, 665—673. Chem. Zentr., 1908, 2, 1338—1339.

THE author has determined the hardness of alloys of antimony and bismuth and of aluminium and tin. The results, expressed in kilos. per sq. mm. (see this J., 1908, 126, 127, 508), were as follows:—

Per cent. Bi	0	10	20	30	40	50
Hardness	26·1	41·1	48·0	49·6	51·3	43·8
Per cent. Bi	60	70	80	90	100	
Hardness	40·2	40·2	33·5	23·1	9·7	

Per cent. Sn	0	10	20	30	40	50
Hardness	21·7	21·0	18·2	15·8	17·7	16·5
Per cent. Sn	60	70	80	90	100	
Hardness	15·4	15·0	18·2	16·3	4·4	

The author discusses the constitution and structure of the alloys in the light of these results (compare Hüttner and Tammann, Z. anorg. Chem., **44**, 131; Gwyer, this J., 1906, 639).—A. S.

Nickel and hydrogen; Relation between ——. M. Mayer and V. Altmayer. Ber., 1908, **41**, 3062—3074.

NICKEL, reduced from the oxide by hydrogen, was introduced into a Jena glass vessel in an electric furnace, and after complete exhaustion, known quantities of hydrogen were introduced, and the temperature kept constant till absorption ceased. The amount absorbed, at temperatures of 360° to 560° C., was at each temperature proportional to the pressure of the hydrogen. At 360° C., 1 volume of nickel absorbed 50·5 volumes of hydrogen at a pressure of 300 mm., whilst at 560° C. the same absorption occurred when the pressure was raised to 440 mm. Within the experimental limits, then, the system nickel-hydrogen is bivariant, the volume absorbed being dependent both on temperature and on pressure.—J. T. D.

Antimony; Determination of —— [*in ores*]. W. F. Coolbaugh and J. O. Betterton. *See* XXIII.

PATENTS.

[*Crucible*] *Furnace; Oil* ——. E. A. Barnes, Fort Wayne, Ind., Assignor to General Electric Co., New York. U.S. Pat. 900,695, Oct. 13, 1908.

A HELICAL channel is provided in the inner casing of the lower portion of the fire-chamber, into which it opens at a point below the exit flue, the wall above the aperture being made quite smooth. By arranging the burner nozzle so as to discharge tangentially into the channel, a whirling column of flame is generated, which, playing round the cylindrical walls of the chamber, is bent over the top of the crucible and passes away through the flue.—C. A. W.

Furnace; Metallurgical ——. W. S. Dempsey, New York. U.S. Pat. 900,916, Oct. 13, 1908.

BY means of a series of valved tuyères, a blast of constant volume and pressure can be supplied at different points within the furnace. By directing the blast either wholly or partially into the furnace, or wholly or partially into the atmosphere, the pressure may be uniformly varied at any point or series of points. Finally, by means of a regulating valve common to all the sets, it may be uniformly varied throughout.—C. A. W.

Furnace; Metallurgical ——. W. F. M. McCarty Pleasantville, N.Y., Assignor to G. O. Eaton, T. M. Acken, and A. J. Guttmann, New York. U.S. Pat. 901,363, Oct. 20, 1908.

THE furnace comprises an upright body for the reception of the charge, the metal on reduction falling through apertures in the bottom into a crucible below. In addition to these apertures, the crucible communicates with the body of the furnace at its upper part by means of a flue. Means are provided for supplying air under pressure to the charge in the furnace proper and for passing superheated steam into the metal in the crucible, the agitation produced within the latter being localised, if necessary, by a series of partitions.—C. A. W.

Furnace; Mechanical —— [*for roasting ores*]. R. von Zelewski. First Addition, dated May 29, 1908 (under Int. Conv., June 21, 1907) to Fr. Pat. 382,138, Sept. 21, 1907 (see Eng. Pat. 21,961 of 1907; this J., 1908, 165).

THE furnace is divided into two or more separate parts, so that the ore, after having been submitted to a preliminary roasting in one portion, falls through apertures in the floor into independent furnaces below, where the process is completed. These last, like the first, are provided with mechanical stirrers and, in addition, contain flues by which they are heated. The waste gases arising from the complete roasting are utilised in heating the first furnace during the preliminary oxidation of the ore.
—C. A. W.

Furnace; Mechanical roasting ——. Scherfenberg und Prager. Fr. Pat. 391,140, June 12, 1908.

THE furnace in form resembles an upright cylinder provided with several floors and traversed longitudinally by a hollow shaft which carries hollow arms containing iron stays. To these are fixed the stirrer teeth which are of special design and in form resemble a ploughshare. It is claimed that, by the use of such teeth, a more perfect agitation is produced in the material, which, instead of being pushed aside by the stirrers, is turned over and over. The stirrer arms may, if necessary, be kept cool by a current of cold air passed up through the hollow shaft and arms. The feeding arrangement at the top of the furnace consists of a toothed wheel placed beneath the hopper and turned with a velocity depending on the speed of the stirrer arms. The several floors are provided alternately at the centre and circumference with vertical openings, so that the current of air passing in at the bottom of the furnace, pursues a zig-zag course to the outlet at the top. In the case of ores of low sulphur content, where the oxidation may have to be assisted by exterior heating, the furnace is provided at the side with a vertical flue containing apertures, opening on the several floors, through which a current of heated air can be passed. No direct communication then exists between the chambers, but each is fitted with a series of partitions. In this way a serpentine passage is provided for the gaseous currents while passing towards the outlet flue at the other side.—C. A. W.

Furnace; Crucible —— *for melting steel, bronze, etc.* A. Baillot. Fr. Pat. 390,952, May 7, 1908.

THE furnace is mounted on trunnions so that it can be tilted. Air under pressure is supplied from an exterior blast chamber to several rows of tuyères arranged in quincunx fashion around the sides of the crucible. In this way, the heat produced during the combustion of the coke at the bottom of the furnace and the formation of carbon dioxide at the top, are utilised more perfectly. To this end, the top portion containing the cover is made in the form of a perforated crucible and may itself contain metal. The tuyères are arranged tangentially, so that an oblique blast is obtained. The furnace is made without gratings

the removal of the ash being effected by the addition of a flux and the subsequent pouring of the liquid slag.
—C. A. W.

Alloy. W. J. Leddell, Summit, N.J. U.S. Pat. 901,014, Oct. 13, 1908.

The patent relates to a series of alloys consisting substantially of zinc and containing equal parts of copper and aluminium respectively. An example cited has the composition: zinc, 90; aluminium, 5; copper, 5 per cent. The alloys are claimed to possess a relatively low factor of shrinkage and a high resistance to distortion, to be dense and homogeneous in structure and practically free from masses of segregated zinc.—C. A. W.

Separating solids from liquids: Machine for ——. [*Amalgamating apparatus*]. F. K. and E. F. Atkins, Denver, Col. U.S. Pat. 901,056, Oct. 13, 1908.

A centrifugal separator with a rotary bowl the diameter of which increases from the bottom towards the top, is driven by a central shaft surrounded by a hollow feed tube open top and bottom. The upper part of the bowl is provided with a number of circumferential grooves adapted to contain mercury, and with variably curved retarding surfaces between them. The grooves are so placed as to enable the material under treatment to acquire the speed of the bowl before reaching the lowest mercury zone, and a removable plug is provided at the bottom of the bowl to draw off amalgam.—C. J. G.

Silver; Recovery of —— from solution. T. A. Ross, Selby, Cal. U.S. Pat. 901,124, Oct. 13, 1908.

The liquid passes from the dissolving tank into the precipitating vessel, whence, after the precipitate has been allowed to settle, it is pumped back again. The liquid within the dissolving tank is continuously agitated by means of some compressed fluid which, passing through a flexible pipe coiled round an ordinary stirring pole, is discharged into the body of the solution.—C. A. W.

Iron and steel; Process of treating ——. W. F. M. McCarty, Rocky Ridge, Md., and Pleasantville, N.Y., Assignor to G. O. Eaton, T. M. Acken, and A. J. Guttmann, New York. U.S. Pats. 901,362, 901,546, and 901,547, Oct. 20, 1908.

The iron or steel is purified by mixing with one or more chlorides, as for instance 100 lb. of sodium chloride and 25 lb. of calcium chloride to every ton of metal, and exposing the molten mass to intermittent jets of superheated steam, the product being subsequently submitted, if desired, to the action of a vacuum. In an alternative process, the treatment with steam is omitted and the metal subjected directly to the action of a vacuum.
—C. A. W.

Steel; Process of refining ——. Bismarckhütte. Addition, dated May 23, 1908, to Fr. Pat. 386,786, Jan. 31, 1908.

In order to shorten considerably the duration of the treatment in the electric furnace, as described in the main patent (see this J., 1908, 814), the steel is submitted to a preliminary refining in a Bessemer or Thomas converter or a Martin furnace.—C. A. W.

Metals; Apparatus for the extraction of —— from their ores. W. E. Greenawalt, Denver, Colo. U.S. Pat. 901,611, Oct. 20, 1908.

The ore is treated with aqueous chlorine solution under pressure, the chlorine being prepared electrolytically.
—C. A. W.

Zinciferous materials; Dezincing ——. Rheinisch-Nassauische-Bergwerks u. Hütten-Act.-Ges. Fr. Pat. 390,562, May 25, 1908. Under Int. Conv., June 13, 1907.

The zinciferous material is fused with an alkaline salt or with a mixture of such salts, which act as oxidising agents, and the melt extracted with some suitable solvent, such as water. In this way a solution is obtained containing most of the zinc. The process may be applied to the dezincing of commercial lead after desilverisation. By the addition of a certain quantity of an alkaline compound, such as sodium nitrate, to the metal in the crucible at a temperature of about 400° C., the whole of the zinc, but only a small portion of the lead, will be oxidised, the oxide dissolving in the molten salt.—C. A. W.

Zinc; New method of manufacture of ——. O. Loiseau. Fr. Pat. 390,672, May 29, 1908.

The mixture of oxidised ore and carbon is submitted to the direct reducing action of practically pure carbon monoxide, free from nitrogen, at the temperature necessary for the reduction of the metal. The gas can be produced by drawing a mixture of oxygen and carbon dioxide over incandescent coke, the proportion of the latter gas being made smaller according as the temperature of the carbon monoxide is to be increased. The ore is contained within a refractory chamber which, being supported on a truck, can be replaced when the action is completed. The metallic vapours having been condensed in a system of chambers, the residual gas, consisting almost entirely of carbon monoxide, is collected and utilised. (See under VII., page 1112.)—C. A. W.

Galena; Apparatus for treating —— with air or with air enriched with oxygen so as to obtain directly lead and "lead sulphide." Soc. pour L'Utilisation de L'Air et de ses Dérivés. Fr. Pat. 390,599, Aug. 2, 1907.

Galena is treated in a converter similar to a Bessemer converter, except that the air or oxygen can be introduced through a large number of openings. By using sometimes all, sometimes only certain of these openings, a thorough mixing of the fused mass is effected, and local solidification prevented.—A. G. L.

Metallurgical briquettes containing silica and lime; Process of hardening ——. J. Kraus. Fr. Pat. 390,805, May 30, 1908. Under Int. Conv., June 7, 1907.

Finely-divided minerals are formed into briquettes with the addition, if necessary, of silica and lime, and the briquettes are hardened by treatment in an autoclave with steam or carbon dioxide gas under pressure. The briquettes are charged into and discharged from the autoclave either by a mechanical conveyor, or else by their own weight.
—A. G. L.

Copper; Method and apparatus for extraction of —— from its ores and mattes. H. K. Hess. Fr. Pat. 391,017, June 6, 1908.

The process consists in treating the roasted and powdered ore with a solution containing chromic and sulphuric acid. Copper is rapidly dissolved and the chromic acid reduced with the formation of sulphates of the metals. The resulting solution is afterwards electrolysed between electrodes of lead or any other convenient metal. The cathodes are contained within porous vessels, conveniently of wood, each cathode being in communication with a mercury cup connected to the source of electricity. Copper is precipitated on the lead cathodes or deposited in the porous containing vessels, while chromic acid is regenerated at the anode. The residual solution is then passed back to the dissolving vessel where it may be used in extracting a fresh portion of the ore.—C. A. W.

Solder for aluminium and method of preparing it. W. H. Finfrock. Fr. Pat. 391,161, June 10, 1908.

The solder consists of an alloy of 8 parts of zinc with 1 part of phosphor-tin containing 5 per cent. of phosphorus. The zinc is first melted and the phosphor-tin then added. The solder is applied as usual to the previously heated pieces of aluminium. It may be used for other hard metals, *e.g.*, wrought iron, and the relative proportions of its constituents may be varied.—A. G. L.

Steel alloys. J. Churchward, New York. Eng. Pat. 15,498, July 5, 1907.

See U.S. Pat. 867,327 of 1907; this J., 1907, 1202.—T. F. B.

Iron ore; Process and apparatus for the direct reduction of —— and its subsequent treatment for making malleable iron and steel. M. Moore and T. J. Heskett. Fr. Pat. 390,947, April 23, 1908.

See Eng. Pat. 26,131 of 1907; this J., 1908, 813.—T. F. B.

Armour plates and similar articles; Manufacture of ——. S. S. Wales. Fr. Pat. 389,891, May 4, 1908. Under Int. Conv., Nov. 11, 1907.

See Eng. Pat. 9380 of 1908; this J., 1908, 1068.—T. F. B.

Armour plates and analogous articles; Process of making ——. Cammell Laird and Co., Ltd. Fr. Pat. 391,227, June 15, 1908.

See Eng. Pat. 15,976 of 1907; this J., 1908, 904.—T. F. B.

Smelting. N. Wikstrom, Hogfors Bruk, Finland. Eng. Pat. 1676, Jan. 24, 1908. Under Int. Conv., Jan. 25, 1907.

See Fr. Pat. 387,080 of 1908; this J., 1908, 814.—T. F. B.

Aluminium solder. W. H. Finfrock, Chicago. U.S. Pat. 901,607, Oct. 20, 1908.

See Fr. Pat. 391,161 of 1908; preceding.—T. F. B.

Soldering; Manufacture of a composition used in —— for deoxidising and cleaning the metallic surfaces to be united. Ges.m.b.H. Classen und Co. Fr. Pat. 390,512, May 23, 1908.

See Eng. Pat. 11,605 of 1908; this J., 1908, 1069.—T. F. B.

Ore concentrator. H. L. and E. A. Sulman, Assignors to Minerals Separation, Ltd., London. U.S. Pat. 902,018, Oct. 27, 1908.

See Eng. Pat. 9981 of 1906; this J., 1907, 928.—T. F. B.

Ores; Treatment of —— by the precipitation process. Imbert Process Co. Fr. Pat. 390,858, Aug. 9, 1907.

See Eng. Pat. 16,834 of 1907; this J., 1908, 688.—T. F. B.

Furnace for melting metals. W. J. Holzapfel. Fr. Pat. 391,030, June 6, 1908.

See U.S. Pat. 891,256 of 1908; this J., 1908, 815.—T. F. B.

Gas from blast-furnaces; Centrifugal purifier for ——. Fr. Pat. 391,201. *See* II.

Carbon monoxide; Manufacture of practically pure ——. Fr. Pat. 390,673. *See* VII.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(*A.*)—ELECTRO-CHEMISTRY.

Patents.

Purifying liquids; Electrolytic apparatus for ——. J. T. Harris, New York. U.S. Pat. 900,926, Oct. 13, 1908. (See also U.S. Pat. 857,277 of 1907; this J., 1907, 829).

A stream of the impure liquid is passed into a vessel where it is submitted to electrolysis, the anode being made of a material which will yield a coagulant when the current is passed. If necessary a gas may be injected into the liquid during the process. The impurities can afterwards be separated from the treated mixture by a suitable arrangement.—C. A. W.

Conductor; Electric-resistance ——. J. T. H. Dempster, Schenectady, N.Y., Assignor to General Electric Co., N.Y. U.S. Pat. 901,428, Oct. 20, 1908.

The claim is for an alloy containing iron, nickel, chromium, and approximately 5 per cent. of manganese. The iron must not be greater in amount than 50 per cent., and the nickel and iron must each be in excess of the other metals.—B. N.

Electrolyte. A. Van Winkle, Assignor to The Hanson and Van Winkle Co., Newark, N.J. U.S. Pat. 901,758, Oct. 20, 1908.

A solution of zinc fluoride is mixed with an alkali, such as ammonium carbonate.—B. N.

Accumulators; Product for the charging of ——. F. F. Bourdil, First Addition, dated Aug. 1, 1907, to Fr. Pat. 385,707, March 26, 1907 (this J., 1908, 630).

The pulverised material, or mixture of materials (such as kieselguhr, pumice stone, etc.), is mixed with gelatinous silica, or other analogous material, which has been prepared previously.—B. N.

Ozone; [Electrical] Generator of ——. Comp. de L'Ozone (Procédés P. Otto). Fr. Pat. 390,665, May 29, 1908.

A tube of glass, or other dielectric material, is covered internally with a sheet of tin or aluminium acting as one of the electrodes, the second electrode consisting of a series of discs, each pierced with a central hole slightly greater in diameter than the dielectric tube. The discs are fitted over the glass tube, and spaced apart in a suitable manner, so that the discharge takes place between the outer surface of the dielectric, and the inner edges of the openings in the discs; the latter thus act both as electrodes and radiators.—B. N.

Metallic films and process of preparing the same for use with storage battery electrodes. T. A. Edison, Llewellyn Park, N.J., U.S.A. Eng. Pat. 15,362, July 20, 1908. Under Int. Conv., Feb. 6, 1908.

See U.S. Pat. 896,811 of 1908; this J., 1908, 986.—T. F. B.

Negative-pole [Planté] plates and process of treating the same. J. Bijur, Assignor to The General Storage Battery Co., New York. Reissues Nos. 12,871 and 12,872, dated Oct. 27, 1908, of U.S. Pat. 845,391, Feb. 26, 1907.

See Eng. Pat. 29,367 of 1906; this J., 1908, 27.—T. F. B.

Battery; Primary ——. K. Heintz, Munich, Germany. U.S. Pat. 901,445, Oct. 20, 1908.

See Ger. Pat. 198,019 of 1906; this J., 1908, 817.—T. F. B.

[Electrical] resistance; Moulded ——. L. E. Barringer, Schenectady, Assignor to General Electric Co., New York. U.S. Pat. 902,048, Oct. 27, 1908.

See Eng. Pat. 6089 of 1906; this J., 1907, 54.—T. F. B.

Plastic mass [for electric lamp filaments]. Additions to Fr. Pat. 378,743. *See* II.

Bleaching; Electrochemical method of ——. Fr. Pat. 390,891. *See* V.

(*B.*)—ELECTRO-METALLURGY.

Patents.

Iron; Electrodeposition of ——. S. O. Cowper-Coles, London. Eng. Pat. 22,311, Oct. 9, 1907.

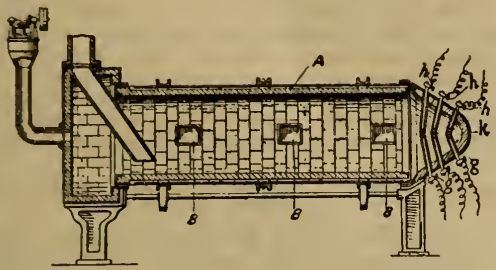
Good deposits of iron may be obtained continuously from ferrous sulphate solutions by blowing air into the cathode electrolyte, or in proximity to the cathode, preferably against the surface on which the metal is being deposited. (See Eng. Pat. 28,897 of 1906; this J., 1907, 699.)—B. N.

Iron articles; Manufacture of —— by electrodeposition. S. O. Cowper-Coles, London. Eng. Pat. 22,312, Oct. 9, 1907.

A magnetic iron ore, such as magnetite, or an iron sulphide ore, such as pyrrhotite, is first concentrated by the usual methods, and then introduced directly into the electrolyte, and maintained in suspension by any suitable method. (See Eng. Pat. 28,897 of 1906; this J., 1907, 699).—B. N.

Iron from tin-plate scrap; Preparation of merchantable ——. E. A. Sperry, Brooklyn, N.Y. U.S. Pat. 901,266, Oct. 13, 1908.—C. A. W.

Furnace; Electric —— [for ores]. R. McKnight, Pittsburg, Pa. U.S. Pat. 900,192, Oct. 6, 1908.



The rotating tubular furnace body, A, is provided at one end with an electrically heated conical fire-box, *k*, fitted with inlet flues for the admission of gases. These gases, heated by means of electric arcs, *g*, *h*, produced within the fire-box, are drawn through the body of the furnace and pass away at the end. Apertures, 8, which can be closed when necessary, are provided along the furnace for the removal of the ore.—C. A. W.

Furnace; Electric transformer —— in combination with graphite crucibles. H. Helberger G.m.b.H. Fr. Pat. 391,010, June 6, 1908.

The furnace is supplied with current from a transformer, the secondary winding having appropriate contacts, and between these a graphite crucible is bound so as to form part of the secondary. The portions making contact with the crucible are water-cooled. The primary consists of a series of windings, any number of which may be put in series by means of a commutator, for the purpose of regulating the tension of the current in the secondary. The shape of the crucible is such that it has a minimum transverse section in the walls, and therefore a maximum resistance, at the point where the maximum heat is required; or, this portion of the crucible may be constructed of a material less conductive than the other parts. For melting metals, the interior of the crucible is protected with a lining of refractory and non-conducting material. In the case of crucibles made from a mixture of clay and graphite, the lining may be prepared chemically by passing a current of oxygen to the inside of the crucible whilst this is incandescent, or by other chemical agents capable of removing the graphite from the inner surface of the mixture.—B. N.

Magnesium; Production of —— by electrolysis. G. O. Seward and F. von Kügelgen, Holcombs Rocks, Va., Assignors to Virginia Laboratory Co., New York. U.S. Pat. 900,961, Oct. 13, 1908.

A mixture of magnesium fluoride with the chloride of calcium or some other alkaline-earth metal more electropositive than magnesium is heated in order to render it anhydrous, a small percentage of an alkali fluoride being added as a flux. After the magnesium has been separated electrolytically, hydrated magnesium chloride is added and the whole subjected to a further dehydration, the resulting mixture of magnesium fluoride and calcium chloride being utilised in a second electrolysis.—C. A. W.

Barium and barium alloys; Production of ——. G. O. Seward and F. von Kügelgen, Holcombs Rock, Va., Assignors to Virginia Laboratory Co., New York. U.S. Pat. 900,962, Oct. 13, 1908.

The process consists in electrolysing fused barium chloride, to which a barium salt of lower melting point, such as the fluoride, has been added. Using a cathode of some metal capable of alloying with the element, barium alloys can be obtained.—C. A. W.

Electrodes for the electrolytic production of metals lighter than the electrolyte. Soc. Anon. des Usines de Rioupéroux. Fr. Pat. 390,596, Aug. 1, 1907.

The anode is made in two pieces surrounding a fixed cathode, so that, when necessary, the former may be brought nearer to, or placed further apart from, the latter. A similar arrangement may be employed where two or more fixed cathodes are used.—B. N.

Metals; Apparatus for the electrolytic deposition of ——. L. F. J. Quivy. Fr. Pat. 391,194, June 13, 1908.

The apparatus refers more particularly to the manufacture of tubes of copper, etc., but may be used for coating bodies of any form suitable for revolution. The mandrels are simultaneously given a circular movement of translation, and one of rotation in the bath, these movements preventing polarisation, maintaining the uniformity of the electrolyte, and assuring a uniform and regular deposition of metal. The mandrels are supported horizontally between two revolving discs, and the motion of rotation of each mandrel is obtained from rubber-covered rollers of insulating material, fixed to the ends of each mandrel, which rub over fixed guides. Rubbers, for polishing the deposited metal, are mounted in line on a rod in a manner similar to that employed with the brush-carriers of a dynamo, so that by twisting the rod they may be turned aside or put into action.—B. N.

Electric furnaces. H. Nathusius and Westdeutsche Thomasphosphatwerke, Berlin. Eng. Pat. 7188, April 1, 1908.

See Fr. Pat. 388,668 of 1908; this J., 1908, 948.—T. F. B.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

Animal fats; Detection of some —— in admixture with other animal fats. E. Polenske. Arbb. Kais. Gesundh.-Amt., 1908, 29, 272—275.

The author gives a description of further experience with the detection of certain animal fats in the presence of others by means of the "difference number" (difference between the melting and solidifying points). Of a large number of samples of butter examined, only one gave a higher "difference number" than 14·3, but the author states that up to the present, the results obtained are not sufficient to allow of stating a sample of butter to be adulterated if its "difference number" exceed a certain value. A butter may, however, be described as adulterated with lard or other fat having a higher "difference number" if a mixture of 75 parts of the butter fat and 25 of beef tallow has a "difference number" higher than 15, and also higher than that of the butter-fat itself.—A. S.

Oil of nutmeg; Constituents of the expressed ——. F. B. Power and A. H. Salway. Chem. Soc. Trans., 1908, 93, 1653—1659.

The characters of the expressed oil were as follows: m. pt., 48° C.; sp. gr. at 50/50° C., 0·9399; acid value, 11·2; saponification value, 174·6; iodine value, 57·8; and of the total fatty acids: m. pt., 49° C.; sp. gr. at 50/50° C., 0·9012; acid value, 218·3; and iodine value, 23·1. The essential oil obtained from the fats had a sp. gr. of 0·8794 at 20/20° C. and the optical rotation, $\alpha_D = +22° \ 30'$ in a 1-dcm. tube. The expressed oil contained 12·5 per cent. of essential oil and 73·0 per cent. of trimyristin, together with small quantities of oleic and linolenic acids as glycerides and very small amounts of formic, acetic and cerotic acids. From the unsaponifiable matter a new substance, $C_{18}H_{22}O_5$, was isolated, which is a viscid liquid of b. pt. 270—280° C. at 15 mm.—J. C. C.

Japanese vegetable oils; Notes on ——. T. Kametaka. J. Coll. Science, Imp. Univ., Tokyo, 1908, **25**, Article 4.

Japanese wood oil (Kiri-abura).—A specimen of the oil prepared by the author by pressing the seeds of *Elæococca vernicia* in the cold, with as little exposure to the air as possible, had the iodine value (Hübl), 161·3; after keeping the oil for eleven months in the dark in a stoppered bottle, the iodine value was 150. A 3 months' old specimen of the oil had the iodine value (by Wijs' method), 156·3, and an 11 months' old sample, 153·2. These results show that the low iodine value of Japanese wood oil (compared with that of linseed oil) is not due to previous oxidation (see Ingle, this J., 1902, 187). The other characters of the fresh oil were: acid value, 3·81; sp. gr. at 24°/24° C., 0·9307; saponification value, 196·0. The seeds of *Elæococca vernicia* contain a fat-hydrolysing enzyme.

Camellia oil or oil of Thea japonica (L.) Nois (Tsubaki-abura).—A commercially pure specimen of the oil had the sp. gr. 0·9138 at 15°/4° C., and iodine value (Hübl), 79·47. The principal acid in the oil is oleic acid.

Oil of Terreya nucifera S. et Z. (Kayano-abura).—A specimen of the oil prepared by pressing the seeds in the cold, had the iodine value (Hübl), 137·3. The oil contains stearic acid and linolic acid or an isomeride of the latter.

Soja bean oil or oil of Glycine hispidia Maxim (Daidzu-abura).—The unsaturated acids of the oil consist principally of oleic acid and linolic acid or an isomeride of the latter.

Oil of Perilla ocymoides, L. (Eno-abura).—This contains linolenic acid or an isomeride of the same.—A. S.

Elæomargaric acid; Constitution of the so-called ——. T. Kametaka. J. Coll. Science, Imp. Univ., Tokyo, 1908, **25**, Article 3.

The author has previously shown (this J., 1903, 1138) that elæomargaric acid has the composition, $C_{18}H_{32}O_2$, and is an isomeride of linolic acid. The action of alkaline potassium permanganate and other oxidising agents, concentrated sulphuric acid, fused potassium hydroxide, and aniline on the acid has since been studied. It is probable that one of the two ethylenic linkages in the molecule is in the middle of the chain of 18 carbon atoms and that the other is on that side of the middle double linkage which is further removed from the carboxyl group.—A. S.

Oil trade of Marseilles. Chem. and Drug., Nov. 14, 1908. [T.R.]

Marseilles now produces an average of 420,000 tons of oil and oilcake per annum, valued at 130,000,000f. (£5,200,000). The industry dates from 1817, when experiments were first made by crushing linseed in the primitive wooden screw presses locally used for extracting olive oil. In 1828 hydraulic presses began to replace the horse-power hitherto utilised. New industries were gradually added; sesamé oil from the Levant, ravison from Russia, and in 1841 Senegal earth-nuts were first treated; in 1850 Smyrna and Alexandria cotton-seed; in 1860 poppy-seed and afterwards castor oil, etc. The thirty-nine crushing mills at Marseilles now contain 1,600 presses. One-third of the oils now produced at Marseilles are "concrete oils"—*i.e.*, substances which are solid in our European climate: the copra and cabbage-palm type of products, mostly used for soap-making or alimentary purposes; palm oil, "karité," etc., used in the stearine trade, cacao-butter, Chinese "vegetable lard," extracted from the pulp of the *Stillingia sebifera*, etc. Besides these "industrial" oils, Marseilles is the leading market for "comestible" salad oils. Some 20,000 to 30,000 tons are imported yearly, of which rather over one-half is usually re-exported. Comestible oils also include poppy-seed, sesamé, arachis, cotton-seed, and beechnut oils.

Turkey Red dyeing; Application of different oils and soaps in ——. F. Erban and A. Mebus. *See* V.

Patents.

Oleaginous seeds; Process and apparatus for pressing —— *in open presses.* A. Austerlitz. First Addition, dated April 1, 1908, to Fr. Pat. 381,350, Aug. 29, 1907 (this J., 1908, 131).

The seeds, when sufficiently heated, are discharged into a receptacle beneath, so that over-roasting is prevented and a more uniform product obtained. To facilitate the charging and emptying of the press, an opening may be provided in the head of the press for the introduction of the seeds and plates, the latter being guided into position by the upright supports of the press. There may also be a side platform for the lateral introduction or removal of the plates through the opening, whilst the plates themselves may be constructed so that the edges which prevent the seed escaping may be either open or closed.—C. A. M.

Soap composition. J. Sierra V., San Francisco, Cal. U.S. Pat. 901,204, Oct. 13, 1908.

The composition consists of a soap containing glycerin and excess of caustic soda, prepared by heating together 50 parts of olive oil and 20 parts of caustic soda, mixed with 5 parts of fine table salt, and 25 parts of the pulp of the "alligator pear."—A. S.

Emulsifying preparation. G. Imbert. Fr. Pat. 390,497, May 22, 1908.

A soap which readily forms emulsions is obtained by heating halogenated hydroxy-fatty acids or halogenated fatty acids with alkali or alkali carbonate in smaller proportion than is theoretically necessary to eliminate the halogen and completely neutralise the fatty acids.—C. A. M.

Bleaching fats, oils, resins, waxes, and the like; Process for ——. K. Lüdecke, Assignor to Verein. Chem. Werke, Act.-Ges., Charlottenburg, Germany. U.S. Pat. 901,718, Oct. 20, 1908.

See Fr. Pat. 378,515 of 1907; this J., 1907, 1150.—T. F. B.

Hydroxy-fatty acids; Process of producing ——. G. Imbert, Nuremberg, Germany. U.S. Pat. 901,905, Oct. 20, 1908.

See Fr. Pat. 368,543 of 1906; this J., 1907, 25.—T. F. B.

Oleic acid; Apparatus for treating ——. P. Schwoerer, Strassburg, Germany. U.S. Pat. 902,177, Oct. 27, 1908.

See Ger. Pat. 199,909 of 1906; this J., 1908, 949.—T. F. B.

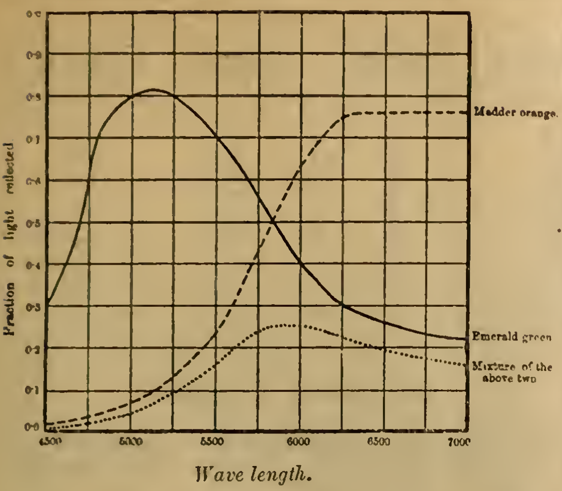
Hydrosilicates of aluminium, animal charcoal, etc.; Treating —— *with volatile solvents.* Fr. Pat. 391,169. *See* I.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(A.)—PIGMENTS, PAINTS.

Artists' colours: Some properties of ——. H. E. Watson. Phil. Mag., 1908, **16**, 725—730.

The author has investigated three properties of paints:—(1), stability; (2), transparency; (3), absorption spectra.



(1). *Stability of paints.*—The action of hydrogen peroxide was tried because this substance is produced by the action of air on water in the presence of organic matter and light. A few drops of a finely ground paint, suspended in water, were poured into two test-tubes. To one tube 1 c.c. of pure 10 vol. hydrogen peroxide was added, and to the other an equal volume of water. The ends of the tubes were drawn out to fine capillaries to avoid loss by evaporation, and the tubes were kept for a fortnight in the cold, and afterwards at 40° C. for a year. The changes of shade were compared with those of water colours which had been exposed to light for 30 years and with corresponding specimens which had been kept in the dark. A paper on "The Action of Ozone on Water Colour Pigments," by Sir Wm. Abney [Proc. Roy. Soc. A., vol. lxxx., p. 146 (1908)] supplied another comparison. A few of the results are given below:

Name of paint.	Sunlight.	H_2O_2.	Ozone.
			hr. min.
Naples yellow .	no change	deepened 1 day	0·45
Chrome yellow	slightly green	paled slightly	unchanged
Vermilion	dark brown	stable	,,
Carmine	white	colourless in 1 day	0·10
Emerald green .	darkened	brown at once	0·45
Crimson lake .	white	colourless in 2 weeks	0·30

Note.—The figures show the time taken by moist ozonised air to bleach the paint.

The following paints were stable to both hydrogen peroxide and sunlight:—

*Yellow ochre, other ochres, *raw sienna, orange chrome, red lead, "light red," *Venetian red, burnt sienna, *Indian red, madder red, burnt umber, *"Terra Verte," cobalt green, *chromium oxide, transparent chromium oxide, smalt, *cobalt blue, ceruleum, *Prussian blue, *Antwerp blue. (Paints marked with a star were treated with ozone and remained unaffected.) Generally speaking hydrogen peroxide is identical, as to its action, with ozone. From the conditions of the experiment too much attention must not be paid to the actual times taken. In the majority of cases fading is due to oxidation; the evidence is strong, though of course not conclusive. Water colours are known to be much less stable than oil colours, and by finding a medium very impermeable to air and moisture, it should be possible to prolong almost indefinitely the life of even a fugitive colour.

(2). *Transparency of paints.*—The transparency, or its inverse, the covering power, of a paint has been investigated by the author. The experiments consisted in coating weighed metal surfaces with just sufficient colour to hide a series of black lines on the metal and determining the gain in weight due to the paint. The results are expressed in mgrms. of paint required to cover one sq. cm. Sixty paints were examined, and the following are a few examples: Zinc white, 5·32; Naples yellow, 7·25; carmine, 1·57; yellow ochre, 3·62; madder orange, very great; emerald green, 4·17; Prussian blue, 0·68; Vandyke brown, 1·86.

(3). *Absorption spectra of paints.*—The absorption spectra of about 50 of the most important paints were determined, using Mees' spectrophotometer (Revue des Sciences Photographiques, Feb., 1905). The paints were applied to strips of dull white paper, 3 by 2 in., leaving half of the paper blank, and the whole was illuminated by an Auer burner. The light reflected from the white paper formed the standard spectrum. Diagrams are given in the paper showing the nature of the absorption, and in them the fraction of the total light reflected by a paint is plotted against the wave length. They show the true nature of the reflected light and also the percentage of white light, this being given by the ordinate of the lowest point of the curve. It is noteworthy that the apparent colour of a paint is never even approximately monochromatic, although to the eye it may appear to be so. The effect of mixing one or more paints may be approximately obtained from the curves. In the case of a mixture of equal quantities of two paints, the absorption curve of the resulting colour will be obtained by multiplying together the ordinates of the two curves for each wave length, and joining the resulting points. An example of this is given for a mixture of emerald green and madder orange which combine to give a dull brownish-yellow (see figure). In order to obtain a bright colour from a mixture of others, it is necessary that they should have some part of the brightest portion of their spectra in common, and should possess broad maxima of intensity.—R. S. M.

Paints; Covering power of ——. P. Beck. Chem.-Zeit., 1908, 32, 958—959.

The determination of the covering power has been up to now too much dependent on the personal factor. The author recommends that the value of a paint be determined by (1) its covering capacity measured by: (*a*), the thickness (in hundredths of 1 mm.) of layer required to coat efficiently a given surface; and (*b*), the area in sq. cm. which 1000 grms. or 1000 c.c. of the paint will cover; and (2), its durability. In stating the covering power of a paint, it is of importance to give the amount of linseed oil used, because this will depend on the nature of the colour:—*e.g.*, white lead requires 8—10 per cent. of oil, whilst zinc white takes 25 per cent. of its weight of oil. The price of the linseed oil compared with that of the colour must be considered. The author describes an apparatus whereby the covering power of a paint may be expressed in the terms given above without any uncertainty due to the personal factor. It consists essentially of a metal frame in which a glass plate 4 cm. by 50 cm. is tightly fixed by means of screws. The long sides of the frame are connected at intervals by cross bars. Above the glass plate is a special scraper, which can be moved backwards and forwards by means of a rack and pinion. The paint is applied to the glass from a squirt and is then distributed by means of the scraper. The latter carries a blade which can be raised or lowered by means of a micrometer screw. The thickness of the layer of paint is so adjusted by means of this blade that the shadows of the cross bars of the frame just begin to be visible through the glass and the layer of paint thereon. Some results obtained with this apparatus are given in the table on p. 1122:—

The weight of the paint used is given by the loss in weight of the squirt. The above numbers show the differences in covering capacity of several paints in reference to the thickness of the pigment layer and the area covered by a given weight of paint (the area is given by the length of the layer multiplied by the width of the glass plate). The durability of a paint can only be determined by practical tests, painted surfaces being exposed to the atmosphere for months. The author has found that of the white pigments, white lead is the most durable, followed by zinc white, whilst the least resistant are the different kinds of lithopone. He considers this to be due to the linseed oil reacting with white lead to give linoxyn

Pigment.	Percentage of boiled oil.	Thickness of layer in 1/100 mm.	Length of layer in cm.	Weight of paint used.
White lead in boiled linseed oil	9·7	78	18	14·0
,, ,, with 20 per cent. barytes	9·7	80	21	15·5
,, ,, ,, 40 per cent. ,,	9·6	86	16	13·3
,, ,, ,, 60 per cent. ,,	10·1	100	29	25·6
Zinc white in boiled oil	21·0	68	20	9·2
,, ,,	25·0	75	18	9·9
,, ,,	25·0	81	14	7·8
Lithopone—green seal	17·0	83	16	10·0
,, blue seal	15·0	95	19	14·0
,, yellow seal	15·0	110	17	13·7
Finest ground heavy spar	19·0	475	9	28·5
Red lead	7·0	58	33	21·4
Pale orange lead	15·0	70	36	22·0

and a lead salt, which are more stable to weathering agents, whereas zinc oxide does not give such compounds with linseed oil and the mixture is more easily hydrolysed, causing a separation of oil and colour.—R. S. M.

PATENTS.

Antimony pigment; Preparation of a new ——. A. Nicolle. Fr. Pat. 390,617, May 29, 1908.

THE invention consists in the preparation of a pigment from barium or strontium sulphantimonate by transformation of these salts by acids and sodium sulphate into an insoluble mixture of yellow and red antimony sulphides and barium sulphate. Into a solution of barium sulphantimonate a stream of sulphur dioxide is passed, whereby a precipitate of antimony yellow and barium thiosulphate is formed. To the liquid saturated with sulphurous acid, sodium sulphate is added until the solution is free from soluble barium salt. The pigment is filtered off and the filtrate is evaporated down to give sodium thiosulphate, or it is treated with antimony chloride to give antimony vermilion. In this latter case it is unnecessary to filter off the barium sulphate and antimony yellow, and antimony chloride can be added directly.—R. S. M.

Paints; Non-rusting ——. E. Liebreich. Fr. Pat. 391,084, June 10, 1908.

THE invention depends on the well-known fact that alkaline liquids prevent the rusting of metals, and consists in incorporating with the paint a substance which yields an alkaline solution when it comes in contact with water. The following substances are recommended: potassium and sodium sulphides, potassium amide, and potassium, sodium, and calcium cyanamides. The sulphides and amides of potassium are considered to be particularly suitable. The sulphides or amides must not be brought into contact with the pigments except in the presence of oil (linseed or boiled oil). The substances may be added at the ordinary temperature to the prepared paints or to the boiled oil before being mixed with the colours; 0·57 grm. of potassium sulphide would be sufficient for 10 grms. of a deep grey paint. The protecting compound is to be present in the first coat. The second coat must not contain the above sulphides and amides; moreover, it must be as impermeable to water as possible.—R. S. M.

Zinc pigments or mixtures containing zinc sulphide; Production of ——. H. W. de Stucklé, Dieuze, Germany. Eng. Pat. 575, Jan. 9, 1908.

SEE U.S. Pat. 884,874 of 1908; this J., 1908, 512.—T. F. B.

Pigments. J. C. Heckman, Avalon, Pa., U.S.A. Eng. Pat. 8550, April 16, 1908.

SEE U.S. Pat. 887,042 of 1908; this J., 1908, 579.—T. F. B.

Orange-lake dyestuff. Eng. Pat. 18,736. *See* IV.

(*B.*)—RESINS, VARNISHES

Oil of turpentine; Analysis of ——. *Determination of mineral oil in rosin oil.* R. Adan. Bull. Soc. Chim. Belg., 1908, 22, 389—396.

A SAMPLE of oil of turpentine suspected of adulteration with mineral oil was examined by the author, together with two samples of rosin oil. By means of fractional distillation and examination of the distillates, the suspected sample was found to be free from mineral oil but contained some rosin oil. The author considers that the method of determining the proportion insoluble in sulphuric acid (Herzfeld's method) is not suitable for ascertaining the amount of mineral oil in rosin oil. Burton's method, in which the oil is treated with strong nitric acid, is more satisfactory. Where there is any doubt, the oil should be distilled, and the fraction collected between 120° and 150° C. tested for its solubility in aniline and acetic anhydride. If the liquids mix in all proportions, the absence of considerable amounts of petroleum may be concluded.—F. SHDN.

Resins [and gums]; Tropical —— *as rosin substitutes.* P. Klemm. *See* XIX.

PATENTS.

Substitutes for natural resins; Manufacture of ——. Les Prod. Chim. de Croissy, Ltd. Fr. Pat. 390,713, Aug. 5, 1907.

THE process consists in combining an aldehyde, *e.g.*, formaldehyde, with an intermediate substance such as glycerin by means of catalytic agents (acids or alkalis); the compound so formed is made to react with phenol, whereby the glycerin is regenerated, the resulting oil being worked up into a substitute for lac, amber, or copal. The formation of the compound of aldehyde with glycerin moderates the violence of the interaction of the aldehyde and the phenol so that a product of the proper quality is obtainable.—R. S. M.

Siccative; Preparation of a ——. J. Pilgram and L. G. Leffer. Fr. Pat. 390,804, May 29, 1908.

THE new siccative is prepared by melting resin and adding 0·5 per cent. of aluminium hydroxide and 2 per cent. of aluminium acetate. After allowing the mass to stand for some time, it is reheated and 5 to 20 per cent. of sodium carbonate is added, the amount depending on the nature of the resin taken. After cooling, the solid product is ground to powder and added to colours in the proportion of 1—3 per cent., or it may be dissolved in the paint oil. It is claimed that the new siccative causes no darkening of the paints into which it is introduced.—R. S. M.

Sealing wax; An elastic ——. F. Schaar and H. Bergmeister. Fr. Pat. 391,121, June 11, 1908.

A SEALING-WAX which is elastic and flexible so that seals made with it are always of a smooth surface and retain their original impression, is made by working up thoroughly a mixture of 100 parts by weight of gutta-percha or caoutchouc with 12·5 parts of lac in a water-bath at 100° C. The adhesive property of the lac is increased by mixing with it 25 parts of indiarubber dissolved in benzene. Colouring matter is added and the product is moulded into any desired shape.—R. S. M.

(C.)—INDIA-RUBBER, &c.

Castilloa elastica ; Cultivation of —— in Mexico. C. S. Treacher. Tropical Life, 1908, No. 7. Gummi-Zeit., 1908, 23, 92.

Contrary to generally accepted views on the subject, *Castilloa* appears to flourish at heights more than 500 feet above sea-level, fine examples of the species having been found in the State of Oaxaca, on the Mano Marquez Estate, at a height of 1100 feet. The soil there is a light and somewhat sandy loam ; the rainfall is considerable but not excessive. Methods of tapping and coagulating have hitherto been somewhat primitive in Mexico, but improvements are taking place, and a " scientifically " prepared sample of rubber has been valued at as high a price as 5s. 2d. per lb., fine Parà being 5s.

Two samples of " fine-Castilloa " gave the following results on analysis :—resins, 7·09 and 4·99 ; mineral matter, 0·13 and 0·72 ; caoutchouc, 92·78 and 94·29 per cent. respectively. The amount of resin varies more or less with the age of the tree, from 30 per cent. or more in the case of young trees, to 8 or 10 per cent. in the case of a 10-year old tree. The second sample, referred to in the above analysis was taken from a much older tree than the first. A pure, transparent product is obtained by diluting the latex with more than its own volume of boiling water, adding a certain amount of formaldehyde, and, after three days' standing, sprinkling the latex with a decoction of the native " huamole " or " moon-vine." The rubber thus obtained gradually darkens on keeping, but to a less extent than that prepared by other methods.—E. W. L.

Rubber ; Extraction of —— from the guayule plant. Atrevido. Gummi-Zeit., 1908, 23, 93—94.

The author summarises the methods of extracting guayule rubber now in use. There are two main systems employed, the chemical and the mechanical, the latter being used almost to the exclusion to the former, which is adopted by only one factory, to the author's knowledge. The chemical method depends upon the use of benzol and alcohol, and appears to be more costly to carry out than the mechanical process, though the product obtained is possessed of superior properties. The mechanical process consists in cutting-up or comminuting the plants, and then grinding the fragments with water in a kind of tube-mill. By this means the rubber is released from the containing vessels in the plant, and forms a pasty mass with the fragments of plant-tissue. On soaking this mass in water the woody particles sink, leaving the rubber on the surface. The rubber is subsequently further purified by washing, between rollers. A more highly refined product is obtained if the last fragments of plant-fibre, together with some of the rubber resins, be removed by heating the mass with a solution of caustic soda, lime, or bleaching-powder.

Strong, fresh-cut plants yield as much as 14 per cent. of rubber of a medium grade ; young plants give lower yields of rubber of a poorer quality. The author anticipates a crisis in this guayule rubber industry, on account of the rapid exhaustion of natural supplies of the plant, and the fact that it cannot profitably be worked up before it is at least 5 years old. (See also this J., 1908, 633.) —E. W. L.

Caoutchouc globules in the latices of Hevea braziliensis and Funtumia elastica ; Comparative size of ——. D. Spence. India-rubber J., 1908, 36, 233—234.

Whereas the latex of *Hevea* is coagulated with great readiness by means of acid solutions, *Funtumia* latex is scarcely affected ; a small clot of rubber may separate when the acid is added, but the greater part of the latex remains in its original emulsified state. Complete coagulation only takes place on heating. That this stability towards acids is not to be accounted for by a change in sign of the electric charge on the caoutchouc globules, in the sense of the modern theory, was shown in the case of some samples of *Funtumia* latex from Southern Nigeria, which arrived very acid in reaction but quite uncoagulated. On diluting and dialysing the latex, and then passing a current through it, the globules still wandered to the positive pole, as in the case of *Hevea* latex. It was found, however, on microscopic examination that the *Funtumia* globules were very much smaller than those of *Hevea*, the average diameter of the former being probably about 0·5 μ, whereas the *Hevea* globules averaged about 2μ. On dilution with water containing a trace of ammonia, the Brownian movement shown by the *Funtumia* globules was more considerable than that exhibited by the *Hevea* globules, and while the movement was almost completely stopped in the latter case by the use of a 20 per cent. sodium chloride solution for dilution, the *Funtumia* globules remained in motion under similar conditions. It is thought that these observations, when interpreted in the light of the current theory in regard to coagulation, may serve to explain some of the differences between the two latices with respect to their behaviour towards coagulants.—E. W. L.

Phytosterols from balata. N. H. Cohen. Arch. Pharm. 1908, 246, 510—514.

Two crystalline bodies termed α- and β-balalban were isolated by Tschirch and Schereschewski (this J., 1905, 898) from the " resin " of balata, and subsequently (Arch. Pharm., 245, 245) α-balalban was shown to be identical with β-amyrol acetate. Since the amyrols are so frequently associated with lupeol in the vegetable kingdom, the author considered it probable that lupeol might also be present in balata. This was found to be the case, the crude balata yielding, after repeated crystallisation from alcohol, a lupeyl ester, in addition to the β-amyryl acetate and β-balalban. This ester crystallised in white tablets (m.pt. 208°—210° C.), and when saponified and recrystallised from alcohol, formed white needles melting at the same temperature as lupeol (210° C.). The acid liberated in the saponification was identified as acetic acid. The lupeyl acetate in balata is not identical with synthetical lupeyl acetate, which crystallises in needles (m.pt. 215° C.). In explanation of this the author suggests that it is probable that the lupeol in balata is not identical with ordinary lupeol (m.pt. 210° C.), but that it is converted into that body on treatment with alcoholic alkali.—C. A. M.

Phytosterols from African rubber. N. H. Cohen. Arch. Pharm., 1908, 246, 515—520.

A sample of " euphorbia rubber " examined had the following composition :—Caoutchouc, 5·5 ; resin, 70·0 ; water, 25·4 ; and impurities, 1·7 per cent. The resinous substance, after repeated treatment with small quantities of boiling alcohol, left a small amount of a white powder, which when recrystallised from acetone, formed prismatic crystals melting at 235° C. and having the specific rotation in chloroform solution in a 100 mm. tube of +83·7°. On hydrolysis with alcoholic alkali this yielded β-amyrol (m.pt. 194° C.), and was identified as β-amyryl acetate. The portion of the resin soluble in alcohol, melted at 110° C. after recrystallisation from alcohol and drying at 60° C. to expel the two mols. of water of crystallisation. It crystallised in brilliant scales, and had the composition, $C_{30}H_{50}O,2H_2O$. From the behaviour of the acetate and benzoate, however, the author concluded that this apparently individual substance was really a mixture of probably two distinct compounds. Further experiments showed that lupeol was not present in the rubber, since the benzoate prepared from the resin was completely soluble in hot acetone, whereas lupeyl benzoate was nearly insoluble. By repeated crystallisation first from acetone and then from ethyl acetate, the benzoate was obtained from the resin in brilliant needles melting at 193°—195° C. On hydrolysis it yielded a phytosterol,

$C_{24}H_{40}O,H_2O$, which crystallised in needles containing 1 mol. of water of crystallisation, and had the specific rotation in chloroform solution of +58·6°. On acetylation it yielded an acetate crystallising in brilliant scales of m.pt. 134°—135° C. In these characteristics it closely resembled the *iso*cholesterol isolated by Schulze from wool fat, and the author suggests the probable identity of the two compounds. If this be confirmed, the distinction between cholesterols (from the animal kingdom) and phytosterols (from the vegetable kingdom) will no longer hold good.—C. A. M.

Lupeol. N. H. Cohen. Arch. Pharm., 1908, **246**, 520—522.

In the author's opinion it is probable that many "phytosterols" which have been described are really lupeol. Thus the phytosterol separated by Klobb (Bull. Soc. Chim., 1902, 27, 1229) from the buds of *Anthemis nobilis* and termed *anthesterol* agrees so closely in its properties with lupeol as to leave little doubt as to the identity of the two compounds. The phytosterol isolated by Zuco, however (Gazz. chim. ital., 1889, 19, 208), from insect powder, was also obtained from the same source by the author, and found to contain neither a derivative of *a*-amyrol nor lupeol. It formed an acetate crystallising in plates (m.pt. 221—223° C.), and yielding on saponification an alcohol crystallising in needles melting (not sharply) at 192°—195° C. The benzoate crystallised in small needles, which began to melt at 252° C. and decomposed at 260° C. Dammar resin, benzoin, and Para rubber were also found to be free from lupeol.—C. A. M.

Patents.

Gums [*rubber, gutta-percha*] ; *Process for the regeneration, devulcanisation, and agglomeration of* ——. E. A. L. Rouxeville. First Addition, dated Aug. 2, 1907, and Second Addition, dated Aug. 3, 1907, to Fr. Pat. 378,251, Aug. 4, 1906 (this J., 1907, 1153).

The present additions refer to certain modifications of details of the process described in the main patent. Besides the terpenes mentioned therein, other terpenic compounds such as those obtained by the action of heat, acids, or halogens on oil of turpentine may be used.—A. S.

Rubber waste ; Process of treating —— with the object of rendering it capable of industrial application. J. Basler et Cie. Fr. Pat. 390,637, Aug. 3, 1907.

The process consists in mixing the rubber waste with an oxidising agent and heating the mixture at a temperature of 150°—200° C. As oxidising agents the following are mentioned: oxygen, ozone, hydrogen peroxide, nitric acid, nitrates, chlorates, permanganates, chromates, and aromatic nitro-derivatives.—A. S.

Rubber ; Removal of the uncombined sulphur from vulcanised ——. G. Koeber and V. Scholz. Ger. Pat. 202,130, Nov. 11, 1906.

Solutions of vulcanised rubber are treated with liquids in which the sulphur only is insoluble. For example, the rubber is dissolved in twice its weight of carbon bisulphide, and warmed for ten hours under pressure in an autoclave. The mineral matter is then filtered off, and the solution evaporated, the residue being treated with ether or benzene, which only dissolves the rubber. The solution is then evaporated to recover the rubber and the solvent.—T. F. B.

XIV.—TANNING, LEATHER, GLUE, SIZE.

Myrobalans in extract manufacture. J. Wladika. Gerber, 1908, **34**, 250—251, 265.

An account is given of the reasons why myrobalans has been employed in the manufacture of mixed extracts with quebracho and other materials. The extent to which this is desirable is discussed, together with various precautions necessary in the actual manufacture.—H. G. B.

Sumac and myrobalans ; Extraction of ——. C. Eachus. J. Amer. Leather Chemists Assoc., 1908, **10**, 297—301.

The final report of the Committee of the American Leather Chemists' Association is given, and results recorded that have been obtained with experimental methods of extraction for analysis. It is found that if extraction be made with a reflux condenser, even for only part of the time, distinctly higher results are obtained for "soluble solids" and "tannin," both with sumac and myrobalans. The use of the Procter percolator for sumac extraction is advised, but the employment of 4 hours percolation and 4 hours reflux extraction is suggested for other materials. —H. G. B.

Tannin reaction and its application ; A ——. E. Stiasny. Collegium, 1908, 419—420, 422—427.

The author refers to his previous work on the action of formaldehyde on tannins (this J., 1906, 275) in which it is shown that catechol tannins are completely precipitated by heating their solutions with formaldehyde and hydrochloric acid, but that pyrogallol tannins are only incompletely precipitated by this reaction, some indeed giving no precipitate at all. In spite of the observations of Jean and Fraboti (this J., 1907, 213, 702), of Etchegorry (Revue internat. Falsif., 1907, 114) and of H. Franke (this J., 1907, 160), he reaffirms this view and supports it by experiment. To 50 c.c. of a tannin infusion of about 0·4 per cent. strength, 10 c.c. of 40 per cent. formaldehyde solution and 10 c.c. of hydrochloric acid (1 : 1) solution were added, and the mixture was heated under a reflux condenser for 10 minutes, then cooled and filtered. The precipitate was collected in a Gooch crucible, washed with water, dried at 105° C. and weighed. The filtrate was tested for tannin by means of gelatin-salt, iron alum, and lime solutions. The author concludes that this reaction is useless for the quantitative estimation of catechol tannins, partly because certain non-tannins are precipitated by formaldehyde in this way, and partly because certain pyrogallol tannins are also partially precipitated. Although the reaction therefore has only a qualitative significance, it can be employed to detect the presence of pyrogallol tannins in mixtures, *e.g.*, the detection of myrobalans in quebracho extract. A more important application of this reaction is its use in determining whether catechol or pyrogallol tannins are more quickly absorbed by hide when in mixture. The author estimates the "soluble solids" and the amount of formaldehyde precipitate which can be obtained from a mixed liquor, and states the latter in percentage of the former. He then places pieces of pelt in the liquor and repeats his determinations from time to time. On applying this to mixtures of pine bark and oakwood extracts, of pine bark and chestnut extracts, and of quebracho and oakwood extracts, it was found in each case that the percentage ratio of formaldehyde precipitate to the soluble solids decreases rapidly, showing that the catechol tannins are more freely absorbed by hide than the pyrogallol tannins. Another application of this reaction is to compare the rates of diffusion of catechol and pyrogallol tannins. Various mixtures of such tannins are dialysed and the percentage of formaldehyde precipitate on the soluble solids found as before, from which conclusions are drawn as to the respective diffusive powers of the tannins. It is further recorded that with phenols and phenolic acids the amount of formaldehyde precipitate obtainable decreases as the phenolic groups are methylated.—H. G. B.

Tannin analysis. J. Paessler. Collegium, 1908, 383—388, 389—396.

The second report of the commission of the German Section of the Internat. Assoc. of Leather Trades Chemists contains a record of further comparative experiments with various hide powders when used by the shake method on the common tannin extracts.—H. G. B.

Patents.

Hide; Transformation of —— in order to render it capable of replacing whalebone and other products. A. Vantajol. Fr. Pat. 391,002, June 9, 1908.

Strips of hide are immersed in a bath of water at 50° C., and after half-an-hour, the temperature is allowed to fall gradually to 45° C., the strips remaining in the bath for a further 1½ hours. This process is repeated twice, a suitable colouring matter being added, if desired, to the third bath. After the hide has been in the third bath for two hours, the water is allowed to cool to the ordinary temperature, and after a further 5 hours, the hide is withdrawn and dried. During the drying process, the hide is kept stretched and "set out" with a "sleeker" from time to time.—A. S.

Tanning skins and obtaining leather; Process and apparatus for ——. Internat. Process Tanning Co. Fr. Pat. 391,170, June 13, 1908.

The skins are suspended on transverse bars in a vat containing the tan-liquor. On or near the bottom of the vat are tubes or coils through which air is delivered with the object of agitating the liquor and ensuring that all parts of the skin are uniformly impregnated. A weak tan-liquor is used at first, and its strength is gradually increased towards the end of the tanning process.—A. S.

XV.—MANURES, &c.

Patents.

Fertilising compounds. J. T. M. Fraser-Hewett and C. L. Watchurst, London. Eng. Pat. 22,180, Oct. 8, 1907.

The fertilisers are prepared by mixing varying proportions of petroleum, resin, lime, and absorbent material; the dry product is then mixed with well known fertilisers such as bone-meal, fish guano, kainite, sodium nitrate, etc. The term "petroleum" includes petroleum refuse, astatki, paraffin or shale oils, and the resin may be replaced by resin oil, pitch, coal tar, or wood tar. The absorbent material used may be dry clay, fossil meal, bone dust, tan, peat, sawdust, etc. Charcoal and coal dust may also be added.—W. P. S.

Insecticide fertiliser. E. C. R. Marks, London. From F. G. Dokkenwadel, Coshocton, Ohio, U.S.A. Eng. Pat. 8779, April 22, 1908.

See U.S. Pat. 888,148 of 1908; this J., 1908, 635.—T. F. B.

XVI.—SUGAR, STARCH, GUM, &c.

Cane sugar [sucrose]; Inversion of ——. Y. Osaka. J. Coll. Science, Imp. Univ., Tokyo, 1908, **25**, Article 1.

The author prepared solutions of sucrose containing 80, 70, 60, and 50 grms. respectively per 100 c.c. Portions of the original solutions and of the solutions after dilution (5 c.c. diluted to about 20 c.c.) were inverted with 2·5-*N* hydrochloric acid under identical conditions at 25° C., and the rotatory powers of the inverted and of the original solutions were determined. In all cases, under the experimental conditions, inversion was practically complete with the diluted solutions, but incomplete with the original concentrated solutions, the degree of inversion in these latter cases ranging from 98·9 per cent. with the solution containing 80 grms. to 99·8 with that containing 50 grms. of sucrose per 100 c.c. An experiment was also made on the reverse reaction, *viz.*, the formation of sucrose from invert sugar. A solution was prepared containing 20 grms. of sucrose per 50 c.c. together with hydrochloric acid up to concentration of 0·5-*N*. When inversion was complete, 5 c.c. of the solution were withdrawn, weighed, treated with sodium acetate, diluted to 25 c.c., and polarised. Another 5 c.c. were weighed, air passed over until the volume was reduced to one-half, and the solution then again weighed, diluted to 25 c.c., and polarised. The results obtained indicate that in concentrated solutions, it is very probable that a reversion to sucrose from its hydrolytic products takes place.—A. S.

Sucrose; Accelerating influence of magnesium salts on the hydrolysis of —— by invertase. J. Tribot. Compt. rend., 1908, **147**, 706—707.

Invertases of successive degrees of purity were prepared by dissolving the original enzyme in water, precipitating with absolute alcohol, and drying in a vacuum, the process being repeated with a portion of each product. The enzymes were then used to hydrolyse sucrose under identical conditions: in addition the amount of ash and of magnesium oxide which they contained was determined. The results are summarised in the following table:—

Invertase.	Per cent. of ash.	Per cent. of MgO.	Per cent. of sugar hydrolysed in 1 hour.
Commercial ...	45·76	1·8	10·9
A	12	10·9	9·9
B	7·52	6·9	9·3
C	3·48	3·17	7·8
D	1·94	1·83	4·5
E	0·78	0·69	2·1

The mineral content of the purified enzymes decreases with that of magnesium oxide; all the preparations contain traces of iron and calcium. The author concludes that the more the enzyme is purified, the less active it is, and that invertase is most active in presence of the largest quantities of magnesium oxide.—E. F. A.

Maltose, pure; Preparation of ——. J. L. Baker and F. Day. Brit. Assoc. Rept., 1908, through Analyst, 1908, **33**, 393—394.

In view of the increasing demand for pure maltose in analytical and physiological chemistry, the authors have devised the following process for the preparation of this carbohydrate. To a 3 to 4 per cent. starch-paste or soluble starch solution, the precipitated diastase from barley is added in such proportion that for every grm. of starch the enzyme of 1 grm. of barley is present. The conversion is carried out at 50° C. for three hours, and allowed to run on in the cold for another twelve hours. At this stage 60 per cent. of maltose is present, the remainder of the product consisting of *a*-amylo-dextrin (J. L. Baker, this J., 1902, 1087). The conversion product is evaporated to a thin syrup, and poured into such a volume of cold 95 per cent. alcohol that the resulting strength of the alcoholic solution is 85 per cent. The precipitated *a*-amylodextrin is removed and the alcohol distilled from the solution. On standing, maltose of a high degree of purity separates. It may be further purified by recrystallising from a small quantity of water. The preparation of maltose according to these conditions is very easy, since the conversion products only contain one dextrin, which is insoluble in alcohol; whereas when malt diastase acts on starch, the separation of dextrins of low molecular weight from the maltose frequently presents considerable difficulties.

Honey; Distinction between natural and artificial —— and detection of sucrose and its decomposition products. I. Fiehe. *See* XVIII*A*.

Resins [and gums]; Tropical —— as rosin substitutes. P. Klemm. *See* XIX.

Sugar production of Queensland. Board of Trade J., Nov. 5, 1908. [T.R.]

The output of sugar last year established a record for the State, due to the very high sugar content of the cane cut; yet both the areas cultivated and quantities crushed were smaller than in the two immediately preceding seasons, whilst the tonnage of cane was also below that for 1906. The area under cane was 126,810 acres in 1907, against 133,284 in the previous year. In the area from which canes were crushed there were also decreases of 3,810 and 1,709 acres in 1907 as compared with 1906 and 1905 respectively. The tonnage of cane cut last year exceeded that for 1905 by 249,283 tons, but was 63,752 tons below the return obtained in 1906. The satisfactory feature of the season's crop was the output of 188,307 tons of sugar, the returns for the four previous years being—1903, 91,828 tons; 1904, 147,688 tons; 1905, 152,722 tons; and 1906, 184,377 tons.

Patents.

Sugar [from wood]; Apparatus for producing a ——. Comp. Ind. des Alcools de l'Ardèche. Fr. Pat. 391,057, June 9, 1908.

The apparatus is intended for use in the conversion of woody fibre into sugar by means of sulphurous acid, and consists of a cylindrical vessel surrounded by a steam-jacket; steam tubes also pass through the cylinder. The whole is mounted so that it can be rotated, and the mixture of sawdust and sulphurous acid is placed in the cylindrical part of the apparatus. The cylinder and tubes are constructed of steel.—W. P. S.

Crystallisation of all kinds of solutions at rest. Fr. Pat. 390,976. *See* I.

Diffusion apparatus. Fr. Pat. 390,629. *See* I.

XVII.—BREWING, WINES, SPIRITS, &c.

Colour-malt roasting; Technology of ——. G. Jakob and E. Rausch. Z. ges. Brauw., 1908, **31**, 381—385, 394—398, 406—410, 428—431, 442—445, 456—459.

The roasting of colour malts takes place between very narrow limits of temperature, *viz.*, 220°—225° C.; below this range of temperature the desired change is very slow, whilst above it the roasting becomes so rapid as to be uncontrollable. The result to be aimed at is the development of a maximum of colour with a minimum loss of extract. The best results in every respect are afforded by the roasting of partially kilned malt, taken from the upper floor of the German type of two-floor kiln. Next to this kind of malt, a pale low-cured malt gives the most favourable results. The undesirable effects, which the curing process has upon malts intended for roasting, are attributed to a dehydration, *i.e.*, a loss of porosity, of the endosperm cells, which takes place during the curing stages of kilning. It is best therefore to take the malt from the kiln at a stage when the culms can be easily removed and the grain contains 7—8 per cent. of moisture. The presence of this moisture is of no value in itself, but is a guarantee that the colloids of the malt are still in a sensitive condition, which cannot be re-established by the subsequent wetting of a fully dried malt. The malt selected for roasting purposes should be of the very best quality, since a high colouring power can only be attained with malts very rich in extract, and the development of colour is accompanied by a loss of extract. Colour malts prepared from malts of poor quality show not only a low colouring power and low yield of extract, but are very deficient in aroma. Colour malts must not be allowed to absorb moisture nor be exposed to dust during storage. Long storage and consequent "slackness" are very deleterious. Colour malt also requires special treatment in mashing, and unsuitable conditions may easily give an inferior product from this class of malt of the best quality.—J. F. B.

Malt and malt extracts; Determination of diastatic power of ——. C. Wirth and C. J. Lintner. Z. ges. Brauw., 1908, **31**, 421—425.

The authors have made experiments with a view to the simplification of Lintner's method for the determination of diastatic power. In the first place they endeavoured to obtain a means for expressing the liquefying as well as the saccharifying power of the diastase, but no satisfactory results were obtainable with starch paste, owing to the lack of proportionality. The authors have adopted Ford and Guthrie's method for neutralising preparations of soluble starch, *viz.*, by sodium bicarbonate in presence of "rosolic acid" as indicator. The saccharification of a 10 per cent. starch solution was very much more rapid than that of a 2 per cent. solution. At a temperature of 20° C., complete proportionality was not maintained for one hour; at higher temperatures, the falling off of the diastatic activity was far more rapid. Owing probably to secondary reactions induced by other constituents of the malt extract, a strict proportionality between the quantity of diastase taken and that of the maltose produced could only be maintained by working at a comparatively low temperature, and a temperature of 20° C. has been selected as affording the most direct measure of the quantity of diastase present. With a 2 per cent. starch solution, the law of proportionality holds good up to a cupric-reducing power of 35 (calculated as maltose) and the divergence is not great up to 48. On their observations, the authors have based a new method for the determination of diastatic power:—The malt extract is prepared by infusing 25 grms. of malt grist with 500 c.c. of water at the ordinary temperature for 6 hours; a longer infusion is not advisable. Of the clear, filtered extract, 2 c.c. are taken for green malt, 4 c.c. for pale, and 8 c.c. for dark. For the saccharification, 100 c.c. of a 2 per cent. neutral starch solution are placed in a marked flask together with the requisite quantity of malt extract, and allowed to remain for exactly half an hour at 20° C. Ten c.c. of $N/_{10}$ sodium hydroxide are then added and the whole is diluted to 150 c.c. The maltose is then determined volumetrically against 5 c.c. of Fehling's solution, using Ling and Rendle's ferrous thiocyanate indicator. This result serves as a preliminary indication. For the exact titration, 5 c.c. of the sugar solution are placed in each of 6 tubes, and measured quantities of Fehling's solution, differing by 0·05 c.c., calculated from the preliminary titration, are added to each. The heating is performed according to Wein's directions ("Tabellen zur quantitativen Bestimmung der Zucker-arten"), and the final result is obtained from his table No. XIII. The diastatic power is represented by the number of grams of maltose produced per 100 grms. of malt. According to this method, pale malts show diastatic powers ranging from 159 to 343, and dark malts from 67·7 to 92·9. Corrections should be made for the reducing power of the malt extract. The values on the new scale of diastatic powers, when multiplied by 0·27, give the values on the old scale.
—J. F. B.

Malt enzymes; Action of —— on the enzymes of ungerminated cereals. J. L. Baker and H. F. E. Hulton. Brit. Assoc. Rept., 1908, through Analyst, 1908, **33**, 392—393.

In a previous communication (this J., 1908, 368) the authors showed that, when a flour is doughed with yeast and water, the evolution of carbonic acid under standard conditions bears no relation to the diastatic activity of the flour as expressed in degrees Lintner. When, however, a minute quantity of malt is added to the dough, the volume of gas evolved during the fermentation is increased in inverse ratio to that originally given off; and in those cases where the original gas production was low, it is very largely increased. J. S. Ford and J. M. Guthrie (this J., 1908, 389) have shown that the filtrate obtained by digesting an aqueous suspension of flour in presence of papain is enabled to saccharify a greatly increased quantity of soluble starch. This increased activity is attributed to the protective action exerted by the papain on the diastase, which is apparently much weakened by water alone, and also to the probable liberation of otherwise insoluble enzyme. In view of this work, it appeared to the authors probable that the increased gas production obtainable from dough by the use of malt might be due to the proteolytic enzyme known to exist in malt, which, by liberating more diastase, or owing to its protection of that already present, renders more of the enzyme available for the hydrolysis of the starch in flour.

If barley or wheat, when digested with malt—a substance which contains both a starch-liquefying and a proteolytic enzyme—were to yield a filtrate more diastatic in its activity than that obtainable from barley or wheat alone, then presumably this enhanced activity of the extract might be due to the action of the proteolyst in the malt upon the enzymes of the barley or wheat. The nature of the increase was investigated by comparing the action upon soluble starch and starch-paste; for liquefying diastase, if liberated, could not be supposed to increase the amount of maltose produced from soluble starch, but would materially aid the saccharification of starch-paste; on the other hand, if saccharifying diastase were the one formed, then the conversion of starch-paste would probably not be facilitated, but soluble starch would be further saccharified and yield more maltose. A convenient method of experiment was the extraction, in presence of each other, of malt and barley in equal proportions, separate extractions being made of both of these substances alone, and their activities measured in terms of the maltose produced. It was found that the activity of the extract from the mixture was greater than the mean of the actions of its constituents, and this was taken to be evidence that fresh enzyme was liberated. This enzyme is one that facilitates liquefaction of starch to a far greater degree than saccharification of already soluble starch.

Asporogenous budding fungi, occurring in the neighbourhood of breweries; Studies on ——. *IV.* H. Will. Zent. Bakt., Abt. II., 1908, **21**, 386; Z. ges. Brauw., 1908, **31**, 528—531. (See also this J., 1903, 814; 1906, 490; 1908, 701.).

The author has continued his examination of the various yeast-like fungi previously described. On studying the behaviour of these organisms towards different sugars, it is found that, on a large scale, results are obtained which differ from those yielded by Lindner's microscope slide method. The latter method is, indeed, incapable of deciding whether an organism is able to ferment or whether a sugar is fermentable, in cases where the fermentation is slow and the amount of alcohol formed small. When these organisms ferment sugar, they also produce acid, which is apparently not formed at the expense of the alcohol. The inhibiting action of alcohol on the growth of the various fungi in different nutrient media was also investigated. In peptone solution or yeast water, growth is prevented by 4—6 per cent. by vol. of alcohol, whilst with pure-yeast beer, 8—9 per cent. is required. In yeast water alone, growth is at first more rapid than when alcohol is present, but later on the cultures containing alcohol become considerably more vigorous than the others and yield a more marked ring and membrane formation. With one of the torula organisms, alcohol is utilised as a food-material in the later stages of development. The growth of the organisms is also prevented by organic acids in various proportions. In small amounts, citric, malic, succinic, and lactic acids are assimilated by the torulæ, and the same is the case with acetic and tartaric acids, which are, however, only very slowly decomposed. Many of the torulæ form yellow, yellowish-green, or orange-yellow colouring matters, which in some cases exhibit fluorescence, and with one species the giant colonies are red; the production of colouring matter, which usually surrounds the colonies, is most marked in the dark. No diastatic or lipolytic enzymes are formed by the organisms; hydrogen peroxide is, however, decomposed by them, the action taking place more readily when the cells are simply suspended in water than when they are previously ground with quartz sand. The shapes of the cells formed by the various torulæ under different conditions were also studied.—T. H. P.

Sucrose; Accelerating influence of magnesium salts on the hydrolysis of —— *by invertase.* J. Tribot. *See* XVI.

Maltose, pure; Preparation of ——. J. L. Baker and F. Day. *See* XVI.

Patents.

Alcoholic and other liquids; Apparatus for purifying and ageing —— *and for separating the volatile constituents of liquids.* F. W. Golby, London. From H. D. Laidlaw, San Francisco. Eng. Pat. 21,730, Oct. 1, 1907.

The apparatus consists of an air-tight tank, from the top of which a pipe leads to a worm in a chamber which may contain either a cooling or heating fluid. The worm is attached to a cylindrical chamber, having a conical bottom terminating in a pipe and draw-off cock. A pipe connects this chamber to a vacuum chamber in the middle of which is a fume arrester. The gases are exhausted by means of a single-acting pump connected through a pipe having a check valve. The pump discharges the gases into a heating chamber in which they are heated by a steam coil, and a pipe leads from this to the bottom of the air-tight tank, where it is connected to a number of radial arms having small openings therein. The process consists of a series of repeated distillations: by it such substances as fusel oil are readily extracted from whisky.—E. F. A.

Brandy; Apparatus for the continuous distillation of fine ——. E. A. Barbet. Second Addition, dated July 31, 1907, to Fr. Pat. 376,352, June 9, 1906 (this J., 1907, 1024, 1250).

The apparatus is the same as that described and illustrated in this J., 1907, 1024. The liquid condensing in the part of the apparatus marked H (*loc. cit.*) is returned to the plate-column, D, where the aldehyde is removed with the acid gases of the wine. The esterified liquid coming from the rectifying plate-column, F, is conducted to a final heating vessel; this is rectangular in shape and is divided into five communicating compartments by means of partitions, a steam pipe being provided for heating the liquid. The vapours are passed through a chamber surrounded by hot water, where the less volatile portions are condensed and returned to the heater, whilst the uncondensed vapours are conducted to a refrigerator. The liquid which is not distilled from this final heating vessel is returned to the column, D.—W. P. S.

Carbonating liquids; Process and apparatus for ——. Eng. Pat. 22,932. *See* XVIII A.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

(*A*.)—FOODS.

Honey; Distinction between natural and artificial ——, *and the detection of sucrose and its decomposition products.* I. Fiehe. Chem.-Zeit., 1908, **32**, 1045—1046.

The ethereal extract of artificial honey forms a residue on evaporation which gives an intense red coloration with resorcinol and hydrochloric acid (resorcinol 1·0 grm., hydrochloric acid 100 grms. of sp. gr. 1·19). The coloration is never shown by natural honeys: it is due to the ether-soluble decomposition products formed by the action of acids and heat on lævulose and is therefore given by any sucrose or invert sugar product which has been heated with acids. Neither dextrose, galactose, maltose, nor lactose show the coloration under like conditions. The method is applicable for quickly detecting the presence of sucrose in other sugars. In milk for example it may be detected by warming the milk for 10—15 minutes with a few drops of acid, extracting with ether, and applying the resorcinol reagent. The test may also be made by bringing a layer of the concentrated ethereal extract in contact with a layer of the resorcinol reagent in a test tube; in positive cases a rose red ring results.—E. F. A.

Casein; Products of hydrolysis of ——. Z. H. Skraup. Monatsh. f. Chem., 1908, **29**, 791—798.

The author has examined the non-volatile residue obtained by fractionating the products of the hydrolysis of casein by hydrochloric acid, after their esterification by E. Fischer's method. Three diketopiperazines, derived from leucine and valine, have been isolated, all apparently of the formula, $C_{11}H_{20}N_2O_2$; two are lævo-rotatory, $[\alpha]_D = -53°$ and $[\alpha]_D = -17{\cdot}6°$ respectively, and the third is almost inactive; their respective melting points are 289°, 250°, and 275° C. Besides these, only leucine and butyl- and amylamine were detected, and a base, $C_4H_{11}N$, probably resulting from the decomposition of valine.—F. Sodn.

Animal fats; Detection of some —— *in admixture with other animal fats.* E. Polenske. *See* XII.

Malt enzymes; Action of —— *on the enzymes of ungerminated cereals.* J. L. Baker and H. F. E. Hulton. *See* XVII.

Patents.

Carbonating liquids; Process and apparatus for ——. R. W. Webster, L. Chew, and H. J. West and Co., Ltd., London. Eng. Pat. 22,932, Oct. 17, 1907.

The improved process for charging liquids with "carbonic acid or other gas" consists in saturating the liquid with gas at a comparatively high temperature and pressure, cooling the liquid to a lower temperature without reducing the pressure, and immediately bottling. An apparatus is also claimed consisting of a closed receiver immersed in a cooling medium, and means for introducing the liquid to be carbonated, under pressure, through an atomising nozzle into the receiver.—G. W. McD.

Grape juice and other fruit juices; Process for clarifying and preserving ——. P. de Mestral, F. Simonard, and B. de Plazanet. Fr. Pat. 390,505, May 23, 1908.

The freshly-pressed juice is cooled, decanted from any insoluble matter, again cooled, and filtered through sterilised filters. The filtered juice is collected and stored in sterilised receptacles. The cooling may be effected by immersing frozen blocks of the juice in the portion of juice to be treated, or closed metallic vessels, containing ice or a freezing mixture, may be immersed in the juice.—W. P. S.

Separator for liquids [*milk*]. Albaugh-Dover Co. Fr Pat. 390,615, May 26, 1908.

The separator, which is suitable for separating cream from milk, contains a separating drum with pivoted blades shaped to nest into each other, and perforated at the ends furthest from the axis. The blades are corrugated and it is claimed that their shape and construction increase the speed of separation and the efficiency of the operation.—C. J. G.

Flour; Process of bleaching ——. W. Ramsay. Fr. Pat. 391,562, June 22, 1908. Under Int. Conv., July 3, 1907.

See Eng. Pat. 15,340 of 1907; this J., 1908, 872.—T. F. B.

Food product from cereals; Process for preparing an easily digestible ——. A. de Crignis. Fr. Pat. 391,595, June 24, 1908.

See Eng. Pat. 1041 of 1907; this J., 1907, 1212.—T. F. B.

Salt of sodium and lactalbumin soluble in water; Process for obtaining a pure, neutral ——. J. A. Wülfing. Fr. Pat. 391,642, June 25, 1908.

See Eng. Pat. 6179 of 1908; this J., 1908, 1079.—T. F. B.

(*B.*)—SANITATION; WATER PURIFICATION.

Patents.

Household refuse; Process for obtaining finely divided slag from the ash obtained by burning ——. H. Stein. Fr. Pat. 391,059, June 9, 1908. Under Int. Conv., Feb. 27, 1908.

Ash from household refuse is transferred, while still red-hot, to a furnace in which it is fused by the addition of coke and fluxes. The slag obtained is granulated as usual, and used for making artificial stone, concrete, etc. —A. G. L.

Water and foul liquids; Purification and filtration of ——. A. Vogelsang, Dresden, Saxony. Eng. Pat. 3357, Feb. 14, 1908.

See Fr. Pat. 383,947 of 1907; this J., 1908, 417.—T. F. B.

(*C.*)—DISINFECTANTS.

Patents.

Trioxymethylene; Process and apparatus for disinfecting by means of ——. E. Huwart, Liége, Belgium. Eng. Pat. 27,646, Dec. 14, 1907. Under Int. Conv., Dec. 14, 1906.

The invention has reference to an improved process for the production of a disinfecting mixture of formaldehyde and steam. The combustion gases which heat the water are cooled by the steam generated, so that a gaseous mixture is obtained having a temperature high enough to vaporise trioxymethylene but too low to cause the vapour to take fire. In the apparatus, an open tubular water boiler is mounted between the burner and the recipient containing the trioxymethylene: the combustion gases pass through the boiler tubes and mix with the steam generated, and this mixture acts upon the trioxymethylene.—E. F. A.

Casein derivatives or compounds [*antiseptics*]; *Manufacture of* ——. J. Wetter, London. From Knoll und Co., Ludwigshafen on Rhine, Germany. Eng. Pat. 5087, March 6, 1908.

Oxidised and chlorinated derivatives of casein, which possess strong antiseptic properties, are obtained by treating solutions of casein in alkali hydroxides or carbonates with alkali hypochlorites or chlorine, the solutions being kept alkaline, or the reaction stopped as soon as the solution becomes acid; the new compounds are precipitated from the resulting solutions by treatment with acids. Alcoholic or alkaline solutions of these new casein compounds may be treated with tannic acid; addition of acid precipitates tannin compounds of the casein derivatives; these tannin compounds are also applicable as antiseptics.—T. F. B.

Oxygen; Solid product, soluble in water, containing "condensed" ——. Fr. Pat. 390,520. *See* VII.

XIX.—PAPER, PASTEBOARD, &c.

Jute ; " Heart damage " in baled ——. C. F. Cross and E. J. Bevan. Report to Indian Govt., 1908.

" Heart damage " is a fault which is occasionally found at the centre of commercial bales of jute when they are opened after shipment to this country. Its extreme form is represented by a total disintegration of the fibre, which breaks down under slight pressure to a fine dust. The authors have examined samples of this disintegrated fibre comparatively with the undamaged portions of the same strands. Microscopically, the appearance of the fibrous dust closely resembles that of fibre disintegrated by the action of mineral acids ; no penetration of the tissues by the mycelia of fungus growths was observed, the fractures were sharp, and there was no tendency to resolution of the bundles into their constituent ultimate fibres. An elementary analysis of the sound and damaged fibres showed no difference in ultimate composition, but the determinations of the various chemical characteristics showed considerable differences (see table) :—

		Sound fibres.	Damaged fibres.
		per cent.	per cent.
Constituents soluble in water		1·1	11·5
Soluble in boiling 1 per cent. sodium hydroxide	5 mins. boiling	11·0	23·3
	60 mins. boiling	14·0	58·3
Furfural		7·8	5·8
Phloroglucinol absorption		4·2	8·0
Chlorination reaction (hydrogen chloride formed)		8·9	10·2
Cellulose from chlorination		75·0	62·6

The aqueous extract had a powerful reducing action on Fehling's solution ; it gave an osazone with phenylhydrazine in the cold, corresponding with a parent substance, $C_{12}H_{18}O_{10}$, with two contiguous carbonyl groups. After hydrolysis with acid, the aqueous extract gave, in addition to the above osazone, a further yield of glucosazone on heating with phenylhydrazine. The authors describe the chemical result of " heart damage " as a profound hydrolytic degradation of the lignocellulose complex as a whole. The changes take place in both lignone and cellulose components simultaneously and equally, no selective separation of either component being observed. No tannins are produced, but the phloroglucinol reaction and the formation of an osazone in the cold, point to the opening up of carbonyl groups in the lignone residue as the result of the hydrolysis, whilst the cellulose portion of the molecule is converted partly into soluble carbohydrates, readily resolved into glucose by acids, and partly into forms which are extremely susceptible to the action of boiling alkali. The decrease in the furfural " constant " may indicate attendant deoxidising conditions. The authors suggest that the " heart damage " is probably caused by the activity of bacteria developed under anaërobic conditions in the tightly pressed bale. In connection with this inquiry and the causative influence of damp packing, bales were shipped from India containing known quantities of excess moisture, sugar solutions, and antiseptics. In no case, however, was " heart damage " developed, and bales containing up to 25 per cent. of moisture in excess of the normal arrived here in good condition. After prolonged incubation, with the further addition of moisture, moulds and other aërobic growths developed on these samples superficially, and ultimately attacked the fibre, but this attack bore no resemblance to the very profound and specific form of damage under investigation. The use of a formaldehyde spray, in the proportion of 14 lb. of " formalin " per ton of fibre, when making up the bales, is suggested as an efficient means for preventing bacterial changes in transit.—J. F. B.

Cellulose ; Action of ammonium persulphate on ——. *II. A new test for oxycellulose.* H. Ditz. J. prakt. Chem., 1908, **78**, 343—364. (Compare this J., 1907, 988, 1026.)

The author has observed that when oxycellulose is placed in Nessler's solution at the ordinary temperature, it is coloured brown at first, but rapidly assumes a pale or dark grey colour, due to the reduction of the mercury salt. The intensity of the colour is proportional to the intensity of the yellow colour which is developed on heating the oxycellulose with alkalis. Cellulose and hydrocellulose do not react with Nessler's solution unless they contain traces of oxycellulose, in which case a slight greyness may be developed after a long time. The reduction of Nessler's solution by oxycellulose may be attributed to its aldehydic function : all aldehydes react in the same way, and Nessler's reagent may be used as an extremely delicate test for formaldehyde. Continuing his investigations on cellulose peroxide (*loc. cit.*), the author records the fact that hydrogen peroxide does not yield a peroxide with cellulose when heated with it in acid solution. When cellulose is heated with acidified ammonium persulphate, an irritating odour of " active oxygen " is observed. The gases thus evolved contain considerable quantities of carbon dioxide and a gas which liberates iodine from potassium iodide. Neutral ammonium persulphate, when heated alone, yields none of this latter gas, and acidified persulphate yields much smaller quantities than when cellulose is present. It would appear that cellulose peroxide is an unstable intermediate product, which largely breaks down at the moment of its formation with the liberation of " active oxygen." Zinc, tin, and antimony also yield large quantities of " active oxygen " when heated with acid ammonium persulphate. Very little of this active gas is obtainable with potassium persulphate. The principal product of the action of acid ammonium persulphate on cellulose is oxycellulose and the author discusses whether the cellulose peroxide is an immediate peroxide of the alcohol (cellulose) or of the aldehyde (oxycellulose).—J. F. B.

Resins [*and gums*] *; Tropical* —— *as rosin substitutes* [*for paper sizing*]. P. Klemm. Wochenbl. Papierfabr., 1908, **39**, 3201—3203.

Three vegetable products have been examined as to their suitability as rosin substitutes for paper sizing :—(1). *Exudation from Acacia suma from Togo.*—This was a true gum of the arabic class, soluble in water, not precipitated by alum, and therefore of no use for the engine sizing of paper. It occurred as clear lumps of a brownish colour, and might take a place among the commercial gums. (2). *Resin of Daniella thurifera, fam. Cæsalpinaceæ from Togo.*—This was a saponifiable resin, consisting of mixed pale and dark-coloured lumps. The pale resin required 4·6 per cent. and the dark 5·5 per cent. of sodium hydroxide for complete saponification. A paper-maker's size was prepared by boiling with 5 per cent. of soda ash and 50 per cent. of water, a certain amount of unsaponifiable matter being skimmed off. Papers containing 2·5 per cent. of the resin were sufficiently sized to bear ink, whilst papers prepared with 4 per cent. were quite hard-sized. The presence of the dark brown lumps in the crude sample would, however, preclude its use for white papers, and the pale lumps would have to be picked out for this purpose. (3). *Resin of Canadium Mansfeldi.*—This is an unsaponifiable resin and therefore useless for paper sizing. It is a dull brown, partly porous product, very hard and not very brittle. It is only slightly soluble in alcohol, ether, petroleum, and benzene, but readily soluble in carbon tetrachloride and turpentine. It melts at a higher temperature than colophony rosin to a clear brown glass. In the author's opinion it should have a very high value for varnish-making.—J. F. B.

Cellulose production of Sweden. Board of Trade J., Nov. 12, 1908. [T.R.]

The production of cellulose in Sweden this year is estimated at 450,000 tons of sulphite and 108,000 tons of sulphate, as compared with 383,000 tons of the former and 78,000 tons of the latter produced in 1907.

Wood pulp from Chile. Paper and Pulp, Nov., 1908. [T.R.]

Over 2,000,000 acres of the Chilean forests consist of timber suitable for the production of wood pulp. Recent experiments made with Chilean larch and *coihue* woods furnished samples of wood pulp considered equal to the best coniferous pulp made in Canada and Norway.

PATENTS.

Relief-like effects on paper ; Production of ——. Farbwerke vorm. Meister, Lucius, und Brüning, Höchst a/Main, Germany. Eng. Pat. 10,529, May 14, 1908. Under Int. Conv., June 7, 1907.

THE paper web whilst still in the moist condition on the wire cloth or felt, is impressed with the required pattern by means of rollers which are deeply engraved in relief. In order to obtain coloured effects, dye solution is sprayed on at an acute angle through nozzles ; or the dye is applied by a trailing felt, one end of which dips into a colour bath. By the latter method, only the raised portions of the pattern on the paper are dyed. The paper is finished in the usual manner.—A. B. S.

Copying-paper ; Manufacture of ——. A. P. y and M. P. y Brias, Barcelona. U.S. Pat. 901,824, Oct. 20, 1908.

SHEETS of paper are impregnated with a solution containing glycerin, gallic acid, saponified wax, and honey, and are then calendered. Impressions made in ink are copied by pressing in contact with the prepared paper.—A. T. L.

Sulphonic esters of cellulose ; Process for preparing ——. Act.-Ges. f. Anilinfabr. Ger. Pat. 200,334, Jan. 10, 1907.

ALKALI-SOLUBLE cellulose, obtained by treating cellulosic materials with zinc chloride and hydrochloric acid or with ammoniacal copper oxide, is treated with aryl sulphochlorides in presence of aqueous alkali hydroxide solutions.—T. F. B.

Cellulose esters ; Process of separating —— *from solutions.* L. Lederer, Sulzbach, Germany. U.S. Pat. 902,093, Oct. 27, 1908.

SEE Fr. Pat. 371,356 of 1906 ; this J., 1907, 340.—T. F. B.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, & EXTRACTS.

a-Eucaine and β-eucaine ; Distinctive test for ——. G. Caudussio. Apoth-Zeit., 1908, **23**, 778.

A REAGENT is prepared with 1 grm. of potassium iodide, 0·5 grm. of iodine, and 10 c.c. of water. On adding 2 drops of this to 2 c.c. of a 1 per cent. aqueous solution of *β*-eucaine, a brown colour is obtained, and after 1 or 2 hours, a slight dark brown precipitate, the supernatant liquid being clear. With *α*-eucaine under similar conditions a reddish-brown precipitate is formed, which becomes orange after 1 or 2 hours, the supernatant liquid being coloured lemon yellow by a suspended precipitate. —J. O. B.

Terpenes and essential oils. 97th communication. Synthesis of fenchene, β-pinene, camphene, and camphor from nopinone. O. Wallach. Annalen, 1908, **363**, 1—19.

WHEN nopinone is treated with bromoacetic ester and zinc, a hydroxy-ester is produced, which on hydrolysing and distilling at the ordinary pressure, yields a terpene, This terpene has the sp. gr. 0·863, $n_D = 1·4699$ at 20° C. ; b. pt., 155°—161° C. ; and $[\alpha]_D = +15·93°$. It proved to be identical with *L-d*-fenchene. On oxidation it yielded a hydroxyfenchenic acid melting at 154° C. On repeating the whole series of reactions a lævo-rotatory terpene, *L-l*-fenchene, was obtained, which on oxidation gave the hydroxy-acid melting at 135°—136° C. The nopinolacetic ester used in the above experiments was boiled with an alkali in order to obtain the free acid. Nopinolacetic acid, $C_{11}H_{18}O_3$, melts at 83°—85° C. after crystallising from light petroleum. When this acid is heated on the water-bath with dilute sulphuric acid, *iso*-fenchyl alcohol is formed. By warming nopinolacetic acid on the water-bath with an equal weight of acetic anhydride for a quarter of an hour, *β*-pinene is produced. When *β*-pinene is heated with acetic and sulphuric acids, terpinene and a little *iso*-fenchyl alcohol are produced. The same synthetic *β*-pinene when treated with dry hydrogen chloride in glacial acetic acid, yields a mixture of bornyl chloride and dipentene dihydrochloride. From the bornyl chloride, which was lævo-rotatory, there were successively produced, camphene, *iso*borneol, and camphor.—F. SHDN.

Menthols ; The isomeric ——. R. H. Pickard and W. O. Littlebury. Chem. Soc. Proc., 1908, **24**, 217.

ACCORDING to theory there should be eight optically active forms of 1-methyl-4-*iso*propyl*cyclo*hexan-3-ol corresponding in pairs with four racemic compounds. Of these menthols, one, the ordinary *l*-menthol, occurs in nature, whilst the existence of others has been indicated by the researches of Beckmann, Kondakoff, and Brunel. It is now found that these compounds can be separated by the fractional crystallisation of suitable esters, such as the hydrogen phthalates, hydrogen succinates, etc. By the reduction of thymol with hydrogen in the presence of reduced nickel, Brunel (this J., 1905, 248) obtained a low-melting thymomenthol, which he considered was transformed into an isomeride by conversion into an ester and subsequent hydrolysis. The authors have been able to show that this " *α* " thymomenthol of Brunel contains three (or perhaps all four) of the racemic compounds mentioned above. Up to the present, two of these have been fully characterised and resolved into their optically active components by fractional crystallisation of various alkaloidal salts of some of their acid esters (see Pickard and Littlebury, Chem. Soc. Trans., 1907, **91**, 1974).

Arsacetine (sodium p-acetylaminophenylarsinate) ; Characters and tests for ——. Meister, Lucius, und Brüning. Apoth.-Zeit., 1908, **23**, 582 ; J. Pharm. Chim., 1908, **28**, 359.

SODIUM *p*-acetylaminophenylarsinate, introduced into medicine under the name of arsacetine, is a colourless crystalline powder, soluble in cold water (1 : 10) and in boiling water (3 : 10) ; it is stable in boiling solutions or at 130° C. in an autoclave. A 10 per cent. aqueous solution gives a white precipitate with silver nitrate solution. When arsacetine is heated with a mixture of equal parts of sulphuric acid and alcohol, an odour of ethyl acetate is developed. A 10 per cent. aqueous solution of arsacetine should be clear and colourless, and unaffected by the addition of dilute hydrochloric acid. A 5 per cent. aqueous solution, acidified with 1 c.c. of dilute hydrochloric acid, then treated with 10 drops of sodium nitrite solution and filtered, should give no red colour with an alkaline solution of *β*-naphthol. A similar solution, treated with 20 c.c. of magnesium mixture, should show neither turbidity nor precipitate in two hours. When powdered and dried for 4 hours at 110—120° C., arsacetine should lose about 20 per cent. in weight.—J. O. B.

Eubornyl [bornyl a-bromoisovalerate]. F. Luedy. Pharm. Zentralh., 1908, **49**, 625—626.

EUBORNYL is obtained by brominating chloro*iso*valeric acid and esterifying borneol with the product. It is a syrupy aromatic liquid, soluble in organic solvents ; insoluble in water ; b.pt. 175—178° C., with partial decomposition. It has been introduced into medicine as a sedative.—J. O. B.

Euphylline. P. Dessauer. Apoth.-Zeit., 1908, **23**, 599 J. Pharm. Chim., 1908, **28**, 362—363.

EUPHYLLINE is a compound of theophylline with ethylenediamine. It is a white, crystalline substance, very soluble in water, and is a powerful diuretic.—J. O. B.

Imides of aromatic sulphonic acids; Simple method of preparing ——. T. Haga. J. Coll. Science, Imp. Univ., Tokyo, 1908, **25**, Article 13.

The method consists in reducing aromatic sulphohydroxylamines, preferably with sulphur dioxide. Starting from aromatic amines, these are diazotised and converted into the corresponding sulphinic acids by Gattermann's method (this J., 1899, 675), and the latter are treated with nitrous acid to obtain the sulphohydroxylamines (see Königs, Ber., 1878, **11**, 615). The author describes the application of the method to the preparation of dibenzenesulphimide, and di-*o*- and *p*-toluenesulphimide. The results of a detailed study of the preparation of the first-named compound by reducing an alcoholic solution of dibenzenesulphohydroxylamine with a rapid current of sulphur dioxide indicate that the following two reactions take part in the formation of the sulphimide:—

(1). $(C_6H_5SO_2)_2NOH + SO_2 + H_2O = (C_6H_5SO_2)_2NH + H_2SO_4$;

(2). $4(C_6H_5SO_2)_2NOH + H_2O = 2(C_6H_5SO_2)_2NH + 4C_6H_5SO_3H + N_2O$.

the first one largely preponderating.—A. S.

Salicylic acid and derivatives; Detection of phenol and cresotinic acid in ——. H. Engelhardt and H. W. Jones. Amer. Pharm. Assoc.; Druggists Circ., 1908, **52**, 464—465.

The modified test of Carletti (Boll. Chim. Farm., 1907, [11]) for phenol in salicylates is also available for the detection of cresotinic acids. In the case of salicylic acid, 0·25 grm. is triturated with 5 c.c. of water and transferred to a test-tube without filtering. Two drops of 2 per cent. alcoholic solution of furfural are added and mixed, then 3 c.c. of strong sulphuric acid, without mixing. In the presence of 0·2 to 0·15 per cent. of orthocresotinic acid, a brown colour zone is evident; with traces of phenol, or meta- or paracresotinic acids, a faint violet colour is obtained. Sodium salicylate, 0·5 grm., is dissolved, acidified with dilute sulphuric acid, made up to 10 c.c. with water, then filtered. To 5 c.c. of the filtrate, 2 drops of furfural solution and 3 c.c. of strong sulphuric acid are added as described above. Of 12 samples of synthetic salicylic acid examined, two gave a positive reaction for phenol; as did 4 out of 14 specimens of synthetic and 2 out of 5 samples of natural sodium salicylate. Four out of 8 of the specimens of strontium salicylate tested contained phenol; 5 out of 7 of ammonium salicylate; 3 out of 9 of the lithium salt; one out of two of cinchonidine salicylate, 4 out of 15 of synthetic winter green oil (methyl salicylate), and 3 out of 4 of "natural" wintergreen oil.—J. O. B.

Ether; Action of bromine on ——*: bromo-acetaldehyde.* C. Maugin. Compt. rend., 1908, **147**, 747—749.

When a mixture of ether, bromine, and water is exposed to the light, the liquid is decolorised and it is possible in this way for ether to decolorise double its weight of bromine. The velocity of the reaction varies greatly with the intensity of the light, being very rapid in direct sunlight. When the reaction is finished, two colourless layers of liquid are obtained; the lower aqueous layer contains much hydrobromic acid, and the upper ethereal layer shows aldehydic reactions. In order to determine the nature of the aldehyde, the reaction was carried out in presence of urethane. In this way from 1000 grms. of ether, 300 grms. of water, 90 grms. of urethane, and 160 grms. of bromine, after decolorising by sunlight and treatment with dilute potassium carbonate solution, crystals were obtained which, after recrystallising from dilute alcohol weighed 70 grms. and melted at 146° C. These proved to consist of the condensation product of monobromo-acetaldehyde and urethane, having the formula, $CH_2Br.CH(NH.CO_2C_2H_5)_2$. On distilling with 10 per cent. sulphuric acid the free monobromo-acetaldehyde was obtained in aqueous solution, and was further identified by conversion into the corresponding glycollic aldehyde with barium hydroxide solution, and this again into glyoxal osazone with phenylhydrazine.—E. F.

Formaldehyde; New reaction of ——. F. Todtenhaupt. Chem.-Zeit., 1908, 32, 1045.

On adding formaldehyde to a dilute solution of ammonium sulphide, a white precipitate is formed which settles to the bottom. The liquid remains clear and has lost all smell of hydrogen sulphide. Concentrated solutions of ammonium sulphide and formaldehyde interact immediately, giving a tough colourless transparent mass which is sticky, and can be drawn into threads. This hardens under water to a resinous mass which becomes soft when worked between the hands and can be moulded into any shape. It melts at 45° C.; after heating at 100° C. for a time, and cooling, it becomes transparent. It is soluble in chloroform and hot acetic acid; from the latter solvent it separates, on cooling, in long colourless needles, m.p. 208° C. The latter substance is also formed on warming the soft compound with 20—30 per cent. sulphuric acid.—E. F. A.

Rare earths; Sulphides of ——. *I. Cerium sulphide and its limits of stability.* W. Biltz. Ber., 1908, **41**, 3341—3350.

Cerium disulphide was prepared by heating cerous sulphate in a current of dry hydrogen sulphide. The substance was placed in a porcelain boat in a tube, slowly heated to 580°—600° C., and kept at that temperature for several hours. For the preparation of 2—3 grms., 20 hours heating are required. Pure cerium disulphide, Ce_2S_4, is a dark yellowish-brown powder, which does not appear to be crystalline. It is moderately stable towards the air and cold water. It dissolves slowly in cold dilute acetic acid, and more rapidly on heating, with evolution of hydrogen sulphide, and separation of sulphur. It dissolves easily in cold strong hydrochloric acid (17·7 per cent.); after a time the liquid smells of hydrogen persulphide, and on further standing, sulphur separates. Lanthanum disulphide, La_2S_4, was prepared by a similar reaction; it has a full bright yellow colour, and possesses properties corresponding to those of cerium disulphide. Cerium sesquisulphide, Ce_2S_3, can be prepared by heating the sulphate or disulphide to 750°—800° C. in a current of hydrogen sulphide. It is a powder resembling red lead or cinnabar in colour, which dissolves in dilute acids, without separation of sulphur, and gives a solution free from sulphate. On heating cerium disulphide in a current of hydrogen sulphide, with the temperature increasing from 615° C. to 1350° C., the change from disulphide to sesquisulphide takes place at 720° C., and is not reversible. At 1350° C. the substance begins to melt. The equilibrium is heterogeneous.—F. Shdn

Lupeol. N. H. Cohen. *See* XIII *C.*

Patents.

Borneol esters from turpentine; Process for the preparation of ——. J. Hertkorn, Berlin. U.S. Pat. 901,293, Oct. 13, 1908.

A mixture of turpentine oil with an alcohol and an acid anhydride (*e.g.*, boric anhydride) is heated for several hours at 120°—140° C., the water and uncombined alcohol are then distilled off, and the residue heated at 170°—180° C., the resulting borneol esters being purified.
—T. F. B.

Lecithin from the seeds of lupins, etc.; Process for obtaining ——. H. C. Buer. Ger. Pat. 200,253, July 9, 1907.

Dry lupin seeds are extracted with hot, 96 per cent. alcohol, and the extract is evaporated to a syrupy consistency. The product is shaken with a mixture of 45 parts of alcohol, 40 to 45 parts of water, and ten parts of ether, benzene, or petroleum spirit, until it is completely dissolved. After standing for a long time, the lecithin separates from the solution, and is said to be free from fatty compounds and bitter principles.—T. F. B.

Perfumes having the odour of violets ; Preparation of ——. Metzner und Otto. Ger. Pat. 201,058, Dec. 24, 1905.

Magnesium is caused to act on halogenated acetone, and the product is treated with citral in presence of dissociating agents, such as ether, alcohol, dimethylaniline, etc. When treated with acids, the resulting product yields substances possessing the odour of violets. The intermediate product is different from that obtained when magnesium is replaced by alkaline substances, such as sodamide, barium hydroxide, etc.—T. F. B.

Thebaine derivative ; Preparation of a ——. J. D. Riedel. Ger. Pat. 201,324, Sept. 27, 1907.

By treatment of acid or neutral, aqueous solutions of thebaine salts with ozone, a new substance is obtained, containing two atoms of oxygen more than thebaine ; it is represented by the formula, $C_{19}H_{21}NO_5$. Its melting point is 125°—126° C., and its properties are similar to those of morphine and codeine.—T. F. B.

Arsenic-albumin compounds which also contain sulphuric or phosphoric acid residues ; Preparation of ——. J. Gnezda. Ger. Pat. 201,370, Nov. 27, 1906.

Albuminous compounds are treated, either alone or in presence of indifferent solvents, with sulphuric or phosphoric acids or anhydrides, or with the acid halides, and then with arsenic trichloride ; water is added, and the precipitate is washed until the washings are free from acid. The compounds are stated to possess therapeutic value.—T. F. **B.**

Sulphur in colloidal, solid, stable form ; Production of preparations containing ——. Chem. Fabr. von Heyden. Ger. Pat. 201,371, Nov. 6, 1907.

Ten parts of sulphur are boiled with 100 parts of alcohol, filtered, one part of albumin added to the filtrate, and the whole stirred into 500 to 1000 parts of water. The milky liquid is stated to contain colloidal sulphur ; if it is acidified, the precipitate dissolved by neutralising the acid, and the solution evaporated, stable, colloidal sulphur, soluble in water, is obtained. Other " physical " solvents of sulphur may take the place of alcohol.—T. F. B.

Lecithin free from bitter substances ; Process for obtaining —— *from the seeds of lupins or other leguminous grains.* H. C. Buer. Fr. Pat. 391,009, June 6, 1908.

See Ger. Pat. 200,253 ; preceding.—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Silver acetylide emulsion. C. E. K. Mees and S. H. Wratten. Phot. J., 1908, **48**, 338—339.

Emulsions containing silver acetylide were obtained by adding ammonia to a solution of silver nitrate until the precipitate had re-dissolved, adding soft gelatin to the solution, and then passing acetylene through it. The emulsion was found to be very sensitive to light, but whatever the length of exposure, the exposed and unexposed portions were reduced equally by the usual reducing agents, indicating that no latent image was formed. Similar results were obtained after the emulsion had been heated at 70° C.—T. F. B.

Silver sulphide and sulphate ; Reaction between ——. *Production of dark-coloured glass.* O. Sackur. *See* VIII.

Patents.

Three-colour screens for photography ; Process for the production of ——. J. Bamber, London. Eng. Pat. 3252, Feb. 13, 1908.

Separate sheets of gelatin are dyed violet, green, and orange-red, the dyed sheets are dried and treated with 15 per cent. formaldehyde solution, and again dried. The sheets are now immersed in water until they are fully expanded, and they are then finely ground, preferably at a temperature of about 200° F. The powdered gelatin is elutriated, for example in petroleum spirit, and the three portions of coloured grains mixed in such proportion as to present a neutral grey tint by reflected light. The mixture is spread closely on a celluloid or glass sheet, then coated with a solution of celluloid and a resinous gum, and the whole is dried. If the screens be now exposed to the air, each grain will absorb sufficient moisture to cause it to expand, and thus a continuous film of coloured gelatin is formed. Rapid expansion of the grains may also be produced by spraying with a solution of gelatin. The screens are now pressed between rollers, covered with a suitable varnish, and again pressed, when they are ready to receive a coating of sensitive emulsion. —T. F. B.

Printing plates ; Preparation of gelatin ——. A. Tellkampf. Ger. Pat. 201,968, Aug. 10, 1905.

A silver image which has been bleached by ferricyanide is applied to a gelatin film containing a ferrous salt (prepared by mixing 100 grms. of gelatin and 1 grm. of ferrous sulphate with 600 c.c. of water). The unaltered ferricyanide in the print combines with the ferrous salt, producing an insoluble salt in the gelatin, which is thus given the power to absorb fatty inks. After washing, relief films are obtained, which may be utilised as printing plates.—T. F. B.

Pigment pictures ; Preparation of —— *by combining pigmented colloids with photographic silver pictures in presence of reducible metallic salts.* Neue Photographische Ges., A.-G. Ger. Pat. 202,108, May 15, 1907.

Silver prints are treated with a 5—10 per cent. solution of potassium ferricyanide until they are completely bleached. They are then washed, and coated with a mixture of casein with a suitable pigment. When dry, the whole is treated for 10—15 minutes in a solution containing 2 grms. of potassium bromide and 2 grms. of potassium bichromate in 100 c.c. of water, washed with warm water, and fixed by thiosulphate.—T. F. B.

XXII.—EXPLOSIVES, MATCHES, &c.

Patents.

Explosive ; New ——. Soc. Anon. d'Explosifs et de Produits Chimiques. Fr. Pat. 391,106, Aug. 19, 1907.

The condensation products obtained by heating oxalic acid with primary aromatic amines are converted into nitro-bodies and the latter are claimed as explosives. Hexanitro-oxanilide is given as an example.—G. W. McD.

Explosives ; Blasting and propellant ——. Soc. Anon. d'Explosifs et de Produits Chimiques. Fr. Pat. 391,107, Aug. 19, 1907.

The nitro-derivatives of aromatic diamines are proposed as explosives either alone or in conjunction with other explosive bodies. Pentanitrodimethylmetaphenylenediamine is mentioned as being particularly suitable. —G. W. McD.

Matches ; Manufacture of ——. H. Schaefer, Brussels. Eng. Pat. 23,250, Oct. 21, 1907. Under Int. Conv., Oct. 22, 1906.

The dried leaf of esparto grass is used as a substitute for wood in the manufacture of matches.—G. W. McD.

XXIII.—ANALYTICAL CHEMISTRY.

APPARATUS.

Ebullioscopic determinations and fractional distillation ; Electrical heating in ——, [*and preparation of sulphur dichloride*]. E. Beckmann. Z. physik. Chem., 1908, **64**, 506—507.

In ebullioscopic determinations quiet boiling may be induced, without the aid of filling material, by employing direct electrical heating, using a platinum spiral fused into the glass of the boiling tube. The passage of an indifferent gas through the liquid further reduces errors due to superheating, and in this way correct results may be obtained with high-boiling solvents, such as aniline and glycerol, even *in vacuo*. Direct electrical heating has also been successfully applied to the separation of the chlorides of sulphur by fractional distillation at 4 mm. pressure, sulphur dichloride, SCl_2, having been obtained quite pure.—F. Sodn.

INORGANIC—QUANTITATIVE.

Antimony ; Determination of —— [in ores]. M. F. Coolbaugh and J. O. Betterton. Mining World, Oct. 17, 1908, 606.

The ore is decomposed by fusion at a low temperature with 8—10 times its weight of ammonium persulphate. The melt is extracted with 20 c.c. of hot hydrochloric acid (sp. gr. 1·1), diluted to 100 c.c., heated, and the antimony precipitated as sulphide, by the passage of a rapid stream of hydrogen sulphide for 15 min. The precipitate is filtered off and dissolved in 40 c.c. of concentrated hydrochloric acid, together with a little potassium chlorate, to ensure full oxidation of the arsenic. Any separated sulphur is filtered off, two drops of ferric chloride added as an indicator, and stannous chloride run in drop by drop. All the antimony is reduced before the reduction of the iron commences. When the yellow colour of the iron has been discharged, the excess of stannous chloride is at once destroyed, to prevent the reduction of any arsenic, by pouring the solution into 10 c.c. of a saturated solution of mercuric chloride. The solution is diluted to 500 c.c. and titrated with standard potassium permanganate. The whole of the antimony is readily precipitated by the hydrogen sulphide in 10—15 minutes, but the volume of solution should not exceed 100 c.c. It is advisable to have two solutions of stannous chloride, a strong one to combine with the free chlorine liberated by the potassium chlorate, and to reduce the greater part of the antimony, and a weaker solution to finish the reduction so that only a slight excess is used. The temperature during reduction should be about 90° C. Silver, lead, bismuth, arsenic, and tin do not interfere, but any considerable amount of copper should be removed by treating the sulphides with sodium sulphide. The time required for a complete determination is not more than 1½ hours.—F. R.

Arsenic ; Mercurous nitrate as a microchemical reagent for ——. G. Denigès. Compt. rend., 1908, **147**, 744—745.

The reagent is prepared by triturating 10 grms. of crystallised mercurous nitrate with 10 c.c. of nitric acid of sp. gr. 1·39 and adding 100 c.c. of distilled water. The arsenical product is transformed into a solution of arsenic acid in water or nitric acid, and is placed in small drops on a microscope slide. It is then carefully evaporated to dryness, treated with a drop of ammonia and again evaporated. On to the centre of the dry residue a small drop of the mercurous nitrate solution is then placed in such a manner that the edges of the deposit are not touched by the reagent; after allowing to stand for two minutes the glass is rubbed with the drawn out end of a glass rod, within the moistened portion. After standing for another 2 minutes, the preparation is examined under the microscope, with a magnification of 40 to 150 diameters. If arsenic be present, (1), thick chiastolites, (2), crystallites which are often arranged as twin crystals, and (3), almost colourless plates with rounded extremities, are formed. The presence of arsenic should not be considered to be proved unless all these details are observed.—E. F.

Cyanide process ; Notes on the solutions used in the ——. K. Nugel. *See* X.

ORGANIC—QUALITATIVE.

Tannin reaction and its applications. E. Stiasny. *See* XIV.

Animal fats ; Detection of some —— in admixture with other animal fats. E. Polenske. *See* XII.

Honey ; Distinction between natural and artificial —— and detection of sucrose and its decomposition products. I. Fiehe. *See* XVIII*A*.

Cellulose ; Action of ammonium persulphate on ——. II. New test for oxycellulose. H. Ditz. *See* XIX.

a-Eucaine and β-eucaine ; Distinctive test for ——. G. Caudussio. *See* XX.

Arsacetine [sodium p-acetylaminophenylarsinate] ; Characters and tests for ——. Meister, Lucius, und Brüning. *See* XX.

Salicyclic acid and derivatives ; Detection of phenol and cresotinic acid in ——. H. Engelhardt and H. W. Jones. *See* XX.

Formaldehyde ; New reaction of ——. F. Todtenhaupt. *See* XX.

ORGANIC—QUANTITATIVE.

Oil of turpentine ; Analysis of ——. Determination of mineral oil in resin oil. R. Adan. *See* XIII*B*.

Tannin analysis. J. Paessler. *See* XIV.

Malt and malt extracts ; Determination of diastatic power of ——. C. Wirth and C. J. Lintner. *See* XVII.

XXIV.—SCIENTIFIC & TECHNICAL NOTES.

Radium ; Heat development of ——. E. v. Schweidler and V. F. Hess. Monatsh. f. Chem., 1908, **29**, 853—862.

The quantity of heat given out by a sample of radium salt prepared from pitch-blende residues (this J., 1908, 917) was found to be 118 grm.-calories per hour for 1 grm. of metallic radium. A differential calorimeter was used for the determination, and the possible error in the value obtained is stated to be 1·4 per cent.—F. Sodn.

Carbon suboxide. O. Diels and L. Lalin. Ber., 1908, **41**, 3426—3434.

In preparing carbon suboxide (this J., 1907, 169), great care must be taken that the malonic acid is thoroughly dried, and that the phosphorus pentoxide is of good quality; the author has obtained as much as 20 per cent. of the theoretical yield. At a low temperature (dissolved in liquid sulphur dioxide) carbon suboxide and formic acid unite to form an addition compound, of probable formula, $C[:C(OH)COOH]_2$, which readily crystallises, and if kept dry is fairly stable at low temperatures. On heating, it decomposes, in part regenerating carbon suboxide and formic acid, in part giving carbon monoxide and malonic acid. Acetic acid forms a similar (but liquid) compound, which readily decomposes with formation of acetic and malonic anhydrides.—J. T. D.

Colloidal aluminium hydroxide ; Coagulation of —— by electrolytes. S. Kawamura. J. Coll. Science, Imp. Univ., Tokyo, 1908, **25**, Article 8.

The author studied the effect of different electrolytes on the coagulation of a colloidal solution of aluminium hydroxide prepared by Crum's method (J. Chem. Soc., 1853, **4**, 216). The method adopted consisted in observing the alteration of the viscosity of the solution on addition of increasing quantities of the electrolytes; coagulation was complete when further additions of the electrolyte had no perceptible effect on the viscosity. The results obtained are set out in detail. The degree of coagulation was found to increase in some cases suddenly and in others more gradually with increasing concentration of the added electrolyte. In accordance with Hardy's rule, only anions exercised coagulating action, and the coagulating effect of the anions increased rapidly with increasing valency, as indicated by Schulze's rule. The final degree of coagulation differed considerably in different cases, and was apparently characteristic of the action of each electrolyte. The concentration of the colloidal solution, the temperature, and the duration of the experiments had no marked effects on the general relations observed.

—A. S.

Colloidal ferric ferrocyanide ; Oxydasic effects produced by ——. J. Wolff. Compt. rend., 1908, **147**, 745—747.

THE author has already shown (this J., 1908, 474, 772) that colloidal ferric ferrocyanide shows very similar properties to the peroxydases. He has now found that in weakly alkaline solutions it acts as an oxydase on quinol, producing quinhydrone. The presence of alkali is necessary, but the natural alkalinity of ordinary (calcareous) tap-water, or even of very slightly mineralised waters such as Evian water is quite sufficient to promote the action. The effect is also produced if the alkali is replaced by disodium phosphate. The oxidising effect of manganese salts of weak acids on quinol solutions described by G. Bertrand (Ann. Chim. Phys., 1897) is doubled in rapidity by the addition of a quantity of iron as ferrocyanide of only one hundredth the weight of the manganese, and the present author also points out that such manganese salts show an alkaline reaction. He has also found that aqueous solutions of manganese sulphate, which under ordinary conditions are practically inactive, become very active on adding traces of pyridine, a base which does not precipitate manganese from its solutions.—E. F.

Colloids ; Organic ——. S. Levites. Z. Chem. Ind. Kolloide, 1908, **3**, 145—153.

ORGANIC colloids only show colloidal characteristics in aqueous solution. Most natural organic colloids are soluble in water only, if soluble at all. The author has found that if an organic colloid is insoluble in a liquid miscible with water, mixtures of the same liquid with water often dissolve the colloid, sometimes even more freely than pure water. For instance, glutin is soluble in warm water only, and not at all in pyridine. In a 10 per cent. aqueous pyridine solution, glutin swells up without dissolving ; in presence of 20 to 25 per cent. of pyridine, it is readily soluble ; in a 60 to 70 per cent. pyridine solution, it is partly soluble in the cold and completely on heating, whilst in an 80 per cent. pyridine solution it is completely insoluble, even on warming to 60° to 70° C. Solutions of glutin in mixtures of pyridine or piperidine and water are very viscous. In aqueous solutions of ammonia, glutin is less soluble than in pure water. In aqueous solutions of alcohol and acetone, the solubility of glutin also increases with the percentage of alcohol or acetone up to a certain point, after which it decreases. Organic colloids differ from inorganic colloids in the manner in which they can be "salted out." The former are coagulated by very small quantities of electrolytes ; the latter require much larger quantities of neutral salts for precipitation, and it is noteworthy that in such cases many salts are without action. Thus dextrin is precipitated from aqueous solution by concentrated solutions of sulphates only, and not by other salts, even when they are added until the liquid is saturated. Chemical considerations appear to influence these relationships ; thus E. Fischer has shown that polypeptides containing a tyrosine group are precipitated by ammonium sulphate solutions, even though of simple chemical constitution. Organic colloids are often coagulated by absorption of energy in the form of heat, or of other forms of energy such as ultra-violet rays or radium emanation. The albumins are coagulated by all these agencies. Such coagulation is irreversible and is probably accompanied by chemical change. The author carried out investigations on purified egg-albumin and blood-globulin. 5 c.c. of albumin solution were mixed with 10 c.c. of the salt solution, heated very gradually, and the temperature observed at which a bluish turbidity first appeared in the liquid. In the case of egg-albumin no regularities could be observed in the result, beyond the fact that the temperature of coagulation increases steadily with the concentration of the salt. Potassium and sodium iodides and potassium thiocyanate do not produce complete coagulation at any temperature. In the entire absence of electrolytes the albumins do not coagulate. The maximum effect of the salt is soon reached. When higher concentrations are employed, the temperature of coagulation remains steady or even falls, as in the case of potassium thiocyanate. The relation between temperature of coagulation and concentration of the salt agrees well, up to certain concentrations, with Ostwald's formula : $\frac{1}{t} = \mathrm{KC}^m$, where t is the temperature of coagulation, C the concentration of the salt-solution, and K and m unknown constants. The temperature of coagulation of globulin solutions was found to be considerably raised by even very small quantities of all the salts examined, and on raising the amount of the added salt, it remained constant within certain concentrations, after which it had a tendency to fall.—E. F.

Caseinates of sodium and ammonium ; Dissociation of solutions of "basic" ——. T. B. Robertson. J. Phys. Chem., 1908, **12**, 473—483.

IN a previous communication (J. Phys. Chem., 1907, **11**, 542) the author showed that neutral caseinates (neutral to litmus) gave conductivity results in accordance with Ostwald's dilution-law for salts of monobasic acids. He now shows from the results of Sackur's experiments (Z. physik. Chem., 1902, **41**, 672) that the same law applies to "basic" caseinates (alkaline to litmus, but neutral to phenolphthalein). The suggested explanation is that neutral caseinates are "ampho salts" of the type $\mathrm{NaX^+ + XXOH^-}$, whilst the "basic" caseinates are true salts of the combined base (typified by the formula $\mathrm{Na^+ + XXOH^-}$) resulting from the addition of more alkali to the ampho salts. The equilibrium in a solution of a caseinate is not changed by dilution, but depends upon the relative proportions of the base and of the casein in the system, and is probably of the type—

$$\mathrm{NaX^+ + HXOH \rightleftarrows Na^+ + HXXOH}.$$

Contrary to the conclusions of Sackur, the author finds that, as in the case of weak polybasic acids, only one COOH group in the casein molecule plays any appreciable part in the neutralisation of bases. The velocity of the casein ion in solutions of caseinates is calculated from Sackur's results to be $15{\cdot}2 \times 10^{-5}$ cm. per second for the "basic" sodium caseinate, and $9{\cdot}1 \times 10^{-5}$ cm. per second for the "basic" ammonium salt, with a potential gradient of 1 volt per cm. The amount of dissociation of both salts is practically equal, the dissociation constants estimated from Sackur's results being 0·0499 and 0·0404 respectively.

—C. A. M.

Viscosity of dilute alcoholic solutions. T. Hirata. J. Coll. Science, Imp. Univ., Tokyo, 1908, **25**, Article 5.

IT has been shown by Arrhenius (Z. physik. Chem., 1887, **1**, 285) that the viscosity of dilute aqueous solutions containing indifferent dissolved substances, can be expressed by the exponential formula : $z = \mathrm{A}^x$, when one substance is in solution, or $z = \mathrm{A}^x\mathrm{B}^y$, when two substances are dissolved : A and B are constants characteristic of the substances dissolved, at a constant temperature, and x and y are the respective volume percentages of the dissolved substances. The author has studied the viscosities of alcoholic solutions of acetone, ether, carbon bisulphide, ethyl acetate, benzoate, bromide, and iodide, methyl propyl, and amyl alcohols, benzene, chloro- and nitro-benzene, aniline, glycerol, and water. It was found that, except in the case of water, the formula : $z = \mathrm{A}^x$ can be applied up to 12·5 volume per cent. solutions and in many instances up to 25 vol. per cent. solutions. In the case of water, the formula is only applicable to solutions of less than 3 vol. per cent. concentration. The formula, $z = A^x B^y$ was found to be applicable up to 10 vol. per cent. solutions.—A. S.

Trade Report.

Chemical trade of India. Review of the Trade of India, by C. W. E. Cotton.

Imports. The total value of chemicals imported into India in 1097–8 was Rs. 79·3 lakhs, against Rs. 68·7 lakhs in 1906–7. Bleaching materials, disinfectants, and sodium bicarbonate all showed increases. Caustic soda advanced from Rs. 7·03 lakhs to Rs. 8·94 lakhs, owing to the increasing demands of match and soap factories. "Soda (other sorts)" increased from Rs. 1·18 lakhs to Rs. 6·53 lakhs. Camphor imports rose from 851,049 lb. to 1,191,921 lb., whilst values rose from Rs. 22·99 lakhs to Rs. 27·05 lakhs, there being a decline of 16 per cent. in specific value. Quinine imports increased from Rs. 6·28 lakhs to Rs. 7·21 lakhs. A further increase is shown under aniline and alizarin dyestuffs, from 11,736,744 lb. to 12,957,817 lb. Imports of mineral oils amounted to Rs. 315·45 lakhs, as compared with Rs. 242·7 lakhs in 1906–7. Of the total, kerosene accounted for 78·7 per cent. Burmah oil represented 49·2 per cent. of the imports in 1907–8, as against 53·8 per cent. in 1906–7.

Exports. Metals, etc., amounted to Rs. 91·86 lakhs in 1906–7 and Rs. 105·68 lakhs in 1907–8. Of this, manganese ores amounted to 81·3 per cent. Saltpetre exports increased from 353,378 cwt. to 363,954 cwt., with a slight decline in specific value. Borax was exported to the extent of 5,247 cwt. (Rs. 1·08 lakh). Cinchona bark exports amounted to 473,200 lb., a decrease of 21,387 lb., compared with the previous year. The exports of indigo amounted to 32,490 cwt. in 1907–8, as against 35,102 cwt. in the previous year, with a corresponding fall in value. Myrabolans increased by 28·5 per cent. in quantity and 34·1 per cent. in value; turmeric exports also showed good increases, but cutch declined slightly, both in quantity and in specific value. Exports of oils increased from Rs. 69·86 lakhs to Rs. 85·82 lakhs; there were increases in all the principal oils, viz., fish oil, lemongrass oil, and mineral oils, the latter chiefly owing to increased exports from Burmah. Vegetable oils declined slightly, but paraffin wax increased. Oil seeds also increased considerably.

[NOTE—3 Lakhs of rupees=£20,000.]

Japan; Chemical industry of ——. Chem. Ind., 1908, 31, 690—691. [T.R.]

THERE were 1326 establishments carrying on chemical industries in Japan in 1906, against 1222 in 1905. Of these, 563 were ceramic factories, 7 gas works, 92 paper mills, 181 dye works, 25 tanneries, 263 explosives and match factories, 22 artificial manure works, and 84 chemical factories. These works employed 62,708 persons.

The match industry was carried on in 209 factories in 1907, the production of which was valued at over 15 million yen. Artificial indigo imports are still increasing, to the exclusion of the natural product, which now only represents 5 per cent. of the imports. Other dyestuff imports are practically the same as before. Oil colours are also stationary, but imports of paints for submarine structures show an increase of 14 per cent. Imports of the group, "chemicals, drugs, and medicines," increased about 80 per cent. in value. The chief articles are ammonium sulphate, soda ash, sodium nitrate, potassium chlorate, potassium bichromate, acetic acid, rosin, antipyrin, phenol, boric acid, glycerin, santonin, quinine, and cocaine. England has the largest share of these imports. Imports of soaps increased by 220,000 yen to 769,255 yen (toilet soap amounting to 528,520 yen). Nearly two-thirds of the soap comes from Germany and France. Exports of camphor increased from 3,632,785 yen in 1906 to 5,026,858 yen in 1907. Camphor oil also increased from 132,502 yen to 367,778 yen. A considerable increase is also recorded in exports of menthol, but peppermint oil exports decreased somewhat, as did those of sulphur.

[NOTE.—20 yen=£2 0s. 11¾d.]

New Books.

ROYAL COMMISSION ON SEWAGE DISPOSAL. Supplementary volumes presented with the Fifth Report of the Commissioners appointed to inquire and report what methods of Treating and Disposing of Sewage (including any liquid from any factory or manufacturing process) may properly be adopted. APPENDIX VI. REPORT BY PROFESSOR LETTS AND DR. W. E. ADENEY, ON THE POLLUTION OF ESTUARIES AND TIDAL WATERS. Presented to both Houses of Parliament by command of His Majesty. Wyman and Sons, Limited, 109, Fetter Lane, London, E.C., and 32, Abingdon Street, Westminster, S.W.; Oliver and Boyd, Tweeddale Court, Edinburgh; or E. Ponsonby, 116, Grafton Street, Dublin. 1908. Price 9s. 7d.

QUARTO volume (Blue Book), containing 558 pages of subject-matter, illustrated with 25 maps and charts, and 15 plates. An alphabetical index of subjects closes the work. The matter is classified as follows:—I. (*a*), Course and nature of fermentative changes in polluted water under continual aerobic conditions. (*b*), Course of change in distilled water polluted by known quantities of organic substances, as Rochelle salt; Rochelle salt and urea; albumose; asparagin; and urea. (*c*), Conclusions to be drawn from these experiments. II. THE FERMENTATIVE CHANGES OCCUR IN TWO DISTINCT AND PROGRESSIVE STAGES. Experiments with distilled water polluted with known quantities of Rochelle salt and asparagin. III. CONDITIONS UNDER WHICH NITROGEN DOES, AND DOES NOT, APPEAR AMONGST THE PRODUCTS OF AEROBIC FERMENTATION. IV. QUANTITIES OF OXYGEN ABSORBED, AND OF PRODUCTS FORMED ON THE COMPLETION OF EACH STAGE, CONSTANT FOR SIMILAR VOLUMES OF THE SAME POLLUTED WATER. V. CHANGES OCCURRING DURING THE SECOND STAGE OF FERMENTATION—(1), In effluents from percolating filter-beds. (2), In distilled water polluted by humus and ammonium compounds. (3), In waters polluted by peaty matters and ammonium compounds. VI. CLASSIFICATION OF ORGANIC SUBSTANCES FOUND IN POLLUTED WATERS ACCORDING TO THEIR FERMENTATIVE PROPERTIES VII. DIRECT ABSORPTION OF DISSOLVED OXYGEN BY DE-AERATED WATERS AND BY DIRECTLY AND EASILY OXIDISABLE SUBSTANCES. VIII. (1). Influence of nitrates and nitrites on fermentative changes in polluted waters. (2), Influence of manganese peroxide on fermentative changes in solid sewage matters. IX. THE DISSOLVED OXYGEN ABSORBED IN EACH STAGE OF AEROBIC FERMENTATION COMPARED WITH THE "OXYGEN CONSUMED" FROM ACID PERMANGANATE. X. RATE OF RE-AERATION OF FRESH AND OF SALT WATERS AFTER BEING DE-AERATED BY POLLUTING MATTERS. XI. (*a*), Maximum rate of absorption of dissolved oxygen allowable in tidal waters. (*b*), Maximum proportion of liquid sewage matters, which may be discharged into tidal waters, &c. XII. STANDARDS FOR TIDAL WATERS. XIII. THE AERATION METHOD OF ANALYSIS AND APPARATUS. XIV. RELATIVE CAPACITIES OF FRESH WATER AND OF SEA WATER TO BEAR POLLUTION WITHIN LIMITS OF FOULING.

MEAT EXTRACTS AND SIMILAR PREPARATIONS, INCLUDING STUDIES OF THE METHODS OF ANALYSIS EMPLOYED. U.S. Department of Agriculture. Bureau of Chemistry. Bulletin No. 114. H. W. Wiley, Chief of Bureau. By W. D. BIGELOW and F. C. COOK. Government Printing Office, Washington, U.S. America. 1908.

8vo pamphlet, containing 56 pages of subject-matter subdivided and classified as follows:—I. Chemical examina tion. II. Meat extracts. III. Meat juices. IV. Yeast extracts. V. Miscellaneous preparations. VI. Methods of analysis and their discussion. VII. Preparation of sample. VIII. Moisture. IX. Ash. X. Separation of organic and inorganic phosphorus. XI. Acidity. XII. Nitrogenous bodies. XIII. Total meat bases. XIV. Kreatin and kreatinin. XV. Xanthin bases. XVI. Ammonia. XVII. Succinic acid. XVIII. Ether extract. XIX. Glycerol. XX. Nitrates, etc.

Recent Advances in Organic Chemistry. By A. W. Stewart, D.Sc., Lecturer on Stereochemistry in University College, London, etc. With an introduction by J. Norman Collie, Ph.D., LL.D., F.R.S. Longmans, Green, and Co., 39, Paternoster Row, London. 1908. Price 7s. 6d. net. New York, Bombay, and Calcutta.

8vo volume, containing 269 pages of subject-matter, 6 pages of bibliography, and an alphabetical index of names of authors and subjects. The treatment of the subject-matter may be gathered from the following classification of the text:—I. Main currents in organic chemistry during the last half century. II. The Grignard reaction. III. Asymmetric syntheses, and new methods of producing optically active compounds. IV. The polyketides and their derivatives. V. The polymethylenes. VI. The monocyclic terpenes. VII. The dicyclic terpenes (the camphene, fenchone, pinene, and other groups). VIII. The olefinic terpenes (Isoprene, citronellal, and the citral group). IX. The synthetic alkaloids (the pyridine, pyrrolidine and purine groups). X. Some alkaloid constitutions (the quinoline and isoquinoline groups). XI. The polypeptides. XII. The chemical action of light. XIII. Some theories of addition reactions. XIV. Unsaturation.

An Organic Chemistry for Schools and Technical Institutes. By A. E. Dunstan, B.Sc., Head of the Chemical Department, East Ham Technical College. Methuen and Co., 36, Essex Street, Strand, London, W.C. Price 2s. 6d.

Crown 8vo volume, containing 156 pages of subject-matter, with a frontispiece and 33 illustrations in the text. There is an index of subjects. The subject-matter is classified thus:—I. Alcohol, and its reactions; its formula, and its homologues. II. Action of acids on alcohol. III. Preparation of ethyl acetate. IV. Phenol. V. Ultimate reduction of alcohol. VI. Partial oxidation of alcohol. VII. Acetic acid. VIII. Amides and nitriles. IX. Amines. X. Aromatic amines. XI. Urea. XII. The cyanides. XIII. Phosphines and the metallo-organic derivatives. XIV. The chloracetic acids and derivatives. XV. The olefines and acetylenes. XVI. Glycol. XVII. Unsaturated dibasic acids. XVIII. Glycerol and its derivatives. XIX. Carbohydrates. XX. Organic sulphur compounds. XXI. Nomenclature of the alcohols.

A Text-Book of Inorganic Chemistry. By Dr. A. F. Holleman, Professor ord. in the University of Amsterdam, etc. Issued in English in co-operation with Hermon C. Cooper. Third English Edition. John Wiley and Sons, New York, U.S. America. 1908. Price $2.50.

8vo volume, containing 502 pages of subject-matter, with 81 illustrations, and an alphabetical index of subjects. There is a chart graphically representing the periodic variation of the atomic volumes of the elements, with their atomic weights: also a plate exhibiting the spectra of the elements. The subject-matter is classified into the following principal groups:—I. Introduction. II. Physical and chemical phenomena. III. Chemical operations. IV. The elements. [Gases, metalloids, and metals]. V. Compounds and mixtures. VI. Explanation of the constant composition of compounds. Atomic theory. VII. Chemical symbols. VIII. Stoichiometrical calculations. IX. Molecular weight from the measurement of the depression of the freezing-point, and elevation of the boiling-point. X. Dissociation. XI. Electrolytic dissociation. XII. Thermochemistry. XIII. Methods of determining atomic weights, etc. XIV. Periodic system of the elements. XV. Salt solutions. XVI. Acidimetry and alkalimetry. XVII. Spectroscopy. XVIII. The unity of matter. XIX. Electrochemistry. XX. Werner's extensions of the notion of valency.

Le Parfum chez la Plante. Par Eug. Charabot et C. L. Gatin. Octave Doin, 8, Place de l'Odéon, 8, Paris. 1908. Price 5 fr.

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The Lac Insect (*Tachardia lacca*), its Life History, Propagation, and Collection. By E. P. Stebbing. Indian Forest Records. Vol. I., part 17. Price Rs. 1.40. Government Printing Office, Calcutta.

This book is divided into nine chapters, as follows:—Origin and nature of lac. Historical. Growth of the industry. The lac insect. The food plants. Injury done by the lac insect to trees. Enemies of lac. Distribution. Method of cultivation and propagation.

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24,007. Johnson (Chem. Fabr. Griesheim Elektron). Preparation of iron or steel for casting. Nov. 9.

24,083. Durant, Sulman, and Picard. Treatment of zinc box precipitate. Nov. 10.

24,089. Reynolds. Manufacture of steel. Nov. 10.

24,244. Schneider et Cie. Treatment of steels for industrial purposes. [Fr. Appl., Jan. 25, 1908.]* Nov. 11.

24,282. Winder. Manufacture of steel. Nov. 12.

24,283. Winder and Dufty. Recovery of valuable metals from mill scale or forge scale. Nov. 12.

24,503. Rogerson and Donaldson. Treatment of ores.* Nov. 14.

24,537. Vivian, Davies, and Grote. Forming mineral or like substances into solid bodies, briquettes, etc. Nov. 14.

Complete Specifications Accepted.

24,283 (1907). Schoop. Welding or melting objects of aluminium. Nov. 11.

24,875 (1907). Viel. Production of pure chromium from commercial ferrochromium. Nov. 18.

25,087 (1907). Machlet. Case-hardening iron and steel articles. Nov. 18.

2971 (1908). Carrick and Pattison. Treating pyritic copper and nickel ores. Nov. 18.

13,699 (1908). Torrini and Hoffmann. Converting iron into steel. Nov. 18.

16,093 (1908). Carney. Manufacture of steel from chromiferous pig iron. Nov. 11.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

Applications.

23,930. Connor, Stubbs, and Electrolytic Alkali Co., Ltd. Electrodes for use in electrolysis. Nov. 9.

24,128. Cowper-Coles. Electrodeposition of metals. Nov. 10.

24,139. Gerbing. Electroplating articles of electrically non-conductive material. Nov. 10.

24,224. Fiedler. Manufacture of plates for secondary batteries.* Nov. 11.

24,355. Schauli. Depolarisers for electric batteries and general electrolysis. [Comprised in No. 14,609 of 1908.] Nov. 12.

24,356. Schauli. Depolariser for electric batteries. [Comprised in No. 14,609 of 1908.] Nov. 12.

Complete Specification Accepted.

28,132 (1907). Tate. Storage battery plates. Nov. 18.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

Applications.

23,698. Boult (Fischer). Apparatus for use in manufacturing soap.* Nov. 5.

23,725. Gallati-Grob. Fluid washing and bleaching compound.* Nov. 5.

23,744. Whitehouse. Production of soaps and glycerine. Nov. 6.

24,209. Hood and Salamon. Treatment of vegetable oils. Nov. 11.

24,484. Riddle. Treatment of old grease from axle boxes, etc. Nov. 14.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(*A.*)—Pigments, Paints.

Complete Specifications Accepted.

8549 (1908). Heckman. Pigments. Nov. 11.

17,105 (1908). Rowland and Paton. Paints or preservative compounds for marine use. Nov. 11.

(*B.*)—Resins, Varnishes.

Application.

23,429. Marks (Suter). Varnish and the manufacture of the same.* Nov. 3.

(*C.*)—India-Rubber.

Applications.

23,501. Joly. Purification of india-rubber.* Nov. 3.

23,627. Hutchinson and Milne. Manufacture of vulcanised rubber. Nov. 5.

24,003. Bradley and Thew. Manufacture of an india-rubber substitute. Nov. 9.

24,110. Brosse. Elastic and supple material.* Nov. 10.

Complete Specification Accepted.

26,852 (1907). Suhr. Manufacture of an insoluble, elastic, and plastic substance, suitable for use as a substitute for india-rubber. Nov. 18.

XIV.—TANNING, LEATHER, GLUE, SIZE, &c.

Complete Specifications Accepted.

13,517 (1908). Petrie. Treatment of leather. Nov. 18.

21,091 (1908). Guilleteau. Artificial leather. Nov. 18.

XV.—MANURES, &c.

Application.

24,374. Cuming. Fertilising compounds. Nov. 12.

Complete Specification Accepted.

13,198 (1908). Thompson (Engle, Walker, and Main). Method of making fertilisers. Nov. 11.

XVIII.—FOODS; SANITATION, WATER PURIFICATION; AND DISINFECTANTS.

(*A.*)—Foods.

Applications.

23,585. Sleeman. Digestive ferment. Nov. 4.

23,693. Ingle. Dietetic preparation. Nov. 5.

23,917. Millet and Mussi. Alimentary or nourishing ferruginous salt.* Nov. 7.

Complete Specification Accepted.

16,363 (1908). Heid. Pickling grain, *i.e.*, treating it with disinfectants. Nov. 18.

(*B.*)—Sanitation; Water Purification.

Applications.

23,651. Morrison and Warren. Appliances for use in treating sewage effluent, etc. Nov. 5.

23,668. Koch. Apparatus for purifying sewage water.* Nov. 5.

Complete Specifications Accepted.

25,362 (1907). Losange. Biological purification of waste water and sewage. Nov. 11.

9656 (1908). Losange. Biological purification of waste water and sewage. Nov. 11.

(*C.*)—Disinfectants.

Complete Specification Accepted.

6783 (1908). Dame. Solid disinfectant soluble in water. Nov. 11.

XIX.—PAPER, PASTEBOARD, &c.

Applications.

23,802. range. Manufacture of paper. Nov. 6.

23,947. Gunn. Bleaching pulp used in the manufacture of paper. Nov. 9.

24,131. Herz. Treatment of waste printed paper.* Nov. 10.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

APPLICATIONS.

23,330. Sorger. Manufacture of therapeutically valuable iron salts.* Nov. 2.

24,072. Hoffmann-La Roche und Co. Guaiacol compounds. [Ger. Appl., Oct. 5, 1908.]* Nov. 10.

24,428. Newton (Bayer und Co.). Manufacture of a new pharmaceutical compound. Nov. 13.

COMPLETE SPECIFICATIONS ACCEPTED.

24,806 (1907). Schmitz und Co. Manufacture of borneol from isoborneol. Nov. 11.

25,458 (1907). Klein. Production of cantharidinic acid derivatives containing iodine and mercury. Nov. 18.

28,536 (1907). Newton (Kentucky Tobacco Products Co.). Treatment of tobacco stems and other tobacco material for recovering products. Nov. 11.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

COMPLETE SPECIFICATION ACCEPTED.

11,341 (1908). Bremer Trockenplattenfabr. B. Klatte. Photographic dry plates. Nov. 18.

Journal of the Society of Chemical Industry.

No. 23, Vol. XXVII. DECEMBER 15, 1908. No. 23, Vol. XXVII.

Journal and Patent Literature.

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I.—PLANT, APPARATUS, AND MACHINERY.

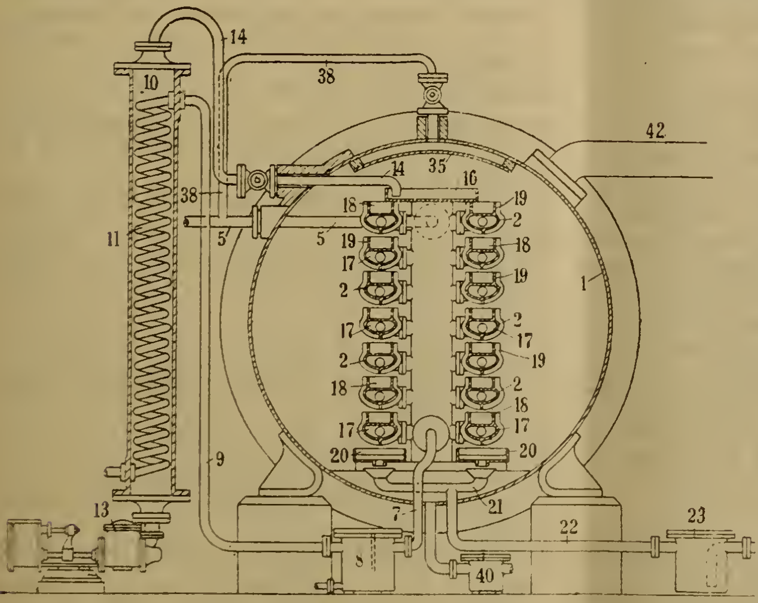
Patents.

Drying machines; Centrifugal ——. J. W. Macfarlane, Cathcart, and R. Williamson, Motherwell. Eng. Pat. 23,362, Oct. 23, 1907.

The regulation of the water supply to the turbine in direct water-driven centrifugal machines is effected by a governor which is secured to an upward extension of the spindle of the machine, or is actuated by gearing attached to this extension. A modification is claimed in which the governor is located below the bearing which carries the weight of the machine and is connected to the throttle-valve by a rod passing through the bore of the spindle.
—W. H. C.

Pasteurising apparatus. Eng. Pats. 6351 and 8084, 1908. *See* XVIII*A*.

Concentrating lyes with two or more evaporators arranged in series by which the liquid is evaporated under a pressure decreasing by stages. O. Venter, Chemnitz, Germany. Eng. Pat. 27,645, Dec. 14, 1907. Under Int. Conv., Sept. 20, 1907.



The liquid to be concentrated is pumped by the pump, 13, through the preheater, 10, and passes on by the pipe, 14, into the distributing vessel, 16, of the first evaporator. This consists of a horizontal cylinder, 1, within which the double series of heating and evaporating pipes, 2, are placed. Each pipe, 2, consists of a steam chamber, 17, connected at one end with a steam supply chest, and at the other end with an exhaust steam chest. Above the steam chamber, 17, is a heating trough, 18, having perforations, 19. The liquid flows from the distributing vessel, 16, into the upper heating troughs, 18, and is heated to boiling. It then passes through the perforations, 19, and trickles over the outer surface of the steam chamber, 17, and is partially vaporised, its temperature being thereby lowered. The liquid which drips from the top pipe, collects in the heating trough of the second pipe, is reheated to boiling and again trickles over the steam chamber. From the lowest pipe the concentrated liquid drips into the collecting trays, 20, and flows from thence by the pipe, 21, 22, to the pressure vessel, 23, by which it is elevated to the supply tank of the next evaporator, which is of similar construction. The steam enters by the pipe, 5, and passes to the steam chest at one end of the pipes, 2, and the exhaust is conveyed away from the exhaust steam chest, at the other end of the pipes. From the lower part of the steam chest, a pipe, 7, conveys steam through a water separator, 8, and the pipe, 9, to the coil, 11, of the preheater, 10. Another branch, 38, conveys steam from the pipe, 5, to the steam space, 35. The vapour given off in the vessel, 1, which is under a plus pressure, passes by the pipe, 42, to the steam chest of the next evaporator. Any water condensing on the interior surface of the cylinder, 1, is conveyed away through the trap, 40. The steam box, 35, prevents any condensation taking place immediately above the heaters. Two or more evaporators may be employed in series, being so arranged that the pressure remains constant in each, but gradually decreases from vessel to vessel to the last, which is not enclosed, and is at atmospheric pressure.—W. H. C.

Liquids; Device for heating or vaporising ——. Deutsche Continental-Gas. Ges. and F. Mucke. Fr. Pat. 391,380, May 9, 1908.

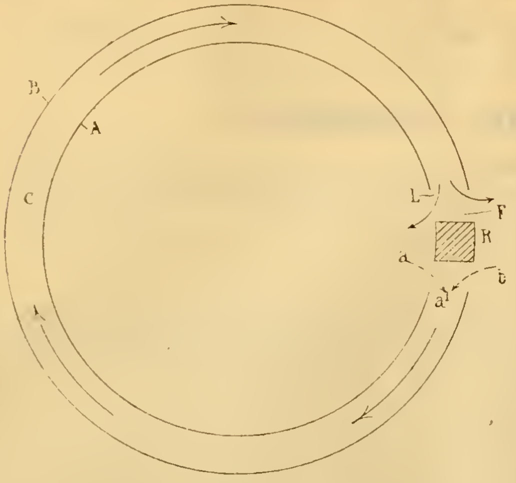
The claim is for a tubular heater the tubes of which are vertical and have a crescent-shaped cross-section in order to offer a greater heating surface. The tubes are grouped in a series of concentric rings, the concave sides of the tubes being turned in opposite directions in alternate rings.—W. H. C.

Filter-press. L. A. Philippe. Fr. Pat. 391,646, Sept. 2, 1907.

The claim is for a washing press with a light metal frame and plates of wood or other suitable material, for use at comparatively low pressures. The plates are pressed together by four screws at one end of the press, arranged in pairs, one above the other, and passing through cross bars which can be rotated. When it is necessary to open the press, a few turns are given to the screws and each pair is then tilted so that the plates can be moved.
—W. H. C.

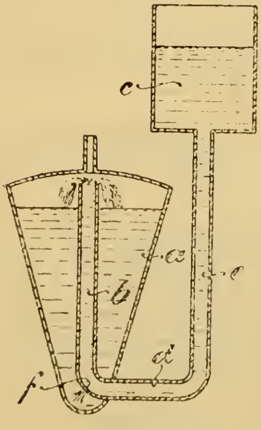
Gaseous mixtures; Separating the components of ——. E. Mazza, Turin, Italy, and C. de Murrieta, London. Eng. Pat. 11,546, May 27, 1908.

The gaseous mixture is compressed and allowed to enter, as indicated by the arrows, *a*, *b*, at the point, *a′*, into the



annular space, C, formed by two concentric cylinders, A, B. The potential energy of the compressed gas is transformed into kinetic energy in the annular space, C, and the centrifugal force which is set up, causes the denser gaseous particles to accumulate in the outer layers on the side next to B. After traversing the annulus, C, the gases arrive at the partition, R, and escape through the openings, F, L, on opposite sides of the annulus, the portion escaping at F, being richer, and that escaping at L, poorer in the denser gaseous particles.—W. H. C.

Mixing of liquids; Processes for the —— and apparatus applicable thereto. Ados Ges.m.b.H. and O. Matzerath, Aachen, Germany. Eng. Pat. 14,686, July 10, 1908. Under Int. Conv., July 13, 1907.

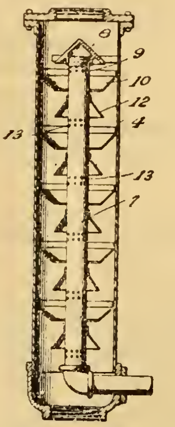


This process is especially suitable in cases where the saturation of the surface layer of an absorbing liquid takes place readily. The apparatus consists of a mixing vessel, *a*, connected to a second vessel, *c*, by means of a tube, *b*. The top of *a* is closed and when pressure from a suitable source is applied to the surface of the liquid, the latter is forced through the fine opening, *f*, in the connecting tube and so into *c*. When the pressure is released, the flow is reversed, and the liquid issues on to the surface of that in *a*. Instead of the rigid tube, *b*, *d*, *e*, a flexible connection may be used, and the liquid caused to flow under the action of gravity by alternately raising and lowering the second vessel. The fine opening may be made with a non-return valve or placed within a by-pass tube. —C. J. G.

Distilling apparatus; Continuous ——. E. Wernecke. Ger. Pat. 201,372, April 28, 1907.

The still is heated by direct fire, and is provided around its inner surface with annular troughs or gutters for holding the liquid to be distilled. The still is of inverted conical shape, so that the size of the troughs diminishes from the uppermost one downwards: the troughs are formed by means of removable flanges attached to the wall of the still. Outlets are provided at different heights so that vapours of different density can be withdrawn separately from the still. Hitherto, wrought-iron stills have been used for petroleum and coal tar, and cast-iron stills for lignite tar, the difference being due to the fact that with products yielding a large proportion of residue, large stills must be used, whilst with products yielding larger proportions of volatile substances, smaller stills are available. The apparatus described above can be adapted to both cases and can be constructed of cast iron.—A. S.

Condensing vapours; Means for withdrawing and ——. C. B. Lowry, Lexington, Ky., and R. Bernhard, Chicago, Ill. U.S. Pat. 902,097, Oct. 27, 1908.



The space from which the vapours are to be withdrawn, is connected to the upper end of the cylinder, 4. Water is supplied to the interior of the cylinder by the pipe, 7, having a hood, 8, at the upper end, and a series of rings of perforations at intervals, as shown at 9, 13, etc. Funnels, 10, projecting inwards from the cylinder are arranged below each ring of perforations, and conical deflectors, 12, are fixed on the pipe, 7, just below the funnels and above the perforations. The vapours pass down the cylinder and are compelled by the funnels and deflectors to pass through successive showers of water spray with the result that they are cooled and condensed and leave the vessel at the bottom along with the water.—W. H. C.

Centrifugal machine for nitrating, impregnating, degreasing, etc. Gebr. Heine. Ger. Pat. 202,489, Feb. 12, 1907.

The essential feature of the machine consists in the provision of an impermeable bowl surrounding the ordinary perforated cage, the two being provided with adjustable connecting devices, so that they can be rotated together, or the inner cage rotated alone as desired. For instance in the process of nitration, the two bowls are rotated together, but when nitration is complete, the inner cage is disconnected and rotated alone at a higher speed.—A. S.

Vacuum; Process and apparatus for the production of a ——. S. Benkö, Budapesth, Austria. Eng. Pat. 8956, April 24, 1908.

See Fr. Pat. 387,159 of 1908; this J., 1908, 795.—T. F. B.

Liquid separators; Centrifugal ——. G. Barker, Birmingham. From Albaugh-Dover Co., Chicago. Eng. Pat. 11,385, May 26, 1908.

See Fr. Pat. 390,615 of 1908; this J., 1908, 1128.—T. F. B.

Kilns heated by gas; Process and apparatus for producing as high temperatures as possible in rotary ——. M. G. Semper, Weferlingen, Germany. Eng. Pat. 11,851, June 1, 1908.

See Fr. Pat. 390,586 of 1908; this J., 1908, 1101.—T. F. B.

Drying machine. J. Black and A. H., H., and A. B. Lennox. Newcastle on Tyne. U.S. Pat. 902,931, Nov. 3, 1908.

See Eng. Pat. 24,295 of 1907; this J., 1908, 885.—T. F. B.

Mixing liquids and gases; Apparatus for ——. B. Leuschner, Dresden, Germany. U.S. Pat. 903,297, Nov. 10, 1908.

See Eng. Pat. 5189 of 1907; this J., 1907, 1189.—T. F. B.

Gases and liquids; Apparatus for producing interactions between ——. H. Koppers, Essen on Ruhr, Germany. U.S. Pat. 903,483, Nov. 10, 1908.

See Eng. Pat. 25,507 of 1906; this J., 1907, 815.—T. F. B.

Distilling column. R. Vallat, Assignor to G. A. Pfizer, Paris. U.S. Pat. 903,636, Nov. 10, 1908.

See Fr. Pat. 376,872 of 1907; this J., 1907, 1040.—T. F. B.

Distilling or rectifying column. R. Vallat, Paris. U.S. Pat. 903,637, Nov. 10, 1908.

See Fr. Pat. 387,558 of 1908; this J., 1908, 871.—T. F. B.

II.—FUEL, GAS, AND LIGHT.

Wet carbonisation in vertical retorts; Advantages of ——. E. Körting and Geipert. J. Gas Lighting, 1908, **104**, 404—405.

The authors have compared the cost of producing a mixture of coal-gas and water-gas, obtained, in the one case, by the admission of steam to vertical retorts, and in the other by the subsequent addition of water-gas prepared in a separate apparatus to coal-gas produced in vertical or inclined retorts worked dry. They conclude that it is much more profitable to use the wet process and for the following reasons. The coke in the wet process leaves the retorts at a lower temperature than that from the dry process. This difference, about 250° C., is accounted for by the fact that a portion of the heat of the coke is utilised to form water-gas which is consequently produced without the use of a further quantity of coke to supply the heat necessary for the reaction when it is carried on in a separate apparatus. Part of the carbon deposited on the interior surface of the retorts is utilised to produce water-gas in the wet process; this effects a twofold economy, as it reduces the quantity of coke required and saves a certain amount of scurfing. To produce approximately the same volume of mixed gas, 15 furnaces are required by the wet process against 14 furnaces and a water-gas plant by the dry process. The extra furnace costs considerably less in the first instance and for repairs and upkeep than the water-gas plant, and the labour for operating it is also less. With an annual production of 4 million cubic metres of water-gas, the saving resulting from the adoption of the wet process is estimated at M46,300.—W. H. C.

Hydrogen from water-gas; Industrial preparation of ——. I. Bay. Monit. Scient., 1908, **22**, 727—730.

Three processes have been proposed for the production of hydrogen from water-gas. In the first (Frank; Fr. Pat. 371,814; this J., 1907, 408) the water-gas is dried and passed over calcium carbide at a temperature above 300° C.; the carbon dioxide and monoxide react with the carbide forming calcium oxide and carbonate and carbon, whilst the nitrogen goes to form calcium cyanamide. In order to partially remove the carbon monoxide and dioxide, the water-gas may be first passed through solvents of these gases, or it may be strongly cooled to liquefy the monoxide and solidify the dioxide, or again it may be completely liquefied and the hydrogen separated by fractionation. Jouve and Gautier (Fr. Pat. 372,045; this J., 1907, 401) propose to pass the gas through a porous partition, *e.g.*, unglazed porcelain, in order to separate the gas by reason of the more rapid passage of hydrogen through the partition; it is stated that the percentage of carbon monoxide is reduced from 45 to 8 per cent. by a single passage through such a partition. In the third process (Cie. des Gaz de Lyon, Fr. Pat. 375,164; this J., 1907, 863) it is suggested that the water-gas should be passed, together with steam, over ferric oxide at a temperature of 400°—500° C.; most of the carbon monoxide is thus converted into the dioxide, which is removed by solution in water under pressure; after one such treatment, a water-gas consisting of hydrogen, 45 per cent.; carbon monoxide, 45 per cent.; carbon dioxide, 7 per cent.; nitrogen, 3 per cent., is converted into a gas containing hydrogen, 85·4 per cent.; carbon monoxide, 9·4 per cent.; nitrogen, 5·2 per cent., which can be utilised directly.
—T. F. B.

Methane; Synthesis of ——. *Direct union of carbon and hydrogen.* W. A. Bone and H. F. Coward. Chem. Soc. Proc., 1908, **24**, 222.

The authors describe experiments which demonstrate the formation of large quantities of methane when less than 0·1 grm. of sugar-charcoal (highly purified by prolonged ignition in dry chlorine, first of all at 700° and then at 1100° C.) is heated in a stream of pure dry hydrogen to between 1100° and 1200° C. in an apparatus similar to that used by Bone and Jerdan in 1897. In two separate experiments, the yields of methane (namely, 137·0 c.c. and 125·5 c.c. at 0° and 760 mm. from 0·0995 and 0·092 grm. of carbon respectively) were as much as 73 per cent. of those theoretically obtainable, the remainder of the methane being lost by unavoidable oxidation or decomposition in contact with the intensely hot walls of the porcelain tube in which the carbon was heated. In one group of four experiments, the formation of altogether 422 c.c. of methane from 0·306 grm. of carbon was demonstrated. The authors therefore consider that the synthesis of methane from its elements, as originally carried out by Bone and Jerdan in 1897 and 1901, is fully confirmed (see this J., 1901, 696).

Coal dust experiments. Times, Eng. Suppl., Nov. 25, 1908. [T.R.]

A series of tests has been carried out in the new experimental station in connection with the Liévin coal mines, Pas de Calais, France. The testing gallery consists of the main explosion chamber, the imperviousness of which is assured by means of partitions or diaphragms formed of waxed packing paper. In continuation of this first chamber there is a gallery, constructed of reinforced concrete, the reinforcement of which consists of steel bars 30 mm. in diameter. Beyond this there is a further gallery, timbered in the same way as a colliery working. The length of this at the present time is 75 metres, but it will ultimately be extended to 500 metres, and lateral workings will be added in such a way as to reproduce as nearly as may be possible the conditions existing in a coal-pit. An observation chamber, well screened or guarded, annexed to the testing galleries, will enable a distant view to be obtained of the effects of the explosions. The explosions are caused by electrically-fired cannon.

Practical working tests.—1. In an atmosphere containing 450 grms. of dust per cubic metre, 320 grms. of the explosive known as "grisoutine-couche" (fire-damp allayer) were fired without causing the dust to become ignited. Previous tests made with still larger quantities of this explosive had led to similar results.

2. The same experiment conducted with 80 grms. of dynamite-jelly caused a violent explosion, by which flames and smoke were ejected beyond the testing gallery. The speed of flame propagation reached 80 metres per second.

3. The experiment was repeated, only the dynamite was caused to act on a mixture of atmospheric air containing 10 per cent. of fire-damp. The explosion in this case was still more violent. The fire-damp does not, however, add to the length of the flame, but increases the rapidity of its transmission.

4. Trials were made in a similar way with a dust-laden atmosphere, this dust containing either 40 per cent. of ashes or consisting of a powdered incombustible schist. The after-explosive action no longer takes place with dust of this character, even if dynamite is used. Most of the mines have air highly charged with dust of this nature, and in all cases it is easy to bring about this state of things artificially. This would be a safer proceeding than the suggested system of watering in the case of a large number of mines.

Patents.

Fuel. T. Parker, London. Eng. Pat. 18,856, Aug. 21, 1907.

The claim is for a method of carrying out the process described in Eng. Pat. 14,365 of 1906 (this J., 1907, 1130) and consists in using fine coal or slack with which long vertical retorts are completely filled, so that during the carbonisation the charge is compressed by its own weight and a hard, dense fuel of uniform character is produced.
—W. H. C.

Fuel; Manufacture of briquettes for ——. J. P. Nelson, London. Eng. Pat. 15,086, July 16, 1908.

About 36 parts of Cardiff steam coal and 57 parts of anthracite small coal are ground, mixed, and steamed to the requisite temperature. The mixture is then placed in a heater in which about 2 parts of mineral or vegetable pitch and 4 parts of evaporated or distilled gas-tar, previously boiled by direct fire have been mixed with ½ to 2½ parts of powdered lime. After thorough mixing and heating, the whole mass is cooled and is then compressed into briquettes.—W. H. C.

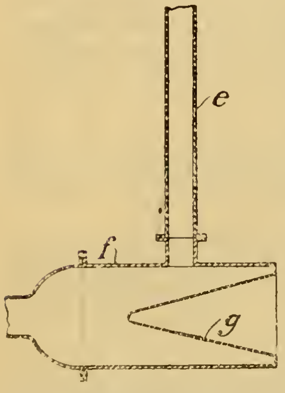
Heat and gas ; Production of —— under pressure. A. Lang, Karlsruhe, Germany. Eng. Pat. 23,524, Oct. 24, 1907.

A mixture of aluminium or other suitable metallic powder with oxides or sulphides, which when ignited will burn non-explosively without access of air, is associated with a compound which will, on heating, evolve a combustible gas, or one capable of supporting combustion. The mixture is ignited and the mixture of gases evolved is either used as a heating agent or in the cylinder of an engine.—W. H. C.

Coal-gas ; Apparatus for use in the manufacture of ——. A. A. Johnston, Brentford. Eng. Pat. 22,274, Oct. 9, 1907.

Inclined or horizontal retorts for the manufacture of coal-gas are formed of considerable depth vertically as compared with their width horizontally. Undercut lips or projections or ridges, which extend the whole length of the retorts, are formed on the inner side of either one or both side walls. These ridges serve as gas channels to convey the gas away from the coal practically as fast as it is generated. As an alternative method, inclined, shielded orifices are formed in the inner wall of the retort connected to outlet passages parallel to, and of similar section as, the retorts, for the rapid conveyance away of the gas.—W. H. C.

Gas ; Means for producing inflammable ——. J. Sculthorpe, Liverpool. Eng. Pat. 25,279, Nov. 14, 1907.



A mixture in suitable proportions of water and an oil containing not less than 70 per cent. of unsaturated hydrocarbons, either with or without saponified oleine, is introduced through the pipe, *e*, into the vaporising chamber, *f*, which is heated by a gas flame or in a furnace. The mixture drops on to the metallic cone, *g*, and the water and oil are vaporised together, producing the desired gas. Oils which are naturally rich in oleine, such as fish oils, may be substituted for the saponified oleine, and metallic salts may be added to either the water or the oil, for the purpose of producing a coloured flame when the gas produced, is burned.—W. H. C.

Gas-producer. W. Thomas, Vancouver, Canada. Eng. Pat. 11,533, May 27, 1908.

The claim is for a rectangular producer-chamber, the lower part of which has vertical walls and is divided by cross walls into two or more separate generator-chambers. The upper part of the producer-chamber has the side walls inclined outwards and is common to all the separate generator-chambers. Each of the latter has a grate near the bottom with a closed ash-pit, into which a pipe passes, through which air or steam can be introduced. A gas-exit pipe provided with a valve, and connected to the gasholder or engine, is placed just above the level of the grate. The upper chamber is provided with automatic charging hoppers and has at one end a valved connection to the chimney flue, and at the other a gas-delivery pipe. The upper chamber serves as a store for a reserve of fuel which is dried by the gas. After being charged, all gas connections except that to the chimney are closed, and air is blown beneath the grates. When the fuel has become incandescent, the air is shut off and steam turned on, the connection to the chimney is closed, and the upper gas outlet opened ; "straight" water-gas only is formed. If it be desired to produce enriched water-gas, after the fuel has been raised to incandescence as before, the chimney outlet is closed, one of the lower gas-outlets is opened and steam turned on in place of air in the other lower compartments. The water-gas formed rises to the upper chamber, gasifies the volatile constituents of the reserve of fuel and carries them down through the incandescent fuel in the chamber which has the lower gas-outlet open. The volatile matters are fixed, and enriched water-gas is obtained.—W. H. C.

Gas-producer. C. H. Morgan, Worcester, Mass. U.S. Pat. 902,432, Oct. 27, 1908.

The generator chamber is surrounded by double walls, enclosing between them an annular space, in which are placed a number of vertical pipes. The gas produced leaves the generator near the bottom and passes through ports, into the annular space, circulates round the vertical pipes, and is conducted away for use through a side pipe near the top. Air enters the lower ends of the vertical pipes, and meets a jet of water introduced into the upper ends. The hot gas circulating round the pipes, heats the air and vaporises the water, and the mixture of hot air and steam leaves the vertical pipes at the top, passes through channels in the top of the producer, and enters the upper part of the generator chamber through a central tuyère. Any water that is not vaporised, is collected and conveyed away by a gutter, into which the lower ends of the vertical pipes extend.—W. H. C.

Oil-gas ; Process and apparatus for the production of ——. F. G. L. Rincker and L. Wolter. Fr. Pat. 391,867, May 11, 1908.

Two generators are arranged one above the other and are charged with coke. The coke in the lower generator is ignited and then brought to incandescence by a blast of air which has been preheated by being caused to pass through a jacket surrounding the upper generator. The fuel in the latter is also ignited and then raised to incandescence by natural draught. The products of combustion are allowed to escape to the chimney. When the fuel is glowing brightly, the air supply is cut off and a charge of oil is introduced into the lower generator through pipes in the top. The oil passes over the glowing fuel and is partially converted into permanent gas which escapes through a pipe in the side by its own expansion. The blast of air is then again turned on, whereby the vapours of oil left in the lower generator are blown into the upper one, where they are gasified and fixed during their passage through the glowing fuel. The lower generator is at the same time again raised to incandescence and the process is repeated.—W. H. C.

Gas from tar ; Process and apparatus for the production of ——. F. G. L. Rincker and L. Wolter. Fr. Pat. 391,868, May 11, 1908.

Two generators are arranged side by side and charged with coke. After they have been raised to incandescence by a blast of air, a charge of tar is introduced into one of them and is partly transformed into gas by the glowing fuel. The gas formed escapes by its own expansion. A current of air is then introduced, which carries forward the remaining vapours of tar into the second generator where they are converted into a permanent gas. At the same time the blast of air raises the contents of the first generator to incandescence again, and the process is reversed by introducing the tar into the second generator and repeating the operations in the reverse direction.
—W. H. C,

Sulphur compounds from the refuse water of gas generators ; Removing ——. F. Bauke, Berlin. Eng. Pat. 28,280, Dec. 23, 1907.

The water from the washing and cooling tanks of gas-generators is freed from sulphur compounds by being passed through a bed of blocks, formed of 60 parts of finely-divided manganese dioxide and 40 parts of gypsum or other binding material.—W. H. C.

Dust content of technical gases ; Process for the rapid determination of the ——. M. Hahn. Ger. Pat. 201,789, Dec. 5, 1907.

A measured quantity of the gas is passed through a filter of collodion or similar substance, and the collodion is subsequently dissolved in a suitable solvent. The dust content of the gas is then estimated from the degree of turbidity of the solution, *e.g.*, by comparison with standard solutions.—A. S.

Filaments for electric lamps; Manufacture of hollow metal ——. F. W. Le Tall, London. From A. Lederer, Vienna. Eng. Pat. 26,179, Nov. 26, 1907.

Hollow filaments of tungsten or molybdenum are produced by first coating a carbon filament with the metal in question by electrically or otherwise heating it in an atmosphere of a halogen or oxyhalogen compound of the metal, and then heating the coated filament electrically to a high temperature in an atmosphere containing nitrogen, which may advantageously be mixed with a reducing gas, preferably hydrogen. The two processes may be combined by heating the carbon filament at once in a mixture of a volatile tungsten or molybdenum compound, nitrogen, and hydrogen. The union of the carbon and nitrogen is said to probably be due to the catalytic action of the metallic tungsten. A sintered, tubular metallic filament of great uniformity, suitable for the production of high voltage lamps is said to be produced.—E. F.

Filaments of Chinese ink for electric incandescent lamps; Process of producing ——. K. Rittersberg, Berlin, and H. Rubert, Charlottenburg, Germany. Eng. Pat. 11,600, May 28, 1908. Under Int. Conv., Oct. 30, 1907.

Dry Chinese ink is pulverised to dust, mixed with water to a stiff paste, and pressed by hydraulic pressure through a die in the usual manner. The paste is preferably kept hot during this process, as the filaments are then more uniform, and less pressure is required. The pressed filament can be given any form; it is not carbonised, but before being fixed in the lamp bulb it is made conductive by passing through it a high-tension electric current, as the filament has such a high resistance that ordinary currents as used for lighting cannot make it glow. When the current has once been passed, the filament can be used for any tension by varying its length and cross-section.—E. F.

Filaments for electric metallic-filament lamps; Decarbonising ——. H. Aron, Charlottenburg, and A. Geiger, Berlin, Germany. Eng. Pat. 15,079, July 16, 1908.

The carbon is removed from filaments, in which it is present together with a metal, by heating the filament to incandescence in a partial vacuum, as produced for instance by an oil-pump, in presence of just the right amount of water-vapour. The desired degree of humidity is produced by connecting the vacuum chamber with another chamber containing a substance such as sulphuric acid or sodium hydroxide solution of such dilution that it produces a definite vapour pressure under the conditions employed. If too much moisture is present in the chamber in which the carbon is removed, the filament is destroyed, whilst on the other hand the carbon is not removed at all if the amount of moisture is too small.—E. F.

Electric conductors; Manufacture of refractory ——. W. D. Coolidge, Shenectady, New York. Eng. Pat. 16,534, Aug. 5, 1908. Under Int. Conv., Aug. 7, 1907.

A binding material containing an amalgam of cadmium and lead is used in the production of refractory metallic conductors for electric lamp filaments, for use in electric furnaces, or for other purposes. The process is applicable to the production of such conductors from tungsten, molybdenum, boron, zirconium, tantalum, titanium, graphite, their compounds, or other materials, and the binder may consist of 42 parts of cadmium, 53 parts of mercury, and 5 parts of lead. The binder is driven out by heating after the mixture has been worked into the desired shape. For preparing the amalgam, the cadmium and lead are melted together and the mercury added. The alloy is homogeneous, and when partially cooled is smooth and plastic. It is mixed with tungsten powder or the like by rubbing in a mortar. The tungsten may amount to 30 to 50 per cent. by weight of the mixture, which is ductile and pliable and can be easily worked. To obtain wires or other forms, the mixture is squirted through a die at 100° to 150° C. It is stated that wires may thus be squirted of less than 1 millim. diameter; they are smooth, homogeneous, and so tough that they can survive a sharp twist and then be straightened out, without rupture. Most of the mercury and some cadmium are then removed by heating the wires, bent into loops of the shape of lamp filaments, over a Bunsen burner *in vacuo*. Enough of the binding material remains to hold the filaments together during subsequent handling. The remainder of the binding material is removed by heating electrically *in vacuo* in close proximity to an absorbent such as phosphorus pentoxide; a low current is passed till the binding material is all expelled, and is followed by a stronger current for 15 to 60 seconds. The filament so produced, is said to be strong enough for commercial use in incandescent lamps at a very high efficiency. The process may be modified by replacing half of the lead in the binding material by bismuth; the bismuth is probably expelled from the filament later than the cadmium, and therefore strengthens it when it is free from cadmium but not yet sintered and shrunk.—E. F.

Arc lamp electrodes. G. M. Little, Pittsburg, U.S.A. Eng. Pat. 17,419, Aug. 19, 1908. Under Int. Conv., Sept. 3, 1907.

The invention relates to lamps in which the arc is produced between a lower metal electrode and an upper electrode composed of magnetic oxide of iron and the oxides of titanium and chromium. The formation of a coating, on the lower electrode, of fused slag from the upper electrode produces a steady and luminous arc. To promote the fluidity of the slag, the supporting rod for the lower electrode is made of heat-insulating material, so that the heat of the arc will be but slowly conducted away from the electrode. According to the present patent the lower electrode is constructed of an alloy of iron and chromium, which has such a high fusing-point that it is only very slowly consumed, and to which the molten slag from the upper electrode will firmly adhere.—H. H. S.

Filaments for incandescence electric lamps; Process of manufacture of ——. O. and R. von Inwald. Fr. Pat. 391,722, June 26, 1908.

Very finely divided carbon in preference to colloidal graphite is added to the mass from which the filaments are made before its extrusion into threads. After extrusion the filaments are placed in a closed vessel filled with a gas under pressure and a current of electricity is passed through the filaments.—W. H. C.

Hydrocarbons having a high boiling point, and also of ethyl alcohol; Process for increasing the explosiveness of ——. Rütgerswerke Akt.-Ges., Berlin. Eng. Pat. 18,706, Aug. 19, 1907. Under Int. Conv., Oct. 17, 1906.

See Fr. Pat. 380,883 of 1907; this J., 1908, 67.—T. F. B.

Fuel suitable for internal combustion engines or the like and a method of manufacturing the same. C. E. H. Medberg and A. F. F. Medberger, Stockholm. Eng. Pat. 7703, April 7, 1908.

See Fr. Pat. 389,616 of 1908; this J., 1908, 1010.—T. F. B.

Filaments for illuminating and heating purposes; Manufacture of ——. G. Michaud and E. Delasson, Montreuil, France. Eng. Pat. 8104, April 11, 1908. Addition to Eng. Pat. 4461, Feb. 27, 1908.

See Second and Third Additions to Fr. Pat. 378,665 of 1907; this J., 1908, 677 and 742.—T. F. B.

Incandescent filaments for electric incandescent lamps. Wolfram-Lampen Akt.-Ges., Augsburg, Germany. Eng. Pat. 8416, April 15, 1908. Under Int. Conv., April 26, 1907.

See Fr. Pat. 389,363 of 1908; this J., 1908, 973.—T. F. B.

Ferrocyanogen compounds; Obtaining soluble —— *from spent gas-purifying material or other products.* Ger. Pat. 202,399. *See* VII.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

Petroleum wells in Turkey. P. Martell. Petroleum, 1908, 4, 144.

At Kajara (Asiatic Turkey) a number of shallow pits yield an aggregate of about 1 ton of crude oil per diem. This is distilled in a very primitive manner, and furnishes oil for local consumption, the asphaltic residuum being utilised as fuel. Near Kerkuk there are seven producing wells about 25 ft. deep, from which the oil is baled into earthen reservoirs, and conveyed to Kerkuk for treatment. The primitive refinery there produces about 110 galls. of distillate per diem. Another well at Neftdagh, S.E. from Kerkuk, yields a similar quantity of crude oil. Near Mendeli, 33 oil springs have been discovered, at which the oil exudes from the sides of the wells which have been dug, and collects on the saline water therein. The output is given as about 20 tons per month in summer, and half that quantity in winter; but the well-equipped refinery erected at Bakuba has been closed, and the oil is now distilled at Bagdad, in the usual primitive manner. The crude oil is largely used for veterinary purposes, and the malodorous distillate as lamp oil. Sources of crude oil also exist at Parghiri near Warr, in the neighbourhood of Baiburt, and near Alexandretta where, however, extensive prospecting has failed to reveal any workable quantity of oil.—C. S.

Petroleum; A new reaction of ——. E. Molinari and P. Fenaroli. Ber., 1908, **41**, 3704—3707.

On treating crude and refined petroleums for about an hour with ozonised air, they behaved like unsaturated compounds containing double linkages. The white ozonide obtained by treating purified Russian petroleum (b. pt. 135°—290° C.) with ozone at 8° to 10° C. was separated and washed with petroleum spirit (b. pt. below 40° C.). After separation of the ozonide, the optical activity of the petroleum remained unaltered, showing that the optically-active constituents do not react with ozone, and that there can therefore be no unaltered cholesterol in petroleum. Four samples of the ozonide after drying *in vacuo* at 4° to 5° C. were found to contain from 62·52 to 64·14 per cent. of carbon and 6·43 to 6·81 per cent. of hydrogen, corresponding closely with the formula, $C_{17}H_{20}O_6$. The yield of ozonide from the original petroleum was about 12 per cent., whilst at least 32 per cent. was obtained from the fraction distilling between 295° and 300° C. A hydrocarbon, $C_{17}H_{20}$, of the naphthene series yielded an ozonide, $C_{17}H_{20}O_6$, with a molecular weight of 320, and this, it was concluded, was the substance contained in the Russian petroleum. A Roumanian crude petroleum yielded 16·63 per cent. of an ozonide of the same composition, whilst from the fraction of this petroleum distilling between 275° and 300° C. at a pressure of 35 mm., the yield was nearly 80 per cent. From a crude Italian petroleum a small proportion of an ozonide was obtained. This had the composition, $C_{15}H_{16}O_6$, and was apparently derived from a hydrocarbon $C_{15}H_{16}$, belonging to the series C_nH_{2n-14}, and homologous to the compound in Russian and Roumanian petroleum. It thus may be possible to distinguish between petroleums of different origin by the difference in composition of the ozonides obtained from the respective unsaturated hydrocarbons they contain. These experiments also show that the optical activity of petroleums is not due to compounds with unsaturated double linkages.—C. A. M.

Patents.

Distillation of carbonaceous substances. T. Parker, London. Eng. Pat. 18,118, Aug. 9, 1907.

The claim is for improvements in the process described in Eng. Pat. 14,365 of 1906 (this J., 1907, 1130) and consists in effecting the carbonisation in tubular retorts having an internal diameter of from 4 to 6 inches. The use of such narrow retorts ensures the easy penetration of the heat and complete carbonisation of the material. The retorts are preferably arranged vertically and have a slight "downwardly flaring" shape. They are spaced apart in the furnace so that the hot gases may pass around and heat them uniformly.—W. H. C.

Liquids [crude petroleum, glycerin, water, etc.] contaminated by coloured or evil-smelling organic substances, decomposition products, or micro-organisms; Purification of ——. H. Wislicenus and H. Bucherer. Ger. Pat. 202,166, Nov. 7, 1905.

The claim is for the use of spongy aluminium hydroxide (this J., 1904, 765; 1905, 294; 1908, 973) as a purifying agent. It is stated that by treatment with this hydroxide, dark-coloured, viscous crude petroleum diluted with petroleum spirit can be converted directly into a light-coloured oil free from evil-smelling constituents. The hydroxide can also be used for decolorising crude glycerin, sterilising water, etc.—A. S.

Lignite-bitumen; Purification of ——. E. Schliemanns Export-Ceresin-Fabr., G.m.b.H. Ger. Pat. 202,909, May 2, 1907.

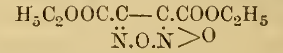
The crude bitumen extracted from lignite forms a valuable raw material for the preparation of a high-melting, hard wax. In order to free it from the dark-coloured, pitch-like, substances accompanying it, the following process is proposed:—The crude bitumen is melted with an equal or greater quantity of paraffin wax, and the mixture is first heated with concentrated sulphuric acid, and then treated with "decolorising powder." In this way a light-coloured product is obtained, and finally, if the process be repeated, a colourless one. It is stated that the paraffin wax, which can be subsequently removed by hot pressing, renders the bitumen capable of resisting the action of the acid.—A. S.

Distilling apparatus; Continuous ——. Ger. Pat. 201,372. *See* I.

IV.—COLOURING MATTERS AND DYESTUFFS.

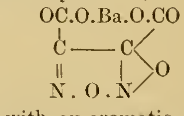
Indigo group; A new synthesis in the ——. H. Wieland and E. Gmelin. Ber., 1908, **41**, 3512—3517.

The authors have discovered a new and easy synthesis of derivatives of the indigo group. Pröpper's ester,

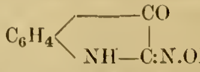


$$\begin{array}{c}H_5C_2OOC.C{-}C.COOC_2H_5\\ \ddot{N}.O.\dot{N}{>}O\end{array}$$

is readily saponified by barium hydroxide to the barium salt of furoxandicarboxylic acid,



On condensation with an aromatic amine, one carboxyl group is split off as carbon dioxide and the furoxan ring disappears, the base entering into combination; with aniline the substance formed is *iso*nitrosomalonic acid-anilidoxime, HOOC.C(: N.OH).C(: N.OH).NH.C_6H_5. Under the action of acetic anhydride, the second carboxyl group now disappears; the aldoxime group thus formed loses water, giving a nitrile, and at the same time an acetyl residue combines with a secondary nitrogen yielding cyano-N-acetylformanilidoxime, NC.C(: N.OH).N(CO.CH_3)C_6H_5. On warming with ammonium sulphide the acetyl group is split off and a thioamide results which when treated with concentrated sulphuric acid is converted into α-isatoxime,



identical with the substance prepared by Baeyer in 1882 by the action of nitric acid on ethylindoxylic acid. On warming with sulphuric acid, this substance yields indigo, or if reduced with zinc and dilute acetic acid and subsequently oxidised, it yields isatin. The reactions described can be made to give an almost quantitative yield: the raw materials are glacial acetic acid, nitric acid, and aniline. Owing however to the relative length of the synthesis and the exceedingly low cost at which synthetic indigo is being produced to-day by other methods, it is doubtful if this process could find application on the manufacturing scale.—R. B. B.

Halogenated indigotins. C. G. Schwalbe and H. Jochheim. Ber., 1908, **41**, 3796—3798.

A table is given showing the solubilities in various solvents, the colour of the solutions, the light-absorption of the pyridine solutions, and the dyeing properties of indigo and *o*-, *m*-, and *p*-dichloroindigo. *o*-Dichloroindigo dyes a bright greenish-blue, the *m*-compound, a reddish blue and the *p*-compound violet.—J. C. C.

Halogenated indigotinsulphonic acids. C. G. Schwalbe and H. Jochheim. Ber., 1908, **41**, 3798—3802.

m-Dichloroindigotetrasulphonic, *p*-dichloroindigohexasulphonic, and tetrachloroindigodisulphonic acids have been prepared by treating the corresponding halogenated phenylglycines with fuming sulphuric acid containing 60 per cent. of sulphur trioxide. The two former were isolated by precipitating their solutions in amyl alcohol with light petroleum or benzene and were purified by precipitating the alcoholic solutions with ether. The tetrachloro-acid separates from its hot aqueous solution on cooling. The colour of the solutions and the light-absorption in aqueous solution are recorded and compared with those of Indigo Carmine. *m*-Dichloroindigotetrasulphonic acid dyes a greenish blue, *p*-dichloroindigohexasulphonic acid dyes in green shades, and tetrachloroindigodisulphonic acid dyes a bluish green.—J. C. C.

Anthraquinone derivatives; Colour and affinity for mordants of ——. G. Heller. Ber., 1908, **41**, 3639—3640.

β-Chloroanthraquinonecarboxylic acid ($CO_2H : Cl = 1 : 2$ or $2 : 3$) and 4-chloroanthraquinone-1-carboxylic acid resemble other simple anthraquinone derivatives in that they are pale yellow in colour. The sodium salts are paler than the acids, and the alkaline solutions are almost colourless. The substances are not fixed by mordants. The author considers that the affinity for mordants of anthraquinone derivatives varies with the intensity of colour of the sodium salts.—J. C. C.

Patents.

Disazo-colouring-matters [dyestuffs] dyeing cotton and wool; Manufacture of blue ——. C. Ris and E. Haager, Dusseldorf, Germany. Eng. Pat. 27,609, Dec. 14, 1907.

The disazo-dyestuffs prepared by combining a tetrazo-compound of the benzidine series (for example the tetrazo-derivative of dianisidine) with, first, one molecular proportion of 2-naphthol-8-sulphonic acid and second, with 1-amino-8-naphthol-4-sulphonic acid, dye both unmordanted cotton and wool in a boiling bath containing sodium sulphate, bluish-violet to pure blue shades which are fast to fulling; by a further treatment with copper sulphate the shades also become very fast towards light. —J. C. C.

Aniline, its homologues and derivatives; Manufacture of ——. A. G. Bloxam, London. From Act.-Ges. für Anilinfabr., Berlin. Eng. Pat. 3966, Feb. 21, 1908.

The process consists in heating chlorobenzene or a homologue or derivative thereof with ammonia in the presence of a suitable copper compound. *Example* 1. A mixture of chlorobenzene (200 parts), 25 per cent. solution of ammonia (550 parts), and copper sulphate (25 parts) is heated in a closed vessel for about 20 hours at 180° C., the temperature being raised to 200° C. towards the end. The mass is then acidified with sulphuric acid, the aniline sulphate filtered off and converted into the base in the usual manner. *Example* 2. A mixture of chlorobenzene-*p*-sulphonic acid (85 parts), 25 per cent. solution of ammonia (370 parts), and cupric chloride (5 parts) is heated similarly for 12 hours to 170° C. The mass is mixed with sodium carbonate, ammonia distilled off, and, after filtering, the liquid is concentrated, when the sodium salt of sulphanilic acid crystallises out. —J. C. C.

Para-aminophenol, its homologues and substitution products; Manufacture of ——. A. G. Bloxam, London. From Act.-Ges. für Anilinfabr., Berlin. Eng. Pat. 4044, Feb. 22, 1908.

The process consists in heating *p*-chlorophenol or a homologue or derivative thereof with ammonia or a primary amine of the fatty series in the presence of a suitable copper compound. *Example* 1. A mixture of *p*-chlorophenol (50 parts), 25 per cent. solution of ammonia (370 parts), and copper sulphate (8 parts), is heated in a closed vessel during 12 hours to 140° C. After acidification and removal of unaltered *p*-chlorophenol by a current of steam, *p*-aminophenol is obtained by adding sodium carbonate and some sodium sulphite. *Example* 2. In a similar manner *p*-methylaminophenol is prepared by heating a mixture of *p*-chlorophenol (130 parts), 33 per cent. of solution of monomethylamine (270 parts), and copper sulphate (2 parts) to 135° C. for 10 hours. *Example* 3. 4-Chloro-1-phenol-2-sulphonic acid (100 parts), 25 per cent. solution of ammonia (550 parts), and cupric chloride (6 parts) are heated similarly to 165° C., for 12 hours. On acidification with hydrochloric acid, 4-amino-1-phenol-2-sulphonic acid separates out.—J. C. C.

Monoazo dyestuffs; Preparation of yellow ——. Act.-Ges. f. Anilinfabr. Ger. Pat. 202,016, June 19, 1907.

Yellow, acid dyestuffs, fast to light, acids, and alkalis, are obtained by combining the diazo derivatives of mono-, di-, or trichloroaniline with 1·3-phenylenediamine-2·5- or 4.6- disulphonic acids. These acids are obtained either by the action of sodium sulphite on 1·3-dinitro-2-chlorobenzene-5-sulphonic acid and subsequent reduction, or by the sulphonation of *m*-phenylenediamine.—T. F. B.

p-Phenylenediamine; Process for preparing ——. Act.-Ges. f. Anilinfabr. Ger. Pat. 202,170, Dec. 7, 1907.

p-Dichlorobenzene is converted into *p*-phenylenediamine by heating under pressure with ammonia, in presence of copper compounds.—T. F. B.

p-Phenylenediaminemonosulphonic acid; Process for preparing ——. Act.-Ges. f. Anilinfabr. Ger. Pats. 202,564, Nov. 15, 1907, and 202,565, Dec. 6, 1907.

p-Phenylenediaminemonosulphonic acid is obtained by heating *p*-dichlorobenzenesulphonic acid with aqueous ammonia under pressure, in presence of copper compounds. When no copper compounds are present, *p*-chloraniline-*o*-sulphonic acid is produced. According to the second patent, this is also converted into *p*-phenylenediaminesulphonic acid by heating with ammonia in presence of copper salts.—T. F. B.

Bromo-substitution products of β-naphthylindigo; Manufacture of ——. O. Imray, London. From Meister, Lucius, und Brüning, Hoechst a/Main, Germany. Eng. Pat. 5299, March 9, 1908.

It is found that by the methods described it is possible to directly brominate β-naphthylindigo, the substitution products obtained being distinguished by the fastness and clearness of the shades which they yield upon dyeing. Example I. 15 parts of β-naphthylindigo are suspended in 500 parts of carbon tetrachloride, 13 parts of bromine are added, and the cold mixture is stirred for 24 hours. After filtering, the residue is washed with carbon tetrachloride, dried, boiled with 10 parts of "a bisulphite solution" and 100 parts of water, filtered, washed, and boiled with alcohol until the alcoholic filtrate is of a pure green colour. The product contains approximately the amount of bromine calculated for monobromo-β-naphthylindigo. It is a dark green powder which is most readily dissolved by such solvents as aniline, nitrobenzene, and chloroform, and gives with concentrated sulphuric acid, a blue solution. From an alkaline hydrosulphite vat cotton is dyed in light green tints. Example II. Using 15 parts of β-naphthylindigo, 500 of carbon tetrachloride, and 53 of bromine, boiling for 36 hours under a reflux condenser, and then treating as in Example I., a blackish-green powder is obtained which contains approximately the amount of bromine calculated for dibromo-β-naphthylindigo. Example III. 15 parts of β-naphthylindigo are introduced in small portions into 100 parts of bromine, cooled by ice, and the mixture stirred for two days. It is then diluted with carbon tetrachloride and treated as in Example I. The product corresponds to a tetrabromo-β-naphthylindigo; it is not readily soluble in sulphuric acid, and gives, in the vat, fast green shades upon cotton.—F. M.

Vat [thioindigo] dyestuffs; Manufacture of ——. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 390,484, July 29, 1907.

See U.S. Pats. 872,085 and 872,086 of 1907; this J., 1908, 116. The *m*- or *p*-aminophenylthioglycol-*o*-carboxylic acids or their acidyl derivatives can be converted into similar red-brown or violet dyestuffs by heating with nitrohydrocarbons. Brown, violet, and black dyestuffs are also formed when the acetaminophenylthioglycol-*o*-carboxylic acids are heated with sulphur or alkali bisulphites. Halogen derivatives of the above dyestuffs are obtained, for example, by treating the black dyestuff from *p*-amino-oxythionaphthene with bromine, a fast black dyestuff being formed, or by brominating the brown dyestuff from *m*-amino-oxythionaphthene, when an orange dyestuff results.—T. F. B.

Vat dyestuffs; Preparation of ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 201,837, April 21, 1907.

Oxythionaphthenes or their carboxylic acids, which contain an amino-group in the benzene nucleus, may be condensed with isatin to form vat dyestuffs. Thus, 6-amino-3-oxy(1)thionaphthene gives a dyestuff which dyes wool bright orange-yellow shades, and cotton pale red-brown.—T. F. B.

Dyestuffs of the anthracene series; Preparation of blue ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 201,905, Nov. 1, 1907.

Blue dyestuffs, which have the constitution of 1-arylamino-4-amino-8-methoxyanthraquinones, are obtained by treating 4-nitrochrysazindimethyl ether (see Ger. Pat. 193,104; this J., 1908, 680) with an aromatic amine and with a reducing agent such as stannous chloride, with or without an indifferent solvent.—T. F. B.

5-Alkyloxy-2-acetyl-(1)-thiophenols; Preparation of ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 202,632, June 22, 1907.

By reducing alkylated *m*-phenolsulphonic acids with zinc dust and dilute sulphuric acid, or by alkylating *m*-aminophenols in the hydroxyl-group, and subsequently replacing the amino group by the -SH group, *m*-alkyloxythiophenols are obtained. These may be converted, by treatment with acetyl chloride in presence of aluminium chloride, into 5-alkyloxy-2-acetyl-1-thiophenols; a certain quantity is further acetylated in the -SH group, but this acetyl group can be readily removed by warming with dilute mineral acids.—T. F. B.

Halogen derivatives of nitrogenous substitution products of the thioindigo series; Preparation of ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 203,029, Oct. 20, 1907. Addition to Ger. Pat. 198,644.

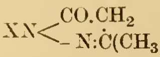
A very fast, orange dyestuff is obtained by brominating 6,6′-diaminothioindigo. A similar increase of fastness is produced on brominating the brown dyestuffs obtained by condensing *m*-amino-aryl-thioglycollic acids or their acidyl derivatives (which have both *o*-positions to the -S.CH_2.COOH group unoccupied) by means of sulphuric acid chlorhydrin: the dyestuffs obtained thus are reddish-brown. By halogenating the blue dyestuff obtained by condensing *m*-amino-*o*-tolylthioglycollic acid by means of sulphuric acid chlorhydrin, another blue dyestuff, considerably faster than the parent, is formed.
—T. F. B.

Monoazo dyestuffs particularly suitable for the manufacture of lakes; Production of ——. Badische Anilin und Soda Fabrik. Fr. Pat. 391,155, May 29, 1908. Under Int. Conv., Feb. 10, and May 9, 1908.

The diazo compound of 3-chloro-6-nitraniline-4-sulphonic acid is combined with β-naphthol or with 2.6-naphtholsulphonic acid or 2.3.6-naphtholdisulphonic acid. The yellowish-red dyestuffs thus formed are well suited for the manufacture of lakes of brilliant orange colour, which are insoluble in oil, of good covering power, and fast to light, heat, and lime.—T. F. B.

Naphthylpyrazolone-sulphonic acids and azo dyestuffs derived therefrom; Manufacture of ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 391,456, June 15, 1908. Under Int. Conv., June 28, 1907.

By condensing the sulphonic acids of naphthylhydrazines with acetoacetic ester, sulphonic acids of 1-naphthyl-3-methyl-5-pyrazolone are obtained which have the formula,



$$XN<\begin{matrix}CO.CH_2\\ -N{:}\dot{C}(CH_3)\end{matrix}$$

where X represents the radical of a naphthylamine-sulphonic acid.

Example.—A paste (warmed to 70° C.) consisting of 100 kilos. of 2-naphthylhydrazine-4-8-disulphonic acid and 650 kilos. of water is mixed with a solution of 48 kilos. of sodium acetate crystals. 42 kilos. of acetoacetic ester are gradually added, the mixture being kept feebly acid. The mass is then heated to 80° C. and salt added. On cooling, the pyrazolone sulphonic acid crystallises in colourless needles. By combining the new product with diazo-compounds, azo dyestuffs are produced in the ordinary manner.—P. F. C.

Disazo dyestuffs; Process for preparing secondary ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 202,116, June 28, 1907. Addition to Ger. Pat. 198,102, Dec. 11, 1906.

The aryl-sulphonic esters of 1.8-aminonaphthol or its sulphonic acids are diazotised, and the process is completed as in the original patent (this J., 1908, 218), the arylsulpho group being removed either after combination with the intermediate amine, or after the final combination. Combination is stated to take place more readily and smoothly than in the original process. The arylsulphonic esters are obtained by the action of arylsulphochlorides on solutions of the aminonaphthol or its sulphonic acids containing alkali hydroxides.—T. F. B.

Trisazo dyestuffs; Process for preparing ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 202,117, June 30, 1907. Addition to Ger. Pat. 198,102, Dec. 11, 1906. (See Eng. Pat. 14,248 of 1907; this J., 1908, 800.)

The aminoazo-compounds obtained by combining amines with diazotised *peri*-aminonaphthol or its sulphonic acids or their acidyl esters, are diazotised and combined with a further molecule of an amine before the final combination with 2.5-aminonaphthol-7-sulphonic acid or -1.7-disulphonic acid or their derivatives. The introduction of this further nucleus into the dyestuffs results in increased fastness without affecting the purity of the shades.—T. F. B.

Mercury salts of fluorescein; Preparation of ——. H. Pauly and V. Traumann. Ger. Pat. 201,903, Nov. 20, 1906.

As many as four atoms of mercury can be introduced into the flourescein molecule by the action of mercuric chloride on alkaline solutions of fluorescein. The products give fast lakes of fine shades on mordanted fabrics. The introduction of mercury deepens the colour of the dyestuffs, as in the case of the halogen substituents.—T. F. B.

Sulphide dyestuffs; Process for preparing brown ——. Chem. Fabr. Griesheim-Elektron. Ger. Pat. 202,639, Nov. 17, 1907. Addition to Ger. Pat. 199,979, Aug. 15, 1907.

Aromatic *m*-dinitro compounds, which contain no hydroxy-groups, or their reduction products, are heated to high temperatures with polysulphides and higher alcohols, such as pentoses, hexoses, or other carbohydrates. (See U.S. Pat. 889,936 of 1908; this J., 1908, 744.)
—T. F. B.

p-Chloro-1-hydroxyanthraquinone; Process for preparing ——. R. Wedekind und Co. Ger. Pat. 202,770, March 16, 1907. Addition to Ger. Pat. 167,743, Aug. 19, 1904. (See this J., 1906, 472.)

p-Chloro-1-hydroxyanthraquinone is obtained by the action of nascent chlorine on an aqueous suspension of *α*-hydroxyanthraquinone in presence of a large excess of sulphuric acid, at a temperature of about 115° C. In aqueous suspension alone, or even in presence of acetic acid, no chlorination takes place.—T. F. B.

Anthraquinone derivatives; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 1678, Jan. 24, 1908. Addition to Eng. Pat. 28,765, Dec. 17, 1906.

See Addition of Jan. 24, 1908, to Fr. Pat. 372,676 of 1906; this J., 1908, 800.—T. F. B.

Sulphur [sulphide] dyestuff; Brown ——. A. Herre and B. Jaeckel, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 895,637, Aug. 11, 1908.

See Fr. Pat. 388,539 of 1908; this J., 1908, 895.—T. F. B.

Azo dyestuff. P. Volkmann, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 902,186, Oct. 27, 1908.

See Fr. Pat. 391,456 of 1908; preceding.—T. F. B.

Dithiosalicylic acid compounds; Manufacture of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 3155. Feb. 12, 1908.

See Fr. Pat. 387,303 of 1908; this J., 1908, 800.—T. F. B.

p-Phenylenediamine, its homologues and derivatives; Manufacture of ——. A. G. Bloxam, London. From Act.-Ges. f. Anilinfabr., Berlin. Eng. Pat. 3875, Feb. 20, 1908.

See Ger. Pat. 202,170; preceding.—T. F. B.

o-Nitrated derivatives of amino compounds of the benzene or naphthalene series; Process for the production of ——. Act.-Ges. f. Anilinfabr. Fr. Pat. 392,006, Sept. 13, 1907.

See Ger. Pat. 194,951 of 1906; this J., 1908, 623.—T. F. B.

Vat [anthracene] dyestuffs; Orange to yellow —— *and process of making same.* B. Mayer and A. Schaarschmidt, Assignors to Soc. Chem. Ind. in Basle, Basle, Switzerland. U.S. Pat. 902,895, Nov. 3, 1908.

See Eng. Pat. 7583 of 1908; this J., 1908, 1015.—T. F. B.

Dyestuff; Orange or brown —— *and process of making same.* A. Gressly, Frankfort on Maine, Germany. Assignor to Cassella Color Co., New York. U.S. Pat. 903,284, Nov. 10, 1908.

See Eng. Pat. 19,807 of 1907; this J., 1908, 975.—T. F. B.

Sodium arylamines; Manufacture of ——. O. Liebknecht, Assignor to Deutsche Gold- und Silber-Scheide Anstalt, vorm. Roessler, Frankfort on Maine, Germany. U.S. Pat. 903,588, Nov. 10, 1908.

See Eng. Pat. 11,335 of 1908; this J., 1908, 893.—T. F. B.

Triphenylmethane series; Blue chrome dyestuffs of the ——. Fabr. de Coul. d'Aniline et d'Extraits ci-dev. J. R. Geigy. First Addition, dated Sept. 6, 1907, to Fr. Pat. 384,979, Feb. 21, 1907.

See Ger. Pats, 198,729, 198,909, and 199,943; this J., 1908, 801, 936.—T. F. B.

Condensation products of gallocyanines with ammonia; Production of ——. Manuf. de Mat. Col., Ancien. L. Durand, Huguenin, et Cie. Fr. Pat. 391,888, May 27, 1908. Under Int. Conv., June 3, 1907.

See U.S. Pat. 898,842 of 1908; this J., 1908, 1015.—T. F. B.

[Thioindigo] dyestuffs; Process of making red ——. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 391,917, June 22, 1908. Under Int. Conv., Oct. 22, 1907.

See Eng. Pat. 16,017 of 1908; this J., 1908, 1106.—T. F. B.

Tannin and dyewood extracts, etc. Fr. Pat. 391,306. *See* XIV.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES YARNS, AND FIBRES.

Fibres from the Gold Coast. Bull. Imp. Inst., 1908, **6**, 239—242.

The following fibres were examined:—(1). Fibre of *Sansevieria* species, probably *S. guineensis.* The soft, white fibre, about 3 ft. 9 in. long, was valued at £60 per ton. (2). Plantain fibre (*Musa sapientum*). The fibre was brownish-white, of fair strength, and about 4 ft. long; it was worth £40 per ton as compared with £38—£42 for good Manila hemp. (3). Banana fibre (*Musa sapientum*). This was similar to the plantain fibre, and was valued at £36 per ton as compared with £35—£36 for fair Manila hemp. (4). Fibre of *Triumfetta semitriloba.* The fibre was soft, of a pale buff colour, and 5 ft. long, the length of the ultimate fibre being 0·04—0·14 inch; it was worth £35 per ton, as compared with £35—£40 for finest Bengal jute. (5). Pineapple fibre (*Ananas sativus*). The soft, white fibre, about 3½ ft. long, was valued at £30 per ton, and might perhaps be used as a flax substitute. (6). Kapok (*Eriodendron anfractuosum*). The specimen was inferior to good commercial kapok. The results of the chemical examination of the first five fibres are shown in the following table.

	(1).	(2).	(3).	(4).	(5).
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Moisture	10·3	10·5	10·1	10·3	9·5
Ash.............	0·2	0·9	0·8	0·8	1·1
*α-Hydrolysis (loss)	8·8	11·1	13·0	7·3	13·7
*β-Hydrolysis (loss)	10·5	19·7	20·7	10·4	19·4
*Acid purification (loss)	1·4	1·6	1·3	0·6	1·7
Cellulose	81·8	77·0	74·0	73·5	81·5

* (See this J., 1907, 757.)

—A. S.

Fixation of various derivatives of the same dyestuff and explanation of the depth of the dyeing. L. Pelet-Jolivet and N. Andersen. Compt. rend., 1908, **147**, 808—810.

The authors consider solutions of dyestuffs to act as solutions of electrolytes with dissimilar ions. Hence a solution of the pure dyestuff without the addition of either salt or acid, should play the part of an electrolyte in the presence of wool or other adsorbent. The fixation of the dyestuff should follow the laws relating to the distribution of electric charges in aqueous solutions. Equivalent solutions of several dyestuffs were prepared and treated with the same amount of wool. With derivatives of Safranine, the depth of the shade increases in the following order: hydrochloride, sulphate, hydroxide, phosphate. The salts of Crystal Ponceau were then examined. The depth of the shade decreases in the following order, aluminium salt, free dye-acid, magnesium salt, sodium salt. Substantive dyestuffs for cotton behave like acid dyestuffs, except that their greater tendency to form colloids increases the depth of the shade.—F. Shdn.

Oleic acid; Colour reaction of ——. *Rapid method of distinguishing between animal and vegetable fibres.* A. Manea. *See* XII.

Poisoning by chromium in industrial operations. Lewin. *See* XVIII*B*.

Patents.

Mercerising, bleaching, dyeing, and the like treatment of yarns; Machinery for ——. W. P. Yates, Bradford, Yorks. Eng. Pat. 27,963, Dec. 19, 1907.

The machine consists of a series of tanks provided with tracks for supporting and guiding a number of travelling carriers. These carriers hold carriages over which the hanks are stretched. Each carriage consists of two rollers, which can be relatively adjusted by means of contracting arms, and have a number of lateral projections in order to allow easy access of the liquor to the yarn from all sides. The ends of the rollers are provided with toothed wheels, by means of which they are rotated during their passage through the machine.—P. F. C.

Cop dyeing machines. The British Cotton and Wool Dyers' Assoc., Ltd., and A. Hoegger, Manchester. Eng. Pat. 13,933, Nov. 20, 1907.

The machine is intended for use with a series of vats, which contain the dye-liquor to be circulated through the cops. These dye-vats are fitted with rails upon the edges, along which the frame supporting the cop-carriers may be moved. In this frame an exhaust cylinder is so fixed that it may be raised and lowered by means of a rack and pinion and is connected at its lower end by means of pipes with a circulating pump and the cop-carriers. These latter are hollow, the top being formed by the cop-plate, which is secured by clamps, and the interior space is connected by pipes with the circulating pump and the exhaust cylinder. The cops are lowered into the dye-vat and the liquor circulated by the aid of the pump, and upon completion of the dyeing operation, the cops may be freed from excess of liquor by exhausting the cylinder and drawing air through them. Flexible pipes are employed for conveying the steam for the circulating pump and exhaust jet from the main steam pipe.—F. M.

Dyeing process whereby designs are produced on sealskin and all kinds of plush and velvet. W. Weinzirl, Wels, Austria. Eng. Pat. 17,681, Aug. 22, 1908.

The material is folded or gathered up according to the design which it is desired to produce, and the folds are firmly bound or stitched. The material is then quickly dyed, the folds are opened out, and the process is completed by washing, drying, and finishing.—P. F. C.

Dyeing; Apparatus for ——. H. Anner, Phillipsburg, N.J., Assignor to Standard Silk Co. U.S. Pat. 902,271, Oct. 27, 1908.

A reel, which is caused to revolve at the required speed, is mounted on a carriage on the top of the dye-vat. The carriage can be mechanically moved in either direction along the top of the dye-vat, or locked in any particular position.—P. F. C.

Dyestuffs for animal fibres, and processes for obtaining them. H. R. Vidal. Fr. Pats. 391,465 and 391,466, Aug. 29, 1907.

When aromatic amines, polyamines, or hydroxyamines are condensed with one another or with phenols, polyphenols, naphthols, dihydroxynaphthalenes, hydroxyquinolines, hydroxyanthraquinones, dihydroxydiphenylamine, etc., products are obtained which give dyestuffs when their neutral solutions are treated with bichromates or other oxidising agents. The colouring matters may be obtained on animal fibres by immersing the fibre, previously impregnated with the oxidising agent, in a neutral solution of the condensation product. Example.—By adding 188 grms. of phenol to 108 grms. of paraphenylenediamine in 5 litres of water, a solution is obtained which deposits pearly scales on cooling. This substance, dissolved in warm water, develops an intense black on chromed wool. The same effect may also be obtained by immersing the chromed wool in the solution of the two ingredients without isolation of the condensation product. In the second patent, reserve effects are obtained on fabrics, especially in conjunction with the above process, by means of the application of paraffin wax, either molten or in solution, the paraffin wax afterwards being recovered by solvents in an apparatus based on the Soxhlet principle. —P. F. C.

Chrome lakes on textiles; Process for fixing —— with the aid of ammonium chromate. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 391,388, May 16, 1908. Under Int. Conv., May 23, 1907.

Chrome lakes are fixed on the fibre by applying ammonium chromate, or a mixture of another chromate and an ammonium salt, together with either a mordant dyestuff and an organic reducing agent, or a composition capable of forming a dyestuff on the fibre by oxidation, followed by steaming.

Examples. A mixture of 2 parts of paraphenylenediamine, 95 parts of starch thickening, and 2—3 parts of ammonium chromate, printed and steamed, gives brown shades. A mixture of 10 parts of Alizarin Yellow GG paste, 96 parts of thickening, 1½—2 parts of ammonium chromate, 4—5 parts of glycerin, and 7 parts of ammonium ricinoleate, (40 per cent.) is printed, and the material is dried and steamed for 2—15 minutes. By adding chalk to this printing paste, fast resist colours can be obtained on Aged Black.—P. F. C.

Impregnation of paper, textiles, or similar materials: Preparation of a mass for the ——. H. F. E. Zander. Ger. Pat. 201,228, Feb. 11, 1906.

About 150 grms. of agar-agar are dissolved by boiling with 3 litres of water, with addition of a solution of 5 grms. of oxalic acid or salicylic acid; the quantity of acid added may be increased or diminished according as a harder or softer product is desired. To this solution are added 80 grms. of glycerin and 100 grms. of Japan wax, stearine, or ceresin, and the whole is boiled, a colouring matter being also added if desired.—A. S.

Artificial horse-hair and ribbons of cellulose; Manufacture of ——. E. Crumière, Paris. Eng. Pat. 7126, March 31, 1908.

See Addition of March 17, 1908, to Fr. Pat. 377,118 of 1907; this J., 1908, 977.—T. F. B.

Dyeing machine. J. Sulzbach, New York. Eng. Pat. 23,902, Oct. 29, 1907.

See U.S. Pat. 871,376 of 1907; this J., 1908, 119.—T. F. B.

Dyeing acetylcellulose or fabrics made from the same; Processes for ——. J. Wetter, London. From Knoll und Co., Ludwigshafen on Rhine, Germany. Eng. Pat. 24,284, Nov. 2, 1907.

See Fr. Pat. 383,636 of 1907; this J., 1908, 332.—T. F. B.

Formaldehyde-sulphoxylic acid; Preparation of ——. Fr. Pat. 391,924. *See* VII.

Sizing of paper, and fulling, weighting, dressing, dyeing, and finishing of paper and textiles. Ger. Pat. 202,312. *See* XIX.

VI.—COLOURING WOOD, PAPER, LEATHER, &c.

Patent.

Dyeing skins; Machine for ——. Billaud, Fillias et Cie. Fr. Pat. 391,717, June 20, 1908.

A machine for the brush dyeing of skins is provided with means for automatically carrying away the skin after it has passed under the brush for the number of times desired.—H. G. B.

VII.—ACIDS, ALKALIS, SALTS, AND NON-METALLIC ELEMENTS.

Tangential [sulphuric acid] chambers; Direction of the gases in Meyer's ——. K. J. Beskow. Z. angew. Chem., 1908, **21**, 2312—2315.

In order to ascertain the path followed by the gases in Meyer's tangential sulphuric acid chambers, the author used an open glass tube, in which a glass spiral was mounted, and which on its under side was provided near the ends with indentations, so as to form a kind of boat, in which sulphuric acid could condense. This tube was placed in a chamber in different positions, and the amount of acid condensed in it in a given time determined. The results obtained, details of which are given, show that the motion of the gases is mainly tangential throughout nearly the whole of the chamber.—A. S.

Ammonia and organic bases; Oxidation of —— by means of contact substances. E. Orlow. J. Russ. Phys.-Chem. Ges., 1908, **40**, 659—660. Chem. Zentr., 1908, **2**, 1499.

A mixture of air and ammonia can be oxidised to nitrous and nitric acids by using copper wire gauze as a catalyser.

The tube containing the gauze must be heated at first, but the heating can be stopped as soon as the catalyser becomes strongly incandescent. Aniline and analogous bases can be oxidised in a similar manner.—A. S.

Acid carbonates of calcium and barium ; Preparation and composition of ——. E. H. Keiser, S. Leavitt, and L. McMaster. J. Amer. Chem. Soc., 1908, **30**, 1711—1718.

By the interaction of ammonium bicarbonate and calcium or barium chloride solution at 0° C., a precipitate of the acid carbonate of calcium or barium is obtained, which may be dried without decomposition, provided the temperature is not allowed to rise. Analyses show that the proportion of carbonic acid is higher than that generally assumed to be present, the composition of the calcium salt corresponding nearly with the formula, $CaCO_3.1\cdot75H_2CO_3$. The acid carbonate of barium, prepared as above, but with the addition of gelatin to the solution to prevent decomposition, has been analysed, without drying, by determining the ratio, $Ba : CO_2$; it corresponds with the formula, $BaCO_3,1\cdot5H_2CO_3$. Solutions of the acid carbonates, prepared at the ordinary temperature by passing an excess of carbon dioxide into solutions of the hydroxides and then agitating with air until just alkaline to phenolphthalein, give figures, on analysis, agreeing closely with the above formulæ.—F. Sodn.

Ferric chloride ; Influence of neutral salts on the hydrolysis of ——. G. Malfitano and L. Michel. Compt. rend., 1908, **147**, 803—806. (See also this J., 1908, 74.)

In solutions of ferric chloride containing potassium chloride, the formation of the colloidal hydroxide takes place more rapidly than in a solution containing ferric chloride alone. When the ratio, $FeCl_3 : KCl$, is greater than unity, the increase with time, in the electrical conductivity of the solution when kept at 50° C., is more rapid and attains a higher value than with a solution of ferric chloride alone. When the ratio of these chlorides is less than unity, the increase of conductivity reaches a lower value, even if the increase is more rapid at the commencement. The hydrolysis of ferric chloride in the presence of potassium chloride can be more rapid or slower according to the relative amount of the latter present. The chlorides of sodium, ammonium, barium, and magnesium, and potassium nitrate behave in an analogous manner. Salts with multivalent negative radicals, such as potassium sulphate or acid potassium phosphate, hinder the hydrolysis, smaller amounts at low temperatures producing the same effect as larger amounts at higher temperatures.—F. Shdn.

Stannic oxide ; Reduction of ——. D. B. Dott. Pharm. J., 1908, **81**, 585.

When stannic oxide is heated with hypophosphorous acid (30 per cent.) to a temperature approaching redness, it becomes reduced to the stannous state (phosphate or pyrophosphate), the resulting mass dissolving almost completely in hydrochloric acid. Silica, when present, remains insoluble in a form in which it is readily removed by filtration.—F. Sodn.

Tungstic acid and silica ; Separation of ——. P. Nicolardot. Compt. rend., 1908, **147**, 795—797.

The method depends upon the fact that tungstic acid is converted into a volatile oxychloride when heated to 500° C. in a current of chloroform vapour mixed with air, the silica being unattacked. The method can be applied to the determination of tungsten in wolfram.—F. Shdn.

Zirconium oxide ; Natural —— *free from iron.* E. Wedekind. Z. angew. Chem., 1908, **21**, 2270—2271.

Natural crystalline zirconium oxide usually contains 93—95 per cent. of the pure oxide, the impurities consisting of titanium dioxide, ferric oxide, silica, and zirconium silicate. Zirconium oxide also occurs in hard glassy black lumps, which on examination under the microscope, are seen to consist of black threads or particles imbedded in a brownish-yellow medium. One of these lumps was broken and the black threads were separated from the rest of the mineral. On analysis they were found to be free from iron. The black colour is therefore not due to the presence of colloidal iron compounds as is generally supposed, but is probably caused by the titanium dioxide which is always present.—P. F. C.

Oxygen from sodium peroxide ; Material for the evolution of —— *in a Kipp's apparatus.* L. Wolter. Chem.-Zeit., 1908, **32**, 1066.

The evolution of oxygen in a Kipp's apparatus by the action of dilute acids on sodium peroxide is difficult to control, and even dangerous. Even when the peroxide is distributed in an indifferent medium like paraffin wax, spontaneous ignition sometimes occurs. The author recommends a mixture of sodium peroxide, distributed by fusion with a readily fusible inert salt, *e.g.* potassium nitrate, and mixed with a little magnesium oxide to prevent it from deliquescing in moist air. Suitable proportions are : 100 grms. of sodium peroxide, 25 grms. of magnesium oxide, and 100 grms. of potassium nitrate. The nitre is first fused in an iron dish, and the peroxide, previously mixed with magnesia, is then added in small quantities at a time, the fused mass being stirred after each addition. The melt finally becomes very stiff and must be stirred vigorously ; it is then spread out on an iron plate to cool, broken up, and stored in air-tight tins. As a further protection, the large lumps may be dipped in melted paraffin before storage. The oxygen is evolved by the action of dilute hydrochloric acid on this mixture, and the gas is washed by potassium hydroxide solution to remove traces of carbon dioxide.—J. F. B.

Sulphur ; Boiling point of —— *on the constant pressure air thermometer.* N. Eumorfopoulos. Roy. Soc. Proc., 1908, A, **81**, 339—362.

As the mean of several determinations the boiling point of sulphur is given as between 443·58° C. and 443·62° C. —O. F. H.

Electrolytic soda ; Manufacture of ——. *Theory of the "bell" process.* A. Brochet. *See* XIA.

Poisoning by chromium in industrial operations. Lewin. *See* XVIII*B*.

Boric acid ; Determination of —— *in insoluble silicates.* E. T. Wherry and W. H. Chapin. *See* XXIII.

Patents.

Sulphuric acid ; Manufacture of —— *in lead chambers.* E. Hoefling. Ger. Pat. 202,631, April 10, 1907.

In order to obtain a more thorough mixing of the gases, and thereby, it is claimed, reduce the consumption of nitric acid, and increase the output of sulphuric acid, helical surfaces are disposed in the inlet- and connecting pipes of the different lead chambers.—A. S.

Phosphoric acid ; Production of ——. F. J. Maywald, Brooklyn, N.Y. U.S. Pat. 902,157, Oct. 27, 1908.

A low-potential arc, produced by a current at about 60 volts, is maintained in a granular mass of phosphates (of an "earthy base") to which air has access, so as to decompose the phosphate into a basic residue and phosphoric oxide which latter is volatilised and collected. —F. Sodn.

Carbon dioxide ; Mixtures for the generation of ——. F. Menter and W. A. Sedlitzky, Vienna. Eng. Pat. 14,863, July 13, 1908.

The claim is for dry mixtures of a carbonate or bicarbonate and a salt or double salt which is readily hydrolysed in aqueous solution. A mixture of sodium bicarbonate and one of the alums, aluminium sulphate, or ferrous sulphate, may be taken as a typical example.—O. R.

Chromates [*and aluminates*] ; *Process of making* ——. W. T. Gibbs, Buckingham, Canada, Assignor to the National Electrolytic Co., New York. U.S. Pat. 901,436, Oct. 20, 1908.

Alkali chromates and aluminates are produced by mixing finely-ground chrome iron ore with an alkali carbonate and roasting the mixture in an oxidising atmosphere, in a revolving furnace, at a temperature sufficient to keep the mass fluid.—A. S.

Aluminous materials ; Process of treating ——. L. E. Saunders, Niagara Falls, N.Y., and J. G. Petrikin, Lock Haven, Pa. U.S. Pat. 902,255, Oct. 27, 1908.

The process is for the treatment of aluminous materials, such as calcined bauxite or clay, with the vapour of aluminium chloride at a high temperature, the elements capable of yielding volatile chlorides, being in this way separated as such. The chlorides are then converted into a chloridising agent, hydrochloric acid, for instance, by treatment with steam, and this is made to react with a portion of the residual alumina to give aluminium chloride again.—F. Sodn.

Metallic [zinc, etc.] oxides ; Process of obtaining ——. R. Seiffert, Bobrek, Germany. U.S. Pat. 902,260, Oct. 27, 1908.

Zinc and other metals are obtained in the form of oxides by mixing the ores or other products, " containing the necessary fuel," with a suitable binding material, and moulding into lumps. These lumps are introduced into a receiver, and, when combustion is started, a blast of air at low pressure is forced in to dry the material and render it porous. The pressure of the blast is then increased, so as to rapidly and uniformly raise the temperature to that required for the reduction and volatilisation of the metals in question, and, when the greater part of the zinc has been expelled, the removal of the metal fumes being aided by suction, the blast is further increased, so as to liquefy the charge and, by continued blowing through the liquid mass, to ensure complete removal of the zinc. —F. Sodn.

Nitric oxide ; Method for producing ——. J. L. Roberts, New York. U.S. Pat. 902,607, Nov. 3, 1908.

Nitrogen and oxygen are continuously supplied to the lower end of a tubular passage, in which is formed an electric arc " containing chromium, or chromium and iron," the nitric oxide produced being drawn off from the upper end of the passage.—A. G. L.

Oxygenated compounds [nitrogen oxides] ; Preparation of ——. O. H. Dahl. Fr. Pat. 391,822, June 30, 1908. Under Int. Conv., July 1, 1907.

In oxidising processes, such as the combination of atmospheric nitrogen and oxygen in the electric arc, the product of the reaction must be rapidly withdrawn and cooled below the high temperature necessary for union, so as to prevent subsequent dissociation. The reaction takes place at a lower temperature, as for instance in an acetylene gas furnace, if the oxygen be previously ozonised. Less cooling of the resulting nitrogen oxides is necessary, and a better yield is obtained.—O. R.

Copper ; Extraction of —— *as subacetate from copper-containing minerals.* E. Abresch. Fr. Pat. 391,603, June 24, 1908.

Minerals containing copper oxide or carbonate are treated with a 15 per cent. solution of acetic acid, the excess of acid is neutralised or removed by distillation, the dissolved impurities (iron, alumina, lime, etc.), precipitated by means of an alkali, and copper subacetate recovered from the filtered solution by crystallisation. —O. R.

Lead oxide ; Process and apparatus for the manufacture of —— *and the treatment of raw litharge and white lead residues.* V. J. Barton, Fr. Pat. 391,612, June 24, 1908.

Lead, raw litharge, or white lead residue, is heated in a current of air which carries over the finely-divided lead oxide into a collecting vessel, the specifically heavier particles of lead and other impurities being left behind in the heating chamber.—O. R.

Water-glass ; Process for increasing the mobility and reactivity of ——. R. Eberhard. Fr. Pat. 391,682, June 16, 1908. Under Int. Conv., June 17, 1907, and June 15, 1908.

The mobility and reactivity of water-glass is increased by adding the salts or acids of chromium, and the treated substance may be used with advantage in all cases in which water-glass is generally employed. For instance, in preparing a vehicle for water colours, 70 grms. of potassium bichromate, dissolved in water, added to every 100 kilos. of water-glass solution (18°—23°B.), makes the colour easier to spread and more resistant to the action of the air. Silicic acid does not separate, on exposure, from a solution of water-glass treated in this manner, and by its spontaneous evaporation the silicates are deposited as a gelatinous mass which is soluble in a weak solution of alkali. Besides salts containing chromium, or in place of them, bases or salts of bases soluble in alkalis, or salts of the heavy metals, such as tin or lead, or hydroxides or acids soluble in alkalis, may be used, and in practice a joint addition is often advantageous.—F. Sodn.

Formaldehyde-sulphoxylic acid ; Preparation of —— *in the free state.* J. Tay. Fr. Pat. 391,924, June 26, 1908.

A solution of formaldehyde-sulphoxylic acid is obtained by treating formaldehyde-zinc sulphoxylate with oxalic acid in the presence of excess of formaldehyde, the proportions recommended being : 250 parts of oxalic acid dissolved in 250 parts of water, 300 parts of formaldehyde-zinc sulphoxylate, and 300 parts of formaldehyde of 40 per cent. strength.—O. R.

Ferrocyanogen compounds ; Obtaining soluble —— *from spent gas-purifying material or other product* . C. Petri. Ger. Pat. 202,399, Oct. 5, 1906.

The spent gas-purifying material is mixed with lime and then with finely ground sodium chloride, calcium chloride, or ammonium chloride, and extracted with water, or the mixture of the material and lime is extracted with a solution of one of the chlorides mentioned. It is stated that higher yields of soluble ferrocyanogen compounds are obtained than by extraction with water alone.—A. S.

Ammonium thiosulphate ; Manufacture of high-percentage ——. Chem. Fabr. auf Aktien, vorm. E. Schering. Ger. Pat. 202,503, Nov. 5, 1907. Addition to Ger. Pat. 202,502.

According to the chief patent, ammonium thiosulphate was prepared by the interaction of ammonium chloride and sodium thiosulphate at about 100° C., the solution being also separated from the solid phase at this temperature. According to the present patent the use of other ammonium salts, *e.g.*, the sulphate and oxalate, instead of the chloride, is claimed.—A. S.

Liquefaction of air ; Apparatus for the ——. J. F. Place. Fr. Pat. 391,326, Feb. 24, 1908.

The air purified by compression, cooling by liquefied carbon dioxide, and passage through potassium hydroxide, is caused to pass under high compression through the coils of a series of counter-current coolers, to a liquefier where it is liquefied under pressure. From the liquefier, the liquefied air passes, still under pressure, to a supercooler where it is further cooled before being released from the pressure. The supercooling is effected by liquid air compressed and liquefied in a separate isolated machine and delivered under a lower pressure to the supercooler. As this air evaporates, it passes backwards through the interchangers over the coils by which the highly compressed air is conveyed to the liquefier.—W. H. C.

Hydrogen generator. C. Dansette. Fr. Pat. 391,793, Sept. 6, 1907.

Water vapour is fed into the arc produced in a gas-tight electric furnace, by passing water through the lower, vertical, carbon tube, which constitutes one of the electrodes. The furnace communicates by means of a valve with a reservoir, into which the hydrogen and oxygen produced by dissociation pass. The oxygen may either be absorbed by a suitable reagent, or the two gases separated by diffusion through a porous earthenware vessel. —O. R.

Cyanides and cyanamides ; Manufacture of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 1841, Jan. 27, 1908.

See Fr. Pat. 387,001 of 1908 ; this J., 1908, 809.—T. F. B.

Sodium thiosulphate and sodium hydrosulphide ; Process of making ——. W. Hasenbach, Mannheim, Germany. U.S. Pats. 903,135 and 903,136, Nov. 3, 1908.

See Fr. Pat. 383,136 of 1907 ; this J., 1908, 282.—T. F. B.

Nitrogen compounds ; Process of making ——. O. F. Carlson, Stockholm. U.S. Pat. 903,541, Nov. 10, 1908.

See Eng. Pat. 15,445 of 1906 ; this J., 1906, 858.—T. F. B.

Zinc salt of formaldehyde-sulphoxylic acid ; Process for obtaining a sparingly soluble ——. C. Rademacher und Co. Fr. Pat. 391,970, July 3, 1908. Under Int. Conv., Feb. 26, 1908.

See Eng. Pat. 4761 of 1908 ; this J., 1908, 1058.—T. F. B.

Sodium bicarbonate ; Method of making ——. R. H. F. Finlay. Fr. Pat. 392,116, July 8, 1908.

See Eng. Pat. 16,853 of 1907 ; this J., 1908, 898.—T. F. B.

Chlorates ; Electrolytic manufacture of —— *from alkali and alkaline-earth chlorides.* Ger. Pat. 202,500. *See* XIA.

VIII.—GLASS, POTTERY, AND ENAMELS.

Industrial diseases ; Second Report of the Departmental Committee on Compensation for ——. [Cd. 4386.]

The report deals with glassworkers' cataract, telegraphists' cramp, and eczema. With regard to the first, it recommends "that 'Cataract in Glassworkers' be added to the First Column of the Schedule of industrial diseases, for which compensation may be claimed ; that 'Processes in the manufacture of glass involving exposure to the glare of molten glass' be added to the Second Column ; but that the compensation should be made payable only in cases where an operation is undergone and for a period not exceeding six months."

Patent.

Ceramic ware ; Decoration of ——. F. Fuchs. Fr. Pat. 391,781, June 29, 1908.

300 parts by weight of gelatin, 200 parts of quince pips, and 100 parts of beetroot juice, are separately digested with hot water, and after filtering the quince mucilage, the three solutions are mixed and diluted with sufficient water to allow of the mixture being applied by means of a brush. The solution is applied to a coloured design, which is transferred to the unglazed ware, after which the latter is glazed and fired. Similar solutions are used for producing reliefs on unglazed ceramic ware, in which case the first colourless design is followed by a second transfer, which is dusted with faience or porcelain powder.—O. R.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Patents.

Grinding, sharpening, burnishing, or polishing metal articles ; Composition for ——. J. Wilson, South Shields. Eng. Pat. 24,433, Nov. 5, 1907.

The preparation consists of "sulpho-carbolate of soda" with the addition of 20 per cent. of phenol and 4 per cent. of cresol.—O. R.

Kiln for burning limestone, dolomite, and the like. E. Schmatolla, London. Eng. Pat. 17,609, Aug. 21, 1908.

In a vertical gas-fired kiln, the central shaft is circular in section for the greater part of its length, but is divided towards the bottom into three separate, arched chambers, by means of three curved bridges or walls. Each bridge contains a straight flue, which is connected with an external gas producer and extends to the outer end of the kiln. The bridges are so constructed as to form a cone in the centre, which deflects the greater part of the burnt material into three lower shafts, through which most of the material is discharged, but at the same time deflects a portion of the material to three doors, at the outer ends of the upper part of each of the bridges. Through these upper outlet doors, any material resting on the bridges is withdrawn, and required repairs of the bridges are effected. The greater part of the gas is introduced into the centre of the main shaft, so as to avoid loss of heat and overheating of the firebrick walls. Upper gas inlets, communicating by means of uptakes with a main circular gas flue at the base of the kiln, admit the gas to the combustion zone, and above each upper gas inlet, recesses in the outer wall of the kiln are arranged. These recesses communicate by short closed passages with the interior of the kiln, thus facilitating the cooling and repair of the lining in the combustion zone, and the cleaning, regulation, and control of the upper gas inlets.—O. R.

Wood ; Preserved —— *and method of making same.* P. C. Reilly, Indianapolis, Ind. U.S. Pat. 901,557, Oct. 20, 1908.

The process consists in filling the pores of the wood with a hydrocarbon oil "derived by the direct filtration of tar," this oil being fluid at ordinary temperatures, containing practically all the oils of the tar, and being substantially free of solids in suspension.—A. S.

Wood ; Solution for impregnating and preserving ——. B. Malenkovic and Landau und Co. Fr. Pat. 391,908, June 10, 1908.

Wood is treated with a solution of the fluoride or acid fluoride of a heavy metal such as zinc, to which are added an alkali fluoride or ammonium fluoride, and ammonia, aniline, hydroxylamine, or other weak base. The resulting almost neutral solution does not attack metals appreciably. —O. R.

Bricks, shaped stones or blocks, tubes, tiles, and the like ; Manufacture of ——. H. Dresler, Creuzthal, Germany. U.S. Pat. 903,062, Nov. 3, 1908.

Approximately equal parts of slag granulated in water and slag ground after solidifying in air, are mixed, moulded, and subjected to the action of carbon dioxide gas under pressure.—A. G. L.

Cement ; Manufacture of hydraulic ——. C. J. Potter, Willington Quay. Eng. Pat. 25,969, Nov. 23, 1907.

To obtain a white hydraulic cement, an intimate mixture of chalk, china clay, and flint is burnt, preferably in a rotary kiln, at a high temperature with a fuel free from iron, such as tar, gas, or oil. The clinker is then cooled in a reducing atmosphere or in an atmosphere of steam. The proportions of the raw materials may be varied so as to give a mixture of the composition : 60—70 per cent. of lime, 3—8 per cent. of alumina, 18—25 per cent. of silica, and not more than 0·5 per cent. of iron.—H. H. S.

Rotary kilns [for slag cement]. H. J. Haddan, London. From W. R. Warren, New York. Eng. Pat. 3010, Feb. 10, 1908.

This invention relates to the application of rotary kilns to the manufacture of cement from blast-furnace slag and the like. The kiln is mounted on a pivoted platform, which is capable of tilting it to a considerable angle, up or down. One end of the kiln communicates with a stack, and the draught may be forced if required. The other end of the cylinder is closed by a removable cover, through a hole in the centre of which an intake pipe supplies the fuel for combustion. At the top of the cover and above the fuel-intake pipe, is an opening which serves both for the entry of the molten slag and for the withdrawal of the molten cement, the former taking place when the apparatus is tilted down towards the stack, and the latter when it is tilted in the opposite direction.—O. R.

Cement from blast-furnace slag and the like ; Manufacture of ——. W. Lessing, Troisdorf, Germany. Eng. Pat. 19,070, Sept. 10, 1908. Under Int. Conv., Sept. 10, 1907.

A mixture of molten blast-furnace slag and lime, clay, marl, or the like, is atomised by conducting it on to the surface of a drum, which rotates rapidly on a horizontal axis ; two or more similar drums rotating in opposite directions are mounted in proximity to the first. The drums are so disposed that all material, which is scattered or blown away from the first drum, is caught on the second or third drum. If the stream of slag is very powerful, as many additional drums as may be required can be added to the system. When it is required to cool the cement, a cooling liquid is allowed to fall in the form of a fine spray on to the projecting portion of the last of the drums. If lime water or an alkaline solution be used as cooling liquid, the resulting cement becomes more suitable for grinding, and subsequent swelling is prevented.—O. R.

Cement from blast-furnace slag; Manufacture of ——. Soc. J. et A. Pavin de Lafarge. Fr. Pat. 391,454, June 13, 1908.

Molten slag is run direct from the blast-furnace into a second furnace, where it is mixed with the requisite quantities of lime and bauxite (or iron ore) to give it as nearly as possible the composition represented by the formula, $SiO_2,2CaO + Al_2O_3,CaO$. The thoroughly mixed and molten material is then granulated by means of a jet of water at high pressure, and the excess of water eliminated in a centrifugal drum, which delivers the product into a rotary dryer, from which it finally passes into a mill where it is ground to cement.—O. R.

Rotary kilns; Process and apparatus for burning cement in ——. F. J. Poths. Fr. Pat. 391,698, June 25, 1908.

With the object of alternately heaping up and spreading out the raw materials used in cement manufacture, the interior of a rotary kiln, instead of having the usual circular shape, is provided with a number of plane surfaces, which are made as wide as possible. The kiln thus forms a tube of triangular, rectangular, or polygonal cross section, or it may consist of a number of such parallel tubes grouped around and rotating about a common axis. In this latter arrangement, each tube or unit of the kiln may be subjected to an independent or "planetary" motion in addition to the rotation of the whole system about its common axis.—O. R.

Hydraulic cements; Process for retarding and regulating the setting of ——. J. Gresly. Fr. Pat. 391,711, June 26, 1908.

The addition of a small quantity of a carbohydrate, (*e.g.*, from ½ to 2 per cent. of the weight of the cement), is claimed to retard very considerably the setting time of Portland, or other hydraulic calcareous cements, without in any way influencing their ultimate strength and properties. Suitable carbohydrates are one or more of the ordinary sugars or gums, especially dextrin, and they may be dissolved in the water used for gauging, added to the cement in the act of gauging, or incorporated with it in any other suitable manner. As an additional advantage of the process, it is claimed that 10 per cent. less water than the usual amount suffices for working up the cement.—O. R.

Lithographic stone; Manufacture of —— artificially. The British Stone and Marble Co., Ltd. Fr. Pat. 392,060, July 6, 1908.

See Eng. Pat. 15,964 of 1907; this J., 1908, 859.—T. F. B.

X.—METALS AND METALLURGY.

Cementation steel. F. Giolitti and F. Carnevali. Gaz. chim. ital., 1908, **38**, II., 258—275, 309—351.

In the first series of experiments, test pieces of the steel (containing 0·116 per cent. of carbon and 0·6 per cent. of manganese) were embedded in a mixture of equal quantities of barium carbonate and of powdered wood charcoal to which 5 per cent. of potassium ferrocyanide had been added. The experiments extended over 120 hours, at temperatures ranging from 700° C. to over 1000° C. At the higher temperatures cementation took place to a depth of 8·7 mm. The speed of cementation increased rapidly with rising temperature, and diminished gradually with the time, when the temperature remained constant. Below 850° C. the rate increased, within certain limits with the carbon content of the metal; above 900° C., the reverse was the case. Further experiments were made with a steel containing 0·05 per cent. of carbon, in a mixture of 70 per cent. of wood charcoal and 30 per cent. of animal charcoal. In all cases, at a given temperature, after the cementation, the carbon content of the outermost layer was approximately the same, but when the time of cementation was short, the carbon content decreased rapidly from the outer layer of the metal inwards, whilst when the experiments extended over a longer period, the decrease in the carbon content was gradual: this applies to temperatures of 850°—880° C. Above 900° C. the decrease in the carbon content from the outer to the inner layers, with varying duration of cementation, was much more uniform.

Experiments were also made on cementation with different gases, *viz.*, carbon monoxide, methane, ethylene, and illuminating gas. The pieces of steel, which contained 0·06 per cent. of carbon and 0·17 per cent. of manganese, were placed in a porcelain tube, heated electrically, and a current of the gas passed through. At 780°—800° C. only slight cementation was effected in 6 hours by carbon monoxide—the carbon content of the outer layer of the metal was not more than 0·6 per cent.

With charcoal, under similar conditions, the cementation was considerably greater, the outer layer containing more than 0·9 per cent. of carbon. With charcoal, the carbon content, proceeding inwards from the outer layer, decreased at first rapidly and then more slowly, whilst with carbon monoxide, the decrease was regular. With ethylene at 780° C., carbon was deposited, and carburisation proceeded mainly just as with charcoal. With methane and illuminating gas at 800° C., there was scarcely any deposition of carbon and practically no carburisation of the metal. At higher temperatures the differences were still more distinct. Ethylene and methane acted in a similar manner to charcoal. With carbon monoxide, the depth of the carburised layer increased, but the carbon content decreased with rise of temperature. Illuminating gas was intermediate between methane and carbon monoxide in its action. The carburisation with carbon monoxide is controlled by the equilibrium: $2CO \rightleftarrows C + CO_2$. The rate at which carbon monoxide decomposes is slower than the rate at which carbon is dissolved by iron. Carbon is soluble in β-iron, but not in α-iron. In cementation with gases, besides the carburisation by carbon deposited by the gas on the surface of the metal, the diffusion of the gas into the interior of the metal plays a part.—A. S.

[*Gold and silver from cyanide solutions*]. *Zinc dust precipitation at Cerro Prieto.* R. Linton. J. Chem. Met. and Min. Soc., S. Africa, 1908, **9**, 74—75.

The author gives a description of one of the few plants successfully using zinc dust for the precipitation of gold and silver from cyanide solutions. The ore is stamped, and the coarse sands reground in tube mills. The sands are treated by percolation with a 0·15—0·2 per cent. solution of potassium cyanide, and the slimes with a 0·075 per cent. solution, by decantation and filter-pressing. The gold-bearing solutions are filtered and then pumped into a large tank from which they flow by gravity to the zinc press. The press is of the Dehne type having 24 leaves with 4-inch frames intervening, the total filtering surface being 367 sq. ft. Two cotton cloths are used over the leaves, and each time the press is cleaned, new cloths are placed next to the leaves, the inner cloths placed over them, and the outer cloths burned. The solution on its way to the press, flows through a 6-in. pipe, into which, through a 1-in. branch pipe, is run an emulsion of zinc dust, prepared by agitating a mixture of cyanide solution and zinc dust by means of compressed air, a certain proportion of lead acetate being also added. On starting the press, an excess of zinc dust is used, in order that a film of it shall be formed on every filter cloth, and when necessary, enough potassium cyanide is added to the solution to ensure the immediate commencement of precipitation. After the precipitation of the gold and silver has started, solutions as low as 0·07 per cent. of potassium cyanide are rapidly and completely precipitated without difficulty. The press has a capacity of 1200 tons of solution in 24 hours, the entire volume of the press being displaced every 3 minutes. The period of contact of the gold-bearing solution with the zinc dust is less than five minutes. The average output, including the time required for the weekly clean up, is about 900 tons per 24 hours. The original solution contains about 2—3 dwt. of gold and 10 dwt. of silver, and the average values remaining in the effluent are only one grain of gold and a trace of silver. The press is cleaned up four to six times a month, the precipitate being dried, briquetted with borax and litharge, and melted and refined in an English cupellation furnace. The consumption of zinc dust is about 0·4 lb. per oz. of gold and silver precipitated, representing 5½ parts of metallic zinc to one of gold and silver.—F. R.

Gold; Solubility of metallic —— in hydrochloric acid in presence of some organic substances. N. Awerkiew. J. Russ. Phys.-Chem. Ges., 1908, **40**, 840—859. Chem. Zentr., 1908, **2**, 1566—1567.

Experiments with finely-divided gold, especially that precipitated by means of ferrous sulphate, showed that measurable quantities of the metal are dissolved by hydrochloric acid of sp. gr. 1·19 in presence of methyl, ethyl, and amyl alcohols, glycerol, phenol, sucrose, formaldehyde, trioxymethylene, chloroform, and chloral hydrate. The solubility increases with rise of temperature. The maximum solubility observed was 0·302 grm. of metal in a mixture of 100 c.c. of methyl alcohol and 100 c.c. of hydrochloric acid.—A. S.

Metallic films; Transparent silver and other ——. T. Turner. Roy. Soc. Proc., 1908, A, **81**, 301—310.

Gold leaf, 1/303,000th of an inch thick, which transmits green light, becomes apparently transparent at 550° C., but the change is shown to be due to the aggregation of the gold leaving spaces through which the light passes, the gold itself being opaque. When heated in air, silver leaf, 1/120,000th of an inch thick, is rendered transparent, the change being a gradual one, and depending on both time and temperature; it commences at 240° C. and is very rapid at 400° C. Transparency was not produced by heating to 500° C. in coal gas or in charcoal powder, or to 400° C. in hydrogen. The metal was also unchanged on heating to 500° C. in a vacuum, but as little as 1/25th of an atmosphere of oxygen was sufficient to cause the change to take place rapidly at 400° C. Although oxygen is necessary, the change is not accompanied by any sensible increase in weight, and evidence was obtained of only a very slight volatilisation of silver. The author therefore considers it probable that finely divided silver combines with oxygen at temperatures varying from about 240° C. to 400° C., and that the oxide so produced is again decomposed leaving the silver in a peculiar amorphous condition in which it is transparent in moderate thicknesses. Copper leaf, 1/75,000th of an inch thick, when heated in coal gas, hydrogen, or charcoal powder remains opaque and unchanged, but when heated in air becomes covered with a film of oxide and becomes translucent, the transmitted light varying from green through yellow to reddish-brown according to the extent of oxidation. It is shown, however, that the oxidation does not take place throughout the copper, for the oxide could be dissolved, leaving metallic copper which transmits white light. Aluminium, 1/60,000th of an inch thick, and Dutch metal, 1/37,000th of an inch thick, are not rendered transparent on heating in air, although the latter showed surface coloration due to the formation of oxide. The work is held to support the view that the surface coloration of metals by oxidation is due to the formation of a transparent film.—O. F. H.

Silver; Partition of —— between zinc and lead. G. N. Potdar. J. Coll. Science, Imp. Univ., Tokyo, 1908, **25**, Article 9.

Weighed portions of lead, silver, and zinc were melted in an atmosphere of carbon dioxide, and after 5½ hours, were cooled as rapidly as possible, and the composition of the heavier and lighter layers determined. From the results obtained it is concluded that at about 540° C., the coefficient of partition of silver between zinc and lead is about 300, *i.e.*, silver is about 300 times more soluble in liquid zinc than in liquid lead. Parkes' process for desilverising lead is based on the partition of silver between solid zinc and liquid lead. From the author's results, together with those of Alder Wright and Thompson (this J., 1890, 944), it appears that if the last skimming in the desilverising process takes place between 325° and 360° C. as is the case in practice, the amount of zinc remaining in the desilverised lead will be between 0·2 and 0·6 per cent., any zinc added in excess of this amount being available for the extraction of silver. Attempts to determine experimentally the coefficient of partition of silver between solid zinc and liquid lead gave results which were discordant, but nevertheless showed that this must be enormously large, thus explaining the practical completeness with which lead is desilverised in practice. —A. S.

Silicon and silver; Alloys of ——. G. Arrivaut. Compt. rend., 1908, **147**, 859—861.

A thermometric examination of the alloys of silicon and silver showed that no compounds are formed. The eutectic melts at 820°—830° C. and contains about 5 per cent. of silicon.—A. S.

Copper-tin alloys. F. Giolitti and G. Tavanti. Gaz. chim. ital., 1908, **38**, II., 209—239.

The authors have made a comprehensive study of copper-tin alloys by thermal and micrographic methods. The equilibrium-diagram constructed by the authors is somewhat similar to that of Heycock and Neville (this J., 1896, 810; 1901, 814), but is interpreted somewhat differently. It is regarded as being composed of two distinct parts, corresponding to alloys of the compound, Cu_3Sn, with copper on the one hand and with tin on the other. The influence of the rate of cooling on the alloys is also discussed.—A. S.

Copper and copper alloys. J. T. Milton. Paper read before the Institute of Metals, Nov., 1908.

The author raises questions as to the causes of occasional failure in manufactured copper and copper alloys, and quotes instances of unaccountable corrosion, brittleness, or weakness of copper steam pipes, Muntz metal sheathing, brass bolts, etc. He points out that there is considerable divergence in present practice in the methods of annealing, and suggests that details of the exact physical effects due to these different methods and also of the effects of varying impurities both in large castings and small work, should be obtainable in order that the best methods could be standardised and a greater uniformity of product ensured.—F. R.

Phosphor-bronze; Notes on ——. A. Philip. Paper read before the Institute of Metals, Nov., 1908.

Detailed results are given of the analyses, together with the effects of mechanical tests, on 120 different samples of phosphor-bronze supplied to the Admiralty during the last two or three years. These results are tabulated with a view of arriving at some definite conclusion as to the best chemical specification for this alloy. The data indicate that for castings that require to have an ultimate tensile strength of over 17 tons per sq. in. and an elongation of not less than 20 per cent. on two inches, the composition should be 90—92 per cent. of copper, 7·4—9·7 per cent. of tin, and 0·3—0·6 per cent. of phosphorus. This closely approximates to the Admiralty specification for the phosphor-bronze used on H.M.S. "Dreadnought" which was copper, 90; tin, 9·7; and phosphorus, 0·3 per cent. For bearings, the phosphorus content should be high, probably 0·8—1 per cent. or higher. High phosphor bronzes consist of a network of hard copper phosphide, probably Cu_3P, supported and held together in a matrix of softer copper-tin alloy, so that the actual bearing surface of the journal is this skeleton of phosphide which, while hard enough to resist abrasion, possesses a low coefficient of friction.—F. R.

Tin "pest." E. Cohen. Chem.-Zeit., 1908, **32**, 1041—1042.

"Chemically pure" tin possesses the property of changing, at low temperatures, into a grey allotropic modification which on heating to 100° C. is reconverted into the familiar silver white tin. This change has been found to take place when tin is stored at low temperatures for any length of time; the metal, it is stated, at first, blisters, holes form in thin objects, and finally the structure is entirely lost and nothing but a grey powder remains. The change from white into grey tin is accompanied by a considerable alteration in volume. Since the white tin has the sp. gr. 7·28 at 15° C. and the grey tin at the same temperature the sp. gr. 5·76, this change of volume amounts to 30 per cent., and affords an explanation of the blistering and swelling of tin objects and ultimate conversion to powder. The transition temperature of the change is +18° C., and the rapidity of conversion into the grey form is greatly increased by inoculation with a granule of it. Articles stored in museums and exposed to cold during the winter months slowly undergo this injurious transformation, and to prevent it the temperature must be kept above 18° C. (See also this J., 1900, 352 and 1121; 1901, 366.)—E. F. A.

Aluminium: and some of its uses. J. T. W. Echevarri. Paper read before the Institute of Metals, Nov., 1908.

THE increasing output of aluminium, through the utilisation of large and small sources of water power, insures the continuance of the present low price of ingot aluminium (£60—£70 per ton). A sheet, 18 sq. ft. in area and 1/16th in. thick, weighs 16 lb. and at 1s. 1d. per lb. costs 17s. 4d.; a similar sheet of brass, copper, German silver, or pure tin weighs about 42—52 lb. and costs from 27s. to 60s. Its low price, together with its great malleability and resistance to corrosion, has enabled aluminium to be utilised for a great variety of purposes. Its rapid conduction of heat and non-poisonous properties render it most suitable for culinary utensils, while the high tensile strength of hard drawn wire and its good conductivity for electricity, enable it to replace copper advantageously for overhead transmission lines. Metallic aluminium, when added in small quantities to the metal in the casting ladle, prevents porosity in steel castings owing to its great affinity for the gases that are occluded in the molten metal. The heat of the reaction is so great that it materially aids in maintaining the temperature and consequently the fluidity of the steel.—F. R.

Manganese deposit in Southern India. R. O. Ahlers. Trans. Inst. Min. and Met., Nov. 19, 1908. (Advance copy.)

THE author gives a general account of the occurrence and output of manganese in India, and describes in detail the deposits in the State of Sandur, in the north of the Madras Presidency. The ore contains much iron, the amount being rarely as low as 5 per cent.; even the purest deposits have large veins of hæmatite running through them. The ore is remarkably free from harmful impurities. Silica is rarely over 2 per cent. and phosphorus about 0·01 per cent. The deposits appear to be of vast extent but do not continue in depth. A thickness of 80 ft. however has been proved in parts, indicating the enormous amount of ore available.—F. R.

Manganese; Magnetic compounds of —— with nitrogen. E. Wedekind and T. Veit. Ber., 1908, **41**, 3769—3773.

THE authors prepared three nitrides of manganese, Mn_3N_2, Mn_5N_2, and Mn_7N_2, the first two of which have been described by Prelinger (Monatsh. f. Chem., **15**, 391), and found that all three are magnetic, the magnetic properties increasing with increasing content of manganese; the last compound even shows some permanent magnetism. The compound, Mn_3N_2, is prepared by heating metallic manganese in a stream of ammonia at a red heat: Mn_5N_2 by heating metallic manganese or Mn_3N_2 in a stream of nitrogen at a red heat; and Mn_7N_2 by heating metallic manganese in a stream of ammonia at the temperature of the oxy-hydrogen flame. The last compound is easily attacked by acids and alkalis, the first two only very slowly. On heating metallic manganese in a current of hydrogen in the oxy-coal-gas flame, a product was obtained which possessed feeble magnetic properties, but appeared to be free from hydrogen; on heating this substance in oxygen the magnetic properties became stronger. Metallic manganese, heated in oxygen at a red heat, yielded a non-magnetic product; after heating in the oxy-hydrogen flame, this became magnetic.—A. G. L.

Eutectic research. I. Alloys of lead and tin. W. Rosenhain and P. A. Tucker. Roy. Soc. Proc., 1908, A, **81**, 331—334.

A COMPLETE equilibrium diagram of the lead-tin alloys is published which differs principally from that published by Roberts-Austen in that the eutectic point is placed at a concentration of 63 per cent. of tin instead of 69, that the eutectic line towards the lead end of the series terminates at a concentration close to 16 per cent. of tin, and that a series of transformations have been found in the solid alloys near the lead end of the series. The transformation in the solid involves the separation of tin from the solid solution of tin in lead, the solid solution passing from one modification (β) to another (α) on cooling. It was found, however, that the constituent of the eutectic rich in lead does not take part in the transformation.
—O. F. H.

Cobalt-tin alloys. S. Shemtschushny and S. Bielynski. Z. anorg. Chem., 1908, **59**, 364—370. Chem. Zentr., 1908, **2**, 1498.

A THERMAL and micrographic examination of alloys of cobalt and tin showed that these metals form two compounds, CoSn and Co_2Sn, both of which are non-magnetic and are considerably harder than pure cobalt. The compound, Co_2Sn, melts at 1171° C., but the compound, CoSn, decomposes at 927° C. before it melts.—A. S.

Zinc; Phosphides of ——. P. Jolibois. Compt. rend., 1908, **147**, 801—803.

AN alloy containing 15 per cent. of phosphorus can be made by pouring melted zinc on to well-dried red phosphorus placed at the bottom of a clay crucible. The crucible is afterwards heated till no more vapours of phosphorus escape. The zinc phosphide, Zn_3P_2, can be separated from the uncombined zinc by several methods. The zinc can be distilled off by heating to 600° C. in a vacuum. Mercury, or fuming nitric acid at 0° C., will dissolve the zinc, leaving the phosphide. This phosphide is a crystalline substance, with the sp. gr. 4·55 at 13° C. It cannot be melted, and is insoluble in zinc. It distils in hydrogen towards 1100° C. When treated with hydrochloric acid, it dissolves with the quantitative formation of hydrogen phosphide. When this phosphide is heated in phosphorus vapour at reduced pressure and at 400° C., it is partially converted into the phosphide, ZnP_2. This may be separated by the action of dilute hydrochloric acid, which dissolves the unattacked lower phosphide Zn_3P_2. The phosphide, ZnP_2, is a black powder, with the sp. gr. 2·97 at 15° C. It is not attacked by strong sulphuric acid. With strong hydrochloric acid it is slowly decomposed with the production of hydrogen phosphide.—F. SHDN.

Nickel phosphides. N. Konstantinow. J. Russ. Phys.-Chem. Ges., 1908, **40**, 743—752. Chem. Zentr., 1908, **2**, 1673—1674.

THE author has examined alloys of nickel and phosphorus, containing up to 35·6 atoms per cent. of phosphorus, by thermal and micrographic methods. Three compounds, Ni_3P, Ni_5P_2, and Ni_2P, are formed. Trinickel phosphide, Ni_3P, crystallises in rhombic plates. The phosphide, Ni_5P_2, occurs in two forms: the α-form is transformed at 1025° C. into the β-form, which melts at 1185° C. The dinickel phosphide, Ni_2P, crystallises in long, steel-gray needles; it melts at 1112° C.—A. S.

Uranium; Preparation of ——. F. Giolitti and G. Tavanti. Gaz. chim. ital., 1908, **38**, II., 239—251.

THE so-called "pure" uranyl salts of commerce always contain larger or smaller quantities of alkali salts in the form of double salts, and on ignition, leave a residue containing alkali pyrouranate, *e.g.*, $Na_2U_2O_7$. In order to obtain pure uranium oxide, U_5O_5, this residue was dissolved in nitric acid, and pure ammonium uranate separated by a series of precipitations with ammonia. On ignition, the ammonium salt yielded uranium oxide. Moissan's method of reduction by means of aluminium (this J., 1896, 657) is not suitable for the preparation of uranium or its alloys, the products obtained being mixtures of aluminium, corundum, and uranium oxide. It is possible, however, to prepare uranium and its alloys by Stavenhagen's modification of Goldschmidt's "thermite" method (this J., 1900, 52; 1902, 481).—A. S.

Metallic deposits; Utilisation of —— in metallography. F. Giolitti. Gaz. chim. ital., 1908, 38, II., 352—357.

The author gives further details and modifications of the method of disclosing the structure of metallic alloys by means of thin deposits of metal on a polished surface of the alloy (see this J., 1906, 1104). The application of the method to the study of the structure of bronzes is described.—A. S.

Ferro-alloys, especially ferrosilicons; New method of attacking ——. P. Nicolardot. *See* XXIII.

Mineral production of India. Board of Trade J., Nov. 19, 1908. [T.R.]

The following table showing the total quantity and value of minerals, for which approximately full returns are received, produced in India in the years 1906 and 1907, is compiled from the report of the Director of the Geological Survey of India :—

——		1906.		1907.	
		Quantity.	Value.	Quantity.	Value.
			£		£
Gold	ounces	581,545	2,230,284	556,488	2,133,691
Coal	tons	9,783,250	1,912,042*	11,147,339	2,609,726*
Petroleum	gallons	140,553,122	574,238*	152,045,677	610,015*
Salt	tons	1,225,280	420,901*	1,193,168	434,076*
Saltpetre†	cwts.	347,251	270,547	357,589	274,679
Manganese ore†	tons	495,730	435,268	898,345	589,830
Mica †	cwts.	54,262	259,544	39,055	226,382
Ruby, sapphire, and spinel	carats	329,692	96,867	640,217	98,258
Jadestone†	cwts.	2,566	64,433	2,636	49,643
Graphite	tons	2,600	10,009	2,433	7,387
Iron ore	,,	74,120	11,344*	67,667‡	13,381*
Tin ore	cwts.	1,919	13,799*	1,584	11,882*
Chromite	tons	4,375	7,188*	7,274	9,699*
Diamonds	carats	306	5,160	628	2,784
Magnesite	tons	1,832	488*	186	50*
Amber		—	709	—	385
Total		—	£6,312,821	—	£7,071,868

* Spot prices. † Exports. ‡ Exclusive of production in Mysore not reported at the date of the report.

Patents.

Smelting furnaces. H. F. Höveler, Merton Abbey. Eng. Pat. 23,997, Oct. 30. 1907.

The furnace consists of a horizontal, rotating, cylindrical portion and two end portions, all of which are provided with easily detachable, refractory linings. The two end portions are bolted on to the main cylindrical portion, so that they readily fall away, when the ends are unbolted. Through an aperture in the centre of one end portion, a liquid fuel burner, not connected with the furnace, sprays oil into the furnace by means of compressed air, drawing in at the same time the air necessary for combustion. The extremity opposite to the burner end is provided with a central charge hole, which is closed after the charge has been put in, by a door having a small hole for the escape of fumes and products of combustion. Tap holes are also provided at this extremity, flush with the level of the lining. The charge is constantly brought into contact with the highly heated lining, so that the latter becomes uniformly consumed; whenever necessary, it is replaced by a new lining, the body of the furnace remaining intact.—O. R.

Furnace; Reverberatory smelting ——. A. D. Lee. Fr. Pat. 391,403, May 23, 1908.

The furnace consists of a chamber of circular cross-section. The outlet for the burnt gases is controlled by a valve, which can be completely closed, and may also be connected with an aspirator, so that the chamber can be placed under atmospheric pressure, or under increased or diminished pressure. Gas and air are blown into the chamber from burners, the nozzles of which are placed tangentially with respect to the circumference of the chamber, so that an intimate mixture of the gases within the chamber results, the charge itself also being rotated by the force of the gas-currents. (See also U.S. Pat. 865,309 of 1907; this J., 1907, 1095.)
—A. G. L.

Aluminium [and its alloys]; Soldering ——. T. Harden, and Amalgaline, Ltd., London. Eng. Pat. 26,932, Dec. 5, 1907.

The solder is preferably composed of tin, 75; zinc, 15; and aluminium, 10 per cent. The composition may however be varied according to the purity of the metal to be soldered. The flux consists of stearine, vaseline, and methylated spirits, or in some cases of stearine or stearine and alcohol alone.—C. A. W.

Soldering aluminium; Method of ——. A. Nielsen, Drammen, Norway. Eng. Pat. 5055, March 5, 1908. Under Int. Conv., Mar. 9, 1907.

The article is first cleansed by sulphuric acid or caustic lye, and etched electrolytically by using it as an anode in a suitable electrolyte. It is then coated electrolytically first with nickel, and next with tin, whereupon the soldering is carried on in the usual way. The electrolyte for the etching and for the deposition of nickel consists of 4 parts by weight of nickel salt, 2 of "spirits of ammonia," 0·2 of citric acid, and 100 of water, and that for the tinning, of 0·2 of tin chloride, 2 of sodium pyrosulphate, and 100 of water.—H. H. S.

Steel; Manufacture of ——. S. Stapleford and J. F. Wagner, Aberdeen, Wash., Assignors to R. H. Robinson and N. W. Bush. U.S. Pat. 902,010, Oct. 27, 1908.

A mixture of magnetic iron oxide, "metallic iron ore," or dust, or from any such metallic residues, 100 parts; damp powdered charcoal, 80 parts; sodium bicarbonate, 12 parts; and pulverised borax, 8 parts, is made into a thick paste with sodium silicate. The mass is formed into bricks, which are dried in an oven, and then treated for the extraction of steel by fusion in a crude oil furnace.
—C. A. W.

[*Steel manufacture.*] *Pig-iron; Process for reducing the content of carbon in —— and in articles of cast-iron.* W. Rübel. Fr. Pat. 391,429, June 3, 1908.

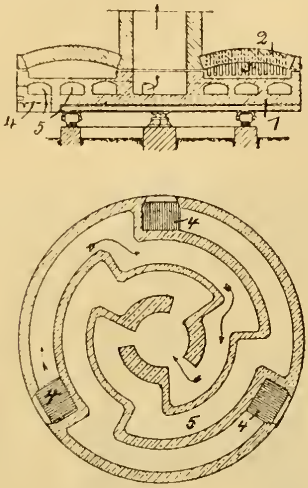
Molten pig-iron is heated and agitated with sodium hydroxide, sodium carbonate being formed and hydrogen evolved. Or else, articles of cast-iron are heated for 2—10 hours at 1100°—1150° C. with sodium hydroxide in retorts or muffles under a pressure of 2 atmospheres; the escaping gases are passed through a condenser and then through a solution of ammonia, which absorbs the vapours of soda ("soude").—A. G. L.

Alloy on the surface of iron or steel articles; Process for producing an ——. M. Winterbauer, C. Kneffel, jun., and R. Wachwitz. Fr. Pat. 391,333, Mar. 25, 1908.

To protect them from oxidation, especially on heating, iron or steel articles are coated with a softer metal, *e.g.*

tin, lead, zinc, antimony, bismuth, thallium, cadmium, or an alloy of these metals. For this purpose, the articles to be coated are heated electrically and plunged into the molten softer metal. To obtain thicker coatings, alternate coatings of softer metal and iron may be formed on the articles. After the coatings have been applied, the articles are heated strongly.—A. G. L.

Furnace ; Roasting —— with rotating hearth. Akt.-Ges. f. Bergbau, Blei- und Zinc.-Fabr. Ger. Pat. 202,377, Nov. 14, 1905.



IN the roasting of sulphide ores such as zinc blende, a uniform and high temperature is needed. In order to obtain this, it is proposed to combine the hearth, grate, and heating flues so that they rotate as a whole. The furnace described (see fig.) comprises the hearth, 1, the grates, 4, and the heating flues, 5. Above the hearth is the arch, 2, from which the rakes, 3, project. The grates and heating flues may be removable.—A. S.

Metallurgical condenser and method of condensing volatile metals. W. M. Johnson. Hartford, Conn. U.S. Pats. 902,534 and 902,535, Oct. 27, 1908.

THE metallic vapours are brought into contact with a large surface of a circulating molten metal. To this end, the latter is made to fall in a shower through the condensing chamber, where it is caught in a number of receptacles arranged above one another in zig-zag fashion. Means are provided for maintaining the fluid metal at a temperature such that its vapour pressure is appreciably less than that of the condensing vapour.—C. A. W.

Zinc furnaces, etc. ; Apparatus for withdrawing dust and fumes from ——. E. Dor-Delattre. Fr. Pat. 391,513, June 20, 1908. Under Int. Conv., July 16, 1907.

INSIDE an ordinary chimney of brickwork is hung a chimney of sheet-iron of considerably smaller diameter, and of such a height as to terminate considerably below the top of the outer chimney. The outer chimney is connected by two flues, provided with dampers, with the zinc or other furnace, whilst the inner chimney is provided at its base with a flue connected with an auxiliary fireplace. The hot gases from the latter, passing up the central chimney, not only heat the gases from the main furnace in the outer chimney, and thus increase their velocity, but also exert an injector action at the point where the inner chimney terminates.—A. G. L.

Zinc ; Removal of —— from products containing zinc and iron. Zinkgewinnungs-Ges.m.b.H. Ger. Pat. 203,149, Feb. 21, 1907.

THE process is intended especially for the treatment of low-grade zinc carbonate ores and by-products and residues from the treatment of such ores. The powdered ore is mixed with sulphuric acid of 50°—60° B., and the mixture heated to 600° C., with access of air, in a reverberatory furnace. The iron is thus converted first into ferric sulphate and then into oxide, whilst the zinc and cadmium form basic sulphates. The furnace gases are utilised for the manufacture of sulphuric acid. The furnace charge is cooled, extracted with dilute sulphuric acid, and the solution, which contains zinc and cadmium as sulphates, is worked up by known methods. The residual iron oxide is finely ground and is of value as a pigment.—A. S.

Tin ; Process of extracting ——. E. C. Higgins, Bayonne, N.J. U.S. Pat. 902,581, Nov. 3, 1908.

THE tin is melted from tin-scrap by radiated heat applied at the centre of the mass, without allowing the flame to come into contact with the tin. The melted tin is immediately removed from the mass by centrifugal action.—A. G. L.

Precious and other metals ; Process of extracting —— from minerals. P. Germain. Fr. Pat. 391,032, Aug. 14, 1907.

IN this process, the mineral is first treated with cold hydrochloric acid, and then with cold sulphuric acid. It is next mixed with finely-divided iron, and treated in an autoclave with agitator, with *aqua regia*, steam under 8 atmospheres pressure being turned in, and solution of sodium hypochlorite at 250°—300° C. forced in with it, when, it is said, the nascent hydrogen will be found to have decomposed the mineral.—A. G. L.

Cobalt, nickel, and manganese ; Separation of —— from crude liquors. G. Schreiber. Ger. Pat. 203,310, Sept. 29, 1907.

CRUDE cobalt liquors are first freed from iron, aluminium, and arsenic by treatment with calcium carbonate, and from copper by means of hydrogen sulphide, and are then heated and subjected to fractional precipitation by means of alkali or alkaline-earth hydroxides, *e.g.*, milk of lime. The precipitant is first added so long as the precipitate remains free from manganese, and the filtrate still contains sufficient cobalt to colour the liquid pink. The precipitant, which contains a part of the cobalt and nickel, is separated, and the filtrate is again treated with the precipitant until the whole of the cobalt is precipitated : this second precipitate contains about 10 per cent. of the manganese, together with cobalt and nickel. The filtrate from it is further treated with the precipitant, yielding a precipitate containing the remainder of the nickel and manganese. The first and third precipitates are redissolved in acid, and the nickel and cobalt, and nickel and manganese respectively separated by fractional precipitation. The second precipitate is re-dissolved in acid and added to the next charge of crude liquor to be treated.—A. S.

Aluminium ; Welding ——. M. U. Schoop, Garenne-Colombes, France. Eng. Pat. 24,096, Oct. 31, 1907. Under Int. Conv., Nov. 12, 1906.

SEE Fr. Pat. 374,089 of 1907 ; this J., 1907, 828.—T. F. B.

Detinning processes. E. A. Sperry, New York. Eng. Pat. 25,496. Nov. 18, 1907.

SEE U.S. Pats. 872,092, 883,500, 897,796, and 901,266 ; this J., 1908, 26, 451, 985, and 1119.—T. F. B.

Alloys useful as electric resistance conductors. British Thomson-Houston Co., Ltd., London. From General Electric Co., Schenectady, N.Y., U.S.A. Eng. Pats. 26,940, Dec. 5, 1907, and 12,183, June 4, 1908.

SEE U.S. Pat. 901,428 of 1908 ; this J., 1908, 1118.—T. F. B.

Retort furnaces ; Regenerative ——. N. L. Heinz, La Salle, Ill., U.S.A. Eng. Pat. 5038, March 5, 1908.

SEE U.S. Pats. 898,409 and 898,410 of 1908 ; this J., 1908, 985.—T. F. B.

Ores ; Apparatus for the volumetric classification of ——. J. C. Demaret, Paris. Eng. Pat. 11,971, June 2, 1908. Under. Int. Conv., June 7, 1907.

SEE Fr. Pat. 388,753 of 1907 ; this J., 1908, 944.—T. F. B.

Thermic mixture. H. Goldschmidt, Assignor to Th. Goldschmidt, Essen on Ruhr, Germany. U.S. Pat. 902,871, Nov. 3, 1908.

See Fr. Pat. 364,313 of 1906; this J., 1906, 935.—T. F. B.

Metal for making homogeneous armour plates, projectiles, etc., and its treatment. Cie. des Forges et Aciéries de la Marine et d'Homécourt. Fr. Pat. 391,827, Sept. 7, 1907.

See Eng. Pat. 25,742 of 1907; this J., 1908, 944.—T. F. B.

Rotary kilns [*for slag cement*]. Eng. Pat. 3010. *See* IX.

Cement from blast-furnace slag and the like. Eng. Pat. 19,070. *See* IX.

Cement from blast-furnace slag. Fr. Pat. 391,454. *See* IX.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(A.)—ELECTRO-CHEMISTRY.

Electrolytic soda; Manufacture of ——. *Theory of the "bell" process.* A. Brochet. Compt. rend., 1908, **147**, 674—676. (See this J., 1904, 545, 786).

In the electrolysis of sodium chloride by the "bell" process, the liberated caustic soda takes part in the electrolysis, and the foremost OH′ ions form a boundary layer which tends to move towards the anode. If the velocity of the liquid is equal to or greater than that of the ions, the yield is a theoretical one. The author has determined by calculation the conditions of working in the case of maximum yield.

He shows that the velocity of the anion, OH′, and consequently that of the liquid in the case where the boundary layer remains stationary, is a function of the mobility of the ion, OH′, of the current density to which it is proportional, and of the conductivity of the liquid to which it is inversely proportional. It may also be established, as with the diaphragm process, that the equivalent concentration of the liquid leaving the electrolyser is proportional to the intensity of the current, and inversely proportional to the volume of liquid leaving. When the velocity of the liquid is equal to that of the anion, OH′, the equivalent concentration of the liquid leaving the apparatus is proportional to the conductivity of the electrolyte, and inversely proportional to the mobility of the anion, OH′. It is independent of the density of the current and of the nature of the alkali. Numerical applications are given showing that with solutions of potassium or sodium chlorides, containing at 18° C., 20 grms. of salt per 100 of the solution, the yields are 86·13 grms. of caustic potash, and 45·00 grms. of caustic soda per litre, and with a saturated solution of sodium chloride, 49·56 grms. per litre. Examples are also given, showing that the velocity of displacement of the liquid in the bell, the velocity of outflow of the liquid, and the fall of potential in the bell may be calculated for any current density. The effect of temperature on the yield is insignificant, but from the point of view of difference in potential between the terminals and of the expenditure of energy, it is profitable to operate under the effect of heat.—B. N.

Alkali metals; Separation of —— *by electrolysis.* J. S. Goldbaum and E. F. Smith. *See* XXIII.

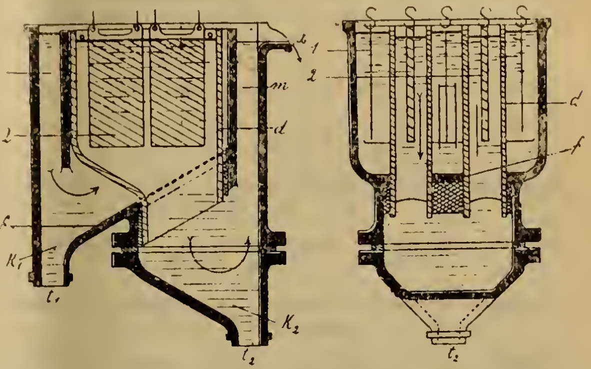
Thallium; Electrolytic determination of —— *and probable existence of a new oxide of this metal.* G. Gallo and G. Cenni. *See* XXIII.

Patents.

Electrolytes; Apparatus for purifying ——. S. O. Cowper-Coles, London. Eng. Pat. 23,145, Oct. 19, 1907. (See Eng. Pat. 8924 of 1906; this J., 1907, 158.)

The apparatus consists of a perforated drum or basket lined with a filtering medium, such as a blanket, and surrounded by an immovable outer casing within which it revolves. This casing is provided with one or more windows through which the rays from an arc lamp can be projected. The electrolyte, introduced into the revolving drum by means of depending pipes, is forced by centrifugal action through the filter into the outer chamber, where, in a finely divided condition, it is subjected to the action of the strong light, the purified product finally passing away through outlets provided at the bottom.—C. A. W.

Electrolyser, arranged to recover separately the products of the electrolysis, which are heavier than the electrolyte, without interrupting the electrolytic process. Usine Genevoise de Dégrossissage d'Or. Fr. Pat. 391,898, June 2, 1908. Under Int. Conv., July 11, 1907.



The electrolyte enters by the channel, *n*, passing into the chamber containing the cathodes, 1, and then through the diaphragm, *d*, into the chamber containing the anodes, 2, the electrolyte leaving the vessel through the channel, *m*. The liquid is thus made to travel along the whole length of the electrodes. The inclined base, *f*, of the cathode chamber, and the inclined portion of the diaphragm which passes through the base, *f*, cause the products of the electrolysis to collect in the hoppers, k_1 and k_2, the products being removed through the tubes, t_1 and t_2.
—B. N.

Chlorates; Electrolytic manufacture of —— *from alkali and alkaline-earth chlorides.* F. Ratig. Ger. Pat. 202,500, April 28, 1906.

It is stated that larger yields of chlorate are obtained if chlorine gas be introduced into the electrolyte before or during electrolysis.—A. S.

Electrolytic apparatus for decomposing water and obtaining oxy-hydrogen gas mixed with air. F. Weber. Ger. Pat. 202,501, March 28, 1907.

The oxy-hydrogen gas produced in the electrolytic vessel escapes through a tube opening into a funnel, the lower part of which is formed of fine-mesh wire gauze or perforated sheet metal. The mouth of the funnel is closed by a strong plate of metal having perforations for the passage of the gas. On this plate rests an inverted funnel leading to the discharge pipe for the gas. The funnels and pipes are enclosed in an outer casing, the lower part of which is perforated for the admission of air.—A. S.

Albuminoids; Production of a substance from —— *particularly applicable for use in secondary batteries.* E. C. and M. Ekstromer, Boston, U.S.A. Eng. Pat. 28,619, Dec. 30, 1907.

An albuminoid, such as gelatin, is first converted into a thin film or filament, and then treated for ten hours with sulphuric acid of sp. gr. 1·001. After removing the acid, the material is covered with water, and heated in a closed vessel for about half an hour to 250° C. On cooling, the albuminoid separates out, but, although the consistency and physical appearance is unchanged, it is rendered porous, plastic, and suitable for the purposes of dialysis and osmosis. This material is mixed with a suitable metallic oxide for use in accumulator plates, 1 per cent. of the substance with 99 per cent. of the oxide being said to yield good results.—B. N.

Accumulator plates; Preparation of negative ——. Akkumulatorenfabr. A.-G. Ger. Pat. 202,836, Jan. 29, 1908.

The active material, *e.g.*, lead, is deposited electrolytically on the support, from an electrolyte which holds in suspension such inert substances as talc, kaolin, barium sulphate, soot, or graphite. In this way an active mass permeated by inert material is obtained.—A. S.

Electrolytic apparatus. P. Borgnet, Liege, Belgium. U.S. Pat. 903,164, Nov. 10, 1908.

See Fr. Pat. 377,249 of 1907; this J., 1907, 1054.—T. F. B.

Insulating materials; Process of the manufacture of ——. H. v. d. Heide, Assignor to Wunner'sche Bitumenwerke G.m.b.H., Datteln, Germany. U.S. Pat. 903,287, Nov. 10, 1908.

See Fr. Pat. 379,359 of 1907; this J., 1907, 1239.—T. F. B.

Filaments of Chinese ink for electric incandescent lamps. Eng. Pat. 11,600. *See* II.

Filaments for electric metallic-filament lamps; Decarbonising ——. Eng. Pat. 15,079. *See* II.

Electric conductors; Manufacture of refractory ——. Eng. Pat. 16,534. *See* II.

Filaments for electric lamps; Manufacture of hollow metal ——. Eng. Pat. 26,179. *See* II.

Filaments for incandescence electric lamps. Fr. Pat. 391,722. *See* II.

Phosphoric acid; Production of ——. U.S. Pat. 902,157. *See* VII.

Nitric oxide; Method for producing ——. U.S. Pat. 902,607. *See* VII.

(*B.*)—ELECTRO-METALLURGY.

Passive state of metals [*cobalt, iron, and nickel*]. H. G. Byers. J. Amer. Chem. Soc., 1908, **30**, 1718—1742.

The author has made a series of measurements of the anodic solution of cobalt, iron, and nickel. Cobalt, in striking contrast to the other two, goes quantitatively into solution in the presence of halogen salts, sulphates, nitrates, chlorates, nitrites, dihydrogen phosphates, citric acid, acetic acid, sulphuric acid, and nitric acid; it cannot be made to remain passive as an anode in these solutions, and increase of current density has no effect, unless very high densities are employed. The passive state of nickel is in general more easily produced and less easily destroyed than that of iron or cobalt. If any of these metals, as anodes, are really passive (*i.e.*, show an unchanged surface, high potential difference in the cell, and liberation of oxygen), they do not dissolve to any extent, although a small loss, probably due to initial activity of the metal, is sometimes noticed. A visible change in the anode surface is generally accompanied by quantitative or partial anodic solution; where a visible deposit is observed, passive conditions are not a necessary consequence, in certain cases solution of the metal still continuing. None of the three metals can be rendered passive in solutions of the halogen acids or their salts. In the oxygen-containing electrolytes the occurrence of passivity depends upon current density, temperature, and the treatment of the metal, as well as upon the electrolyte itself; if the current density is below a critical value, the metals may be passive or active, under exactly the same current conditions. Nickel is not always passive in solutions of sulphates and nitrates (compare Le Blanc and Levi, this J., 1904, 667). The current density required to produce passivity varies within wide limits, and increase of time will, in a certain degree, produce the same effect as increase of current strength. The author arrives at the conclusion that neither the formation of oxide, nor any other explanation which has been put forward, satisfactorily accounts for the phenomena of passivity; he anticipates that the cause will be found in an altered state of the metal itself. —F. Sodn.

Patents.

Calcium; Manufacture of metallic —— [*electrolytically*]. S. O. Cowper-Coles, London. Eng. Pat. 24,396, Nov. 4, 1907.

Calcium chloride is first heated in a calcining chamber, and then passed into a fusing chamber, from which it falls into a crucible in which the salt is electrolysed, the crucible being provided with an "inturned lip" for leading off the chlorine through suitable channels. The electrolytic vessel contains a layer of molten metal (*e.g.*, lead) acting as the anode, and one or more discs (of graphite, iron, or the like) acting as the cathode. These latter are rotated by means of spindles on which they are mounted, and are gradually raised as the calcium is deposited on them. —B. N.

Electrolyte for electroplating. O. Meyer, Richmond, Va. U.S. Pat. 902,755, Nov. 3. 1908.

The electrolyte consists of an alcoholic solution of copper chloride alone or mixed with other metallic chlorides. —A. G. L.

Brass-coated copper wire; Process and apparatus for making ——, *called Léoni wire.* H. Paweck. Fr. Pat. 391,448, June 11, 1908.

The invention constitutes an improvement on Fr. Pat. 323,901 of 1902 (this J., 1903, 501). Copper wire is passed at a speed of at least 100 m. per minute, instead of 4 m. per minute, as formerly, through the bath in which it is electrolytically coated with zinc. The increase in the strength of the current, consequent on the increased speed, renders it convenient to use a part of the same current for the subsequent heating of the coated wire, the whole process thus being carried out continuously in one operation.—A. G. L.

Platinum coating on heavy base metals such as iron, nickel, cobalt, or their alloys; Production of a ——. M. Baum. Ger. Pats. 201,664 of Aug. 20, 1907; 201,665 of Oct. 2, 1907; and 201,666 of Oct. 18, 1907.

(1.) The process, as applied for example to nickel wire, is as follows:—The wire is heated strongly in a reducing gas, *e.g.*, hydrogen, to free it from grease and oxide; it is then scraped clean, and coated electrolytically with a mixture of platinum and nickel. The electrolyte used is prepared by dissolving 25 grms. of platinum chloride in 500 grms. of water, adding a solution of 100 grms. of ammonium phosphate in 500 grms. of water, and pouring the whole into a solution of 500 grms. of sodium phosphate in 1000 grms. of water. To this mixture is added 4000 grms. of a solution of nickelous phosphate in sodium pyrophosphate, containing 5 grms. of nickel per litre, and the whole is boiled until the liquid becomes faintly acid, and ammonia is no longer evolved; fresh water is added to replace that lost by evaporation. The wire coated in this bath with a mixture of platinum and nickel, is next heated to 1000° C. in hydrogen, then cleaned, coated electrolytically with pure platinum, and again heated in hydrogen, these operations of coating with platinum and heating in hydrogen being repeated until the metal shows no signs of oxidation when heated in the air. From three to five coatings of platinum are generally required. (2.) The metal is first coated electrolytically with nickel or cobalt, and then several times in succession with platinum, being heated strongly in hydrogen after the application of each coating. A suitable nickel bath consists of 290 parts of nickel-ammonium sulphate, 75 parts of ammonium sulphate, 20 parts of citric acid, and 4000 parts of distilled water. It is rendered neutral (or faintly acid) by addition of ammonia solution. A suitable platinum electrolyte consists of 25 parts of platinum-ammonium phosphate, 500 parts of sodium phosphate, and 4000 parts of distilled water. (3.) Nickel is coated electrolytically first in an electrolyte containing 25 parts of platinum to 75 of nickel, then in a second bath containing the two metals in equal proportions, next in a third bath containing 75 parts of platinum to 25 parts of nickel, and is finally coated once or several times in succession with pure platinum. After the deposition of each coating, the metal is heated strongly in hydrogen.—A. S.

Melting in electric furnaces ; Processes of —— and their application to the extraction of easily volatilisable metals. H. Herrenschmidt, Paris. Eng. Pat. 24,517, Nov. 5, 1907. Under Int. Conv., Nov. 9, 1906.

See Fr. Pat. 371,260 of 1906 ; this J., 1907, 328.—T. F. B.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

Cocoanut ; Notes on the sprouting ——, and on copra and cocoanut oil. H. S. Walker. Philippine J. Science, 1908, **3**, 111—135.

No evidence could be obtained of the existence of a fat-hydrolysing enzyme in the " meat," milk, and " foot " of the cocoanut. During the sprouting of the cocoanut, oil is lost by the " meat " ; it is not taken up as such by any other portion of the nut, but is either consumed to furnish energy for the growing plant or is transformed by progressive synthesis into sugar and, finally, into cellulose. Sugar is lost by the " meat " and milk, but a corresponding quantity is gained by the " foot." Six different moulds, capable of hydrolysing and destroying fat, have been isolated from among the many organisms growing on rancid copra and cocoanut " meat " ; this fat destruction is independent of bacterial action. Copra which had been acted on by moulds was found to have lost almost all its sugar, whilst the only effect of bacteria was the production of a more or less disagreeable sour odour and the disintegration of the " meat."

The deterioration of freshly prepared cocoanut oil is produced by at least three entirely independent processes and may be divided into two distinct periods of time. The first, rapid decomposition of the fat is caused by moulds which are either pressed out with the oil, together with sufficient sugars and proteins for their growth, or, in the case of hot-pressed oils, enter the oil from the air. The action continues as long as there is sufficient nutritive material for mould growth in the oil ; it may be completely checked by filtration, preferably after heating to a temperature of 100° C. Towards the end of this first period, oxidation by the air sets in ; in extreme cases, the oxidation may cause extremely rapid deterioration, but can be entirely prevented by storing the oil in completely filled, air-tight vessels. In addition to the two above-mentioned processes, slight hydrolysis due to heat, moisture, and free acids already present is constantly taking place, and there is reason to believe that some hydrolysis is brought about by enzymes produced by the moulds. Light has no apparent effect on the oxidation by air of cocoanut oil.—W. P. S.

Lophira alata seeds from Sierra Leone. [*Niam fat.*] Bull. Imp. Inst., 1908, **6**, 243—245.

The seeds are obtainable in large quantities in readily accessible areas of W. Africa. They are conical in shape, about 1 in. in length and ½ in. broad at the base. The interior of the seeds is of a white or pale yellowish colour when fresh, but tends to darken when the seeds are kept. The fat (Niam fat) extracted from the seeds is semi-solid and of a white or pale yellow colour. The results of the examination of four specimens of the seeds are shown in the following table :—

Mark of sample.	B.	C.	D.	E.
Product received	Kernels	Fruits	Kernels	Kernels
Condition of kernels	Good	Many partly decomposed	Good	Fairly good
Percentage of fat (on weight of kernels)	43·0	39·6	41·1	41·76
Characters of fat—				
Sp. gr. at 40° C.	0·9044	0·9044	0·9019	0·9016
Acid value	25·9	33·2	47·5	48·0
Saponification value	181·5	194·6	180·7	183·3
Iodine value	69·8	70·3	72·1	72·5
Reichert-Meissl value	0·9	0·9	0·8	0·8
Unsaponifiable matter, per cent.	0·5	—	—	0·86
Titer test	49·0°	47·0°	47·5°	48·5°

The oil (from sample B) was valued at £24—£25 per ton (£1—£2 more than cottonseed oil) for soap-making, and the seeds are said to be worth £10 per ton c.i.f., Liverpool. (See also this J., 1907, 1265.)—A. S.

Ximenia americana, L. ; Oil of ——. V. Lommel. Der Pflanzer, 1908, **4**, 204—206. Chem. Zentr., 1908, **2**, 1547—1548.

The kernels of the fruit of *Ximenia americana* yield by cold pressing, 5·6, and by extraction with carbon tetrachloride, 45 per cent., of a dark yellow, viscous, somewhat turbid, non-drying oil. On treatment with hot alcohol, 5·5 per cent. of the oil is dissolved. The oil contained 1·5 per cent., and the portion soluble in alcohol, 15·3 per cent. of free fatty acids. The oil may be useful as a lubricant.—A. S.

Oleic acid ; Colour reaction of ——. Rapid method for distinguishing between animal and vegetable fibres. A. Manea. Bul. Soc. Stiinte din Bucuresti, 1908, **17**, 256—257. Chem. Zentr., 1908, **2**, 1702.

Oleic acid and its esters when treated with concentrated sulphuric acid in presence of cellulose (vegetable fibres), starch, nitrocellulose, celluloid, dextrin, sucrose, dextrose, lævulose, etc., give on addition of water, a red coloration. Stearic, palmitic, margaric, butyric, and *iso*butyric acids do not give a similar reaction. In applying the test, a quantity of cotton is dissolved in concentrated sulphuric acid, a few drops of the oil are added, and then water is dropped in and the mixture shaken. The red colour produced if oleic acid is present, changes to violet on addition of a larger quantity of water. The test may be used to distinguish animal and vegetable fibres. Petroleum distillates, especially the fraction boiling at about 250° C., behave like oleic acid, but the addition of water must be made cautiously, as the coloration is destroyed if too much heat is developed.—A. S.

Phytosterol from cottonseed oil. A. Heiduschka and H. W. Gloth. Pharm. Zentralh., 1908, **49**, 836—837. Chem. Zentr., 1908, **2**, 1519.

The acetate of the phytosterol isolated from cottonseed oil, yields only a dibromo-derivative, but no slightly soluble tetrabromo derivative when examined by the method of Windaus and Hauth (this J., 1907, 69, 1150). This phytosterol may therefore be regarded as an individual substance.—A. S.

Cholesterol group ; Contribution to the chemistry of the ——. Part II. Some oxidation products of sitosterol. R. H. Pickard and J. Yates. Chem. Soc. Proc., 1908, **24**, 227.

The behaviour on oxidation of the " vegetable cholesterol," sitosterol, has been studied. This alcohol, which is obtained from the fat contained in wheat, yields oxidation products which are analogous to those given by cholesterol itself.

Sod oils ; Determination of water in ——. L. E. Levi and E. V. Manuel. *See* XIV.

Glycerol ; Aldehydic impurities in——. G. F. Bergh. *See* XX.

Patents.

Fish oils ; Purifying —— and rendering them odourless. E. Petersen and H. Holstein. Ger. Pat. 202,576, Feb. 13, 1907.

The oil is agitated with a mixture of bone charcoal and chalk in a vacuum and simultaneously treated with

superheated steam. It is stated that by the explosive expansion of the bubbles of superheated steam, the non-volatile objectionable constituents of the oil are forced mechanically into the pores of the charcoal and chalk.
—A. S.

Soap; Manufacture of ——. T. H. Oyler, Maidstone. Eng. Pat. 5817, Mar. 16, 1908.

Finely-ground hops, hop extract, hop oil, or other preparation of hops, are incorporated with the soap, to obtain a product having a tonic effect upon the skin.
—C. A. M.

Soap; Apparatus for cooling liquid ——. C. Harzer. Ger. Pat. 201,710, Oct. 1, 1907.

The cooling is effected under pressure in a vessel constructed like a filter-press. The liquid soap flows from the containing vessel, through a jacketed pipe to the cooler. This pipe is provided with a valve, and near this with an opening through which compressed air can be introduced. The valve is first opened, and the liquid soap allowed to flow into the cooler until the latter is full. The valve is now closed, and compressed air forced into the connecting pipe. In this way the soap left in the connecting pipe is forced into the cooler, as the soap in the latter shrinks during the cooling.—A. S.

Detergent for use with hard and salt waters. R. Macpherson, Brondesbury, and W. E. Heys, Bushey. U.S. Pat. 902,750, Nov. 3, 1908.

See Fr. Pat. 364,975 of 1906; this J., 1906, 938.—T. F. B.

Liquids [crude petroleum, glycerin, water, etc.] contaminated by coloured or evil-smelling organic substances, decomposition products, or micro-organisms; Purification of ——. Ger. Pat. 202,166. *See* III.

Plastic masses [rubber substitute] from drying oils, especially linseed oil. Ger. Pat. 201,966. *See* XIII*C*.

Preparation rich in lecithin, or lecithin, cholesterol, and a fatty oil; Process for obtaining ——. Fr. Pat. 390,683. *See* XX.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(*A.*)—PIGMENTS, PAINTS.

Poisoning by chromium in industrial operations. Lewin. *See* XVIII*B*.

Patents.

Ultramarine; Manufacture of artificial ——. L. E. Notelle and M. Corblet. Fr. Pats. 391,779 and 391,780, June 29, 1908. Under Int. Conv., July 25, 1907.

(1). A mixture of hydrated aluminium silicate, sodium sulphate, sodium carbonate, sulphur, and resinous materials is heated rapidly to a temperature of 600° or 700° C., and kept at that temperature until sulphides and hyposulphites of sodium and aluminium are formed. A sample taken from the fused mass shows a brownish-green colour on cooling; about 1 to 3 hours' heating are required. The mixture is then stirred and the temperature raised to 900° C. Oxidation is assisted by vigorous stirring of the mass. After 1 hour's heating at this temperature, test samples show a greenish-blue colour. Powdered sodium chlorate is now thrown on to the heated mass, and after stirring vigorously for 15 minutes at a temperature of 800—900° C., the required blue colour is obtained. The oxidised product is heated for ½ hour longer and then removed from the oven. (2). An improvement in the colour and the yield of ultramarine is effected by adding to the usual constituents, sulphates of sodium and aluminium. A mixture of 35 per cent. of aluminium silicate, 10 per cent. of carbon, 40 per cent. of soda alum, 8 per cent. of rosin, and 7 per cent. of sulphur gives an ultramarine superior to that obtained by the usual processes.—R. S. M.

Oil paint. G. Fraipont. Fr. Pat. 391,930, July 1, 1908.

The new paint is composed of equal weights of zinc oxide and calcium sulphate with one per cent. of lime ground in linseed or poppy-seed oil.—R. S. M.

Lakes; Process of manufacturing pigmental ——. F. M. Winter, Fährbrücke, Saxony. Eng. Pat. 28,424, Dec. 24, 1907.

See Fr. Pat. 385,484 of 1907; this J., 1908, 633.—T. F. B.

Pigments. J. C. Heckman, Avalon, Pa., U.S.A. Eng. Pat. 8549, April 16, 1908.

See U.S. Pat. 887,043 of 1908; this J., 1908, 579.—T.F.B.

[Oil] colours; Production of ——. J. Meurant, Liege, Belgium. Eng. Pat. 9083, April 27, 1908.

See Fr. Pat. 389,051 of 1908; this J., 1908, 988.—T. F. B.

Monoazo dyestuffs particularly suitable for the manufacture of lakes. Fr. Pat. 391,155. *See* IV.

Lead oxide; Manufacture of —— *and treatment of raw litharge and white lead residues.* Fr. Pat. 391,612. *See* VII.

Water-glass; Process for increasing the mobility and reactivity of ——. Fr. Pat. 391.682. *See* VII.

(*B.*)—RESINS, VARNISHES.

Copal resins from British West Africa. Bull. Imp. Inst., 1908, **6**, 245—252.

A specimen of Accra copal from Ashanti was similar in character to the samples examined in 1907 (this J., 1907, 701), but was somewhat harder. If properly cleaned before shipment, it would probably be equal in value to the highest quality of Accra copal. Two copal resins from the Sekondi district of the Gold Coast were found to be sparingly soluble in oil of turpentine and benzene, or in mixtures of the two, but completely soluble in a mixture of oil of turpentine and alcohol. No. 1 was almost completely soluble in alcohol and ether; No. 2 was somewhat less soluble in these solvents. No. 1 was stated to be of poor quality and worth only 27s. 6d. to 30s. per cwt. (May, 1908). No. 2 was of good quality; selected material would be worth 70s. per cwt., and mixed with small pieces, 40s. to 45s. per cwt. (May, 1908). The copal tree of North Ashanti has been identified as a *Cyanothyrsus* species. Two samples of Sierra Leone copal were partly soluble in alcohol, ether, chloroform, carbon bisulphide, and oil of turpentine, and completely soluble in a mixture of alcohol and benzene. A mixture of about equal parts of the two samples was valued at 2s. 2d. per lb. (June, 1906). A specimen of " Ogea gum " from Olokomeji, W. Africa, was found to be very similar in character to commercial Nigerian copal (from *Cyanothyrsus Ogea*, Harms.), but was somewhat more fusible and more soluble in alcohol than the latter. These differences are probably due to differences in the ages of the products, which otherwise appear to be identical. Two specimens of the resin of *Daniella thurifera* from Northern Nigeria were found to be quite different from commercial copals, having a low melting point (about 90° C.), and being practically completely soluble in oil of turpentine and alcohol.—A. S.

Patents.

Wurtzilite. W. F. Doerflinger and L. H. Buck, Niagara Falls, N.Y., Assignors to M. Stine, New York, and E. F. C. Young, Jersey City, N.J. U.S. Pat. 903,275, Nov. 10, 1908.

Wurtzilite is melted with a suitable resinous substance, and when the mass is homogeneous, a gum, such as india-rubber, is added. After cooling, the mass is dissolved in a liquid which is a solvent of both the gum and the resinous substance, and the solution is mixed with " oil " to form a coating composition. In the first operation of melting with a resinous substance, the wurtzilite may be added in small portions, the mixture being melted until homogeneous after each addition.—A. S.

Terpenes from wood ; Process of producing ——. W. J. Hough, Toledo, Ohio. U.S. Pat. 903,471, Nov. 10, 1908.

The wood is treated with a weak solution of sodium sulphide to neutralise the resinous acids and dissolve the non-cellulose constituents, and the terpenes are then removed by distillation with steam.—A. S.

Resinous substances ; Apparatus for the purification and filtration of ——. G. Col. Second Addition, dated June 25, 1908, to Fr. Pat. 378,965, June 18, 1907 (this J., 1907, 1207).

A cylindrical rotatory filter is placed between the vessel in which the gums are melted and the settling pans. The filter consists of a cylinder of brass wire gauze with a suitable iron frame, so that one half of the wire gauze is fixed, whilst the other half is removable. The whole is enclosed in a cylindrical vessel which has an opening leading to the settling pans. The fused resin passes from the autoclave, in which the fusion is performed, into the filter through perforations in the axis of the filter frame. —R. S. M.

Resins ; Process for the systematic and continuous distillation of ——. L. B. Castets. Fr. Pat. 391,835, June 30, 1908.

The process comprises crushing and titurating the crude resins, fusing, filtering, and distilling the liquids obtained. The distillation is carried out *in vacuo*, with gradually increasing temperature. The distillates are condensed, and whilst yet *in vacuo* are subjected to a rectification with addition of suitable products. Finally the condensation of the most volatile parts is completed under slight pressure, so as to cause them to dissolve in the heavier products of distillation.—R. S. M.

Linoleum ; Manufacture of ——. G. A. Barbieri, Ferrara, Italy. Eng. Pat. 28,282, Dec. 23, 1907. Under Int. Conv., May 13, 1907.

In the manufacture of linoleum a powder obtained from hemp stalks is used instead of cork powder or wood sawdust. The hemp stalks are dried, crushed, and then ground to a fine powder. The linoleum is whiter than ordinary linoleum.—R. S. M.

Resin-like products ; Manufacture of new ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 26,317, Nov. 28, 1907.

See Fr. Pat. 384,425 of 1907 ; this J., 1908, 457.—T. F. B.

(C.)—INDIA-RUBBER, &c.

Rubber plants of the Ivory Coast (*W. Africa*). A. Chevalier. L'Agriculture pratique des pays chauds; Gummi-Zeit., 1908, 23, 153—154.

The chief rubber-yielding plant of the Ivory Coast is *Funtumia elastica.* The methods of obtaining and subsequently working up the latex from this tree are such as to leave much room for improvement ; the addition of other latices to the *Funtumia* latex is one of the practices to be dealt with, inasmuch as rubber prepared from such mixtures is considerably diminished in value. *Ficus Vogelii* occurs as an epiphytic form in the region of the sea coast, and the rubber obtained from it, wrongly called "liana-rubber," is shipped from Bliéron, Tabou, and Béréby. Coagulation is effected by allowing the latex to stand ; the rubber is of only medium quality, slightly tacky on the surface, and possessed of little elasticity and "nerve." Four or five species of *Landolphia* also occur, including *L. owariensis,* which yields the best product. The latex is either allowed to coagulate spontaneously, or the coagulation is brought about by the addition of citric acid, salt water, etc. *Clitandra elastica* is also a valuable rubber vine. The latex from this is coagulated by prolonged heating, the clot obtained being afterwards kneaded with the hands. The rubber, which is at first almost white, and possessed of little elasticity, gradually darkens and becomes more elastic. *Clitandra eugenifolia* and *laurifolia* are two new species which yield good rubber, though, partly on account of the smallness of their stems, only in very small quantity. *Periploca nigrescens,* the richest stems of which contain only 0·5 per cent. of caoutchouc, is of frequent occurrence. Of the large number of other plants which contain a latex, the only one to which attention is drawn is the large liana, *Carpodinus hirsuta,* from which "Accra paste" is obtained ; this product is unfortunately often used to adulterate *Kickxia* rubber ("lumps").—E. W. L.

Rubber latex ; Treatment of —— [*to prevent darkening of the rubber*]. M. K. Bamber. Bull. d'Agric. des Straits ; Caout. et Gutta-percha, 1908, **5**, 2437.

The discoloration of (plantation) rubber, which is due to the action of an oxidising enzyme (see this J., 1908, 633, 909) upon soluble organic substances allied to tannin, may be prevented by destroying the enzyme present in the latex, or in the rubber prepared from it, by the action of heat. The heat may be applied either : (1), by passing steam into the latex until a temperature of 80° C. is reached and maintaining the temperature at this level for 15 minutes or so ; (2), by immersing the "biscuits" or sheets in water at 80° C. ; or (3), by using hot water, or steam-heated rollers, for washing the rubber. The first of these methods closely resembles in principle that employed in the production of "hard Parà."—E. W. L.

Latex of the "Melaboeai" of Sumatra ; Presence of inactive dimethylinositol in ——. A. W. K. de Jong. Rec. trav. chim. Pays-Bas, 1908, **27**, 257—259.

Inactive dimethylinositol was obtained from the latex by the following process :—After coagulation, the liquid was expressed from the coagulum, and evaporated to dryness on the water-bath. The residue was dissolved in water and concentrated by evaporation, the crystals which separated were re-crystallised first from boiling 96 per cent. alcohol, then from water, and dried over sulphuric acid, the substance being hygroscopic. The dimethylinositol thus obtained melted at 206° C., and gave inactive inositol when hydrolysed with hydriodic acid. The "dambonite" obtained by Girard (Beilstein, I., 1052), from Gaboon rubber, is probably identical with the substance now described, though the former was stated to contain three molecules of water of crystallisation.—E. W. L.

Rubber crop of the Amazon Valley. Board of Trade J., Nov. 19, 1908. [T.R.]

A supplement to the "Brazilian Review," of 20th October, gives the following statistics of the rubber crops in the Amazon Valley for the seasons 1906–7 and 1907–8 :—

—	1906–7.		1907–8.	
	Rubber.	Caucho.	Rubber.	Caucho.
	Metric tons.	Metric tons.	Metric tons.	Metric tons.
Islands	9,370	—	8,346	—
Itaituba & Lower Amazon	1,198	116	1,109	126
Tocantins, Xingú, and Jary	—	773	—	679
Beni	1,078	169	867	227
Juruá	1,347	126	1,043	132
Purús	3,428	738	3,467	660
Manaos and Itacoatiara	13,329	3,335	13,336	4,154
Iquitos	1,793	1,035	1,540	964
Total	31,543	6,292	29,708	6,942
Total, rubber and caucho	37,835		36,650	

Patents.

Rubber-waste, and vulcanite ; Reclamation of ——. W. H. Hyatt, Cookham, and P. D. Penn, South Croydon. Eng. Pat. 13,599, June 27, 1908.

The improvements consist in the removal of the air from the moulds by means of an exhaust pump during the remoulding of reclaimed rubber and vulcanite.—R. S. M.

Solvents; Recovery of —— from machines for coating fabrics with rubber, etc. R. Labruyère. Fr. Pat. 391,499, June 20, 1908.

THE apparatus described consists of a number of "condensers," each formed of an outer casing of sheet-steel, and containing a water-cooled "refrigerator" of very thin sheet-brass. These condensers are supported on a steel framework resting in slides on the spreading table, and insulated from it by asbestos sheet, the whole forming a hood over the table. The vapours of the solvent enter the condenser from below, through openings in its floor—which is rendered non-conducting by means of asbestos sheet—and the condensed solvent is prevented from falling back on to the work by small hoods arranged above the openings inside the condenser. The condensed solvent is led off by a pipe from the lowest point of each condenser, that is from the outer side in each case. Arrangements are made for maintaining a slight excess of air pressure at the two ends of the hood in order to prevent diffusion of the solvent vapours outwards; also for the provision of a vigorous air-current at the end at which the spread material leaves the hood, in order to drive off the last traces of solvent.—E. W. L.

Plastic masses [rubber substitute] from drying oils, especially linseed oil; Preparation of ——. Chem. Fabr. Liegnitz, Meusel und Co. Ger. Pat. 201,966, Feb. 24, 1907.

THE oil is mixed with a small proportion (*e.g.*, 0·5—1 per cent.) of a finely-divided metal, such as magnesium powder or *ferrum hydrogenio redactum*, and heated at the ordinary pressure at 110°—120° C. or in a vacuum for 3½—4 hours. The product is a plastic mass, m. pt. 110° C., the consistence of which can be varied to some extent by altering the temperature or duration of heating or by admission of more or less air during the heating. It is soluble in benzene, oil of turpentine, carbon bisulphide, and carbon tetrachloride, only slightly soluble in petroleum spirit, and insoluble in alcohol and water. It can be vulcanised and is useful as a rubber substitute and for other purposes.
—A. S.

Gelatin [for rubber substitutes, etc.]; Preparation of ——. Eng. Pat. 23,030, Oct. 18, 1907. *See* XIV.

XIV.—TANNING, LEATHER, GLUE, SIZE.

Compounds of gelatin and tannin. J. T. Wood. Collegium, 1908, 12, 494—495.

THE results published in this Journal, 1908, 384, of the precipitation of tannin by gelatin, may be explained by the known facts recently discovered in the chemistry of colloids.

Stiasny has pointed out to the author that Weiske (Zeits. Phys. Chem., 7, 460) has found that gelatin nearly free from ash is not precipitated by tannin, but only gives an opalescence. On adding a small quantity of an electrolyte to the solution precipitation immediately takes place. It is also known that albumin from which the inorganic salts have been removed by long dialysis is not coagulated by heat. The author has made an attempt by means of Graham's method (Phil. Trans., 1861, 206) to prepare gelatin free from mineral matter, but so far has not succeeded. He can, however, state that when the ash contents of the gelatin are greatly reduced, the quantity of tannin precipitated is much less than with ordinary gelatin. It seems evident that the case is that of the mutual precipitation of two colloids resulting from the opposite electric charges of the particles or molecular complexes of the two bodies, the gelatin carrying a positive charge and the tannin a negative one. It has, however, been shown by Pauli (Pflügers Archiv. f. d. ges. Phys., 1898, 73, 315) that albumin, when free from inorganic impurities, is almost a complete insulator, so that the charges on the colloid molecules of the gelatin, and probably also of the tannin, are due to adsorbed ions; in the case of the gelatin, the ions are those of calcium salts; these positively charged ions meeting the negatively charged ions of the tannin, a colloidal precipitate is produced. This precipitate, or gel, further absorbs tannin owing to its surface attraction, and the quantity absorbed is determined by the concentration of the tannin remaining in the solution. Thus an extremely complicated set of reactions are realised, depending on the state of the gelatin, the amount of electrolytes it contains, and other factors, so that, unless the whole of the conditions are identical, the composition of the compound will vary. A further proof that the precipitate of gelatin and tannin is a colloidal one, is its close resemblance to the precipitation of gelatin and colloidal silicic acid described by Graham (Phil. Trans., 1861, 206).

Gelatin treated with ammonium oxalate in excess, in dilute solution and the precipitate of calcium oxalate filtered off, gave a precipitate with gallotannic acid (Kahlbaum's), but very much smaller in quantity than the precipitate from the original gelatin. The appearance of the precipitate was also quite different; it settled quickly, and both liquid and precipitate were of a slight violet colour like silver chloride after a short exposure to light. The precipitate from the original gelatin was of a bulky nature, quite white, and did not settle.

Gelatin precipitated from alcohol carries down the electrolytes with it, and gives a precipitate very similar to the original gelatin.

Meunier has called the author's attention to the fact that a small quantity of borax entirely prevents the precipitation of the gelatin by tannin; so far as he knows, the quantity of borax necessary to prevent precipitation is less than the quantity required to form a compound with the tannin, so that in this case also it would appear that the precipitation is prevented by the alteration of the electric charges. Boric acid does not prevent precipitation.

It appears to the author that the colloid nature of the bodies here dealt with will prevent the solution of the problem, presented in quantitative determinations, except by adhering to strictly defined rules in carrying out every detail of the analysis, and this the author desires especially to impress.—T. F. B.

Sumach; Commercial Sicilian ——. F. P. Veitch and B. J. Howard. Bull. No. 117, Bureau of Chemistry U.S. Dept. of Agriculture, 1908, Sept. 12.

IN spite of the introduction of the mineral tannages for skins, the imports of sumac into the United States have remained about the same, as shown in the following table:—

Year.	Quantity imported.	Value.
	lb	$
1870	9,634,367	418,919
1875	16,718,678	511,941
1890	16,397,213	—
1895	12,179,203	235,157
1900	10,335,980	—
1905	15,583,334	225,036
1906	14,886,482	235,403
1907	12,244,907	259,974

As good "mascolino" or Sicilian mountain sumac (the leaf of *Rhus coriaria*) contains from 25 to 35 per cent. of tannin, and is a high-grade tanning material commanding a high price, it is much adulterated with stems and with lower grade and darker coloured substances. A careful examination was therefore made in 1905 of many consignments entering the country, a full analytical and microscopic investigation being made. The adulterant found to be almost exclusively used was the leaf of *Pistacia lentiscus* ("lentisco") containing 12—20 per cent. of a catechol tannin which darkens on exposure to air. Other leaves less generally used as adulterants were *Coriaria myrtifolia* ("stinco"), *Tamarix africana* ("brusca"), *Ailantus glandulosa*, *Vitis vinifera* (grape vine). The analyses were conducted by the method of the Association of Official Agricultural Chemists, and for each sample the mineral ash, sand, and tintometer readings were taken. The results are summarised in the following table :—

Samples.	Moisture.	Ash.	Sand.	Soluble extract.	Non-tannins.	Available tannins.	Colour in 0·5 per cent. solution.	
							Red.	Yellow.
All samples—								
Average	7·79	8·18	1·41	48·4	19·5	28·8	3·1	10·7
Maximum	9·46	10·95	3·05	55·4	22·7	35·1	11·2	27·8
Minimum	6·34	6·12	0·28	41·8	17·1	19·6	0·8	4·7

The percentage of available tannin and the colour of the pure and adulterated samples respectively were as follows :—

	Pure sumac.			Adulterated samples.		
	Max.	Min.	Aver.	Max.	Min.	Aver.
Available tannin, per cent.	35·1	27·4	31·9	33·3	19·6	26·6
Colour in 0·5 per cent. solution—						
Red	3·5	0·8	2·1	11·2	1·9	4·1
Yellow	12·8	4·7	9·4	27·8	5·6	11·8

It will be seen that the adulterated sumacs averaged 2·2 per cent. less tannin than the average of all samples. This corresponds to an average adulteration of 30 per cent. of lentiscus, which is possibly below the actual practice as high grade samples are more likely to be adulterated than lower grades. A number of the samples contained an excess of sumach stems, and the average content of these was 29·9 per cent., which indicates that the stems are not added in such large quantities as lentiscus. A similar investigation was carried out in 1907 with similar results summarised as follows :—

Samples.	Available tannin.	Samples.	Available tannin.	Samples.	Available tannin.
All samples—		Pure sumac—		Adulterated samples—	
Average	29·4	Average	30·6	Average	26·3
Maximum	35·7	Maximum	35·7	Maximum	30·4
Minimum	22·4	Minimum	25·6	Minimum	22·4

For microscopic examination the method of Priestman (this J., 1905, 231) was found to be laborious and to require considerable judgment as to when to stop the action of the nitric acid on the leaf. The following method was therefore devised and employed throughout the investigation. A small amount of the specimen is placed upon a microscopic slide with 2—3 drops of a solution of chloral hydrate (150 grms. in 100 c.c.), gently heated to boiling over the micro-bunsenburner, and kept boiling for about one minute. The chloral hydrate solution should be re-applied if necessary. The specimen is allowed to cool somewhat, and a cover-glass placed over it, when the specimen is ready for examination. Another method of procedure specially suitable for powdered samples is the following: Place in a test-tube a small portion of the sample, add a few c.c. of chloral hydrate solution and boil slowly for 2—3 minutes, allow to stand until the larger pieces have settled to the bottom, and then remove a part of them with a pipette and mount on a slide in the usual manner. Chemical tests for adulterants were found to be useless, and neither the percentage of ash nor of sand is an indication of adulteration with lentiscus. It was noted, however, that the colours of the dried samples and of the aqueous extracts were distinctly darker in adulterated samples.—H. G. B

Polishing leathers; Manufacture of ——. W. Eitner. Gerber, 1908, **34**, 263—264.

These leathers are employed for polishing metallic objects. There are two kinds of polishing leather; one is made for polishing the noble metals and is a kind of chamois leather made in the usual way from buffalo hides, and the other is used by knife and sword cutlers, and metal workers, and is made by the vegetable tannage of walrus hides, and of late also of heavy buffalo hides. The former leather is chiefly used by the makers of gold-ware and consists usually of the inferior grades in the manufacture of buff leather for military purposes. The walrus hides for burnishing steel however require a special tannage, resulting in a thick, firm leather with a very loose and spongy texture, so that it is always somewhat rough. The walrus hide is particularly suitable for this purpose, partly because of its great thickness and partly because of the large amount of fat (over 30 per cent.) which is evenly distributed through the hide and which thus separates the fibre bundles. As the hides are received in a dried condition, the difficulty in soaking is very greatly increased by their thickness and greasy nature; soaking indeed can only be satisfactorily effected in a 3 per cent. solution of sodium sulphide, in which the hides are immersed until the fat is emulsified. They are then worked over the beam, which treatment removes much of the fat, and are washed for 2 days in a 1 per cent. solution of sodium sulphide at 30° C. which removes the rest. After again working over the beam, they are brought into an old lime liquor and hauled and set daily for 10 days. They are then unhaired, fleshed, and placed in a freshly prepared lime liquor for 8 days, in order to plump them as much as possible. When this action is complete, the hides are completely delimed with hydrochloric acid and washed in fresh water. The tannage is brought about in very weak liquors which are very acid in the early stages, to obtain the maximum swelling. The goods first enter a round of sour pine bark liquors, 8 liquors being given to each pack, and 2 days in each liquor. As walrus hides are much longer than they are broad, they must either be suspended by doubling over a pole, or must be handled daily. The acidity of these liquors is kept up to the required amount by the addition of hydrochloric acid. After being struck through in this round, the hides now enter a round of sweet liquors in 20 pits, the strongest liquor having a strength not exceeding 25 barkometer degrees. In these liquors the hides become somewhat fallen again from their acid swollen condition, which change is necessary if the leather is not to become too stiff for the purpose intended. The liquors should be clear and should be made up from quickly penetrating tannins, suitable blends being a mixture of equal parts of quebracho and chestnut extracts, or of 70 parts of pine-bark and 30 parts of quebracho wood. Small proportions of divi-divi, algarobilla, and mallet bark may be used in addition. The tanning out is in layers. The first layer consists of a 25° liquor of the same composition as the last sweet liquor. Oak-bark, pine-bark and quebracho wood should be used as dusting material, with the addition of 20 per cent. of knoppern or of 15 per cent. of myrobalans and 5 per cent. of valonia. The goods remain in this layer for 4 weeks. The second layer consists of the same liquor strengthened to 30° by strong quebracho extract liquor. The same dusting material should be used, and the goods allowed to lie 6 weeks. A third layer of 35 barkometer degrees is given, strengthening with quebracho extract as before, and using as dusting material a mixture of 2 parts of the barks, 1 part of myrobalans, and 1 part of valonia. In this layer the goods remain 3 months. For very thick hides a fourth layer may be necessary, but as such hides are exceptional, they are usually placed in the third layer of another pack. The goods are next washed in tepid water and introduced into a sumach bath to brighten their colour. For each hide 5 kilos. of sumach are used. The temperature of the bath is 35° R. and the goods remain in it 5 hours, after which they are hauled, the bath again raised to 35° R., and the goods re-inserted for another 5 hours. They are then hauled, drained, oiled off grain and flesh, and hung up to dry. The drying is difficult because of the thickness of the hides, especially is this so in unfavourable weather, and there is a great tendency to mould, which causes ugly stains. The hides must be hung far apart and in rooms which allow a good change of air. The final drying out is at 24° R. No further dressing is given.

As walrus hides are becoming rarer, and the demand for polishing leathers is becoming greater, a substitute has been found in heavy buffalo hides which also yield a firm but spongy leather. The most suitable hides come from Singapore and Batavia. They are first soaked in a 4 per cent. solution of sodium sulphide for 6—8 days, hauling daily. In this liquor they are strongly swollen. They now enter a new lime liquor for 3 weeks, which is "bettered" with fresh lime each week. In this liquor the hides swell exceedingly and become very thick. They are now unhaired, fleshed, scudded, and delimed with hydrochloric acid which "pulls down" the pelt again. The tannage is commenced in acid pine-bark liquors in which the pelt again swells. If the swelling is insufficient, acetic acid is added to the liquors. A round of 8—12 sweet liquors now follows, made up from equal parts of chestnut and quebracho extracts; the strongest liquor is 30 barkometer degrees and every 3 days the goods are handled forward. They are tanned out in layers of the same composition as the sweet liquors. The first layer (35°) is for 4 weeks, using as dust a mixture of 3 parts of pine-bark and 1 part of myrobalans; the second layer is the same liquor strengthened to 40 barkometer degrees, using the same amount of dusting material as before and leaving the goods 6 weeks. The goods are washed up in a gambier bath at 30° R. for 8 days, or in a myrobalans bath for 4 days, or in a sumach bath as for walrus hides, the last being used where good colour is desired, and the two former when further tannage is necessary. They are dried out like the walrus hides and neither rolled nor dressed.—H. G. B.

Tannery liquors; Acidity in ——. W. K. Alsop. J. Amer. Leather Chem. Assoc., 1908, **3**, 337—353.

Various methods for the determination of acidity in tannery liquors have been investigated, including Procter's lime-water method (see Bennett and Wilkinson, this J., 1907, 1186), Small's gelatin precipitation method, Hoppenstedt's quinine method (this J., 1907, 331, 1246), the charcoal method, and Reed's gelatin-hæmatein and basic dyestuff-hæmatein method (this J., 1908, 347). A large number of results are given, those by the lime-water method being fairly satisfactory. It is suggested that further work be done on the subject before a method for the Association be decided upon, but that the present "official" charcoal method be eliminated.—H. Br.

Sod oils; Determination of water in ——. L. E. Levi and E. V. Manuel. J. Amer. Leather Chem. Assoc., 1908, **3**, 335—337.

A current of carbon dioxide at the rate of two bubbles per minute is passed first through concentrated sulphuric acid, then through a filter of glass wool, and finally through a weighed quantity of the sod oil or moellon, mixed with pure dry sand contained in a flask fitted with suitable inlet and outlet. This flask is kept at a constant temperature of 107° C. by heating it in a jacketed vessel by means of toluene vapour. After three hours, the oil is cooled and weighed.—H. Br.

Poisoning by chromium in industrial operations. Lewin. *See* XVIII*B*.

Patents.

Tannin and dyewood extracts, etc.; Process and apparatus for the production of ——. E. Texier. Fr. Pat. 391,306, June 17, 1908.

The extraction vessel consists of a column or tower, more than 11 m. high and preferably of somewhat smaller diameter at the top than at the bottom. The open lower end of this tower rests in a tank containing hot water into which the spent material falls. The upper part of the column is connected on the one side to a pump for creating a partial vacuum, and on the other side to the inlet pipe for the material to be extracted. This pipe projects horizontally from the tower, and is then bent at right angles and extends downwards into a tank containing water or partially saturated tannin extract; within the tank the pipe curves upwards again, and the curved portion below the level of the liquid is provided with numerous perforations. The material to be extracted is fed into this pipe, and by means of the vacuum is drawn, together with some of the liquid in the tank, into the upper part of the tower. The tannin extract produced in the tower flows out through a side tube to a circulating pump, which delivers it to the tank in which the perforated portion of the inlet pipe rests, whence it passes with the solid material into the tower again. The apparatus is heated by means of steam delivered into the lower end of the tower.—A. S.

Hides; Method of treating ——. W. J. Ward, Assignor to W. H. Jackson and S. T. Moyer, Philadelphia, Pa. U.S. Pat. 903,034, Nov. 3, 1908.

The hides, previous to tanning, are treated in a solution containing 20 lb. of lime, $\frac{5}{8}$ lb. of ferrous sulphate, and 84 lb. of water, before the reaction between the lime and the ferrous sulphate has proceeded to its ultimate stage. —A. S.

Tanning skins; Process for ——. H. Morin. Fr. Pat. 391,474, Aug. 30, 1907.

A process of rapid tannage consists in treating the skins with formaldehyde or with trioxymethylene, in the cold or in warm liquors, with or without the addition of sodium carbonate.—H. G. B.

Gelatin [for rubber substitutes, etc.]; Preparation of ——. W. H. Perkin and Whipp Bros. and Todd, Ltd., Manchester. Eng. Pat. 23,030, Oct. 18, 1907.

A solution suitable for use as an adhesive or in the manufacture of rubber substitutes is obtained by dissolving say, 2 parts, of glue or other form of gelatin, in, say, 3 parts of creosote or a constituent or constituents of creosote. The solvent preferred is a creosote boiling at about 200° C., and containing a considerable proportion of phenol or cresylic acid; or cresylic acid (b. pt. 190° to 205° C.) separated from coal-tar creosote.—C. A. M.

XV.—MANURES, &c.

Soil; Behaviour of the organic substance of —— *and its osmotic pressure.* J. König, J. Hasenbäumer, and H. Grossmann. Landw. Vers.-Stat., 1908, **69**, 1—91. Chem. Zentr., 1908, **2**, 1198—1199. (See also this J., 1907, 1059.)

Nine typical soils have been investigated. Steaming the soil under pressure enables such nutrient substances to be brought into solution as were previously present as complex salts or organic substances. Oxidation of the soil with hydrogen peroxide has the same effect, the amount of nutrient substances rendered soluble being slightly greater. These methods bring to light considerable differences in the amount of available soluble matter in different soils. Humus is present in soil in a more and a less easily oxidised form, the relative proportions of the two varying in different soils. This is considered to be closely connected with the fertility of the soil. So far as potassium oxide is concerned, there appears to be a relationship between the amount rendered soluble by steaming and that taken up by the plant. Steaming would appear to afford a method of estimating this constituent. The mineral content of manured plants is less than that of unmanured plants, probably on account of the more rapid growth. On the other hand the absolute amount of nutrient material absorbed is larger. Soils have a feeble though distinct osmotic pressure or "osmotic water-absorbent capacity" as the authors term it. Methods of measuring this are described, based on the rate of flow of water from the soil into a clay vessel (osmometer) with a semi-permeable membrane.—E. F. A.

Nitrogen; Chemical processes in the assimilation of free —— by azotobacter and radiobacter. J. Stoklasa, A. Ernest, F. Starnák, and E. Vitek. Zentralbl. Bakter. u. Parasitenk., 1908, II. Abt., **21**, 484—500, 630—662. Chem. Zentr., 1908, **2**, 1695—1696.

Azotobacter and radiobacter are present in all well-tilled and manured soils, but not in virgin soils, with the exception of those on which there is a luxuriant growth of blue and green algæ; in such cases azotobacter may be present. On a nutrient soil containing mannitol, azotobacter assimilated 125 mgrms. of nitrogen from the air in 20 days. Radiobacter is not capable of assimilating free nitrogen or at least only to a very slight extent. Crude cultures of both organisms possess greater nitrogen-fixing powers than pure cultures. Experiments with pure cultures of azotobacter, showed that of carbohydrates, arabinose and xylose are the best sources of carbon, and it is probable that in the soil, furfuroids form one of the most important sources of carbon for azotobacter. Radiobacter exerts a strong denitrifying action: in the presence of a suitable source of carbon, 80 per cent. of the nitrate-nitrogen under anaerobic conditions, and 76·3 per cent. under aerobic conditions (in 10 days) is converted into free nitrogen; at the same time protein and ammonia are formed. Nitrate is a less valuable source of nitrogen for azotobacter; in its presence, the assimilation of free nitrogen ceases, and the organism fixes nitrogen only from the nitrate. When nitrate is produced in the soil by means of nitrifying organisms, it is decomposed by the radiobacter with formation of free nitrogen, which latter is assimilated by the azotobacter. During the assimilation of 1 grm. of free nitrogen by azotobacter, the amount of carbohydrate consumed is equivalent to 165 grms. of dextrose. By the respiration of 1 grm. of crude azotobacter in 24 hours, 1·2729 grms. of carbon dioxide are produced; besides carbon dioxide, there are produced from dextrose and mannitol, alcohol, formic, acetic, butyric, and lactic acids, and hydrogen, and probably also acetaldehyde. The nascent hydrogen thus formed plays a part in the assimilation of free nitrogen by azotobacter. Addition of manganese compounds increases the activity of azotobacter with respect to the assimilation of free nitrogen.—A. S.

Cyanamide; Supposed ammoniacal fermentation of ——. C. Ulpiano. Gaz. chim. ital., 1908, **38**, II., 358—417.

Freshly-prepared nitrolime ("Kalkstickstoff") contains its nitrogen in the form of calcium cyanamide. On keeping and on exposure to the atmosphere, the calcium cyanamide is slowly converted into acid and basic calcium cyanamide, calcium cyanamide-carbonate, urea, dicyandiamide, calcium aminodicyanate, and probably also melamine, $N \vdots C.NHC(:NH)NHC(:NH)NH_2$, and ammeline, $N \vdots C.NHC(:O)NHC(:NH)NH_2$. In the determination of nitrogen in nitrolime, Dumas' method always gives lower results than Kjeldahl's method, and it is probable that the difference represents the amount of neutral calcium cyanamide present. Cyanamide is a plant poison and is not directly attacked by bacteria. It may be transformed, according to the conditions, either into a hydration product (urea) or a polymerisation product (dicyandiamide). Both of these products are harmless to plants, and unlike cyanamide can be directly converted into ammonia derivatives. Experiments are needed to ascertain the manurial value of these products, and the possibility of favouring, if desirable, the one or other mode of decomposition of cyanamide.—A. S.

Sulphate-cellulose factories; By-products of —— as manure for moor soils poor in lime. H. v. Feilitzen. Svenska Mosskulturf. Tidskrift, 1908, [1], 42—48. Biedermann's Zentr., 1908, **37**, 729—730.

The dried residues from a sulphate cellulose factory contained about 47 per cent. of calcium oxide, 0·29 per cent. of sulphuric acid, and 0·02 per cent. of sulphur as sulphide. The manurial value was compared with that of ordinary lime and found to be slightly in excess of this, but the author considers such excess to be accidental. The experiments establish the possibility of using the factory residues.—E. F. A.

Beet in the first year's growth; Assimilation of nutriment by the —— and its relation to the sugar-content of the root. III. K. Andrlík and J. Urban. Z. Zuckerind. Böhm., 1908, **33**, 83—94. (See this J., 1907, 214; 1908, 821).

From experiments (made in 1902—1905) on the assimilation of phosphoric acid by the beet, the following conclusions are drawn:—The amount of phosphoric acid assimilated during the first year's growth depends on the nature of the manuring (account being taken of the phosphoric acid-content of the soil), on the rainfall during growth, and on the kind of seed. In the very dry year 1904, it was found that, on the average, about 48 kilos. of phosphoric acid (P_2O_5) were assimilated by the plant per 400 quintals of roots. With a more abundant rainfall, the assimilation of phosphoric acid is greater. The quantity of phosphoric acid assimilated per 100 parts of sugar, also varies with the nature of the seed, soil, and weather conditions; in 1902 (rainfall 354 mm.), the quantity averaged 0·71 part; in 1903 (rainfall 475 mm.), 0·97 part; in 1904 (rainfall 221 mm.), 0·68 part; and in 1905 (rainfall 475 mm.), 1·15 parts and 1·27 parts respectively for two kinds of seed. Of the total quantity of phosphoric acid accumulated in the plant, the proportion accumulated in the root varied from 41·7 to 60·9 per cent.—L. E.

Patents.

Soluble phosphates; Process of making ——. F. J. Machalske, Niagara Falls, N.Y., Assignor to American Reduction Co., Pittsburg, Pa. U.S. Pat. 902,425, Oct. 27, 1908.

Tricalcic phosphate, moistened with water, is treated with sulphur dioxide and is then leached with a dilute solution of sulphur dioxide. This gives a strong solution of calcium phosphate, containing a small proportion of calcium sulphite, and a residue of this latter salt which is decomposed by acid so as to give sulphur dioxide to be used again in the process.—F. Sodn.

Nitrogenous compounds [calcium cyanamide]; Manufacture of ——, utilising atmospheric nitrogen. E. and G. Pollacci. Fr. Pat. 391,693, June 25, 1908. Under Int. Conv., June 26, 1907. (See also this J., 1908, 979.)

Calcium carbide, when heated, preferably under pressure, in the presence of a small quantity of finely divided potassium carbonate, is able to fix atmospheric nitrogen more rapidly and at a much lower temperature (800°—900° C.), than when potassium carbonate is not present. The potassium salt probably acts as a catalyst and it has the advantage of possessing manurial value.—F. Sodn.

XVI.—SUGAR, STARCH, GUM, &c.

Cane juices and syrups; Coloration of ——. Rôle of sulphurous acid. A. Moulé. Bull. Assoc. Chim. Sucr. et Dist., 1908, **26**, 253—255.

To obtain white sugar, an acid defecation is not essential; the same result may be obtained with juice which is slightly alkaline to sensitive litmus paper, and part of this alkalinity disappears during the evaporation process. The process is carried out as follows:—The juice is sulphited to an acidity of 0·70 to 0·80 grm. of sulphur dioxide per litre, as soon as it leaves the mills It is then transferred to cylindrical vessels provided with mechanical agitators. These vessels are filled to known volumes with the juice, and the acidity of the latter is determined with $N/10$ sodium carbonate. The requisite amount of milk of lime to produce the desired alkalinity is then added. If the syrups obtained from the juice are too alkaline, and consequently too highly coloured, they are partly neutralised with phosphoric or sulphuric acid.—L. E.

Sugar cane juices; Occasional abnormally high quotient of purity of some ——. H. Pellet. Internat. Sugar J., 1908, **10**, 558—559.

According to Prinsen-Geerligs, the abnormally high purity shown by some cane juices may be due to the presence of alcohol or other volatile body of low specific gravity, the Brix reading being thereby reduced; the fact that such juices show a normal purity after evaporation tends to support this view. The presence of alcohol has not been detected, however, in these abnormal juices, and the author considers that the low Brix reading is due to air retained tenaciously in an emulsified state in the liquid.—L. E.

Sugar mill products; Determination of total solids in —— by means of the refractometer. S. S. Peck. Hawaiian Sugar Planters' Assoc., Div. Agr. and Chem., Bull. **27**, 1908, 1—25.

Samples of waste or final molasses were examined for the purpose of comparing the results obtained by desiccation and the use of the refractometer. About 2 grms. of molasses were diluted slightly, and the total solids determined by drying on quartz-sand in a vacuum of 20 inches at 100° C., for a period not greater than four hours. Concordantly with these determinations, the refractive index was observed in the Abbé refractometer, and total solids calculated from Prinsen-Geerlig's tables. The average of 25 samples was 82·64 per cent. of solids by the refractometer and 82·49 by desiccation, although differences of +1·81 to —1·28 were observed. With molasses the shadow in the refractometer was considerably obscured, and it required considerable practice to obtain concordant readings. When the image was too obscure, or when the molasses contained any considerable quantity of crystals, it was necessary to resort to dilution. A comparison made at the mills, of refractometer determinations of total solids in the various juices with those made in the usual way with the Brix spindle, as well as with average figures obtained by desiccation, showed close agreement, the variations, particularly in third and fourth mill juices, being attributed to the influence of the large amount of air affecting the hydrometer indications. The refractometer readings are not affected by such causes. For the examination of residual juices, the refractometer is of no use, since with a diffused juice containing, say 0·33 per cent. of sucrose, a difference of one in the fourth place of decimals in the refractive index would mean a variation of five degrees of purity. Results with massecuites were entirely satisfactory. It is also suggested that the refractometer is more convenient than the "brasmoscope" in controlling the boiling of low-grade products to "string proof" at a definite percentage of solids. The refractometer also offers a rapid and convenient method for checking the correctness of the graduations on the Brix spindle.—L. J. de W.

Beet; Optically active non-sugar substances of the —— which are attacked by the lime during purification of the juice, and their polarimetric determination. F. Herles. Z. Zuckerind. Böhm., 1908, **33**, 94—98.

The yield of sugar obtained from the beetroot, sometimes falls short of the calculated maximum by an amount greater than can be accounted for, even in cases where accurate data concerning the products are available. The author has investigated this subject and has come to the conclusion that in such cases the beetroot contains optically active non-sugar substances, which, as a result of the action of lime and the high temperature, are either precipitated, or else suffer a loss or at least an alteration of optical activity. An alternative suggestion is that decomposition of sugar occurs during diffusion. The author recommends that the sugar should be determined, not only in the original juice or pulp, but also in these materials after they have been boiled with lime. In the latter determination, the lime-containing juice should be neutralised in such a way that: (1), the precipitate obtained with basic lead acetate is no greater than that obtained in clarifying the original juice with this reagent; (2), the substances precipitated by the lime are not redissolved; (3), the influence of the neutralising agent on the polarisation does not differ from that of the clarifying agent used for the ordinary polarisation. Neutralisation with normal lead acetate fulfils these conditions; the author has previously described the action of this salt in presence of lime (this J., 1908, 1033). In the case of beetroot juice, the analysis is effected as follows:—52·1 grms. of juice are clarified with basic lead acetate, made up to 100 c.c., filtered, and polarised in the usual way. An equal quantity of the juice is stirred and boiled with 1 grm. of powdered lime, rinsed into a 100 c.c. flask, treated with 14 grms. of lead acetate (either in the form of powder or in solution), cooled, made up to 100 c.c., filtered and polarised. The author found that the polarisation both of beet and diffusion juice was generally less after the lime treatment than before, though in some cases there was no difference. The differences ranged between 0·00 and 0·40 per cent. —L. E.

Syrup; Increase of total yield [of sugar] by rational treatment of the ——. A. Hase. Z. Zuckerind. Böhm., 1908, **33**, 98—100.

The green syrup from the centrifuges is sulphited in the usual way, heated, and run into a small measuring vat, whence it is allowed to run into the diffusion juice. The quantity of syrup thus added to the juice, may be, say, 3 per cent. of the latter. The added syrup at once dissolves in the juice, and the whole undergoes the usual lime treatment. After this process has been in operation for a day, a decrease in the purity of the thick juice is observed; this decrease is so slow, however, as to confirm the expectation that the syrup added to the juice, undergoes further purification. As the purity falls, the yield of green syrup rises, and the amount of syrup added to the juice is slowly increased to 4 per cent. At this point, which is generally reached in 4—5 days, addition of syrup is stopped for 18—24 hours, and the remaining syrup, together with that now obtained from the juice during this pause, is filtered and boiled to grain. At the end of the 18—24 hours, the diffusion juice has recovered its original purity, and the cycle is repeated. By means of this process the yield of first products is increased by 0·75—1·1 per cent., with a corresponding reduction of the second massecuite of about 1·0—1·5 per cent. calculated on the beetroot. The total yield of sugar is increased by 0·35—0·60 per cent., whilst the yield of molasses is reduced by 0·7—1·1 per cent. Both sugar and molasses are of normal quality. Owing to the fact that only about half of the syrup is worked up for after-products, a considerable economy in the cost of working is effected. —L. E.

Invert sugar; Influence of clarification with basic lead acetate on the determination of ——. O. Schrefeld. Z. Ver. deut. Zuckerind., 1908, 947—956.

The author has shown that in the determination of invert sugar in molasses, with Fehling's solution, decidedly low results are obtained if basic lead acetate is used for clarifying the solution; with first product raw sugars, however, the use of basic lead acetate does not involve this error. The difference between molasses and raw sugar in this respect, is probably to be explained by the fact that the former contains a high proportion of organic non-sugar and salts which yield insoluble compounds with lead, whilst in the latter, the proportion of such substances is much less (see this J., 1908, 1033). The author recommends that for the determination of invert sugar in sugar products, normal lead acetate, instead of the basic acetate, should be used for clarifying the solutions. With this agent fairly accurate results are obtained in the case of molasses. —L. E.

Milk sugar [lactose]; Studies on the forms of ——. C. S. Hudson. J. Amer. Chem. Soc., 1908, **30**, 1767—1783.

Continuing his investigations on the three forms of lactose (this J., 1908, 699), the author has determined the following constants: the initial and final solubilities of hydrated and β-anhydrous lactose from 0° to 100° C., the freezing points of lactose solutions, the maximum rate of solution of the β-anhydride, the vapour pressures of saturated solutions of hydrated lactose, the aqueous vapour pressures of the solid hydrate in contact with the β-anhydride, the specific rotatory powers of the three forms of lactose, and the transition temperature of hydrated to β-anhydrous lactose. The solubility determinations showed that the transition temperature between hydrated lactose and the β-anhydride is 93° C., and this value is confirmed by the vapour pressure measurements. A freshly prepared, saturated solution of the β-anhydride at 0° C. contains 40 per cent. of the sugar; such solutions remain clear for about 5 hours at 0° C. before the sparingly soluble hydrate begins to separate. The specific rotation of stable solutions of lactose at 20° C. is $[\alpha]_D = 55{\cdot}3°$ (Schmœger). The author has determined the initial rotation of the hydrate as $[\alpha]_D = 86{\cdot}0°$ (calc. anhydrous), and that of the β-anhydride as $[\alpha]_D = 35{\cdot}4°$. The equilibrium constant of the hydration reaction in solution is 1·54, and it does not change perceptibly between the temperatures of 15° and 25° C., nor with the concentration. The equilibrium between the α-anhydride and the hydrate is established instantaneously in solution, so that the specific rotatory power is the same for both; the equilibrium between the β-anhydride and the hydrate takes place slowly. Lactose requires a considerable time to form saturated solutions.—J. F. B.

Sugars; Hydrazones of the ——. A. Reclaire. Ber., 1908, **41**, 3665—3671. (See also this J., 1904, 340.)

The author has prepared the hydrazones of some sugars with *p*-, *m*-, and *o*-nitrophenylhydrazine, in aqueous alcoholic solution, and, in some cases, in acetic acid solution. The former solvent is preferable, however, since, with acetic acid, osazones are easily formed. The nitrophenylhydrazones were found to possess the following melting points:—

Sugar.	Nitrophenylhydrazone.		
	Para-	*Meta-*	*Ortho-*
Dextrose	187°—188° C.	115°—116° C.	148° C.
Mannose	194°—195° C.	162°—163° C.	173° C.
Lævulose	176° C.	—	155°—156° C.
Galactose	194° C.	181°—182° C.	172° C.
Sorbose	—	—	—
Arabinose	181°—182° C.	179°—180° C.	180° C.
Xylose.........	154°—155° C.	(120°—130° C.)	—
Rhamnose	185° C.	104°—105° C.	151° C.

As the table shows, the *m*- and *o*-nitrophenylhydrazones of these sugars possess lower melting points than do the *para*-compounds. The *m*- and *o*-compounds are also more readily soluble, as a rule, than the *p*-compounds, and are therefore not so well adapted for the separation and detection of the sugars. The author confirms the statement of Van Ekenstein and Blanksma (*loc. cit.*) that in presence of acetic acid, dextrose and *p*-nitrophenylhydrazine yield a hydrazone with a melting point 196° C. (or 195° C. according to Van Ekenstein and Blanksma) differing from that of the hydrazone obtained when alcohol is used. Unlike these workers, however, the author obtained products with identical melting points from mannose and *p*-nitrophenylhydrazine, in presence of acetic acid and alcohol respectively.—L. E.

Starch chemistry; Progress in the domain of ——. Fernbach. Chem.-Zeit., 1908, **32**, 1068.

Modern investigation supports the view of Nägeli as to the heterogeneous nature of starch. Solid starch must be regarded as a coagulated substance which in nature has been converted from an apparently dissolved condition. This transformation has been imitated in the laboratory by Maquenne, who obtained 30 per cent. of an insoluble, unsaccharifiable substance (amylose) from starch pastes kept at a low temperature. The author has extracted from cereals a substance, amylocoagulase, which is capable of causing the production of this insoluble reversion product from starch pastes. This enzyme has different properties from those of diastase. The author has studied the question of the influence of the phosphorus-content of starch on its reactions. The action of diastase on starch paste depends on the acidity or alkalinity of the mixed solutions. A reaction which is neutral to methyl orange is most favourable to diastatic action. In this case the speed of saccharification is most rapid, and the action does not come to an equilibrium, but proceeds until the whole of the starch is converted into maltose. Consequently the ideas as to the existence of "stable dextrin" and of "amylopectin" have to be abandoned. Whilst the saccharifying diastase is most active when the medium is neutral to methyl orange, the coagulating enzyme acts most powerfully when the medium is neutral towards phenolphthalein.—J. F. B.

Beet in the first year's growth; Assimilation of nutriment by the —— and its relation to the sugar content of the root. III. K. Andrlik and J. Urban. *See* XV.

Sugar in the bakery; Employment of —— as a means of increasing its consumption. F. Dupont. *See* XVIII*A*.

Honey, artificial [*invert sugar*]; *Use of resorcinol-hydrochloric acid for detecting* ——. Riechen and Fiehe. *See* XVIII*A*.

Patents.

Sugar; Purification of ——. J. J. Eastick, London. Eng. Pat. 5501, Mar. 11, 1908.

An improvement in Bertel's process of purifying sugar juice with hydrofluosilicic acid (this J., 1906, 859) is claimed. Instead of diluting the syrup or molasses to about 22° B. with water and then adding concentrated hydrofluosilicic acid, the dilution (to 15°—22° B.) is effected with more dilute and therefore cheaper acid (say at 10° B.), or with sugar juices or sweet waters and the dilute acid.—L. E.

Crystallisation from [*sugar*] *solutions at rest.* A. Cossé. Fr. Pat. 390,976, May 22, 1908.

This patent refers more especially to the formation of crystals of sugar candy, and aims at the production of as large a proportion of string-supported crystals as possible, to the exclusion of other kinds. To effect this, a layer of another liquid such as oil, or else a wooden or metal disc or plate floating on the surface of the liquor and completely covering it, may be used to prevent the formation of a pellicle acting as a supporting film. In addition, the crystallisers may be made of a special shape, and provided with internal partitions to prevent the adhesion of crystals, and thus further the formation of the string-supported kind.—C. J. G.

XVII.—BREWING, WINES, SPIRITS, &c.

Brewing waters; Recent investigations on the function of calcium salts in ——. F. Hayduck. Chem.-Zeit., 1908, **32**, 1067.

The beneficial action of calcium salts in the water, in protecting the yeast from sudden disaster has been long known in England, where the practice of "Burtonising" is very general. But this practice, has in its turn, sometimes had evil results on the beer and on the yeast, so that a tendency arose in certain quarters to deny its value. Since, however, the peculiar poisonous action of certain proteins on yeast has been recognised, a satisfactory explanation of the function of the calcium salts in hard brewing waters is forthcoming; such salts act as specific antidotes to these yeast poisons and thus protect the yeast. The fact that the addition of calcium salts to the brewing water produces no effect on the course of a normal fermentation does not prove that it has no effect in another brewery in which the course of fermentation, without this addition, would be abnormal. The presence of calcium carbonate in a water would appear to develop the malty flavour of the beer, but at the same time to impart an unpleasant hop-flavour due to the extraction of undesirable constituents of the hops; gypsum on the other hand tends to suppress the extraction of these hop constituents and larger quantities of hops are required. The author puts the question: would the presence of calcium carbonate to a water enable the brewer to attain his results with a smaller quantity of hops? He also asks whether, in the case of water rich in calcium carbonate, it is possible to restrict the extraction of the extremely bitter components of the hops by altering the conditions of boiling. Lastly he calls attention to the fact that yeast poisons are derived not merely from the cereals but also from the yeast itself, and states that the calcium salts of the water play very important chemical and physiological parts in the brewing industry. —J. F. B.

Hops; Chemical analysis of ——. C. J. Lintner. Chem.-Zeit., 1908, **32**, 1068.

The chemical analysis of hops comprises determinations of the moisture, the tannin, and the bitter principles, also an examination for sulphuring. The moisture is determined by heating 10 grms. of hops at 80° C. for 4 hours or else by Hoffmann's rapid distillation method. For the tannin, Chapman's cinchonine sulphate method gives good results. The test for sulphuring requires some caution, because, with too violent an evolution of hydrogen, almost all hops will give off sulphuretted hydrogen. The author has devised a method for the determination of the bitter principles: the so-called α-resin or α-acid has the formula $C_{20}H_{30}O_5$, and the author calls it *humulone*; the β-acid he calls *lupulinic acid*, it has the formula $C_{25}H_{36}O_4$; but neither of these bodies is a true acid, although they behave as monobasic acids. According to the author's new method, the α-acid is precipitated as a lead salt under certain conditions designed to hinder its resinification which takes place rather easily. The total resins are extracted by means of ether, the extraction process lasting 10 hours; the ether is evaporated first at 40° C., and then *in vacuo*; the residue is dissolved in methyl alcohol and the solution filtered. In one portion of the filtrate the α-acid is precipitated as lead salt; the other portion is evaporated and dried at 80°—90° C. for a determination of the total resins, α, β, and γ. Another portion of the hops, suitably reduced to a powder, is extracted with light petroleum spirit, which dissolves the α- and β-resins; the α-resin is precipitated in the same way as before and the total quantity of α- and β-resins is determined in a separate portion of the extract.—J. F. B.

Extract; Increase of —— by improved sparging of hops. J. Parik. Allgem. Z. Bierbrau. u. Malzfabr., 1908, **36**, 553—554.

Mere rinsing with hot water is insufficient to remove all the wort retained by the hops. The best means of effecting this object is gentle pressure of the hops, followed by thorough washing. The wort thus obtained ferments readily and as its amount is small compared with that of the total wort, its influence on the flavour of the latter is negligible.—T. H. P.

Cells; Further investigations on the physiological condition of ——. M. Delbrück. Chem.-Zeit., 1908, **32**, 1068.

The physiological condition of a cell is different according to whether the predominant tendency is to quiescence or to change. Changes in the physiological condition of the cell may be effected in a favourable sense by the addition of external stimulants, *e.g.*, certain salts. On the other hand certain poisons exist which are capable of killing yeast almost instantaneously. These poisons exist in cereals; they also occur amongst the protein constituents of dried yeast, from which they may be extracted in solution. These poisons are readily neutralised by certain salts, particularly calcium salts. For this reason, Henneberg is inclined to attribute the poisonous action to the over-production of certain acids, but the author considers that this explanation does not suffice to account for the poisonous effects of autodigestion products. "Dead" fermentations may occur both in distilleries and breweries, owing to the poisoning of most of the yeast cells by their own excretions. The yeast is protected by the presence of calcium salts in the fermenting liquid. The death of any organism may be regarded as the result of wrongly regulated enzyme activity and a consequent self-poisoning.—J. F. B.

Alcoholic fermentation; The enzyme of ——. E. Buchner. Chem.-Zeit., 1908, **32**, 1067—1068.

The author still considers it probable that lactic acid or some closely allied substance is an intermediate product of the fermentation of sugar by zymase, although hitherto no success has attended efforts to ferment lactic acid by means of living yeast. After referring to Harden and Young's observations on the separation of yeast cell juice into two inactive components by filtration, and the re-establishment of an active juice by mixing these two components, the author mentions that when a yeast cell juice has become inactive as the result of its fermentative action on a sugar solution, it can be brought into renewed activity by the addition of some boiled yeast juice. Thus the co-enzyme, although it survives boiling, is more sensitive under the conditions of fermentation than the zymase itself. Investigations have shown that this destruction of the co-enzyme is due to the action of a lipolytic enzyme, and that the co-enzyme is probably an organic ester-like compound of phosphoric acid. Thus, in conjunction with Lange's work on the stimulating influence of phosphates on the fermentative activity of living yeast, Harden's observations open up a promising field of inquiry, which suggests a complete study of the function of phosphoric acid in brewery practice.—J. F. B.

Alcoholic fermentation; Reduction of nitrates in ——. G. Paris and T. Marsiglia. Staz. sperim. agrar. ital., **41**, 223—232. Woch für Brau., 1908, **25**, 699.

The authors have observed the reduction of nitrates during alcoholic fermentation, the products being oxides of nitrogen. At the end of the fermentation the nitrates present may be completely reduced; in some cases the reducing action may be strong enough to effect the reduction of relatively large quantities of added nitrates, whilst in other cases the added nitrates may remain largely unaltered.—J. F. B.

Tartaric acid in wines; Determination of —— by evaporation. W. Mestrezat. Ann. Chim. analyt., 1908, **13**, 433—436.

The simple evaporation method proposed originally by Pasteur, and modified by Reboul, was found to give accurate results in the determination of tartaric acid in wines, and is considered to be a better method than the official (French) process. The author prefers to work as follows:—50 c.c. of the wine are evaporated to the consistency of a syrup; when cold the residue should be semi-fluid, but, if the evaporation has been carried too far, a few drops of water may be added. The basin containing the residue is then placed aside for at least four days; after this time, the mass is taken up with a small quantity of 40 per cent. alcohol saturated with potassium bitartrate, and the solution is carefully decanted from the crystals of the bitartrate. The latter are washed with the same solution, by decantation, and then titrated. Results of determinations are given showing that concordant analyses may be made by the method, and that the presence of malic, succinic, and acetic acids is without influence on the determinations. (See also this J., 1908, 913.)—W. P. S.

Alcoholic liquids; Filtration of —— through wood charcoal. W. L. Dudley. J. Amer. Chem. Soc., 1908, **30**, 1784—1789.

"Tennessee" whisky, like "Kentucky" or Bourbon, is prepared from maize, rye, and malt, but the former is passed, after distillation, through "leaching tubs" tightly packed with well-burnt wood-charcoal. When the percolators are properly packed, it takes about 72 hours for the first runnings to come through; these are highly charged with alkali and are returned to the still. Subsequently the percolators will treat one barrel of whiskey per bushel of charcoal, the exhaustion of the latter being determined by the odour of the spirit. Raw whiskies made from maize, rye, or malt have different odours, but after treatment with charcoal they have practically the same odour. The first function of the charcoal filters is the removal of the fatty and essential oils of the grain which are carried over during distillation, and to which the characteristic odour of the raw whiskey is largely due. In all cases some of the fusel oil is removed by filtration, but the percentage removed varies widely according to the conditions of percolation. The ethyl alcohol is removed to a greater extent than the water, and a reduction of alcoholic strength takes place. The acids, esters, and aldehydes are removed to a greater or less extent, and the removal of the acids is not entirely due to the alkali of the charcoal. In all cases the furfural is completely removed. To some extent the removal of substances from solution is due to adsorption, but the major part is due to diffusion into the particles of charcoal, where the liquids of higher molecular weight are held longer than those of lower molecular weight. Consequently, the length of the column of charcoal, the size of the particles, the density of the packing, and the speed of percolation are important factors. If the flow be too rapid, the impurities will not pass into the charcoal, whilst if too slow, they will diffuse out again. The author does not admit that oxidation plays any part in the process; if this were so its action would be exhausted on the first runnings, which are returned to the still. The losses in industrial working range from 12 to 15 per cent.—J. F. B.

Starch chemistry; Progress in the domain of ——. Fernbach. *See* XVI.

Patents.

Fermentation backs; Apparatus for collecting carbonic acid gas from —— *or the like, and compressing same for storage or transport.* J. C. Stead and T. C. Palmer, London. Eng. Pat. 23,763, Oct. 28, 1907.

The gas passes from the collecting bells (this J., 1905, 1248) or from the completely enclosed fermentation backs, through a pipe, fitted with stop- and relief cocks, to a regulator bell suspended in a gasometer by a chain and counterpoise. A vertical perforated pipe, projecting above the normal level of the top of the regulator bell, leads from this bell by a horizontal pipe to a compressor pump, which latter is connected by a pipe, fitted with a three-way cock, to a receiver. At the top of the regulator bell is an extension, closed at its upper end and carrying a depending sleeve, which closely fits the vertical pipe leading to the pump. If, in the first place, the regulator bell is full of air or air and gas, the stopcock between this bell and the collecting bell is closed, the three-way cock between the pump and the receiver is opened to the atmosphere, and the pump is set going. As the regulator bell is exhausted, it falls, the descending sleeve covers, one by one, the apertures in the vertical pipe, and the pump is thus gradually shut off. In the meantime, the collecting bell has been lowered, after opening the relief cock, and as soon as practically pure gas is being evolved, the relief cock is shut and the stopcock opened. The gas then flows into the regulator bell, and communication having been made between the pump and receiver, the gas is stored in the latter under pressure.—L. E.

Wine or other alcoholic fluid; Preparation of a nourishing ——. S. Bendle, W. I. Smith, and T. B. H. Thorne, London. Eng. Pat. 4231, Feb. 25, 1908.

A quantity of a digested preparation of protein, *e.g.*, 0·5 oz. of meat powder is mixed with a sufficient quantity of a substance such as neutral potassium tartrate, to neutralise or partly neutralise the fixed acid of the alcoholic fluid subsequently added. This mixture is made into a paste with water. After a while, this paste is treated with the requisite quantity of still alcoholic fluid, *e.g.*, 10 oz. of still wine, added in small portions at a time, with stirring after each addition. After standing, the wine is decanted or filtered.—L. E.

Beer free from, or low in, alcohol; Preparation of ——. H. Wernaer. Ger. Pat. 202,771, Jan. 29, 1907.

The yeast is first treated by known methods so as to destroy or weaken the zymase, and is then added to the wort, which is maintained at that temperature at which the preliminary treatment of the yeast has been effected, *e.g.*, 25° C. or higher. It is stated that in a very short time, the proteins of the wort are attacked by the proteolytic enzyme of the yeast, without any appreciable quantity of alcohol being formed, and that those aromatic constituents to which the flavour of mature beer is due, are also produced. As soon as the zymase becomes more active, the beer is cooled, in order to prevent alcoholic fermentation, and immediately filtered. It is stated that the whole process is completed in a few hours.—A. S.

Caramelised product for the preparation of a dark beer; Manufacture of a ——. J. A. Ruckdeschel. Ger. Pat. 202,823, Feb. 23, 1908.

In the decoction process of mashing, a portion of the thick mash is withdrawn when saccharification is complete, and treated independently of the wort. It is evaporated until the greater part of the water is removed, and is then caramelised by stronger heating until the desired degree of colour is attained. The caramelised maltose thus obtained is used for the preparation of a dark-coloured beer.—A. S.

Micro-organisms; Preparation of dead —— *in a dry condition.* Ger. Pat. 202,406. *See* XX.

Nitrocolorimeter; Differential —— *for analysis of [determination of nitrate and nitrite in] mineral waters and wines.* Fr. Pat. 390,863. *See* XXIII.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, AND DISINFECTANTS.

(*A*.)—FOODS.

Benzoic acid; Detection of —— *in butter.* L. Robin. Ann. Chim. analyt., 1908, **13**, 431—433.

The author modifies the method described by Halphen (this J., 1908, 954) in order to prevent the formation of an emulsion when the benzoic acid is extracted from the butter. 25 grms. of the butter are melted with a solution consisting of 50 c.c. of water, 15 c.c. of alcohol, and 0·5 grm. of sodium bicarbonate. After mixing and allowing to cool, the aqueous portion is separated, acidified with a few drops of sulphuric or hydrochloric acid, and boiled. The mixture is then filtered, the filtrate is extracted with ether, and the ethereal portion, after separation, is washed once with a mixture of 20 c.c. of water and 5 c.c. of alcohol. The ethereal solution is then shaken with a solution consisting of 20 c.c. of water, 5 c.c. of alcohol, and 0·3 grm. of sodium bicarbonate, the alkaline extract being separated and evaporated to dryness. The residue is heated with a mixture of 5 c.c. of pure sulphuric acid and 10 drops of fuming nitric acid until sulphuric acid fumes are given off, and, after cooling, the acid solution is poured into 50 c.c. of water. The solution is rendered ammoniacal, cooled, and a drop or two of ammonium sulphide are added. A red coloration develops rapidly if benzoic acid is present in the sample under examination.—W. P. S.

Sugar in the bakery; Employment of —— *as a means of increasing its consumption.* F. Dupont. Z. Ver. deut. Zuckerind., 1908, 992—994.

The annual consumption of sugar in France is only 14 kilos. per head, whilst in England, it amounts to about 40 kilos. To increase the sugar consumption in the former country, the author proposes that bread should be made with 2·5—15 per cent. of sugar or more; the sugar so used should be exempted from the sugar tax. According to the author, bread containing sugar is lighter, has a pleasanter taste, and is more nutritious and digestible than ordinary bread.—L. E.

Honey, artificial [invert sugar]; Use of resorcinol-hydrochloric acid for detecting ——. Riechen and Fiehe. Chem.-Zeit., 1908, 32, 1090—1091.

A reaction for the detection of artificial honey (invert sugar) in natural honey, described previously by Fiehe (this J., 1908, 1127) is based on the discovery that invert sugar contains an ether-soluble substance which gives a red coloration when treated with a solution of resorcinol in hydrochloric acid. The trustworthiness of the test having been criticised by Drawe (Chem.-Zeit., 1908, 1045), who states that the reaction simply shows whether the honey has been heated or not, the authors have carried out a number of experiments in which pure honey was heated for 1 hour at a temperature of 100° C., before being submitted to the test. In no case was a coloration obtained which could be confused with that yielded by invert sugar. It is also pointed out that, on a commercial scale, honey is never submitted to so prolonged a heating. —W. P. S.

Salicylic acid; Separation of —— from methyl salicylate, and the hydrolysis of the ester. H. D. Gibbs. *See* XX.

"*Soaked curd*" *cheese.* U.S. Dept. of Agric., Food Inspection Decision, No. 97. [T.R.]

In certain parts of the United States, it has become the practice to soak the curd in cold water at one stage of the manufacture of cheese. It is pointed out that this is a fraudulent practice, an undue amount of water being introduced into the cheese, which also acquires a soft texture and superior appearance. Such cheese deteriorates greatly in quality before the curing process is complete. The Board of Agriculture orders that this article cannot enter inter-State commerce under the name of "cheese," unless further characterised.

Patents.

Pasteurising apparatus. A. J. Boult, London. From E. Goldman and Co., Incorporated, Chicago, U.S.A. Eng. Pat. 6351, March 21, 1908.

The apparatus is intended for the sterilisation of all kinds of materials in bottles, and is of the type in which the sterilisation is effected in a series of intercommunicating chambers. The pasteurising liquid (water) in a number of consecutive compartments is first heated to the sterilising temperature, by means of a steam-jet heating pump, and is then circulated through the whole series of compartments. The material to be sterilised is introduced successively into the different compartments, and means are provided for passing the water from any compartment through the steam-jet heating pump. The claims cover the mechanical details of different parts of the apparatus and the combination of apparatus as a whole.—A. S.

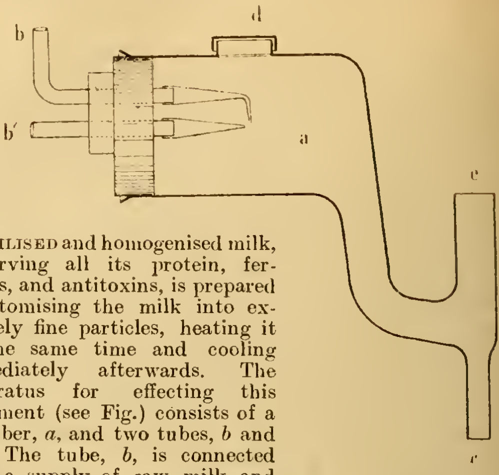
Pasteurising apparatus. A. J. Boult, London. From E. Goldman and Co. Incorporated, Chicago, U.S.A. Eng. Pat. 8084, April 11, 1908.

The invention relates to the type of pasteurising apparatus in which a number of tanks are employed for containing water at different temperatures, and into which the material to be treated (in bottles, etc.) is introduced successively. The essential part of the patent consists in controlling the temperatures of the different tanks by means of a single valve, which is set automatically at required intervals. The valve is actuated by means of a driving shaft geared to the rotating valve plug, the working of the shaft being regulated by a clutch, electro-magnet, and clock. The circulating pipes leading to and from the tanks are in connection with a heater, and the necessary pumps, etc., are provided.—W. P. S.

Milk free from sugar; Preparation of ——. I. Bouma and S. B. Selhorst. Ger. Pat. 202,468, Jan. 1, 1908. Addition to Ger. Pat. 167,863.

Milk is freed from fat by treatment in a centrifugal machine, the cream is washed with water till free from milk sugar, and again treated in the centrifugal machine till of the same water content as at first. The skim-milk is treated with carbon dioxide under a pressure of 25—30 atmospheres to precipitate the casein, which is separated, washed, and dissolved in dilute sodium hydroxide solution. To the solution a saturated solution of monosodium phosphate is added until the mixture has an amphoteric reaction, and then, after addition of some sodium chloride and "crystallose," the liquid is mixed with the separated cream. (See also Eng. Pat. 17,818 of 1904; this J., 1905, 937).—A. S.

Milk free from germs and homogenised; Process and apparatus for the manufacture of ——. T. Heryng. Fr. Pat. 391,358, May 2, 1908.



Sterilised and homogenised milk, preserving all its protein, ferments, and antitoxins, is prepared by atomising the milk into extremely fine particles, heating it at the same time and cooling immediately afterwards. The apparatus for effecting this treatment (see Fig.) consists of a chamber, *a*, and two tubes, *b* and *b*¹. The tube, *b*, is connected with a supply of raw milk and carries a nozzle through which milk is delivered in a continuous jet. The tube, *b*¹, is connected with a supply of steam or heated air or gas; the two tubes are adjustable in relation to each other so as to regulate the atomisation. The door, *d*, serves for the regulation of the temperature in the chamber, the branch, *e*, serves for the escape of steam, and *f* for the delivery of the homogenised milk.—J. F. B.

Egg albumin, yolk of egg, and the like; Process for drying liquid ——. P. A. Schmitt and O. Ahrens. Ger. Pat. 201,680, Sept. 25, 1907.

The albumin is spread, *e.g.*, by means of a brush, in a thin layer on a perforated support such as a screen of wire, horse-hair, or the like, and then exposed to sunlight or to a strong current of air, or it may be dried in a chamber at 25° C.—A. S.

Nitrocolorimeter; Differential —— for analysis of [determination of nitrate and nitrite in] mineral waters and wines. Fr. Pat. 390,863. *See* XXIII.

(*B.*)—SANITATION; WATER PURIFICATION.

Poisoning by chromium in industrial operations. Lewin. Ledermarkt, 1908, **30**, [50]. J. Amer. Leather Chemists Assoc., 1908, **3**, 315.

Workmen in chemical and match factories, dyers, fullers, tanners, textile printers, painters, and others are liable to injuries from chrome poisoning. This may occur with all chromium compounds, in mass or powder, mixed with water or in solution. Chromium compounds may cause injury either by entering the blood or by direct contact with the skin at the inner surface of the nose, mouth, or throat, and especially on the hands. Such injury produces local inflammation, blisters, open sores, secretions and bleeding from the nose, affection of the nostrils culminating in the destruction of the partition, headache, pain in the stomach, and kidney disease. For the prevention of these effects it is recommended that direct handling of such goods should be avoided when possible, but if unavoidable, the hands should be either gloved or well rubbed with vegetable oils. Eating and drinking on premises where chromium compounds are used should also be avoided. The urine should be periodically examined by a physician. —H. G. B.

Water purification by means of double silicates. Mohr. Woch. für Brau, 1908, **25**, 697.

Certain double silicates, called zeolites, which contain alkali bases, possess the property of exchanging these bases with the calcium or magnesium bases present in hard waters, and could therefore be used, other circumstances permitting, for water-softening purposes. After a time the softening power of these double silicates becomes exhausted, but the material may be regenerated by treatment with sodium chloride. For practical purposes the old methods of water-softening are more economical and rapid, but in certain special cases the zeolites possess a decided advantage. Such a case is the removal of manganese from waters in which it occurs, which is only effected incompletely and with difficulty by the ordinary chemical precipitating agents. For this purpose an artificial calcium-aluminium silicate is prepared commercially under the name of "permutite." The activity of "permutite" becomes exhausted when it has absorbed about 2 per cent. of manganese; it then has to be regenerated by treatment with a solution of calcium chloride. In practice, a layer of "permutite," 15 cm. thick, over the ordinary sand filter beds is sufficient. During filtration the water absorbs calcium salts from the "permutite" in proportion to the amount of free carbonic acid in the water.—J. F. B.

Water ; Chemical method of purifying potable —— in the field. J. Laurent. J. Pharm. Chim., 1908, **28**, 392—393.

A slight excess of potassium permanganate and alum is added to the water; after 5 minutes' stirring the excess of permanganate is removed by sodium hyposulphite and sodium carbonate. The manganese is precipitated as hydroxide, and after 10 minutes standing is removed by filtering the liquid through a sterile filter. The chemicals are conveniently put up in the form of tablets. —E. F. A.

Patents.

Waters ; Method and apparatus for softening and purifying natural or polluted —— with primary reference to steam generating and manufacturing purposes. J. H. Dales, Leeds. Eng. Pat. 28,221, Dec. 23, 1907.

The object of the invention is to soften water by extracting from it the free dissolved gases (carbon dioxide) which hold calcium and other salts in solution. The water is pumped into a chamber, from which it rises through a pipe and is discharged through a number of jets into a vacuum chamber situated above the first chamber. A ball valve is placed over the outlet pipe of the first chamber, so that, if the water supply should temporarily fail, air is prevented from entering the vacuum chamber. The jets are also provided with valves which do not open until the pressure of water is sufficient to form a strong jet. The water collecting in the vacuum chamber passes through a filter at the bottom and is conducted to a service tank or other receptacle.—W. P. S.

Water ; Apparatus for use in purifying —— [by means of ozone], A. J. Boult, London. From O. Patin, Paris. Eng. Pat. 6949, Mar. 28, 1908.

The water is sprayed in the form of a fine jet into a dome-shaped chamber in which it collects to a certain depth; it then falls down an exit pipe, at the same time drawing with it a quantity of air which has been passed through an ozonising apparatus and delivered through a tube which ends in the chamber immediately above the exit pipe. The latter consists of a long pipe constricted at the top and bottom and provided at the top with a plate which distributes the falling water over the sides of the pipe. The water finally falls into a barrel. The tap which regulates the water supply also controls the electric current supplying the ozoniser.—W. P. S.

Water or effluent ; Method and apparatus for purifying and clarifying ——. L. Linden, Brussels. Eng. Pat. 16,725, Aug. 8, 1908. Addition to Eng. Pat. 16,239, July 15, 1907 (this J., 1908, 827).

The water is first mixed thoroughly with a reagent, such as lime, and is then conducted through a pipe, about 6 m. in length, and discharged into the top of a bell which is preferably paraboloid in shape. This bell is situated in a tank, and perforated plates are placed across the tank, and in the bell, in order to prevent the formation of eddies in the water; a series of conical baffle-plates surrounding a cone are placed centrally below the mouth of the bell. The water rises in the tank, flows from the top over a shallow tray into an aerating device consisting of a number of cups and a distributing plate, and thence falls into the top of a second bell contained in a tank similar to the first mentioned. From this second tank, the water flows over the upper edge into a reservoir. —W. P. S.

Aspiration of a liquid and a gas which has reacted chemically with the liquid ; Device for the simultaneous ——. [Sterilisation of water by ozone.] J. Steynis. First Addition, dated Aug. 31, 1907, to Fr. Pat. 390,598, Aug. 1, 1907 (this J., 1908, 1101).

The claim is for a method of carrying out the process described in the original patent, particularly applied to the sterilisation of water by ozone. The column traversed in opposite directions by the liquid and the gas, is divided vertically into two compartments in order that the pump may bring the ozone into contact with the water a second time.—W. H. C.

Liquids [crude petroleum, glycerin, water, etc.] contaminated by coloured or evil-smelling organic substances, decomposition products, or micro-organisms ; Purification of ——. Ger. Pat. 202,166. *See* III.

(*C.*)—DISINFECTANTS.

Disinfectants , South African Customs decisions on ——. [T.R.]

The following Customs decisions relating to the rates of duty leviable on certain articles on importation into the South African Customs Union have just been published:—Liquid disinfectants, general rate, 3 per cent. ad val.; goods, the produce of manufacture of the United Kingdom and reciprocating Colonies, free. Soaps imported for use as insecticides, general rate, 4s. 9d. per 100 lb., or 25 per cent. ad val., whichever rate returns the higher duty; goods, the produce or manufacture of the United Kingdom and reciprocating Colonies, 7d. per 100 lb., or 3 per cent. ad val., as the case may be.

Patents.

Disinfecting process applicable in conjunction with cleaning, oil and fat extracting, and like processes. F. H. E. Lehmann, Eilenburg, Germany. Eng. Pat. 23,954, Oct. 30, 1907.

See Addition of Dec. 11, 1907, to Fr. Pat. 363,362 of 1906; this J., 1908, 587.—T. F. B.

Disinfectant ; Solid —— which is soluble in water. P Dame, Paris. Eng. Pat. 6783, March 26, 1908. Under Int. Conv., March 26, 1907.

See Fr. Pat. 385,706 of 1907 ; this J., 1908, 639.—T. F. B.

XIX.—PAPER, PASTEBOARD, &c.

Sulphate-cellulose factories ; By-products of —— as manure for moor soils poor in lime. H. v. Feilitzen. *See* XV.

Patents.

Wood pulp ; Preparation of white —— from steamed or boiled wood. C. G. Schwalbe. Ger. Pat. 203,230, Jan. 3, 1907.

Brown wood pulp is stronger than white pulp, but its colour prevents its more extended application. In order to prevent the formation of the brown colour, it is proposed to carry out the boiling or steaming process with exclusion of air or in presence of a reducing agent. For example the wood is placed in a chamber from which the air is exhausted and is then treated with steam free from air, or it is impregnated with a dilute solution of sodium sulphite or sodium sulphide before being steamed.—A. S.

Sulphite-cellulose waste lyes ; Process for rendering the organic constituents of —— slightly soluble or insoluble. E. Trainer. Ger. Pat. 202,132, May 9, 1907. Addition to Ger. Pat. 197,195 (this J., 1908, 708).

After treatment with an acid and an aldehyde as described in the main patent, the mass is heated to above 100° C. and dehydrated as far as possible. The product is useful as a decolorising agent in addition to the applications previously mentioned.—A. S.

Sulphite-cellulose waste lyes; Removal of sulphurous acid and separation of calcium sulphite from —— in a vacuum. A. Kumpfmiller. Ger. Pat. 203,648, March 6, 1906.

The liquor is first warmed and then sprayed continuously or intermittingly into a chamber in which a strong vacuum is maintained. It is stated that from the small particles of liquor, the sulphur dioxide escapes almost instantaneously, and that the whole of the dissolved calcium sulphite separates, whilst the liquor itself is not discoloured. —A. S.

Sizing of paper and fulling, weighting, dressing, dyeing, and finishing of paper and textile materials. A. Frank. Ger. Pat. 202,312, Nov. 5, 1907.

The claim is for the use of hydrofluosilicic acid and its derivatives, such as the fluosilicates of magnesium, aluminium, zinc, iron, manganese, chromium, copper, and lead for the purposes mentioned in the title. A solution of one of these fluosilicates mixed with calcium oxide or carbonate may be used directly for sizing paper. For fulling and dressing textiles, the latter are impregnated with the fluosilicate solution and milk of lime and then worked or fulled in the usual manner.—A. S.

Nitromethane; Application of —— as solvent for acetylcellulose and nitrocellulose. E. Fischer. Ger. Pat. 201,907, Jan. 20, 1907.

Nitromethane may be employed as solvent of nitrocellulose and acetylcellulose in the preparation of films and for other purposes.—T. F. B.

Celluloid substitute; Preparation of a ——. J. Stocker and F. Lehmann. Ger. Pat. 202,133, May 14, 1907.

Agar-agar, or grass-wrack or other seaweed, is dissolved in or extracted with water, and the solution evaporated nearly to dryness. The residue is heated and agitated with ceresin, stearine, beeswax, or Japan wax, Venice turpentine, castor oil or poppy-seed oil, and a paste prepared by triturating starch with cold water; a colouring matter may also be added.—A. S.

Impregnation of paper, textiles, or similar materials. Ger. Pat. 201,228. *See* V.

Organic ether [ester] for the preparation of nitrocellulose solutions and celluloid. Eng. Pat. 413. *See* XX.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

Cocaine; Presence of crystallised —— in Java coca. A. W. K. de Jong. Chem. Weekblad, 1908, 5, 666—668. Chem. Zentr., 1908, 2, 1613.

By fractional precipitation and subsequent purification, the author obtained crystallised cocaine from the extract of Java coca: the alkaloid melted at 96°—97° C., and had the rotatory power, $[\alpha]_D=-16{\cdot}1^{\circ}$. The alkaloids from old leaves contain more cocaine than those from young ones. —A. S.

Bakankosin [glucoside from Strychnos vacacoua]. E. Bourquelot and H. Hérissey. J. Pharm. Chim., 1908, 28, 433—439.

The fruits from which bakankosin was isolated (this J., 1907, 430) have now been identified as those of *Strychnos vacacoua* Baill., which is identical with *S. gerrardi*, Br., and probably also with *S. baroni*, Bak. The glucoside was previously extracted from the unripe fruit; a further quantity has now been obtained, but with a lower yield, from ripe fruit. Bankakosin contains 1 mol. of water of crystallisation, the formula being $C_{16}H_{23}O_8N+H_2O$. At 20° C., 100 parts of the solvents mentioned, dissolve the following proportions of the glucoside:—Water, 8·053; 95 per cent. alcohol, 1·794; methyl alcohol, 24·5; anhydrous ethyl acetate, 0·032. Bankakosin, unlike other nitrogenous glucosides, is not racemised at the normal temperature, by minute traces of barium hydroxide. —J. O. B.

Essential oils. H. Haensel. Chem. Zentr., 1908, 2, 1436—1437.

Terpeneless *angelica oil* had the sp. gr. 0·9508 at 15° C., $\alpha_D=-3{\cdot}16^{\circ}$; acid value, 0; ester value, 87·3, and after acetylation, 168·1. The oil of the *mugwort* (*Artemisia vulgaris, L.*) was obtained in a yield of 0·0263 per cent. from the fresh plants: it had the sp. gr. 0·9279 at 20° C. and was of a deep brown colour. Colourless crystalline flakes were precipitated from the oil on addition of 90 per cent. alcohol. The oil reduced ammoniacal silver solution. *Birch-bark oil* was prepared from the bark of *Betula alba*. It had the sp. gr. 0·9003 at 20° C., $\alpha_D=-12{\cdot}08^{\circ}$, acid value, 9·1; ester value, 11·4, and after acetylation, 36·5. The sesquiterpene isolated from the oil was colourless; it boiled at 255°—256° C. at 744 mm.; sp. gr., 0·8844 at 20° C.; $\alpha_D=-0{\cdot}5^{\circ}$. Its hydrochloride, X,HCl, had the sp. gr. 0·9753 at 20° C., and when boiled with anhydrous sodium acetate and glacial acetic acid, yielded a hydrocarbon, which had the sp. gr. 0·8898 at 20° C. and boiled at 258°—260° C. at 747 mm. Terpeneless *coriander oil* had the sp. gr. 0·8786 at 15° C., $\alpha_D=+9{\cdot}50^{\circ}$, acid value, 0; ester value, 13·3. It consisted mainly of *d*-linalool together with small quantities of esters of this alcohol. *Cynoglossum oil* was obtained in a yield of 0·107 per cent. from the leaves of the "hound's tongue" (*Cynoglossum officinale*). It had a dark brown colour and a strong odour of camomile; it was miscible in all proportions with 90 per cent. alcohol and had the sp. gr. 0·9412 at 20° C. Terpeneless *Siberian pine-needle oil* had the sp. gr. 0·9767 at 20° C., $\alpha_D=-38{\cdot}3^{\circ}$; it was soluble in 14·2 parts of 60 per cent. alcohol. *Terpeneless lavender oil* had the sp. gr. 0·8898 at 20·5° C., $\alpha_D=-6{\cdot}44^{\circ}$; it was soluble in 0·95 part of 80 per cent. alcohol. *Lovage oil* was found to alter on keeping; the altered oil contained myristic acid, a small amount of an aldehyde with an odour similar to that of octylaldehyde, and considerable quantities of a brown resin, which decomposed when heated under reduced pressure. Terpeneless *palmarosa oil* was optically inactive and had the sp. gr. 0·8851 at 20° C.; it was soluble in 3·5 parts of 60 per cent. alcohol. Italian *peppermint oil*, crude and rectified, had the following characters respectively: sp. gr. at 20° C., 0·9035, 0·9032; $\alpha_D=-19{\cdot}80^{\circ}$ and $-18{\cdot}10^{\circ}$; ester value, 11·2, 9·1, and after acetylation, 154·4, 145·9; menthol esters, 3 and 2·54 per cent.; free menthol, 45·16 and 42·66 per cent. Hungarian and Italian *juniper berry oil* had respectively the sp. gr. 0·8672 and 0·8658 at 20° C., $\alpha_D=-12^{\circ}$ and $-9{\cdot}82^{\circ}$, saponification value, 5·9 and 6·1, and after acetylation, 20·9 and 21·3; both oils contained small quantities of a primary alcohol, $C_{10}H_{18}O$. *Olibanol* isolated from *frankincense oil* (this J., 1908, 641) boiled at 217° C. at 20 mm., and at 333°—334° at 751 mm.; it had the sp. gr. 0·9596 at 20° C., $\alpha_D=-71{\cdot}50^{\circ}$—A. S.

Lemon oil; Detection of small quantities of turpentine in ——. E. M. Chace. J. Amer. Chem. Soc., 1908, 30, 1475—1477.

The difference of the crystalline form of the nitrosochlorides of the terpenes, as shown by the microscope, may serve for detecting the addition of oil of turpentine to lemon oil. When 10 to 15 per cent. of the adulterant is present, the test may be applied directly. With smaller quantities, the oil is first distilled and the test made with the first fraction of 10 per cent. The presence of as little as 2 per cent. of oil of turpentine may be thus shown. Five c.c. of the oil, or of the first fraction, are cooled in a freezing mixture. Five c.c. of ethyl nitrite and 2 c.c. of strong hydrochloric acid are then added, the latter drop by drop, the mixture still being immersed in the freezing-mixture, where it is kept for another 15 mins. The crystals produced are collected, drained, washed with 95 per cent. alcohol and dried. They are then dissolved in the least possible amount of chloroform, and hot methyl alcohol added, until crystallisation starts, when the liquid is cooled. More methyl alcohol is then added, and the crystals are collected. For microscopical examination, they are mounted in olive oil. The addition of alcohol or of acetic acid is often advantageous to aid crystallisation of the nitroso-chlorides. Microphotographs of crystals of the nitrosochlorides of limonene and pinene, and of those obtained from mixtures of oil of turpentine with lemon oil, are reproduced.—J. O. B.

Isopulegone. A. Ebert. Z. Allgem. österr. Apotheker-Ver., 1908, **46**, 545—547, 561—563, 573—575, 589—590.

Isopulegone was treated with magnesium methyl iodide, when a tertiary alcohol, analogous to α-methylmenthol, was produced. This alcohol, $C_{11}H_{20}O$, boils at 93°—94° C. at 12 mm., and at 20° C. has the sp. gr. 0·91085, $\alpha_D = +17{\cdot}43$ in a 100 mm. tube, and $n_D = 1{\cdot}46992$. A hydrocarbon, $C_{11}H_{18}$, was obtained from this alcohol by several methods. The hydrocarbon prepared from the chloride of the tertiary alcohol, boiled at 95°—97° C. at 12 mm., and at 20° C. it had the sp. gr. 0·84015, $\alpha_D = +24{\cdot}37°$ in a 100 mm. tube, and $n_D = 1{\cdot}47345$. An acetyl derivative of the tertiary alcohol was also prepared.—F. Shdn.

Sabromine. S. Kalischer. Deutsch. Med. Wochenschr., 1908, **34**, 1727—1728. Chem. Zentr., 1908, **2**, 1696.

Sabromine is the calcium salt of dibromobehenic acid, which is obtained by the action of bromine on erucic acid. It is insoluble in water, alcohol, ether, and acetone, but soluble in benzene, ligroin (petroleum spirit), and chloroform. It is practically non-poisonous and possesses therapeutic value, since under suitable conditions bromine is very slowly liberated from it.—A. S.

Atoxyl; Reactions of ——. E. Covelli. Apoth-Zeit., 1908, **23**, 784—785.

Atoxyl solutions give a yellow precipitate or a yellow coloration with calcium hypochlorite; and a blue colour with the same reagent in the presence of phenol and ammonia, evident with 1 part in 100,000. With reducing agents (zinc and sulphuric acid in the cold, stannous chloride, or hypophosphorous acid in strong hydrochloric acid on warming), it gives a yellow precipitate. A yellow colour is also obtained with certain fatty aldehydes and mineral acids on warming. Characteristic and sensitive reactions may be obtained, as follows, by converting atoxyl into arsendiazobenzene, by adding to the solution to be tested a few drops of a 0·5 per cent. solution of sodium nitrite and a little sulphuric acid. On adding a very small quantity of acetaldehyde solution to a portion of this, then a few drops of potassium hydroxide solution, a carmine-red colour will be obtained in the presence of atoxyl, which changes to yellow with excess of alkali. Under similar conditions a purple colour is obtained with β-naphthol and other phenols, in presence of alkali.—J. O. B.

Hexamethyleneamine; Detection and determination of —— *in pharmaceutical mixtures.* W. A. Puckner and W. S. Hilpert. J. Amer. Chem. Soc., 1908, **30**, 1471—1474.

Hexamethyleneamine is precipitated from an aqueous solution of bromine as the orange-red tetrabromide, $C_6H_{12}N_4Br_4$. The latter, when allowed to stand over potassium hydroxide, loses 2 mols. of bromine, the resulting canary yellow dibromide melting at 198—200° C., with decomposition. When boiled with water, this dibromide is decomposed, formaldehyde, ammonia, bromine, and hexamethyleneamine being formed. Hexamethyleneamine is precipitated quantitatively from aqueous solutions by mercuric chloride. The mercury compound is decomposed by boiling dilute acid into formaldehyde, ammonia, hexamethyleneamine, and the mercury salt of the acid employed. In the presence of ammonium compounds, hexamethyleneamine may be determined by boiling with strong caustic alkali, by which it is unaffected, until all liberated ammonia is expelled, then making acid and boiling to decompose the hexamethyleneamine, and finally making alkaline, and determining the ammonia liberated, in the usual manner.—J. O. B.

Aloësol: a complex phenol prepared from certain aloes. E. Léger. Compt. rend., 1908, **147**, 806—808.

A solution of aloes (Cape or Uganda aloes) in concentrated hydrochloric acid was treated with potassium chlorate, when a compound, styled *aloësol tetrachloride*, $C_{11}H_4Cl_4O_3$, was obtained. This substance is slightly soluble in alcohol and ether, insoluble in water. It is soluble in a warm solution of sodium carbonate, in cold ammonia, and in cold dilute caustic alkalis. It melts at 267·7°—268·9° C. (corr.), and volatilises perceptibly at a somewhat higher temperature. With cold nitric acid, quinone perchloride is produced. When treated with acetyl chloride, *acetylaloësol tetrachloride*, $C_{11}H_3(C_2H_3O)Cl_4O_3$, is produced, which crystallises in prisms, and melts at 125° C. (corr.). Aloësol tetrachloride can be reduced by zinc and acetic acid to *hydroaloësol bichloride*, $C_{11}H_8Cl_2O_3$, which, when crystallised from acetic acid, forms fine, colourless microscopic needles, melting at 275° C. (corr.). With acetic anhydride it forms a colourless acetyl derivative, and with acetyl chloride a yellow compound, both of which melt at 150°—151° C. (corr.).—F. Shdn.

Salicylic acid from methyl salicylate; Separation of ——, *and the hydrolysis of the ester.* H. D. Gibbs. Philippine J. Science, 1908, **3**, 101—109.

The following process is recommended for the separation and determination of salicylic acid and methyl salicylate in cases where these two substances occur together in foods and drugs. The sample under investigation is rendered strongly alkaline to Congo-red by the addition of *N*/1 solution of sodium bicarbonate; if the mixture be not homogeneous, the aqueous layer is separated and the process repeated until the residue has been extracted thoroughly. The aqueous solution containing the salicylic acid is then extracted several times with chloroform to remove any small amount of methyl salicylate present, and is next acidified with sulphuric acid and extracted in the usual way to separate and determine the salicylic acid. The ester is separated from the sample by extraction with chloroform; in the case of oil emulsions the ester is best separated by steam distillation from a sulphuric acid solution. After saponification, the solution is heated until all the chloroform has been removed, then diluted to a known volume, and the salicylic acid determined in an aliquot portion. It is shown that both natural and synthetic methyl salicylate, when used in foods and drugs, may give rise to the presence of salicylic acid, first, as an impurity in the ester; secondly, through hydrolysis. Salicylic acid may be titrated directly in the ester by means of alkali solutions, using Congo-red as an indicator; the author found from a mere trace to 0·025 per cent. of free salicylic acid in various samples of the ester. It is better to use a solution of sodium bicarbonate for the titration, as sodium hydroxide hydrolyses the ester slowly under the conditions of the titration. The hydrolysis eventually becomes complete in about 24 hours. With sodium carbonate, equilibrium is reached in about one month, at the point where all the normal carbonate has been converted into the bicarbonate.—W. P. S.

Glycerol; Aldehydic impurities in ——. G. F. Bergh. Svenk. Farm. Tidskr., 1908, [15], 385—392. Apoth.-Zeit., 1908, **23**, 689.

The impurities to which the reducing properties of the bulk of the better qualities of commercial glycerols are due, are derived from acrolein. Glycerol and acrolein, according to the author, unite in equimolecular proportions, and the compound formed, he believes to possess the characters of acetal, and accordingly he names it *glycerolacrylal.* It does not reduce Fehling's solution, and only slightly reduces ammoniacal silver nitrate. It is slowly dissociated by water, more rapidly on warming, and by dilute acids. It has but little odour. Its presence may be detected with fuchsine sulphite solution, or by the reducing action on Fehling's solution, obtained after liberating the acrolein by careful warming with dilute sulphuric acid.—J. O. B

Methyl alcohol; Detection of small quantities of —— *in the presence of ethyl alcohol.* L. E. Hinkel. Analyst, 1908, **33**, 417—419.

As traces of formaldehyde are invariably produced by the oxidation of pure ethyl alcohol, it is almost impossible to detect small quantities of methyl alcohol in ethyl alcohol by any oxidation process; when, however, not less than 5 per cent. of methyl alcohol is present, a definite result may be obtained, the following process being the most satisfactory one:—One c.c. of the mixed alcohols is placed in a small, round-bottomed distilling flask and the oxidising agent is added; if ammonium persulphate is used, 0·8 grm. of the salt is added, followed by 3 c.c. of dilute sulphuric acid (1 : 5), or, in the case of potassium bichromate, 1·5 grms. of the salt and 1·5 grms. of pure sulphuric acid. In either case, the mixture is diluted with water to 20 c.c., and then distilled, the distillate being collected in test-tubes in five separate portions of 2 c.c. The first two portions, which will contain all the acetaldehyde (when an aqueous solution of acetaldehyde and formaldehyde is distilled, the whole of the acetaldehyde distils over before the formaldehyde), may be rejected. To each of the remaining portions a few drops of 0·5 per cent. solution of morphine hydrochloride are added, and concentrated sulphuric acid is poured into each test-tube so as to form a layer at the bottom. In the presence of formaldehyde a violet ring will be formed at the junction of the two liquids. The coloration yielded by a mixture containing 5 per cent. of methyl alcohol is very decided and cannot be mistaken for the faint reaction yielded by pure ethyl alcohol.—W. P. S.

Methyl alcohol ; Conversion of —— into formaldehyde, and preparation of formalin. IV. E. Orlow. J. Russ. Phys.-Chem. Ges., 1908, **40**, 796—799. Chem. Zentr., 1908, 2, 1499—1500.

In continuation of his previous work (this J., 1908, 139, 419, 957), the author has devised a " contact igniting body," the use of which does away with the necessity of heating the tube containing the catalyser at the beginning of the process. Pieces of pumice are impregnated with a solution of chloroplatinic acid or ammonium-palladium chloride, and ignited, whereupon finely-divided platinum or palladium is deposited in the pores of the pumice. In contact with this material the mixture of methyl alcohol vapour and air, previously heated to 100° C., ignites and itself heats the copper gauze catalyser to incandescence. The purification of the formalin from methyl alcohol is effected more advantageously, if a rectifying apparatus be used in place of the water-condenser previously recommended.—A. S.

Ether ; Oxidation of —— by contact substances. E. Orlow. J. Russ. Phys.-Chem. Ges., 1908, **40**, 799—800. Chem. Zentr., 1908, 2, 1500.

By the use of a " contact igniting body " (see preceding abstract) and a copper wire gauze catalyser, a mixture of ether vapour and air, previously heated to 100° C., is oxidised to acetaldehyde and formaldehyde. The oxidation of ethyl, propyl, isobutyl, and amyl alcohols can also be effected if the mixture of ether vapour and air be first passed through the apparatus until reaction takes place, and then the alcohol vapour mixed with air be introduced.—A. S.

Bismuth hydroxide. O. Raubenheimer. Amer. Pharm. Assoc. : Amer. Drugg., 1908, **53**, 251—252.

300 grms. of bismuth subnitrate are suspended in 200 c.c. of distilled water and dissolved by the addition of 225 c.c. of nitric acid. The solution is filtered through absorbent cotton into 5000 c.c. of distilled water, previously acidified with 50 c.c. of nitric acid. One litre of ammonia solution (10 per cent.) is mixed with 12 litres of distilled water and the acid bismuth solution is added quickly to it. The vessels which contained the bismuth solution and the filter are then washed with 25 c.c. of nitric acid diluted with 1 litre of distilled water, these washings being added to the mixture, the reaction of which should be distinctly alkaline. After standing for 6 hours, the precipitate is washed with distilled water by decantation, then collected and dried at a temperature not exceeding 60° C. If the above method of mixing be reversed, or if the excess of ammonia in the precipitating liquid be not maintained, more basic compounds and not true trihydrated bismuth oxide will be obtained.—J. O. B.

Mercury ; Volumetric determination of —— by the thiocyanate, iodometric, and acidimetric methods. E. Rupp. *See* XXIII.

Patents.

Organic ether [*ester*] *; Method of preparing an —— and the application thereof to the preparation of nitrocellulose solutions and celluloid.* O. L. A. Dubosc, Rouen, France. Eng. Pat. 413, Jan. 7, 1908. Under Int. Conv., Jan. 8, 1907.

The liquid product obtained, together with pinene hydrochloride, on treating turpentine oil with hydrochloric acid, is heated at 100°—110° C. with an alkali formate in presence of excess of formic acid. An ester is thus formed, which is insoluble in formic acid, and can therefore be separated from the reaction product. It is a liquid boiling at about 210° C., and, when mixed with an equal volume of alcohol, dissolves nitrocellulose in sufficient quantity to enable it to be used in the preparation of celluloid.—T. F. B.

Camphor ; Process of making ——. J. Hertkorn, Berlin. U.S. Pat. 901,708, Oct. 20, 1908.

A solution of cupric chloride and ferric chloride is added to a hypochlorite solution, and the product is mixed with borneol, which is thereby oxidised to camphor. Ferric chloride may be replaced by another salt of a " metal of the sulphide of ammonium group," and cupric chloride by a salt of a " metal of the sulphide of hydrogen group."—T. F. B.

Iodine products ; Process of making ——. J. Hertkorn, Berlin. U.S. Pat. 901,709, Oct. 20, 1908.

An aldehyde and a ketone are condensed by means of alkali, and the reaction product is warmed with " benzin " and heated with a substance which will liberate iodine when heated.—T. F. B.

Iron preparation ; Process for the production of an organic soluble ——. W. Jagelki, Assignor to the Firm of Dr. Degen und Kuth, Düren, Germany. U.S. Pat. 902,234, Oct. 27, 1908.

A preparation of iron salts and the fluid extract of rhubarb roots containing hydroxymethylanthraquinone is obtained by extracting coarsely cut rhubarb roots by percolation, filtering the extract, and adding a solution of an iron salt to the filtrate. The precipitate so formed is filtered off, mixed with mannitol, and the mixture dissolved in a solution of caustic alkali.—G. W. McD.

Preparation rich in lecithin, or lecithin, cholesterol, and a fatty oil ; Process for obtaining a ——. C. A. Fischer. Fr. Pat. 390,683, May 30, 1908.

Animal or vegetable substances rich in lecithin are extracted in the cold by means of volatile esters of fatty acids, thus removing the cholesterol and the fatty oils, leaving a product rich in lecithin, and also containing albumin : to obtain lecithin from this, it is extracted with the fatty ester at a higher temperature, the lecithin crystallising out in a pure state on cooling: the lecithin may also be extracted by means of boiling ethyl alcohol. The first extract obtained is distilled *in vacuo* to remove the ester ; the residue, containing fatty oil and cholesterol, is cooled to 15° C., when the cholesterol separates out, and is purified by crystallisation from benzene. It is stated that the yields from 100 kilos. of egg yolk are 9 to 10 kilos. of pure lecithin, 1·3 to 1·75 kilos. of pure cholesterol, and 25 kilos. of fatty oil.—T. F. B.

Guaïacol carbonate ; Preparation of salts of the mono- and disulphonic acids of ——. A. Einhorn. Fr. Pat. 391,601, June 24, 1908. Under Int. Conv., June 25, 1907.

Two molecules of a guaïacol-sulphonate or equimolecular proportions of guaïacol and a guaïacol-sulphonate are treated with phosgene in presence of alkalis or similar bases. For instance, phosgene is introduced into a cooled solution of 5 grms. of potassium guaïacolsulphonate and 3 grms. of potassium hydroxide in 27 grms. of water until an acid reaction is produced, and the potassium guaïacol-carbonate-disulphonate which separates, is purified in the usual manner.—J. F. B.

Glyoxylic esters ; Preparation of —— by reduction of oxalic esters. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 201,895, June 1, 1907.

Unlike most dibasic acids, oxalic acid can be readily reduced to glyoxylic acid (in the form of esters) by means of sodium amalgam. For example, 300 grms. of diethyl oxalate dissolved in 300 c.c. of alcohol, are reduced in 40 minutes by means of 1,000 grms. of 3 per cent.

sodium amalgam, the mixture being kept cool: the product is mixed with a cold alcoholic solution of oxalic acid (about 63 grms. in 150—200 c.c.), and warmed on the water bath. The sodium oxalate is filtered off, and the filtrate distilled *in vacuo* and fractionated.
—T. F. B.

Phenolsulphonic acids; Separation of a mixture of o- and p- ——. J. Obermiller. Ger. Pat. 202,168, July 12, 1907.

The sulphonation product of phenol is diluted with water, the excess of sulphuric acid is neutralised by means of calcium carbonate, and the sulphonic acids are converted into their salts by addition of the necessary quantity of barium or magnesium oxide or carbonate. When barium carbonate is employed, its addition is continued until no blue reaction is produced with "Congo," the solution is then evaporated until some needle-shaped crystals of the *p*-phenolsulphonate separate out, as well as the nodular mass of the *o*-sulphonate, on cooling (this occurs when the solution is at 20°—25° B.). On addition of cold water, the *p*-salt is again dissolved, and the *o*-salt is separated. The solution is evaporated to about 30° B., when magnesium sulphate is added, and the mono-magnesium salt of the *p*-sulphonic acid is filtered off.—T. F. B.

o-Dihydroxyphenylethanolmethylamine [*adrenine*]*; Preparation of the hydrochloride of —— in crystalline form.* Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 202,169, Sept. 21, 1907.

The hydrochloride of *o*-dihydroxyphenylethanolmethylamine (adrenine) is obtained in a crystalline condition by dissolving the synthetic base in the calculated quantity of an alcoholic solution of hydrochloric acid; the salt crystallises out after some time, the crystallisation being assisted by agitating the solution. The salt melts at 157° C., and is readily soluble in water, giving neutral solutions.—T. F. B.

Bismuth-tannin compound, approximating in composition to bismuth ditannate; Preparation of a ——. Chem. Fabr. von Heyden, A.-G. Ger. Pat. 202,244, Jan. 15, 1908.

The bismuth-tannin compound of the approximate composition, $BiOH.(C_{14}H_9O_9)_2$ (see Ger. Pat. 172,933; this J., 1907, 114), can be obtained by the action of normal bismuth salts on tannin salts at the ordinary temperature, or by precipitating an aqueous solution of tannin by means of a solution of bismuth nitrate, *e.g.*, in acetic acid.—T. F. B.

Santalol ethers; Process for preparing ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 202,352, March 17, 1907.

Santalol ethers are obtained by treating santalyl halides with metal alcoholates or with alcoholic solutions, or by treating santalol or sandal-wood oil with alkylating agents. (See also this J., 1907, 1254).—T. F. B.

Micro-organisms; Preparation of dead —— in a dry condition. L. Sarason. Ger. Pat. 202,406, May 1, 1907.

In order to kill micro-organisms, without appreciably altering the chemical character of the cell contents, they are distributed in the form of a very thin layer on a heated (110°—120° C.) metal surface, *e.g.*, on a rotating cylinder. In this way the mass is rapidly dried; the residue is quickly removed from the hot surface by a scraper. Yeast when treated by this process yields a residue which can be used for the preparation of an alimentary product rich in lecithin, of extracts, or of lecithin or other substances for therapeutic or technical purposes.—A. S.

Preparations containing arsenic in colloidal form; Process for preparing ——. Chem. Fabr. von Heyden. Ger. Pat. 202,561, July 19, 1907.

Soluble preparations containing arsenic in colloidal form are obtained by reducing arsenic compounds in alkaline solution, in presence of a suitable colloid. Phenol derivatives, such as pyrogallol or *p*-aminophenol, are mentioned as the best reducing agents for the process.
—T. F. B.

Preparation for the treatment of tuberculosis; Manufacture of a ——. E. Klebs. Ger. Pat. 202,799, Sept. 10, 1907.

Dried tuberculosis bacilli, from which the fat has been removed, are digested with "strong glycerin" at 37° C. for several months. The residue is filtered off and extracted with distilled water. The solution is freed from a deleterious albumose which is present, by treatment with an acetic acid solution of sodium-bismuth iodide, and after filtering, the active constituent of the solution is precipitated with a mixture of alcohol and ether (8 : 1). The precipitate is dried at 37° C. and dissolved in "physiological sodium chloride" to give a 1 per cent. solution.—A. S.

Quinine and cinchonine salts of p-aminophenylarsinic acid; Preparation of ——. Verein. Chem. Werke A.-G. Ger. Pat. 203,081, April 24, 1907.

Four kilos. of quinine hydrochloride are dissolved in water, and treated with an aqueous solution of 3·1 kilos. of sodium *p*-aminophenylarsinate. The new quinine salt soon separates, the yield being nearly quantitative. It forms white needles, m.pt. 202° C., soluble in warm methylated spirit, and also in water (1 : 635), "physiological sodium chloride solution" (1 : 534), and in a 1 per cent. solution of glycerol (1 : 133). The cinchonine salt obtained in an analogous manner, melts at 180° C. It is stated that these new salts are more resistant to heat than the inorganic salts of *p*-aminophenylarsinic acid, *e.g.*, atoxyl, and hence can be sterilised in an autoclave.
—A. S.

Borneol from isoborneol; Process for manufacturing ——. Dr. Schmitz und Co., Ges.m.b.H., Düsseldorf, Germany. Eng. Pat. 24,806, Nov. 8, 1907. Under Int. Conv., Nov. 15, 1906.

See Fr. Pat. 383,419 of 1907; this J., 1908, 356.—T. F. B.

Isoborneol; Process for manufacturing ——. Dr. Schmitz und Co., Düsseldorf, Germany. Eng. Pat. 28,028, Dec. 19, 1907. Under Int. Conv., Dec. 19, 1906.

See Fr. Pat. 385,341 of 1907; this J., 1908, 591.—T. F. B.

Borneol esters; Process of producing ——. E. Bergs, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 903,047, Nov. 3, 1908.

See Eng. Pat. 6606 of 1906; this J., 1906, 495.—T. F. B.

Tobacco stems and other tobacco material; Treatment of —— for recovery of valuable constituents. P. A. Newton, London. From The Kentucky Tobacco Products Co., Jefferson, Ky., U.S.A. Eng. Pat. 28,536, Dec. 28, 1907.

See Fr. Pat. 385,837 of 1907; this J., 1908, 644.—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Organic sulphur compounds as substitutes for sodium thiosulphate in combined toning and fixing baths; Use of ——. A. and L. Lumière and A. Seyewetz. Monit. Scient., 1908, 22, 725—727.

The only two organic sulphur compounds which have been found suitable as possible substitutes for sodium thiosulphate in combined toning and fixing, are thiourea and thiosinamine (allylthiourea). An advantage obtained by their use is that the use of lead salts is avoided. On the other hand, owing to their slight solubility, only dilute solutions can be employed. Their compounds with silver chloride are more stable towards acids but less so towards alkalis than those with sodium thiosulphate. These facts, as well as their high price, lead the authors to conclude that no advantages result from their use for the purpose of combined toning and fixing.—T. F. B.

Patents.

Toning reagents and processes for toning photographic prints. H. E. Smith, London. Eng. Pat. 22,218, Oct. 8, 1907.

Photographic prints on bromide or "gaslight" papers are bleached (*e.g.*, by a solution of potassium ferricyanide and potassium bromide) and then immersed in a solution of ammonium thiomolybdate. This may be replaced by an analogous salt in which the ammonium is wholly or partially replaced by a metal; thiotungstates may also be used. (See this J., 1908, 833.)—T. F. B.

Photographic colour screen plates; Manufacture of ——. H. W. H. Palmer, London. Eng. Pat. 22,228, Oct. 9, 1907.

The colour screen between the support and the emulsion in plates for direct-colour photography, is formed of extremely fine fluxes intensely stained by means of metallic oxides to the desired colours. The plates coated with the fluxes may be fired in a kiln to produce a transparent glaze, if desired, before applying the emulsion. The fluxes consist of silica, minium, and borax, stained by cobalt oxide for blue, oxides of copper or chromium for green, ferric oxide with cobalt, copper, or chromium for red, ferric oxide or lead chromate for yellow or orange, and gold and stannic oxide for magenta or pink.—T. F. B.

Photographic plates; Flexible ——. M. Hansen, Paris. Eng. Pat. 8875, April 23, 1908.

A layer of dextrin, resin, glue, etc., is interposed between the emulsion and the flexible support; negatives made on such plates are said to be free from halation, and the intermediate layer serves to disperse the shadows usually produced in printing through negatives on a basis of fabric or similar material.—T. F. B.

Polychromatic screens for the production of photographs in natural colours; Method of producing ——. J. Szczepanik, Weisser Hirsch, Germany. Eng. Pat. 17,065, Aug. 13, 1908. Under Int. Conv., Aug. 14, 1907.

Polychromatic screens are prepared by applying to a substratum, vehicles stained with dyestuffs which have less affinity for the vehicle than for the substratum, so that the dyestuffs migrate to the latter. For example, three gelatin films may be stained with basic dyestuffs of the three desired colours; they are then dried and powdered, and the powders moistened and applied to a collodion film mounted on glass, etc., the gelatin being subsequently removed by washing. Several variations of the above process are described in the specification.—T. F. B.

Photographic plates. Bremer Trockenplatten Fabrik B. Klatte. Fr. Pat. 390,572, May 26, 1908. Under Int. Conv., Feb. 22, 1908.

The emulsion is applied to a sheet of glass, celluloid, etc., deeply coloured, *e.g.*, green, by means of chromium salts, to prevent halation. Chromic oxide or chromium salts may also be added to the emulsion.—T. F. B.

Photography in colours; Process of ——. M. Ratignier and H. Pervilhac et Cie. Fr. Pat. 391,785, Sept. 5, 1907.

A film for producing photographs in colour is obtained by incorporating in the film, during its manufacture, a web of threads of suitable colours; or the basis of the film itself may consist entirely of the coloured threads joined together by suitable means, *e.g.*, artificial silk threads may be used. A suitable apparatus is described in the specification.—T. F. B.

Photographic printing in black and in colour; Process of ——. F. W. Donisthorpe. Fr. Pat. 391,874, May 19, 1908. Under Int. Conv., June 15, 1907.

See Eng. Pat. 13,874 of 1907; this J., 1908, 140.—T. F. B.

Nitromethane as solvent for acetylcellulose and nitrocellulose Ger. Pat. 201,907. *See* XIX.

XXII.—EXPLOSIVES, MATCHES, &c.

Poisoning by chromium in industrial operations. Lewin. *See* XVIII*B*.

Patents.

High-explosive compounds; Method of producing ——. P. Wheeler, Chester, Pa., Assignor to The E. I. du Pont de Nemours Powder Co., Wilmington, Del. U.S. Pat. 901,504, Oct. 20, 1908.

An organic nitro-compound, solid at the ordinary temperature, is melted and added to ammonium nitrate, and the two are mixed together at a temperature between "230° F. and the melting point of ammonium nitrate."—A. S.

Explosives; Machine for mixing ——. H. Auchu, Emporium, Pa. U.S. Pats. 902,464 and 902,465, Oct. 27, 1908.

(1). The pan in which the explosive is mixed by means of rotating arms, can be raised and lowered by means of a ratchet wheel connected to an eccentric. The pan and its contents are counterpoised by a set of weights. It is thus possible to move the pan very easily and without any jarring. (2). It is raised and lowered by means of a hydraulic ram.—G. W. McD.

Explosives; Process of producing ——. E. Steele, Pennrhyndeudraeth, England, Assignor to M. S. von Goltzheim, New York. U.S. Pat. 902,619, Nov. 3, 1908.

A powdered, readily oxidisable, organic substance, insoluble in water, but soluble in alcohol, is mixed with a powdered inorganic oxidising agent, and the mixture is sprayed with "a solution of alcohol and castor oil" to dissolve the organic substance. The alcohol is then expelled, leaving the castor oil together with the organic oxidisable substance as a plastic waterproof coating upon the particles of the inorganic oxidising agent.—A. S.

Explosive especially suitable for charging shells and torpedos; Preparation of —— *from trinitrotoluene and oxygen-carriers.* J. Rudeloff and A. and W. Allendorff. Ger. Pat. 201,306, Sept. 29, 1906.

The specific gravity of the mixture of trinitrotoluene and an oxygen-carrier is increased to as much as 2·5, by using as binding agent a "gelatin" prepared from a nitrohydrocarbon and nitrocellulose. A suitable mixture consists of 18 parts of "gelatinised" dinitrotoluene, 14 parts of trinitrotoluene, 60 parts of potassium chlorate, and 8 parts of lead nitrate. The trinitrotoluene is mixed with the "gelatin," heated slowly to 82° C., and then the potassium chlorate and lead nitrate added.—A. S.

Shells and mines; Mixtures for filling ——, *also for smokeless powders and explosives for blasting purposes.* Westfälisch-Anhalt. Sprengstoff A.-G. Ger. Pat. 203,190, Jan. 26, 1907.

Dinitro-dialkyloxamides are employed, either alone or in conjunction with other explosives or components, for shells and military mines, and also for smokeless and blasting powders.—T. F. B.

Matches; Preparation of headless ——. W. Wittig. Ger. Pat. 201,170, June 14, 1907.

The match composition, to which ammonium oxalate has been added (see following abstract), is spread over the ends of the match-sticks, the latter being fastened together in a bundle. The bundle is then unfastened so that the coated ends of the sticks spring apart, and the matches are dried. The ammonium oxalate forms a protecting skin over the coated ends of the matches, preventing accidental ignition.—A. S.

Matches igniting on any rubbing surface; Preparation of ——. W. Wittig. Ger. Pat. 201,520, Nov. 6, 1907.

Non-poisonous strike-anywhere matches frequently ignite when being dried after dipping, and also when packed in boxes. In order to overcome this defect, ammonium oxalate is added to the match composition. On drying the matches, the ammonium oxalate forms on the match-heads a protecting layer, which prevents ignition during drying and packing, but is easily destroyed when the match-heads are rubbed on a rough surface.—A. S.

Matches ; Preparation of headless ——. Deutsch-Dänische Patent-Zündholzfabr., G.m.b.H. Ger. Pat. 201,521, Jan. 28, 1908.

The match sticks are first immersed in water to a suitable depth, and when saturated, are removed, inverted, and then immersed in the solution of the igniting composition. The latter impregnates only that portion of the wood which has not been saturated with water.—A. S.

Segregation [Drying matches] ; Method of ——. A. Junghans, Schramberg, Germany. U.S. Pat. 903,725, Nov. 10, 1908.

See Ger. Pat. 162,696 of 1904 ; this J., 1906, 59.—T. F. B.

Centrifugal machine for nitrating, etc. Ger. Pat. 202,489. *See* I.

Nitromethane as solvent for acetylcellulose and nitrocellulose. Ger. Pat. 201,907. *See* XIX.

XXIII.—ANALYTICAL CHEMISTRY.

APPARATUS.

Patent.

Nitrocolorimeter ; Differential —— *with ascending distribution of liquid, suitable for the commercial and legal analysis of [determination of nitrate and nitrite in] mineral waters and wines.* G. Hyvert. Fr. Pat. 390,863, Aug. 10, 1907.

The apparatus is double U-shaped and the two arms are connected, by fine capillary tubes provided with taps, to the middle graduated tube. The liquid to be tested for nitrate or nitrite is placed in one arm and the reagent (*e.g.*, diphenylamine sulphate) in the middle tube. The reagent is slowly allowed to flow, by opening the tap, into the liquid to be tested contained in one arm, and the coloration produced at the junction of the two liquids noted, and compared with the colour produced by a standard solution in the other arm of the apparatus.
—G. W. McD.

INORGANIC—QUANTITATIVE.

Capillarity and adsorption ; Studies on ——, *and a method for determining the strength of dilute mineral acids.* I. Holmgren. Biochem. Zeits., 1908, **14**, 181—208.

If a drop of a solution of hydrochloric acid, of a concentration below 1 per cent., be allowed to fall on to filter- or blotting-paper, the water impregnates the paper for a greater distance than the acid, the difference being more pronounced the weaker the acid. The phenomenon can be clearly seen if the paper has been previously impregnated with a suitable indicator such as "Congo red": in this case, a blue spot surrounded by a red zone will be obtained, the size of the latter, which represents the area penetrated by the water but not by the acid, being greater the weaker the acid. On the basis of these observations, the author has devised a method by which the percentage strength of weak hydrochloric acid can be ascertained fairly accurately with a very small quantity (0·05 c.c.) of liquid. Nitric, sulphuric, and phosphoric acids, and sodium hydroxide behave in a similar manner.—A. S.

Alkali metals ; Separation of —— *by electrolysis.* J. S. Goldbaum and E. F. Smith. J. Amer. Chem. Soc., 1908, **30**, 1705—1711.

Former work on the electrolytic determination of the alkali and alkaline-earth metals with the help of a mercury cathode and rotating silver anode (this J., 1907, 644 and 1145) has been extended to the chlorides of ammonium, caesium, rubidium, and lithium with satisfactory results, and it is found possible to separate one metal from another by suitably arranging the voltage. With a mixture of sodium and potassium chlorides, for instance, sodium chloride alone is decomposed by keeping the E.M.F. below the decomposition value of potassium chloride, and it is suggested that the separation may prove useful for the determination of small quantities of the alkali metals occurring in silicates. The other alkali metals (including ammonium) may be similarly determined in the presence of each other. In the case of potassium and ammonium salts, the decomposition values lie so close together that attempts at separation have been unsuccessful.—F. Sodn.

Thallium ; Electrolytic determination of ——, *and probable existence of a new oxide of this metal.* G. Gallo and G. Cenni. Atti R. Accad. dei Lincei, Roma, 1908, [5], **17**, II., 276—284. Chem. Zentr., 1908, 2, 1634.

Thallium may be determined electrolytically as oxide in the following manner (compare Heiberg, this J., 1903, 1016). A weighed quantity of thallous sulphate is dissolved in about 100 c.c. of water in a Classen dish, 10 grms. of oxalic acid are added, and the solution is electrolysed at the ordinary temperature with a current of 3—4 volts and 0·15—0·2 ampère. A platinum disc is used as cathode, and is rotated at a speed of about 800 revolutions per minute. The thallium is deposited as oxide on the anode. The values obtained, when calculated for the oxide, Tl_2O_3, are always about 1 per cent. too high, and the authors conclude that the deposit consists of a new oxide, Tl_3O_5 or Tl_2O_3,TlO_2. In agreement with this view, it was found that the deposit when dissolved in dilute hydrochloric acid, caused the evolution of chlorine ; from the solution a yellow salt of the composition, $TlCl_3,3TlCl$, was isolated.—A. S.

Mercury ; Volumetric determination of —— *by the thiocyanate, iodometric, and acidimetric methods.* E. Rupp. Chem.-Zeit., 1908, **32**, 1077—1079.

The volumetric determination of mercury by the thiocyanate method (this J., 1905, 350) is specially applicable in the presence of nitric acid or of "heavy metals" and in the case of organic mercury compounds, but chlorine ions, mercurous salts, and nitrous acid must be absent. Titration with iodine and thiosulphate (this J., 1906, 1175, and 1907, 948) is suitable where chlorine ions are present, as in medicinal preparations, and for the cyanide. The author now puts forward a third method, based on acidimetry, which is sometimes to be preferred. The solution of the mercuric salt is made neutral by the addition of alkali chloride, followed by phenolphthalein and sufficient alkali to just redden the solution, and then an excess of $N/4$ or $N/2$ potassium cyanide, sufficient to produce an intense red colour, is added and the excess over that necessary to form mercuric cyanide, is titrated with $N/1$ or $N/5$ hydrochloric or sulphuric acid, using methyl orange as indicator (the presence of the phenolphthalein in no way interferes). For mercuric chloride, direct titration with potassium cyanide and phenolphthalein is allowable, but in solutions containing much alkali chloride, as obtained with mercuric nitrate and sulphate, the indirect method, given above, is to be preferred. In order to apply the method to mercuric cyanide, potassium iodide is added, so as to form the compound, K_2HgI_4, and liberate potassium cyanide, which is then titrated as above. Mercuric oxide may be dissolved in potassium iodide solution and the potassium hydroxide formed, directly titrated with acid, using methyl orange as indicator.—F. Sodn

Boric acid ; Determination of —— *in insoluble silicates.* E. T. Wherry and W. H. Chapin. J. Amer. Chem. Soc., 1908, **30**, 1687—1701.

Two methods are given for the determination of boric acid in insoluble silicates. (1). 0·3—0·5 grm. of the sample is fused with about 3 grms. of sodium carbonate for 15 mins. The melt is taken up with 20—30 c.c. of hydrochloric acid (1 : 1) and any ferrous iron is oxidised by nitric acid or bromine water. The liquid is then boiled for about 10 mins., under a reflux condenser, with a moderate excess of precipitated calcium carbonate, and the precipitate, containing the sesquioxides of iron and aluminium, is filtered off and washed. A little more calcium carbonate is added to the filtrate, which should not exceed 100 c.c., and this is heated to boiling and the flask connected to a filter-pump ; suction is continued, in order to remove carbon dioxide, until the temperature has fallen to about 50° C. The liquid is then cooled, filtered, if the precipitate have a red colour, and exactly neutralised with $N/10$ sodium hydroxide with phenolphthalein as indicator. 1 grm. of mannitol (which is preferable to glycerol) is added and the liquid again titrated with $N/10$ sodium hydroxide, the treatment with mannitol and standard alkali being repeated, until a permanent pink colour results; the number of c.c. of alkali used, multiplied by the factor 0·0035 gives the weight of boric anhydride present. Some of the boric acid tends to remain with the sesquioxide precipitate, but for small percentages this method is both rapid and reliable. (2), The method is based on that of Low (this J., 1906, 779). 0·3—0·5 grm. of the substance is dissolved on the water-bath in 5 c.c. of hydrochloric acid (1 : 1), and anhydrous calcium chloride is added, in the proportion of about 1 grm. for each c.c. of liquid; an insoluble silicate is first fused with sodium and potassium carbonates and then treated with acid and calcium chloride. The liquid is heated on the water-bath and a slow stream of pure methyl alcohol vapour passed through it. The distillate from this operation is then titrated with sodium hydroxide, first in the presence of *p*-nitrophenol, and then in the additional presence of phenolphthalein, the difference indicating the approximate amount of boric acid in the distillate. A further quantity of sodium hydroxide, twice as great as that corresponding to the boric acid, is now added and the alcohol is distilled off; the volume of the residue is made up to 25 c.c., hydrochloric acid (1 : 1) is added until the colour due to both indicators is exactly discharged, and then carbon dioxide is removed and the titration finished in the presence of mannitol or neutral glycerol, as in the first method.—F. Sodn.

Ferro-alloys, especially ferrosilicons; New method of attacking ——. P. Nicolardot. Compt. rend., 1908, **147**, 676—678.

A spherical flask of 250 c.c. capacity is provided with a rubber cork, through which passes a glass tube carrying a stopcock. The tube passes a few millimetres into the flask; above the stopcock it consists of a narrow portion holding about 4 c.c. and graduated in 0·5 c.c., and a wider portion which may be closed by a cork. Into the flask is placed 0·5 grm. of the coarsely pulverised alloy; the flask is then exhausted to a pressure of about 20 cm. of mercury, and 2 c.c. of sulphur chloride are carefully introduced, through the stopcock. The closed flask is now heated; and as soon as action begins, the heating is discontinued. After cooling, and immersing in cold water to condense the sulphur chloride, the flask is again heated, in order to complete the action on the alloy. After again cooling, first, a few drops of dilute ammonia are cautiously introduced, and then when the excess of sulphur chloride has been destroyed, a greater quantity of ammonia is added. Water is now allowed to enter, without admission of air, till the flask is nearly full, and mixed with the contents so as to ensure decomposition of all silicon chloride. The flask is then washed out.—J. T. D.

Tungstic acid and silica; Separation of ——. P. Nicolardot. *See* VII.

ORGANIC—QUALITATIVE.

Petroleum; A new reaction of ——. E. Molinari and P. Fenaroli. *See* III.

Oleic acid; Colour reaction of ——. *Rapid method for distinguishing between animal and vegetable fibres.* A. Manea. *See* XII.

Benzoic acid; Detection of —— *in butter.* L. Robin. *See* XVIII*A*.

Honey, artificial [*invert sugar*]; *Use of resorcinol-hydrochloric acid for detecting* ——. Riechen and Fiehe. *See* XVIII*A*.

Lemon oil; Detection of small quantities of turpentine in ——. E. M. Chace. *See* XX.

Atoxyl; Reactions of ——. E. Covelli. *See* XX.

Glycerol; Aldehydic impurities in ——. G. F. Bergh. *See* XX.

Methyl alcohol; Detection of small quantities of —— *in the presence of ethyl alcohol.* L. E. Hinkel. *See* XX.

ORGANIC—QUANTITATIVE.

Tannery liquors; Acidity in ——. W. K. Alsop. *See* XIV.

Sod oils; Determination of water in ——. L. E. Levi and E. V. Manuel. *See* XIV.

Beet; Optically active non-sugar substances of the —— *which are attacked by lime during purification of the juice, and their polarimetric determination.* F. Herles. *See* XVI.

Sugar solids in mill products by means of the refractometer. S. S. Peck. *See* XVI.

Invert sugar; Influence of clarification with basic lead acetate on the determination of ——. O. Schrefeld. *See* XVI.

Hops; Chemical examination of ——. C. J. Lintner. *See* XVII.

Tartaric acid in wines; Determination of —— *by evaporation.* W. Mestrezat. *See* XVII.

Hexamethyleneamine; Detection and determination of —— *in pharmaceutical mixtures.* W. A. Puckner and W. S. Hilpert. *See* XX.

Salicylic acid; Separation of —— *from methyl salicylate, and the hydrolysis of the ester.* H. D. Gibbs. *See* XX.

Patent.

Dust content of technical gases; Rapid determination of ——. Ger. Pat. 201,789. *See* II.

XXIV.—SCIENTIFIC & TECHNICAL NOTES.

Argon; Products of arc- and spark-discharge in liquid ——. F. Fischer and G. Iliovici. Ber., 1908, **41**, 3802—3810.

Argon, prepared by the method of Fischer and Ringe (this J., 1908, 768) was liquefied by means of liquid air, and the electric arc and spark discharge respectively produced in it between cadmium electrodes, in the manner of the experiments of Fischer and Marx on ozone (this J., 1907, 416). No compound of cadmium and argon could be obtained, however; the yellow substance formed under the spark discharge proved to be cadmium nitride, produced from traces of nitrogen, which had not been completely excluded. This substance when treated with acids, yielded ammonium salts; when heated *in vacuo*, it evolved all its nitrogen, along with traces of argon, which the authors believe to have been merely taken up by adsorption.—J. T. D.

Copper acetylide; Constitution of ——. J. Scheiber. Ber., 1908, **41**, 3816—3828.

Cuprous acetylide, prepared and dried as usual, corresponds to the formula, Cu_2C_2, and can be obtained pure. If the compound is precipitated from a hot solution, washed with hot water, treated with alcohol and ether, and dried over calcium chloride, a substance is obtained after several days which corresponds approximately to the composition, Cu_2C_2,H_2O, probably $CH \vdots CCu.CuOH$. Acetaldehyde could not be obtained from either compound, although it is readily obtained from the mercury compound, to which the composition, $(HgCl)_3C.CHO$, has been assigned. The small quantities of humoid bodies, apparently of the composition, $(C_{11}H_8O_4)x$, left after solution of copper acetylide in acids are formed during the decomposition, not during the formation, of this substance. —A. G. L.

Rue anemone; Abnormal biochemical products of ——. F. S. Beattie. Amer. Chem. J., 1908, **40**, 415—428.

The author has examined plants of the rue anemone (*Syndesmon thalictroides*, Hoffmg.), which had grown in Rhode Island, U.S.A., and showed marked fasciation. The dried plants were found to contain 1-hydroxy-*iso*-quinoline-3-carboxylic acid in the form of its methyl and ethyl esters, and *py*-3-methylquinoline-4-carboxylic acid in the free state. The total amount of the products was 20 per cent. Normal plants of this species gathered in the same locality, were found to contain no trace of the above compounds. The two acids mentioned have never before been found occurring naturally.—F. Shdn.

Tobacco fermentation; Nature of ——. H. Jensen. Zentralbl. f. Bakter. u. Parasitenk., II., Abt., 1908, **21**, 469—483. Chem. Zentr., 1908, 2, 1620.

The fermentation of tobacco is not inhibited by mercuric chloride, formaldehyde, or chloroform; it is accelerated by placing weights on the tobacco, or by piling up large quantities of the plant. The fermentation is not accelerated by drawing oxygen through the mass; it does not take place with small quantities of tobacco (except with damp tobacco), even if some fermenting tobacco be added. Fermentation can be induced by heating in steam for from 10 mins. to 2 hours at 90°—100° C. These results are in conflict with the views that the fermentation is a microbiological process or is caused by the action of Loew's oxydase, peroxydase, and catalase. (See also this J., 1899, 1161, 1162; 1901, 598.)—A. S.

New Books.

The Chemical Constitution of the Proteids. [Monographs on Biochemistry, edited by R. H. A. Plimmer, D.Sc., and F. G. Hopkins, M.A., M.B., F.R.S.] By R. H. Aders Plimmer, D.Sc., Assist. Prof. of Physiological Chemistry in, and Fellow of University College, London. Longmans, Green and Co., 39, Paternoster Row, London; New York, Bombay, and Calcutta. 1908. Part I. Price 3s. net.

8vo volume, containing 79 pages of subject matter, 17 pages of bibliographic references, and an alphabetical index. The text is subdivided as follows: —I. Chemical composition of the protein molecule. II. Chemical constitution of its units, or the discovery and syntheses of the amino-acids: *a*, Mono-aminomonocarboxylic acids. *b*, Mono-aminodicarboxylic acids. *c*, Diaminomonocarboxylic acids. *d*, Heterocyclic compounds. *e*, The optically active amino-acids.

Part II. Price 2s. 6d. net.

8vo volume, containing 57 pages of subject matter, 6 pages of bibliographic references, and an alphabetical index. The text is subdivided as follows:—I. The condensation together of amino-acids. II. The biuret base. III. The linking together of amino-acids: *a*, Combinations of amino acids with carbonic acid; *b*, with ammonia. IV. The polypeptides: *a*, Syntheses. *b*, Structure. *c*, Configuration. *d*. Properties. *e*, Action of enzymes, (i.) trypsin, (ii.) pepsin, (iii.) other enzymes. V. Polypeptides present in proteins.

Untersuchung und Nachweis Organischer Farbstoffe auf Spectroskopischem Wege. Von Jaroslav Formanek, Tit.Professor an der k. k. bömischen technischen Hochschule in Prag, &c., unter Mitwirkung von Eugen Grandmougin, Professor am eidgenöss. Polytech. in Zürich. 2te. vollständig umgearb. und vermehrte Auflage. Erster Theil. Julius Springer's Verlag, Berlin, N. 24, Monbijouplatz 3. 1908. Price M.12.

8vo volume, containing 252 pages of subject matter, with 19 illustrations and 2 lithographic tables, also an alphabetical index of subjects. The subject matter is classified and grouped as follows:—I. The spectroscope. II. The absorption spectra of the colour solutions and their optical properties. III. The stability and instability of absorption spectra. IV. General relations between colour, absorption, fluorescence, and constitution of colour compounds and dyestuffs. V. Relations between the constitution and absorption spectra of the individual classes of dyestuffs. VI. Di- and triphenylmethane dyestuffs. VII. Quinoneimido dyestuffs. VIII. Fluorindine and triphenyldioxazine. IX. Acridine dyestuffs. X. Anthraquinone dyestuffs.

The Elements of Physical Chemistry. By J. Livingston R. Morgan, Ph.D., Professor of Physical Chemistry in Columbia University. 4th Edition, revised and enlarged. John Wiley and Sons, New York. Chapman and Hall, Limited. 1908. Price $3·00.

12mo volume, containing 517 pages of subject matter, 13 pages of tables, and an alphabetical index. The text is subdivided and grouped as follows:—I. Introduction. II. The gaseous state. III. The liquid state. IV. The solid state. V. The phase rule. VI. Solutions. VII. Thermochemistry. VIII. Chemical change: *a*, Equilibrium. *b*, Chemical kinetics. *c*, Ionic equilibria. IX. Electrochemistry: *a*, Migration of the ions. *b*, Conductivity of electrolytes. *c*, Electromotive force. *d*, Electrolysis and polarisation. X. Problems.

The Methods of Textile Chemistry. Being the syllabus of a lecture course adapted for use in textile laboratories. By Frederic Dannerth, Ph.D. First edition. John Wiley and Sons, New York. 1908. Price 8s. 6d. net., or $2·00. Chapman and Hall, Limited, London.

12mo volume, containing 144 pages of subject matter, bibliographic references to be found in this Journal from the years 1901 to 1907 inclusive, and an alphabetical index. The subject matter is arranged and grouped as follows:—I. Qualitative analysis. II. Quantitative analysis. III. Materials, processes, and products. IV. Glossary.

The Chemistry of Essential Oils and Artificial Perfumes. By Ernest J. Parry, B.Sc. Second edition, revised and enlarged. Scott, Greenwood and Son. 8, Broadway, Ludgate Hill, London, E.C. 1908. Price 12s. 6d. net., 13s. post free, inland.

8vo. volume, containing 516 pages of subject-matter three appendix tabular charts, 20 tables, and the alphabetical index. There are 21 illustrations. The subject-matter is grouped and classified as follows:—I. General properties of essential oils. II. Compounds occurring in essential oils. III. Preparation of essential oils, expression, distillation, extraction. IV. Analysis of essential oils. V. Systematic study of essential oils. Oils of the gymnosperms: (i), Wood oils. (ii), Fruit oils. (iii), Leaf oils. Oils of the angiosperms:—(i), Monocotyledons, (ii), Dicotyledons. VI. Chemistry of artificial perfumes. Vanillin; coumarin; heliotropin; aubepine (hawthorn); ionone; artificial musk; artificial neroli, lilac, hyacinth, lemon oil, rose oil, niobe oil, bergamiol, jasmin oil, cognac oil. Appendix, with table on the constants of the more important essential oils.

Review of Trade of India in 1907-08. [Cd. 4390.] Wyman and Sons, Fetter Lane, London, E.C. Price 1s. 2d.

Foolscap volume of 78 pages, dealing with the import, export, and frontier trade of India during the year ended March 31st, 1908.

Second Report of the Departmental Committee on Compensation for Industrial Diseases. Report. [Cd. 4386.] Price 1d. Minutes of Evidence. [Cd. 4387.] Price 7½d. Wyman and Sons, Fetter Lane, London, E.C. (See page 1153.)

Report for the Year 1907 on the Chemical, Metal and Mining Industries of the Consular District of Lyons. For. Off. Misc., Ser. No. 669.

This report, by H.M. Consul at Lyons, contains particulars of the electro-chemical and electro-metallurgical industries; of the production of soda, sulphuric acid, manures, bone manures, glues and gelatins, stearine and candles, colouring matter and various dyeing products, &c.;

as regards the metal industry, of automobiles, steam, oil and gas engines, pumps, tools, and iron and copper smelting, with remarks on the questions of railway and water transport; together with details of the coal, coke, anthracite and metal industries of the Loire Basin.

Bulletin of the Imperial Institute. Vol. VI. No. 3. Price 1s.

This issue of the Bulletin contains particulars of recent investigations made in the Scientific and Technical Department of the Imperial Institute regarding timbers from Uganda, fibres from the Gold Coast, seeds of *Lophira alata* from Sierra Leone, copal resins from British West Africa, African elemi, ceara rubber from Portuguese East Africa and rubber of *Forsteronia floribunda* from Jamaica, and other notices respecting economic products and their development.

Patent List.

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised. Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

Applications.

24,719. Kauth and Bender. Furnaces.* Nov. 17.

24,784. Satlow. Furnaces. Nov. 18.

24,789. Harrison, Bate, and Perks. Method and apparatus for distillation of liquids. Nov. 18.

24,859. Segalevic. Centrifugal separators.* Nov. 18.

24,937. Schönmann. Apparatus for introducing air or other gases into liquids. Nov. 19.

25,153. Knowles. The exhausting of vacuum drying apparatus. Nov. 23.

25,213. Leclaire and Hericourt. Filter.* Nov. 23.

25,216. Hofmann and Main. Apparatus for drying dissolved leather, concentrated blood, paints, pigments, etc. Nov. 23.

25,300. Boult (Bradley). Centrifugal machines for separating solids from liquids.* Nov. 24.

25,323. Flick. Distilling apparatus.* Nov. 24.

25,643. Tiemann. Drying non-pulverulent materials. [Ger. Appl., March 4, 1908.]* Nov. 27.

25,644. Tiemann. Apparatus for purifying solutions by settling. [Ger. Appl., Sept. 24, 1908.]* Nov. 27.

Complete Specifications Accepted.

2905 (1908). Fenn and Priest. Gas-fired kilns. Dec. 2.

5774 (1908). Webb. Filters. Dec. 2.

5830 (1908). Ridgway. Filtering machines. Nov. 25.

9938 (1908). Muchka. Apparatus for extracting oil from vapour or extracting water from gases. Nov. 25.

II.—FUEL, GAS, AND LIGHT.

Applications.

24,573. Gillon. *See under* XXII.

24,803. Tully. Apparatus for the manufacture of gas. Nov. 18.

24,893. Smith. Apparatus for producing water-gas. Nov. 19.

25,051. Lutyens and Fowler. Manufacture of fuel. Nov. 20.

25,443. Kuzel. Production of incandescence filaments from colloidal elements. [Ger. Appl., Oct. 15, 1908.]* Nov. 25.

25,549. Still and Adamson. Manufacture of incandescent mantles. Nov. 26.

25,557. British Thomson-Houston Co. (General Electric Co.). Manufacture of coherent bodies of refractory material suitable for filaments of electric lamps.* Nov. 26.

25,736. Temple. Gas generating and purifying apparatus.* Nov. 28.

25,742. British Thomson-Houston Co., and Gray. Production of coherent conductors of refractory material suitable for incandescent electric lamps. Nov. 28.

Complete Specifications Accepted.

25,657 (1907). Robin (Salomon). Manufacture of incandescent gas mantles. Nov. 25.

2240 (1908). British Cerofirm Co. (Cerofirm Ges.). Production of incandescent mantles. Dec. 2.

3189 (1908). Hadlow. Treatment of coal for the production of artificial fuel. Dec. 2.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS. PETROLEUM, AND MINERAL WAXES.

Application.

25,318. Thompson (Lingner). Manufacture of condensation products of wood tar with formaldehyde.* Nov. 24.

Complete Specifications Accepted.

26,910 (1907). Wilton and Wilton. Distillation of tar Nov. 25.

15,267 (1908). Guillaume. Rectification and fractional separation of crude petroleum and other liquids capable of volatilisation. Dec. 2.

IV.—COLOURING MATTERS AND DYESTUFFS.

Applications.

24,600. Newton (Bayer und Co.). Manufacture of an azo dyestuff. Nov. 16.

24,601. Newton (Bayer und Co.). Manufacture of flavopurpurin. Nov. 16.

24,604. Johnson (Badische Anilin und Soda Fabrik). Manufacture of colouring matters of the anthracene series. Nov. 16.

24,605. Johnson (Badische Anilin und Soda Fabrik). Manufacture and use of pastes of leuco compounds of indigo colouring matters. Nov. 16.

25,177. Newton (Bayer und Co.). Manufacture of azo dyestuffs. Nov. 23.

25,311. Johnson (Badische Anilin und Soda Fabrik). Manufacture of azo colouring matters.* Nov. 24.

25,551. Imray (Meister, Lucius, und Brüning). Manufacture of vat dyestuffs of the anthracene series. Nov. 26.

Complete Specifications Accepted.

25,513 and 26,276 (1907). Imray (Meister, Lucius, und Brüning). Manufacture of halogen indigo derivatives. Nov. 25.

25,514 and 26,275 (1907). Imray (Meister, Lucius, und Brüning). Manufacture of highly brominated halogenised indigos. Nov. 25.

26,053 (1907). Johnson (Badische Anilin und Soda Fabrik). Manufacture of intermediate products and dyestuffs containing sulphur. Nov. 25.

2683 (1908). Bloxam (Act.-Ges. f. Anilinfabr.). Manufacture of yellow azo dyestuffs. Nov. 25.

15,417 (1908). Haas. Dyestuffs capable of dyeing vegetable fibres without mordants. Nov. 25.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

Applications.

24,810. Newton (Bayer und Co.). Process of dyeing and printing. Nov. 18.

24,842. Cartwright. *See under* VII.

24,870. Jennison. Method of making bleaching liquid. Nov. 19.

24,922. Crombie and Schubert. Apparatus for obtaining fibres from solutions. Nov. 19.

24,935. Green. Production of aniline black on textile fibres and fabrics. [Addition to No. 16,189 of 1907.] Nov. 19.

25,292. Rafter. Manufacture of a preparation for cleaning wool. Nov. 24.

25,308. Grosse. The colouring of fabrics.* Nov. 24.

25,312. Johnson (Badische Anilin und Soda Fabrik). Manufacture of resists and resist pastes for vat dyeing. Nov. 24.

25,441. Corron. Machines for dyeing yarns. Nov. 25.

25,522. Baumann and Diesser. Process for obtaining silk fibroin. [Ger. Appl., Dec. 21, 1907.]* Nov. 26.

Complete Specifications Accepted.

26,414 (1907). Koblischke. Dyeing cotton and other vegetable fibres with alizarin dyes. Dec. 2.

202 (1908). Venter. Removing soda lye from fabrics saturated with it for the purpose of mercerisation. Nov. 25.

6532 (1908). Rossi. Microbiological vegetal retting process by pectic aerobic microbes in a gas current. Dec. 2.

VII.—ACIDS, ALKALIS, AND SALTS.

Applications.

24,823. Steynis. Production of ozone. [Fr. Appl., Nov. 18, 1907.]* Nov. 18.

24,842. Cartwright. Obtaining solutions or pseudo-solutions of ferric oxide and other similar substances, applicable to dyeing, etc. Nov. 18.

24,870. Jennison. *See under* V.

24,969. Wakefield. Stills used in the manufacture of nitric acid and the like. Nov. 20.

25,113. Ozonair, Ltd., and Joseph. Production of ozone. Nov. 21.

25,237. Bell. Purification of brine and salt. Nov. 24.

25,535. Blagburn. Process and apparatus for obtaining nitrogen from the air. [U.S. Appl., Nov. 27, 1907.]* Nov. 26.

25,588. Bell and Ray. Manufacture of salt. Nov. 27.

25,608. Crawford. Silica carbide agglomerates. Nov. 27.

Complete Specifications Accepted.

202 (1908). Venter. *See under* V.

412 (1908). Steynis and Chaumat. Apparatus for the production of ozone. Dec. 2.

3221 (1908). Gartenmeister. *See under* XXII.

9951 (1908). Effront. *See under* XVII.

11,710 (1908). Siemens und Halske A.-G. Manufacture of a plastic mass from tungsten compounds. Dec. 2.

15,490 (1908). Haber and Koenig. Production of compounds of oxygen and nitrogen. Dec. 2.

VIII.—GLASS, POTTERY, AND ENAMELS.

Application.

25,042. Sievert. Manufacture of glass plates. [Ger. Appl., Nov. 21, 1907.]* Nov. 20.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Applications.

24,718. Kayser. Making acid proof cement.* Nov. 17.

24,816. Butler. Composition for making pipes or conduits and paving blocks. Nov. 18.

25,069. Bottomley and Sharrock. Rotary furnaces or kilns for burning calcareous or argillaceous substances. Nov. 21.

25,637. Winkler. Manufacture of wood substitutes. [Swiss Appl., Dec. 6, 1907.]* Nov. 27.

Complete Specifications Accepted.

4947 (1908). Noodt. Production of heat-insulating bodies. Nov. 25.

13,941 (1908). Turner. Manufacture of artificial stone. Dec. 2.

15,797 (1908). Hövermann. Cement. Nov. 25.

X.—METALS AND METALLURGY.

Applications.

24,590. Borchers. Treatment of titaniferous iron ores.* Nov. 16.

24,669. Richards. Treatment of complex sulphide ores. Nov. 17.

24,845. Simpson and Oviatt. Metallurgy of steel. Nov. 18.

24,846. Simpson and Oviatt. Metallurgy of iron. Nov. 18.

25,022. Ebbw Vale Steel, Iron, and Coal Co., and Mills. Production of iron from fine ores. Nov. 20.

25,024. Davis and Fearon. Process for pickling metals. Nov. 20.

25,035. Heide (Titanium Alloy Manuf. Co.). Purifying, casting, and alloying copper.* Nov. 20.

25,089. Stobie. Recovery of metals. Nov. 21.

25,099. Jones. Manufacture of steel.* Nov. 21.

25,620. Touceda. Alloy for bearing metals. [U.S. Appl., Nov. 27, 1907.]* Nov. 27.

Complete Specifications Accepted.

21,356 (1907). Crawford. Manufacture of steel alloys. Dec. 2.

25,408 (1907). Sinding-Larsen. Manufacture of aluminium or aluminium alloys or silicides. Nov. 25.

2322 (1908). Brandenburg. Apparatus for removing tin from tin-plate waste. Nov. 25.

15,196 (1908). Edwards and Edwards. Annealing furnaces. Dec. 2.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

Applications.

24,594. Billiter. Electrolysis of liquids.* Nov. 16.

24,597. Winkler. Production of transparent, flexible, infusible, insulating media. [Ger. Appl., Nov. 18, 1907.]* Nov. 16.

25,208. Greenwood. Electrolytic decomposition of alkaline salts. Nov. 23.

25,707. Weller. Material for insulating, etc. Nov. 28.

Complete Specifications Accepted.

12,747 (1907). Cowper-Coles. Electrodeposition of iron. Dec. 2.

25,655 (1907). Von Seemen. Manufacture of bodies capable of conducting electricity in the cold. Nov. 25.

25,669 (1907). Hausmann. Electrodeposition. Dec. 2.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

Applications.

24,671. Billing. *See under* XIII*B*.

24,836. Barbé, Garelli, and De Paoli. Separation of solid from liquid fatty acids. [Comprised in No. 9758 of 1908. Addition to No. 12,210 of 1907.]* Nov. 18.

24,837. Barbé, Garelli, and De Paoli. Transmission of liquid into solid fatty acids. [Comprised in No. 9758 of 1908. Addition to No. 12,210 of 1907.]* Nov. 18.

24,838. Barbé, Garelli, and De Paoli. Obtaining soda and potash soaps from ammonia soaps. [Comprised in No. 9758 of 1908. Addition to No. 12,210 of 1907.]* Nov. 18.

25,292. Rafter. *See under* V.

25,573. Spencer and Brant. Manufacture of soap. Nov. 27.

Complete Specifications Accepted.

741 (1908). Electrolytic Alkali Co., Connor, and Stubbs. *See under* XIII*B*.

9951 (1908). Effront. *See under* XVII.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES INDIA-RUBBER, Etc.

(*A*.)—Pigments, Paints.

Application.

25,216. Hofmann and Main. *See under* I

(*B*.)—Resins, Varnishes.

24,671. Billing. Bleaching or decolorising and deodorising resins, oleo-resins, fats, oils, or mixtures of them. Nov. 17.

25,118. King's Patent Agency, Ltd. (Lowen). Substitute for oil-cloth, oil-cloth paper, etc. Nov. 21.

25,706. Thomson. Varnish for protecting metals, etc., from acids or other corrosive materials. Nov. 28.

25,752. Castle. Composition for use in making linoleums, floorcloths, &c. Nov. 28.

Complete Specification Accepted.

741 (1908). Electrolytic Alkali Co., Connor, and Stubbs. Treatment of resins, waxes, gums, fats, oils, etc., with chlorine. Dec. 2.

(*C.*)—India-Rubber.

Application.

25,726. Lengfellner. Elastic composition resembling india-rubber. [Ger. Appl. Nov. 29, 1907.]* Nov. 28.

Complete Specification Accepted.

9956 (1908). Degen und Kuth. Process for vulcanising a rubber solution. Dec. 2.

XIV.—TANNING, LEATHER, GLUE, SIZE, Etc.

Applications.

24,580. Wolstenholme. Tanning and like processes. Nov. 16.

25,216. Hofmann and Main. *See under* I.

Complete Specifications Accepted.

12,254 (1908). Boult (International Process Tanning Co.). Tanning hides and making leather. Nov. 25.

21,483 (1908). Redlich and Pollak. Manufacture of quebracho extract. Nov. 25.

XVI.—SUGAR, STARCH, GUM, Etc.

Complete Specification Accepted.

741 (1908). Electrolytic Alkali Co., Connor, and Stubbs. *See under* XIII*B*.

XVII.—BREWING, WINES, SPIRITS, Etc.

Application.

24,592. Barr. Production of ferments. Nov. 16.

Complete Specifications Accepted.

25,356 (1907). Breker. Production of brewers' wort. Nov. 25.

9951 (1908). Effront. Process of fermentation to obtain ammonia and volatile fatty acids from organic nitrogenous substances. Dec. 2.

XVIII.—FOODS; SANITATION, WATER PURIFICATION; AND DISINFECTANTS.

(*A.*)—Foods.

Applications.

25,193. Dombach. Treatment of grain.* Nov. 23.

25,501. Yeo, Hall, and Goskar. Aeration of liquids or manufacture of mineral waters. Nov. 26.

(*B.*)—Sanitation; Water Purification.

Application.

25,142. De Kunwald. Treating solid, liquid, or gaseous substances for disinfecting, sterilising, &c. Nov. 21.

Complete Specifications Accepted.

25,222 (1907). Rumin. Purification of waste water. Nov. 25.

19,646 (1908). Lajoie. Apparatus for purifying water for industrial purposes. Nov. 25.

XIX.—PAPER, PASTEBOARD, Etc.

Applications.

24,809 and 24,811. Brandenberger. Treatment and application of cellulosic films.* Nov. 18.

25,183. Curtius und Co. Agent for use in sizing paper. [Ger. Appl., July 15, 1908.]* Nov. 23.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

Applications.

24,742. Gloystein. Manufacture of concentrated tobacco extract. [U.S. Appl., Jan. 10, 1908.]* Nov. 17.

24,750. Hoennicke. Process for obtaining secretions from organic tissues. [Comprised in No. 26,018 of 1907.]* Nov. 17.

25,443. Jensen (Goldschmidt). Manufacture of anhydrides of fatty acids, especially acetic anhydride, from fatty acid salts. Nov. 25.

Complete Specifications Accepted.

25,453 (1907). Schmitz und Co. Manufacture of camphene. Nov. 25.

26,018 (1907). Hoennicke. Process of obtaining secretions from organic tissues. Dec. 2.

1682 (1908). Zimmermann (Chem. Fabr. auf Actien, vorm. E. Schering). Manufacture of the bromisovaleric acid ester of isoborneol. Dec. 2.

2023 (1908). Wellcome and Barger. Manufacture of cyclic carbonates of halogen derivatives of ethyl and propyl 3.4-dihydroxybenzene. Nov. 25.

8068 (1908). Wellcome, Bates, and Remfry. Manufacture of a therapeutic compound. Nov. 25.

24,750 (1908). Hoennicke. Process for obtaining secretions from organic tissues. Dec. 2.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Complete Specification Accepted.

26,445 (1907). Roth. Producing paper to be used as photographic or blue print paper, etc. Nov. 25.

XXII.—EXPLOSIVES, MATCHES, Etc.

Applications.

24,573. Gillon. Igniting and explosive compositions. Nov. 16.

25,052. Lloyd, and Curtis' and Harvey, Ltd. Manufacture of explosives. Nov. 20.

Complete Specifications Accepted.

3221 (1908). Gartenmeister. Manufacture of readily inflammable phosphorus compounds and kindling or priming compositions. Dec. 2.

10,129 (1908). Bouchaud-Praeciq. Preventing the spontaneous explosion of nitro explosives. Nov. 25.

12,188 (1908). Anglo-French E. and S., Ltd., and Edwards. Explosive charges. Nov. 25.

Journal of the Society of Chemical Industry.

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Liverpool Section.

Meeting held at University on Wednesday, November 11th, 1908.

MR. MAX MUSPRATT IN THE CHAIR.

THE INDIVIDUAL AND THE CORPORATION IN THE CHEMICAL INDUSTRY.

BY MAX MUSPRATT.

There is one phase of Chemical Industry which, though touched upon indirectly, has not been fully treated in addresses to this Society, but which nevertheless requires specific consideration. It is the decline of the individual and the necessity of his resurrection and the rise of the corporate system and the necessity and manner of its continuance.

What must strike one is the diversity of the individualist pioneers of our industry: absolutely opposite methods seem often to have lead to success. Here science succeeded, there rule of thumb paved the way to fortune; the dreamer of dreams met with practical success, the practical man founded an ideal business. There was no royal road to success, even in those days, and, though naturally we hear little of them now, there were men, both scientific and rule of thumb, who failed. Personality was everything in the early days of chemical industry.

As elsewhere, development lead to acute competition, and acute competition to co-operation or amalgamation, and to-day conditions are sufficiently long established upon a corporate basis to allow of their being analysed, criticised, and improved.

Whether the supersession of the private firm by the public company is desirable or not need not be discussed; probably inevitable, at any rate it is an accomplished fact. But what are its effects?

Manufacture.—The keystone to the heavy chemical industry is cheapness of manufacture and excellence of product. The individualistic era, with its fierce competition, was a more fertile soil for improvement; but the corporate era, with its large scope for capital expenditure and experiment, has also its advantages. In the early days of development the field of improvement was very great and the immediate advantage of improvement was patent. This showed itself within the individual works, where the principals were themselves on the spot, either creating or daily watching and appreciating the creations of their staffs, and it produced a class of itinerant genius who found ready bidders for any real improvement of processes. Possibly in no other way could a great industry be moulded; but a point comes where the possibilities of improvement become so small in comparison to the capital cost that, under an unlimited competitive system, the private firm either shrinks from the responsibility or undertakes a burden too great to bear. At this point amalgamation becomes inevitable, with bankruptcy as the alternative.

The immediate results of amalgamation are almost bound to be good on the manufacturing side: each works has its individuality, its special features of excellence and indifference, and a systematic comparison should result theoretically in raising the worst to the standard of the best or even higher. In practice, an undoubted raising of the average standard is effected, and the way is clear for the refinements of manufacture, often entailing big alterations and capital expenditure for small and sometimes hypothetical gains.

It is here that the loss of the individual is felt, and the potential strength of the great corporation is often vitiated by the inertia of its size.

Under the complex conditions of modern manufacture, even with the most accurate system of cost sheets, both improvements and weaknesses are apt to be masked. Thus a works or a department with some appreciable weakness may, by some geographical advantage, luck with regard to raw materials, or exceptional energy of its staff, produce as good or better results than another with more recent equipment or improved plant, with the not unnatural result that disappointment is felt with the improved plant and its extension is discontinued.

It is here that the individualist characteristics of intuition and perseverance, which have done so much to build up our industry, are strongly needed, and one of the problems of the time is how to regraft them on the corporate system.

While reckless love of change is to be condemned, modern industry demands the systematic adoption of the most modern contrivances, unless there is irrefutable evidence of their unsuitability to the particular conditions. The sum of small improvements is in the end enormous and far-reaching, while the policy of contentment leads to atrophy, imperceptible at first, but liable to lead to disaster in emergency.

Labour.—The kind of work required in the chemical industry varies from the heaviest to the lightest, from the crudest to the most skilled. In some of the manual branches skilled labour was in the past highly paid, owing to its very special nature and the demand exceeding the supply. The modern tendency is towards simplification, with a consequent lowering of high individual wages. At the same time there has been a certain almost imperceptible averaging up of medium and low wages in sympathy with industrial conditions generally, and in the most modern works a vastly larger number of men are employed at wages well above the minimum living wage of a generation ago, but the plums are fewer. On the other hand, there are larger openings: the foremen, heads of departments, and supervisors of processes are more and more likely to be recruited from those who work with their brains as well as with their hands.

The labour question in the chemical industry is always complicated by the necessity of continuous labour. The excessive hours physically possible to the raw countryman available 30 to 40 years ago, in return for wages which to him were great wealth, are now an anachronism. Much has been done, but the last word is not yet spoken, and there must be give and take on both sides to place industry on a satisfactory basis in this respect.

Sales.—It is doubtful if the transition from the individualistic to the corporate era entails greater changes anywhere than in this department. In theory the conditions are revolutionised. Under the competitive system the ideal is to place the whole of a limited make at a margin of profit which will give a maximum return on the capital invested: to do this the principal conditions, apart from cheapness, are quality, good-will, and promptness. Quality must be of two kinds: the real, consisting of uniformity of strength and reliability of standard; the artificial, resting on appearance, style of package, and convenience for consumer. Goodwill depends upon enterprise in securing markets either by being the first in the field or assisting consumers by recipes or other information suited to their special needs. Promptness in execution of orders is also vital, and much intelligent foresight is required to strike the happy mean between too heavy and too bare stocks. A single indiscreet manufacturer might ruin, and has ruined, prices for all for long periods by a too optimistic estimate of what he could reasonably place.

Under the corporate system in theory competition ceases and the ideal is to obtain the highest price which will not check consumption. But, apart from the impossibility of really eliminating competition, a powerful factor in keeping prices down is possible competition. Producing corporations have to deal with consuming corporations, who are always having attractive estimates dangled before them tempting them to produce instead of to buy their own requirements. We all know the results that can be obtained by an inventor on paper, and plausible processes are the great protection for the consumer from fancy prices, for once plant has been erected, though the results may be disappointing, the consumer rarely comes back. Some of the principal aims of a manufacturing corporation should therefore be a moderate selling price, but uniformity of price is most desirable. Rapid fluctuations are most embarrassing, both to producer and consumer, and although unpopular at times, the sound policy is to be slow to raise prices in good times, but stiff-necked in lowering prices in bad times. After all, in almost all consuming industries the item for chemicals is not a controlling one, and the consumption of these industries cannot be stimulated by heavy sacrifices on the chemical side, while the absence of fluctuations characteristic of the corporate system has a steadying effect on the trade of the whole world.

A danger of the corporate system in selling is over-centralisation. In old days large bodies of competing sellers specialised in various articles in various markets: on the manufacturing side one works acts as a standard of comparison for another: in selling, centralisation is necessary, but the intimate touch and specialised knowledge of the consuming industries and the various markets is in danger of being blurred, to the prejudice of the seller. Subject to general control of policy, the individual requires rehabilitating in this branch.

Buying, which includes the whole question of raw materials, is undoubtedly facilitated by the corporate system. In purchasing articles where there are competing sellers the very lowest prices are obtainable, partly because of the largeness of the quantities and partly from the sellers having to bid against unknown competitive tenders. The only obvious difficulty is that of quality: the works manager likes the best quality at the lowest price, the buyer aims at the greatest common denominator of the two factors, and it is quite impossible that the two views shall always harmonise. Intimate touch, with frequent visits to the works, should reduce this difficulty to a minimum.

In many raw materials sellers meet the stringency of corporate buying by rings or corners, while in certain articles the supplies may be so limited that monopoly prices can be exacted. The ring or corner where there is no natural monopoly can usually be broken by facing temporary loss for ultimate gain, but the natural monopoly can only be met by fresh sources of supply. For its chief raw materials a large manufacturing undertaking will therefore sooner or later usually acquire its own supplies, and the power of doing this is a great source of strength in the corporate system.

Administration.—With the aggregation of business rendering impossible the daily individual touch, a substitute has to be found, and this is called administration. It has been too readily assumed that commercial administration would follow as a matter of course if sufficient individualist business men were banded together in a board room. Indeed, one big amalgamation started with no less than 80 directors, of whom probably not one knew anything of administration, for the simple reason that such knowledge scarcely exists. A spirit of administration suitable to the new conditions must be developed, which is to combine all that is best in both the individual and the collective. Administration is to the large company what nerve-system is to the human body, all-pervading, all-influencing, but under normal conditions invisible and intangible. It is not vested in a board or in this or that official, but in the spirit running through the whole body corporate, producing harmony and co-operation while developing individuality and creative power. But this metaphysical conception of administration must of course be associated with suitable machinery, and in practical industry a machine is invented and set in motion long before the last theory of its ultimate development is understood. We have therefore in every company a board of directors, the majority free from all routine work, a minority with a certain amount of routine work of a non-departmental nature, and in conjunction with the secretarial department, general supervisory and executive control of the whole undertaking.

There are other departments and activities of an advisory and initiatory nature closely allied to the administration. The principal of these is the Research and Scientific Department, which keeps the administration in touch with scientific developments affecting the specific industry; criticises new processes and compares them with the old; reviews the whole subject of patents, past, present, and future, and evolves the new processes required. The corporate system can keep a highly qualified staff fully equipped in these departments, chemical, engineering, and statistical, and it is here that the scope of the individual most closely touches the corporate system. At the same time over-concentration must be avoided. Scientific men of high standing must be distributed so as to have actual daily touch with manufacturing routine, while inventive genius, which springs up here and there irrespective of great scientific training, must be encouraged and developed. The necessity of strong individualism in this sphere of work is so obvious that it is the corporate that must be accentuated. In industry research is a means, not an end, and as inventive genius cannot be forced, it is incumbent on the individual to keep himself in close touch with the necessities of his industry. Constant intercommunication and personal touch with his more routine colleagues is therefore one of the paths to success.

Another important though not numerically large department is that of Commercial Intelligence, which by systematic study of what is happening in all parts of the world, by both reading and travel, helps to keep the administration both up to date and forewarned as to industrial dangers.

It is essential, however, for attaining the maximum efficiency that the idea of water-tight compartments should be entirely eliminated. While the pure routine of a department should never be interfered with from outside, each department should have good relations with the others.

What then is the future of the individual within the corporation? Material gain is probably the most potent incentive, and this is one of the most difficult to apportion.

Payment by results and profit-sharing are obvious suggestions, and deserve sympathetic attention. At the same time, many of the tentative steps in this direction have led to dissatisfaction on one side or the other, because, owing to the complexity of modern industry and the interdependence of departments, it is well nigh impossible to accurately distribute credit when expressed in £ s. d.

The one department where this method is possible, and is a partial success, is in rewarding successful invention. But even here there is too great an element of chance, and a system, which rewards the maker of thousands and ignores the maker of tens of thousands, because the one is an inventor and the other an adapter, is arbitrary and unsatisfactory. To my mind, the ideal justice to the individual is to be found in rapid and intelligent promotion, both with regard to status and remuneration. The corporations which adopt this method systematically, steering between the Scylla of parsimony and the Charybdis of favouritism, are the most likely to draw the best men and develop their individuality.

The personal relation is, however, also a vital one, and everything possible should be done to develop good fellowship and *camaraderie*.

The modern industrial corporation is a little state, and the individual and the corporate will attain to the highest pitch of development when, adapting Macaulay's words—

None are for a section
But all are for the State.

Discussion.

Dr. Campbell Brown said that in years past, when individual management gave place to limited liability, in the course of ten or twelve years, the manufacture generally went down in quantity and quality, but it was to be hoped that would not be the rule in the future. Early failures were merely the result of the sudden withdrawal of the head and nerves of the manufacturers from their duties without supplying the necessary substitute.

While the personal head of a manufacture was closely interested financially and in reputation with the success and the efficient performance of the work at every stage, in the corporate system there was not that close dependence of everyone upon the perfection of his own work and the performance of his own duty. In this connection he might cite the wonderful Zeiss Company in Jena, which appeared to have solved the problem of getting every person rewarded according to his deeds, and of making him feel that he was so rewarded; and it was not exactly the fair allotment of promotion and other advantages that told, but the making the man realise that his advancement depended upon his work.

Mr. **Eustace Carey** said that the interesting and suggestive address they had heard that evening, reminded him of Professor Tyndall's celebrated one at Belfast many years ago upon the use of the imagination in science. He was sure Mr. Muspratt's paper would lead to others of a similar character. The cessation of individual management and individual ownership had some drawbacks—a very obvious one was that there was less personal touch with the workpeople and the staff—but the balance of advantage was largely on the side of the corporation.

Mr. T. W. **Stuart** cordially agreed with all that Mr. Muspratt had said. He had very definite views as to the advantage of a corporate company against a private firm in the old days. When they had the opportunity of comparing costs of manufacture, quality of manufacture, and other things which constitute good management, it was a very great surprise to many of them to see in the case of many firms who had high reputations, and other firms who had small reputations, what a revelation there was when they were put together side by side. One of the great advantages of a corporation was the fact that they had combined together clever men in the shape of directors, officials, and foremen in a way which was quite impossible in the old days. They had now the opportunity of seeing for themselves the point of perfection to which cost and quality of manufacture could be brought, and of not only comparing one works with another, but also of applying a manufacturing tonic to each works, and all the works were thus brought to a level basis. In that way great corporations could manufacture at an enormously decreased cost compared with individual firms. Thus one of the great advantages of a corporate system was the extreme cheapness of manufacture. There were men in that room who would support him in saying that when they looked upon the costs of 20, 30, 40 years ago, it was perfectly marvellous what perfection could be obtained by a corporation, as the result of its combined capital, skill and resources.

London Section.

Meeting held at Burlington House on Monday, November 9th, 1908.

DR. J. LEWKOWITSCH IN THE CHAIR.

CELLULOSE AND CHEMICAL INDUSTRY.

BY C. F. CROSS AND E. J. BEVAN.

On many previous occasions we have engaged the attention of the Society upon some special point in the Chemistry of Cellulose. Our present task in response to the invitation of the Chairman of the section, is to address ourselves to the wider text under which this contribution appears. Such a review as we can give of the present position of Cellulose Industries in relation to Chemical Science is necessarily based upon familiar facts, but it may perhaps serve a useful purpose to set out these facts as a retrospect of progress, to appreciate which is to forecast in some measure the problems of the future.

This Society must have a particular interest in movements which are rapidly extending the domain of the chemist and the extensions which are being realised are much wider in their import than has perhaps been generally recognised even by chemists.

As a basis of our present enquiry, we may remind ourselves of the preponderating importance of the cellulose industries in the trade and commerce of the United Kingdom.

The few statistics we may introduce in illustration of the point involve figures so colossal that it requires an effort to fix their exact significance.

The staple raw material handled in our textile and paper-making industries, are for the most part imported, and we give figures from the Board of Trade Returns for 1907.

Approximate values in pounds sterling.

	£
Cotton	70,458,000
Flax	3,042,000
Hemp	4,238,000
Jute	8,165,000
Wood Pulp (cellulose)	2,400,000
Esparto	740,000

It is to be particularly noted that as these, our raw materials, are of foreign origin, our cellulose industries rest on an entirely exotic foundation.

The manufactured products from these raw materials are in large proportion sold in competitive markets and their selling prices represent the appreciated values by the work put upon them.

It would be difficult to fix average figures to represent this ratio of values. We may select a few typical instances in general illustration.

Thus in the case of cotton yarns we arrive at the following figures:—

Type of Cotton yarn, per lb.	Raw cotton cost		Labour, &c., cost
s. d.	s. d. s. d.		s. d. s. d.
2/150's 5 4	1 6 to 2 0	Sea Island	3 4 to 3 10
2/100's 2 10	0 10 to 1 6	Egyptian	1 4 to 2 0
1/100 1 10	0 8 to 1 0	,, combed	0 10 to 1 2
1/100 1 8	0 8 to 0 10	,, carded	0 10 to 1 0
1/60 1 1½	0 6 to 0 1	,, carded	0 6½ to 0 7½

In the case of flax yarns the figures for costs show very similar relations, raw material representing 40% of the costs of production, in relation to 60% made up of labour, steam, and general factory costs.

We are leaving out of consideration special or "fancy" products, but we may mention one or two instances to show to what limits costs of production and selling prices are carried in fine yarns—thus in cotton yarns:—cotton yarns are manufactured up to 600's, which represents 500,000 yards per 1 lb. For commercial purposes 420's is a usual limit. As regards value, the current selling price for the range 360's—400's is 60 shillings to 80 shillings per lb.

In flax yarns the finest count usually spun is "300 lea," of which a specimen is submitted. The bundle of this yarn, *i.e.* of 60,000 yards, weighs 10⅔ oz. and sells at 28s. These facts are not without their special significance, and they represent fundamental technical relations.

They may appear to be irrelevant to the subject, but only if we assume that there is an essential antagonism between science and balance sheets, and that science must detach itself from quantitative results when these take the form of money values.

The subject of cellulose involves the consideration of a wide range of such relations and values and we shall make no further apology for touching on economic questions as an essential aspect of the evolution of chemical industry in this field.

In the spinning and weaving industries, the chemist plays but little part and the appreciation of value expresses mechanical work performed in preparing and refining the raw material.

We can understand that the chemistry of cellulose does not interest the cotton manufacturer; his raw material is chemically inert, and is handled without any regard to its being a "chemical substance" with a definitive, if, for the present, problematical constitution, and with definitely ascertained properties and reactions.

In the case of flax and jute the position is somewhat different. These fibres represent compound celluloses, and their chemical activities come into play to some extent in the preparation of the fibres from the plant, and in the processes and treatments auxiliary to the spinning process proper.

As an illustration of chemical investigation in this field, we may instance a research which was recently entrusted to us by the Indian Government into the causes of what is known as "heart damage" of jute. It is a destruction of the fibre observed at the centre or "heart" of the bale as imported, and although not of frequent occurrence it is sufficiently momentous to occupy the attention of the trade and manufacturers on this side, and the Government Department which is concerned with the Agricultural Interests of India.

The results of our preliminary investigation have been published by the India Office, and an abstract appears in this Journal, (1908, p. 1129,) to which our readers are referred for details. We have to call attention to the following more general conclusions:—

In "heart damage" the fibre is reduced to a friable condition: there is a large conversion of the fibre substance into water soluble derivatives (10 to 15%) and a still larger proportion is soluble in dilute alkaline solutions (50%).

The lignocellulose is attacked as a whole, the cellulose and the lignone constituents in the complex being proportionately represented in the break down products. The evidence favours the conclusion that the disintegration, chemical as well as structural, is the result of the action of micro organisms under anaërobic conditions.

Whatever the actual external exciting cause it will be clear to chemists that the determining conditions are intrinsic and inherent in the labile constitution of these natural complexes, and further, that the extreme manifestations of these inherent tendencies is an index of progressive change to which the whole crop may be liable.

During the preparation of our paper we have received a communication from Mr. F. Barnes, chemist to Messrs. E. Lloyd, Ltd., Sittingbourne, giving an account of a similar destruction of "Mechanical Wood Pulp" packed and stored in 4 cwt. bales, and also of investigations which led to the conclusion on his part that the original cause was to be found in the attack of organisms under anaërobic conditions.

Mr. Barnes' experimental numbers show—

	Original sound pulp.	Disintegrated pulp, various specimens.	
Constituents soluble in water .	1·8	12·0	20·0
Furfural, per cent. of lignocellulose	4·45	3·1	2·1

We are further investigating this matter with Mr. Barnes, as a question not only of industrial moment, but of obviously collateral scientific interest. These are the only cases as yet disclosed of a progressive hydrolysis of lignocellulose tissues preserving the intermediate products in water-soluble form, which particularly facilitates the investigation of their relationship to the original lignocellulose.

There is the further inducement to the research chemist to enlist in the interests of a great industry, and if its representative leaders desire fundamental knowledge and control of its raw material, the chemist would receive material encouragement. But the manufacturer and the merchant usually prefer a very different view.

In this case the "trade" will hold that the only point involved is a destruction of value, affecting a fractional percentage of the crop, "that the causes are perfectly well known," and there is no need for further complicating a sufficiently complex industry by the introduction of the "scientific view" of the raw material.

We are old enough in industrial experience to be able to appreciate this attitude of manufacturers as well as the futility of criticising it.

The practical result is that the chemist in this as in other cases has to wait on a favourable conjunction of planetary influences.

Another opening for research work is in contributing to the perfection of methods of working the flax fibre. The retting operation to which the flax stem is subjected is a bio-chemical process, and the flax fibre ultimately separated is in this further sense a chemical product. Both the process, and the product in relation to the process, have been investigated from time to time, but not with that systematic persistency which is required to lay a really scientific foundation of technical progress in a great industry.

And again in the line spinning process, the prepared roving passes through a bath of water immediately before the drawing and spinning into yarn. Various chemical treatments have been successfully used in developing the drawing and spinning quality of the fibre.

It is evident that this is a province of useful investigation for the chemist: such investigations as have been recorded are, it must be admitted, of a by no means exhaustive character: and the subject of the composition of the fibre substance, its relation to spinning quality, is in itself attractive apart from the supposed stimulus of a utilitarian objective.

We as chemists generally accept the position of the "outer court" to which we have been relegated by convention, and from this outside point of view with its greater freedom, and probably less responsibility we can only endeavour to show cause for an enlarged sphere of influence; and this applies even to industries which are presumed to involve mechanical principles only.

On the other hand the operations of bleaching, dyeing, and printing are of course in the main chemical, and these industries are of considerable importance, as is evidenced by the large industrial capital involved in such dividend paying corporations as the Bleachers' Association [£6,800,000], the Calico Printers Association [£8,730,000], The Bradford Dyers Association [£5,100,000].

The papermaking industry offers some particularly interesting features in its later phases of evolution. The introduction of chemical wood pulp (cellulose) synchronizes with the birth of this Society. It is another instance of an exotic raw material—only a small fraction of the wood cellulose which we employ is produced in this country, and for this relatively small industry the raw material is imported wood. The bisulphite process, by which the greater proportion is manufactured, is one which may be described, if we read history backwards, as essentially scientific in conception, since it is based on a specific and selective attack of the non cellulose constituents of wood which are required to be eliminated.

In this respect it is in sharp contrast to the alkaline processes, which are highly complex in regard to the reactions involved, and of which very slender accounts can be given in terms of the soluble by-products. Both groups of processes are, however, actually conducted on an empirical basis.

The *soluble by-products* are in the main "waste products." Some progress is to be noted in their industrial utilisation based upon the colloidal characteristics of the sulphonated lignone complex. Its reactions with gelatin are analogous to those of the tannins and the product therefrom may be used in the sizing of papers, and as an auxiliary to the ordinary methods of tanning hides. But these applications are limited by certain undesirable characteristics of the products, and we must admit as chemists that an exhaustive study of the constitution of these products remains to be accomplished. The exact or more definite knowledge of these complex aggregates should divert them into very much more productive directions of utilisation.

The pulp or cellulose is dealt with on external characteristics of purity, bleaching quality, length of fibre etc. It does not appear to have suggested itself to the papermaker in definite terms that he may be neglecting or ignoring a basis of valuation depending upon the chemical structure or constitution of his cellulose.

We have been engaged in collecting evidence as to the interdependence of structure and chemical constitution in the case of the artificial cellulose fibres (Researches on Cellulose ii. 1905). The investigation of such relationships is more direct in the case of paper fabrics, and when established in definite terms, would lead to a revision of values of papermakers' raw materials.

Here is another invitation to the chemist. It is perhaps true that he will receive no encouragement from the manufacturers to enter into the arduous and prolonged research necessary to establish such a position in technical, and finally industrial terms. But it is not for us to make a grievance of this attitude of manufacturers. Perhaps it implies a want of provision on their part, and the consequent want of provision of means is an added difficulty to the chemist, and a postponement of achievement. But as we have the conviction that systematic work in such extensive fields can have no other than fruitful results, results moreover in proportion to industry, with a due proportion of unearned increment, it is perhaps for us to find the necessary ways and means.

These generalities are permissible in a review of this field of industrial activity, but more importance will be attached to a few typical examples by which these general conclusions may be confirmed.

As a study of appreciated values we may consider in outline the conversion of the fibrous celluloses into Lustra Cellulose or Artificial Silk.

It is regrettable that our language has not the equivalent of the German word " Veredlung." We want a short expression for ratio of value of raw material to that of manufactured products: what the Germans would call the " Veredlungs Index."

The index number in the case of the fibrous celluloses spun as such, is 3—5, the " artificial " product or chemically transformed cellulose represent a large multiple of this figure, say 30—50.

As is well known there are three well established chemical processes, and in the order of this idea the youngest of these, *viz.*, the Viscose process is first since it takes the lowest priced wood cellulose as its raw material; the older processes, *viz.*, the nitro-cellulose, and cupro-ammonium processes, are transformations of original cotton cellulose into a similar structureless thread.

It is a matter of interest incidentally to note the growth of this industry. The present gross production is estimated at 5000 tons per annum, which is about 1/10th of the total estimated consumption of " natural " silk.

It appears that this production, Continental and English, is absorbed without any serious competition with silk. It may be noted however that progressive improvement of method and competition amongst the producers of artificial silks has had the effect of reducing the selling price of natural silk from 30—40 francs per kilo., which obtained for a long period, to the present price of 17—20 francs per kilo.

We are only incidentally concerned with this aspect of the industry. A more important enquiry for us as technologists, is into the actual factors of the structural qualities of the " celluloses " in their derivative amorphous forms, an enquiry which opens out a number of problems of far reaching import.

The comparison with silk is direct and simple since both represent amorphous colloidal matter or substance.

The artificial silks may be taken as showing the following range of textile quality.

	Gramme.
Breaking strain or tenacity per unit denier ...	1·0—1·4
Extensibility under breaking strain	13%—17%
True elasticity	4%— 5%

The corresponding averages for the true silks (in the boiled-off state) are :—

Breaking strain or tenacity per denier	2·0—2·5
Extensibility under breaking strain	15%—25%
True elasticity	4%— 5%

Strehlenert has established the following relationships which are important (Chem.-Zeit., 1901, p. 1100).

The breaking strengths are expressed in terms of kilogrammes per square millimetre of section, which is a satisfactory basis of comparison in view of the close structural similarity of the products investigated :

		Dry.	Wet.
" Natural silk."	China raw silk	53·2	46·7
	French „ „	50·4	40·9
	„ boiled off	25·5	13·6
	„ dyed red, weighted	20·0	15·6
	„ blue black at 110 per cent..	12·1	8·0
	„ „ „ 140 per cent..	7·9	6·3
	„ „ „ 500 per cent..	2·2	—
" Artificial silks." Lustra celluloses	Chardonnet } Nitrate process	14·7	1·7
	Lehner } Nitrate process	17·1	4·3
	Glanzstoff, cuprammonium process .	19·1	3·2
	Viscose, xanthate process	21·5	5·3

The lustra celluloses are thus inferior in tenacity to the silks, but when these are " weighted " there is a loss of strength beyond that which would be directly proportional to the degree of " dilution " of the silk substance.

As the weighting of silks is very largely practised it will be seen that the lustra celluloses are quite on the average level of textile quality, even in this higher sphere.

In regard to elasticity and extensibility which are important correlative measures of textile quality a similar series of relations obtains.

The lustra celluloses on the other hand have a special relationship to water, the colloidal cellulose having a considerable hydration capacity. In actual practice this fact is not of such moment as to impede the very rapid progress of the industry in these new textiles.

That this property or relationship of the cellulose is modifiable appears to be a reasonable deduction from the general reactivity of cellulose. It has been presumed by investigators that the cellulose (hydrate) is susceptible of modification, either by intrinsic or constitutional change, or by reaction to form a new derivative, in such a way as to yield a product more nearly resembling the normal cotton cellulose in resistance to hydration. At this date there is only one method which has been made known for effecting this change, which consists in effecting a reaction with formaldehyde.

The process and its products are described in detail in a paper in the Moniteur Scientifique, 1908, 13—18, (" Etat Actuel de l'Industrie de la Soie Artificielle," F. Beltzer), under the descriptive name " Sthénosage " and " Soie Sthénose " respectively.

The lustra cellulose is treated with an aqueous solution of formaldehyde (6% CH_2O) containing also sulphate of alumina and lactic acid, centrifuged, and dried in a chamber at 30—40° C., the desiccation being aided by the presence of sulphuric acid. When dry it is heated for some hours at 50—60° C.

The effect of this treatment on the physical properties of the lustra celluloses is set out in the following comparative table of figures, which we have recalculated into mean or average numbers.

	Breaking strain grms. per unit denier.		Elasticity elongation per cent.	
	Air dry condition	Wetted.	Air dry	Wetted.
For the lustra celluloses of the three processes, nitro-cellulose, cupro-ammonium, viscose..........	1·25	0·37	12·2	9·0
Sthénose products	1·6	1·1	7·8	7·6

These figures, which are those of the inventor of this process Eschalier, and his collaborators, have been generally verified.

In regard to the proportion of methylene oxide fixed in combination, our own analyses of Sthénose silk, have given numbers between 0·35% and 0·8% CH_2O, which expressed in molecular ratio, $CH_2O : C_6H_{10}O_5$, is approximately 1 : 30. This indicates a curiously disproportionate effect. It might be assumed in explanation that the fractional proportion of molecules or groups actually reacting are in the free or uncombined state capable of influencing the hydration capacity of the complex or aggregate, or as an alternative the suggestion is that a constitutional change in the cellulose itself accompanies the fixation of the H_2CO groups, and this suggestion is of moment as it indicates a capacity of internal structural modification which offers an attractive field for research.

Another point to be noted is that the reaction considerably modifies the dyeing capacity of the lustra-cellulose.

Their relative avidity for colouring matters is a defect, not perhaps in itself, but because it is associated with irregularity, and this want of uniformity is a certain limitation of usefulness. It is not however asserted that the Sthénose process in lowering the dyeing capacity of the cellulose does this uniformly, that is in such a way as to correct its inherent deficiency in this respect.

Lastly, on the important industrial question: it is claimed that the cost of treatment does not exceed 0·50 fr. per kilo., or say 2½d. per lb.

This matter is not yet sufficiently developed for us to form a definite estimate of its industrial importance, but as a technical and scientific fact it is established, that the "artificial" celluloses are capable of modification to a still closer approximation to the range of natural silks.

We set out, however, with the enquiry which arises in comparison with the staple cellulose industries, such as cotton or flax, to what extent are the "chemical yarns" destined to compete with and substitute the ordinary "mechanical" or spun yarns.

Without attempting a direct answer to this question, we will endeavour by a sketch of the essential technical factors of this less obvious competition, to forecast its possibilities.

I. *Structural Qualities.*—The textile characters of yarns are determined in large part by (*a*) tenacity measured in terms of weight or strain required to rupture; and (*b*) extensibility, or elongation under breaking strain.

We have already introduced numerical expressions of these qualities in comparing various types of lustra cellulose and silk yarns. In extending comparisons to the heterogeneous group of fabrics of which cellulose is the basis, and which of course includes papers, we have to be satisfied with a comprehensive expression for strength or tenacity, seeing that the factors for strength are essentially different in various types of fabrics.

Thus in "mechanical" textile yarns, the twist plays a very important part: in papers the fibres and fibrous *débris* are brought together without twist, and the structure owes its cohesion mainly to the adhesion of these fibrous elements, with the added effects of colloidal sizing agent.

In both tissues the fabrics are composed of units which are not continuous solids, and they are put together so as to further include interspaces which are air-filled.

The breaking of such irregular solids is a complex phenomenon, and the determination of breaking strain leads to an integral expression of technical rather than scientific value.

In the comprehensive form of "breaking length" we have the breaking strain reduced to a co-efficient expression in which sectional dimensions are eliminated and also mass or specific gravity are involved.

It is outside the scope of this paper to discuss such points at length. They are familiar terms to specialists, and we merely remind chemists who have not considered matter from the structural point of view, that cellulose cannot be studied apart from these problems, which involve special methods and terminology.

The following table of relations which we have so far explained, will have the advantage of bringing together in a perspective view, a number of groups of effects to which the specialising tendency of industry assigns separate investigation and treatment in our technological institutions:

Averages of structural properties of cellulose textiles and other fabrics.

	Breaking length (metres).	Elongation percentage under breaking strain.
Cotton yarns	13,000—14,000	4—6
Flax line yarns	12,000—20,000	1·5—3
Lustra cellulose (artificial silk)	11,000—12,000	10—15
†Wood pulp yarns	5,500—7,000	6—7
Papers { Normal standard classification of German testing department	6,000—1,000	4·5—1·5

† E. Pfuhl. "Papierstoffgarne." (1904).

External qualities.—Cellulose fabrics present an extraordinarily wide range of secondary qualities which are factors of utility, and therefore value. Such are density and apparent density, lustre with the qualifications of translucency to opacity, dyeing capacity, and resistance to water and atmosphere.

These qualities are all expressible more or less in terms of numbers, and can be made subjects of exact investigation. From the present point of view we have to take note of the general characteristics of the lustra-celluloses under this heading.

In regard to *density*, *i.e.* actual density of fibre substance, the entire range of the vegetable fibrous raw materials of industry fall within the narrow limits 1·48—1·52.

The number 1·500 can be taken for the specific gravity of solid cellulose (air dry). Since the lustra celluloses are for the most part continuous solids, this density is not only actual for the substance but coincides approximately with the "apparent" density of the yarn.

This density contrasts unfavourably with that of silk. We note here that the number 1·33 represents the actual and for similar reasons the approximate apparent density of silk, and it is also to be noted that with all the fibres presenting minute structure, the apparent density of the manufactured products represents a much lower scale of values and these of course are factors of relative utility.

In the next place, the exceptional *lustre* of the structureless celluloses is a considerable factor of their value.

They also have a high dyeing capacity with relative fastness of colours. On the other hand again, the diminution of strength on wetting is a defect.

We close this section by noting that all these qualities are capable of variation, more or less, that is within limits which it is a function of the research chemist to determine.

We now come to the more important question of cost of production. The lustra celluloses are at present mainly produced within a range of from 100 to 150 deniers. If we compare these with cotton yarns at 35's to 55's, the flax yarns 150's to 100's, we shall find that the selling prices indicate a somewhat similar range of industrial costs.

In the case of ordinary textile yarns, with increased fineness, the costs of production mount at a rate disproportionately rapid, and for two reasons.

To produce fine counts of yarn from cotton or flax, a raw material of high quality is required, and this is proportionately dearer. As against this it is obvious that in the case of artificial fibres, the cost of raw material is constant.

Further—in the sliver and roving stages of the ordinary textiles, costs of production mount in direct proportion to handling and waste produced. But, in artificial yarns the increased cost of the final product is limited to the factor of reduced production per spinning unit.

There are obviously two ways of producing the necessary range of variations of fineness or weight-length in the case of these artificial silks, viz., by varying (*a*) the dimensions and (*b*) the number of the constituent unit threads. The general limit of fineness of this unit is represented by a thread of from 6 to 8 say 7 deniers, which means that the skein length of 450 metres weighs 7×0·05 grammes, or about 0·8 milligramme per metre.

The actual textile unit or the commercial yarn is an assemblage of these units, and for the more usual applications, these are twisted loosely together, that is to say, with 100 to 200 turns per metre.

The order of progressive refinement has been in the direction of lowering the number of unit threads, and this has so far satisfied the increasing demands of users, but it is obvious that the limit is by no means reached.

Several of the systems of spinning claim to produce ultimate threads of much greater fineness, in fact to draw threads of the dimensions of the silks proper, and it is known that a large margin remains available to meet further requirements. From these technical facts we may forecast a considerable further expansion of the industry.

A number of variations in other respects are being brought into play, such as are produced by doubling or manifolding the unit threads in the usual twisting operation.

Such effects are of course of no further interest to us than as evidence that a continued expansion of the industry is taking place, and also that the consumption of the product is not a matter of fashion or of demand more or less capricious.

Our present point of view however is outside these details. We have sought to establish the general position that as regards the important element of costs of production, the "artificial" silks or lustra celluloses are already within the range of the "mechanical" yarns produced by working up the natural of fibrous cellulose.

Without drawing any conclusions as to the future which would be premature, it is important that technologists should recognise this new element in their calculations. We may point out that the date of the first invasion by the chemists of the province of fundamental industry is the year 1883. From what has been accomplished in a generation we might be justified in sanguine expectations of the probable extension of this as a chemical industry. But we have no concern with vague predictions and we have rather endeavoured to indicate the fundamental technical facts which constitute a new industrial perspective.

It remains to describe briefly another group of processes by which the chemist has also enlarged and changed this perspective.

The modification of cellulose known as mercerisation is at this date familiar to chemists in all its bearings, and we have only to note the remarkable development of the industry which took place in the period 1891 to 1900 ("Mercerisation," Haywood and Co., 1903). A good deal of this expansion was certainly attributable to the capricious influences of fancy or fashion, but exaggerated effects of this order have long since been eliminated, and it is satisfactory to note that on its permanent industrial basis, mercerisation is an important development of textile chemical industry, the volume of which may be judged in terms of an estimate of the caustic soda which is consumed, which a well-informed friend of ours has given us as 5000 tons per annum. The process chiefly rests upon its lustre effects due to the structural modification of the cotton fibre which it determines.

The associated modification of physical and chemical properties of the cellulose though of secondary technical importance are of moment in their bearings on the main subject of this communication.

Cotton yarns under mercerisation show a considerable increase of tenacity from 40 to 100% according to the nature and quality of the yarn used, and the circumstances of treatment.

But owing to the complexity of the phenomena involved, we cannot make any calculations from such observations on the twisted fibre aggregates, as to the actual physical changes of the ultimate fibre. From a critical examination of the evidence, and allowing full weight to the observations and deductions of Pope and Hübner (this Journal, 1904, 23) it appears that the increased strength observed is an effect of augmented cohesion of the component fibres, an indirect result of the chemical and constitutional changes of the cellulose. In confirmation, we may cite the experiments of O'Neill (*loc. cit.*) on ultimate cotton fibres, in which the following relations were established:—The mean lengths measured before and after mercerisation showed a contraction of 15%, the increase of tenacity was 12%. It is probable therefore that the structural qualities of cellulose as a colloidal substance are but little affected by mercerisation.

Of the chemical changes resulting from the reactions there have been a number of investigations, Pope and Hübner (*loc. cit.*) Vieweg. (Berl. Ber. 1907) Knecht. (J. Soc. Dyers Col. 1907).

Beyond confirming observations of Mercer as to the hydration of the cellulose it is established that here is a progressive change, probably resulting from interior hydrolytic reactions, which is particularly revealed in reactions of the alkali cellulose with carbon bisulphide: and there is a marked development of acidic character of the reacting groups.

This is demonstrated by the behaviour of the mercerised products towards alkaline solutions, as also by their relations to dye stuffs of known constitution.

A further proof is afforded by an observation of our own, previously unpublished, that the mercerised cellulose does not react with a nitrating mixture composed of nitric acid, acetic anhydride, and acetic acid.

It will be evident to students who critically follow these researches that much more remains to be investigated by way of these characteristic reactions of mercerisation.

In the converse direction of chemical change, the ester reactions and derivations of cellulose are the starting point and basis of important industries which are being progressively extended.

Both from the scientific and industrial side, problems of great moment are continually opening out. We are mainly concerned with the structural properties or qualities of the ester derivatives of cellulose in relation to those of the original cellulose.

In the case of the nitrates these reactions have been carefully investigated. The observations of Bronnert (Rev. Gen. Mat. Col., 1900) have shown that by conversion into nitrate under normal conditions there is very little change in the structural properties of the cellulose.

We may conclude from these observations, that the OH groups of cellulose are not primarily concerned in those constitutional features which underlie the qualities in question.

We are able to furnish confirmatory evidence from our investigations of a series of acetates, or acetic esters of cellulose (Cross & Briggs, J. Soc. Dyers & Colorists, 1907) which are produced without structural changes in the cellulose such as mark the initial stages of acetylating processes previously known.

In the latter processes the reaction between the non-cellulose OH groups and acetic anhydride is determined by sulphuric acid (Lederer) or other acid catalysts.

Taking a saline catalyst such as zinc chloride, a very different course of reaction is determined. As stated there are no structural changes in the earlier stages and a complete conversion of cotton yarn into monoacetate may be effected with a gain of weight of 28% and conservation of the textile qualities of the yarn in all respects.

This mono-acetylated cellulose has certain properties which indicate industrial utility. It resists direct dyes, has a much lower hygrometric equivalent than cellulose (2—3% moisture) and is also differentiated from cellulose in regard to insulating and dielectric properties. An important industrial feature of the process of acetylation is the effective utilisation of the acetic anhydride in the reaction, the proportion combining amounting to 80% of the quantity employed in the reaction mixture.

In the higher grades of acetylation up to the tri-acetate the reaction maintains its characteristics of progressive attack, there are no sudden transitions from the lower to the higher stages such as are observed with the powerful acid catalysts. The reaction is in fact perfectly controlled by duly varying the more important factors, which are—

(*a*) Proportion of zinc chloride.
(*b*) Proportion of acetic anhydride.
(*c*) Proportion of reaction mixture to cellulose.
(*d*) Temperature.
(*e*) Time.

These have all been investigated and the results will be dealt with in detail in a forthcoming communication.

The reaction itself, and the textile products which result are illustrated by the specimens submitted. The particular points which they emphasise are that a very large molecular proportion of negative groups can be added to the cellulose aggregate without causing any change in structural properties, and again that the OH groups are not directly concerned in the structural characteristics of cellulose.

Of course the properties which are essential to its useful functions are those which are bound up with its colloidal character.

It would be a mere speculation as to whether the actual configuration of the unit groups is the essential or dominant factor, or whether these qualities are independently attributable to the colloidal state as represented by the cellulose aggregate.

These considerations we have emphasised in a recent publication (Researches on Cellulose, II., 1905) and we look to further progress in the direction of colloidal chemistry as a necessary preliminary to the further resolution of these problems.

Lastly, we may mention a projected industrial application of cellulose, of which, however, it must be said we have never seen the prospective industrial basis, and that is the conversion of cellulose into sugar by acid hydrolysis, and fermentation to alcohol (E. Simonsen, Z. angew. Chem., 1898, 3).

This matter has been carefully treated in a recent publication (Körner, *ibid.*, 1908), and the author's quantitative results and deductions confirm the unfavourable estimate of the industrial potentialities of the several schemes.

But this matter is a side-issue of the fundamental scientific problems of the exhaustive hydrolysis which, systematically worked, should contribute a very important and in fact essential basis to a more intimate knowledge of the actual constitution of cellulose.

We note that in all studies of hydrolytic resolution of cellulose there is nothing comparable to the exhaustive quantitative resolutions which have been carried out in the case of starch.

It by no means follows that when hydrolysed to ultimate units all the celluloses are finally resolved into normal hexoses or pentoses.

To carry out this scheme of resolution requires only the application of well known methods, but an exhaustive, in the sense of quantitative account of the typical celluloses in terms of the sugars, or perhaps other groups into which they can be ultimately resolved, is a very much-needed contribution to the science of the subject.

This is not the occasion for a detailed discussion of these matters. Our point of view is rather that of an impressionist delineator. We desire to communicate to others our general impression that the subject of cellulose teems with well defined problems of research. On its industrial side it is in a condition of active growth and expansion, especially in those directions which chemical research has opened out. What has been accomplished is only to be taken as an index of the much greater and more attractive possibilities in front of us, some of which we have endeavoured to forecast.

Discussion.

The Chairman said that the authors had shown what a great industry this was—he believed the third in importance in this country, taking agriculture as the first. He hoped they would be told in the reply to the discussion more about the raw material, which was becoming increasingly difficult to obtain, so that grasses had to be imported from Algeria and other countries. He would be glad to know how far the experiments had gone with regard to making use of the fibre of maize and other hitherto unused plants.

Some further details with regard to mercerising would no doubt be welcome, as this process had now come to the fore and especially so in consequence of the combination of mercerised with non-mercerised material, which allowed to produce special effects in the finished goods. They had heard of the large amounts of caustic soda used in this industry, and it might be interesting to Mr. Cross to learn that in some works the caustic soda was either given or thrown away. That was still the case some twelve years ago, within his (the speaker's) own experience, and it was only some time after that it dawned upon the makers that the used caustic lye had a value.

He should also have liked to hear more about the artificial silk industry and those acetylcelluloses which will probably revolutionise the industry by replacing celluloid films for cinematographs, and celluloid goods generally, and about the changes which cellulose underwent when subjected to chemical agencies, with the production of such substances as sugar, alcohol, etc. One of the great applications of cellulose, *viz.*, in the explosives industry, had not been touched upon by the authors, as that subject would be dealt with in a later paper by Sir Frederic Nathan.

Mr. W. F. Reid said Mr. Cross' work on the deterioration of the inside of bales opened up a question of great importance to agriculture, to the cotton trade, and to many other industries. He would ask him if he had ever found that heating had taken place in these bales to the extent of carbonisation or firing. He had little doubt that up to a certain point that heating was due to bacteria or some organisms, but they knew that those organisms could scarcely exist at a temperature of 100° C., and if it got to 120° C. they must die; but between that and the ignition point there was a very wide range of temperatures, and as far as he knew there was no theory to account for the bridging over that space in temperature. The only suggestion he had heard was that it was due to oxidation; but as a matter of fact he had found that the gases at that stage were deficient in oxygen, probably from the previous bacterial action. He thought the clearing up of this point was of great importance. With regard to the structure of the fibres made by these new processes, there were many cases in which it was extremely important that the fibre should be regular throughout. For instance, a new industry that was springing up, that of aerial navigation, was closely associated with cellulose, and it was always found that a balloon made of cotton fabric, however it might be varnished, would not hold the gas. The reason appeared to be that the cotton fibre was a capillary tube through which the gas escaped. The silk fibre was solid, and with it it was much easier to get a gas-tight fabric; in fact, the best balloons were constructed of silk.

With regard to the new acetylated products which were shown, it occurred to him that they might be the beginning of a larger industry even than that of silk made from nitrated cellulose. Owing to the denitration that was necessary when nitrocellulose was the raw material, such artificial silks were necessarily deficient in strength.

Mr. B. Blount said he had had the opportunity of examining specimens of copper wire covered with acetylcellulose which was required for winding some special electrical apparatus, and it had a very high resistance, and he believed its inductive capacity was satisfactory. There was, however, a little mechanical trouble, inasmuch as the material chipped and broke away readily, but perhaps that had been overcome.

Mr. Grant Hooper said it would be interesting to know the relative costs and strength of artificial silks of the three kinds which had been referred to. The author might possibly also tell them something of the cost of the acetylated product, for obviously the commercial application of these several products must be largely dependent on the cost.

Mr. W. P. Dreaper said there was one point not mentioned in the paper which was important to English chemists and manufacturers. The total production of artificial silk was equivalent to about 5000 tons, but the authors had not told them that of this amount at least 4600 tons were manufactured on the Continent. One firm alone estimated its output for next year at one million kilos.

With regard to the figures as to the relative strength of silk fibre when weighted, and in its natural state, he thought the authors had over-estimated the average loss of strength. In the case of silk weighted 140 per cent. a reduction from 52 to 7·9 was shown; but he (Mr. Dreaper) thought that under those conditions it would be impossible to weave such a material, and they knew that silks weighted up to this amount were woven with almost equal facility to the unweighted material. It had been stated that the average-sized artificial filament was 6 to 7 deniers, the size of the natural material being about 2·7—3 deniers. The authors also mentioned that progress was being made in obtaining finer filaments, and it might be interesting to the meeting to know that Dr. Thiele had produced on the experimental scale filaments one-tenth of the size of those of natural silk.

Mr. A. R. Ling said that the authors, in their report to the Indian Government, had ascribed the so-called heart-damage to the action of bacteria. Might it not be due to enzyme action? Arguing from analogy in the case of the grain industry, it was well known that the heating tendency of barley, for example, was associated with a large percentage of nitrogen. The heating test was commonly in use in Germany, where it was applied to grain, potatoes and other vegetables. The heating had been proved to be due to enzyme action, and barley, for instance, which showed a large rise of temperature, generally speaking was found to yield an unsatisfactory malt, and such barley was known to be rich in nitrogen and in enzyme-forming capacity. He would like to know whether the authors had found the cotton which showed heart-damage to contain nitrogen.

Mr. J. F. Briggs said there was one thing Mr. Cross might have included in his suggestions of lines of research, and that was the investigation of the artificial forms of cellulose from the ultra-microscopic point of view. Many questions relating to the mechanical and certainly to the dyeing properties of these threads might be solved by an investigation of the minute structure, which under the ordinary microscope seemed to be non-existent.

Dr. E. Feilmann said that with regard to "heart action" in jute it seemed to him that there was a difficulty about the "enzyme action" explanation, because if the heating went on up to the temperature of incandescence it was difficult to see how the enzymes, as ordinarily understood, could go on acting up to anywhere near that temperature. If enzyme action took place at all, it must stop long before the final stage was reached.

Mr. J. Zdanowicz said there was a large field for mercerised cotton in its application to incandescence mantles. He would suggest that a combination of mercerised and acetylated cellulose might be found very useful.

A speaker remarked that the fermentation of cellulose had been described in one or two papers, and the organisms which caused this fermentation had been described and isolated. The heating which took place when cotton was enclosed and compressed could hardly be due to bacteria, but was probably due to oil, for it was nearly always found where combustion occurred on board ship the cotton contained a large percentage of oil, and it was known that this oil in contact with cotton occasioned oxidation and heating.

Mr. Cross, in reply, said that the Chairman in one of his questions invited further discussion of the production of alcohol (and sugar) from cellulose. While the industrial outlook for such processes might be doubtful, they involved a matter of fundamental scientific importance. It was always assumed that cellulose was ultimately hydrolysed to simple sugars, hexoses or pentoses. But the experimental basis of this assumption was incomplete and unsatisfactory; there was urgently needed a quantitative and exhaustive hydrolysis of cellulose, comparable with such investigations as had given us an exact knowledge of starch. On this matter Mr. Briggs, who collaborated with them, had prepared a note for communication to the Society, which would be useful to any chemist who might be attracted to contribute the much-needed investigation. He noted that Prof. Schwalbe in a recent address on a similar theme (Z. angew. Chem., Nov., 1908) had put on record similar conclusions.

With regard to explosives they had purposely left them out of consideration, as also celluloid, because these matters were industrially highly specialised, and they did not pretend to any inside knowledge. There would be occasion for a special memoir, which they commended to Mr. Mosenthal for consideration.

Several speakers, following Mr. Reid's suggestive observations, had raised critical issues of the problem, which he was glad to see had awakened interest, of the "heart-damage" of jute. It was in effect a far-reaching question; they preferred not to theorise about it at the moment, but to confine themselves to what had been experimentally established. Whether bacterial or enzyme action was involved was a question they had had under consideration, and also in relation to the exothermic changes of equilibrium which had been observed in many of the reactions of the lignocelluloses. Rise of temperature due to oxidation would be excluded by the close packing of the bales.

Some speakers wished to "draw" them on certain critical questions which they had been anxious to avoid, notably on the production of artificial silks and costs under the competing systems. The particular facts were known to those directly concerned; they had dealt with the matter on broad and general lines and were anxious not to raise prejudice. They had not specially mentioned "viscose silk" or the other "viscose" industries.

With regard to Mr. Blount's inquiry: the soluble cellulose acetates were used in covering wires for electrical applications; the lower acetates gave promise of similar useful applications.

The subject teemed with attractive problems, and they again commended it more particularly to the younger members of the Society.

Mr. Thomas Tyrer asked why only 200 out of the 5000 tons of artificial silk—mentioned by a previous speaker—were manufactured in this country. It would be remembered that in the report of the Departmental Committee on Industrial Alcohol, it was stated that neither the price nor restrictions on alcohol had so much to do with the limited progress of industries as the want of enterprise of capitalists and the education of chemists. Was this disproportion of home manufacturers due to either of these causes?

Mr. Cross said in his view there was no general want of industrial enterprise; one could always get a particular combination of people in this country for the carrying out of any new industry. The artificial silk manufacture was a flourishing industry in competent hands, and the production was already considerably beyond the figure mentioned by Mr. Tyrer.

AGRICULTURE IN RELATION TO CHEMICAL INDUSTRY.

BY PROF. A. FRANK.

(This J., Nov. 30, 1908, pp. 1093—1100.)

Errata.

P. 1094, col. 2, line 26 from bottom, *for* "somewhat" *read* "further."

P. 1096, col. 1, line 10, *for* "19,000 tons," *read* "190,000 tons."

Yorkshire Section.

Meeting held at Leeds on November 9th, 1908.

PROF. W. M. GARDNER IN THE CHAIR.

THE TANNAGE OF SOLE LEATHER WITH MIMOSA BARK.

BY HUGH GARNER BENNETT, M.SC.

(Contribution from the Leather Industries Department of the University of Leeds.)

The advances in the knowledge of tanning which have been made in the last decade, have indicated what is the most appropriate use of many of the chief vegetable tanning materials, and laboratory experiments have shown what are the most economical methods for their employment. Indeed, it may now be safely said that the knowledge of the effect of the commoner vegetable tanning materials on the colour, weight, and general quality of sole leather made from them, is one of the greatest advantages of the British sole leather tanner over his foreign competitor. That further knowledge is desired on these questions has often been evident to the writer, by the receipt of inquiries as to the nature of the leathers produced by certain vegetable tanning materials if used alone, it being rightly thought that this knowledge will give the best guidance as to the most suitable manner of blending with other materials. The experiments here recorded were carried out by the use of mimosa bark alone, and it is hoped that the results given may be of use in this way.

It is now well recognised that the golden rule for all vegetable tannages is to start the tannage in weak infusions and afterwards to move the goods through liquors whose strength in tannin is gradually increased. The rate of increase in tanning strength must, in all cases, be sufficient to maintain an appreciable rate of penetration, for in sole leather tanning, the use of mechanical means for assisting penetration is not allowable. If, however, the rate of increase in the strength of the liquors is too great, harsh or drawn grain results, and hence it is exceedingly important to know the extent to which it is possible to quicken penetration by rapidly increasing the strength of the liquors, without producing drawn grain. This differs for every vegetable tanning material. With the so-called "astringent" tannins (*e.g.*, quebracho), the rate of increase in the strength of the liquors must be slow, and the infusions used in the early stages of comparatively small strength, whereas with the so-called "mellow" tannins (*e.g.*, gambier), distinctly stronger infusions may be used, of which the rate of increase in strength may also be greater. Hence, in the ordinary mixed tannage of sole leather, the mellow tannins are employed in the early stages and the more astringent tannins in the later stages, which method is accomplished in practice by the system of working the liquors "down the yard."

As the tannin of mimosa bark is known to belong to the class of astringent tannins, it was thought worth while to carry out some experiments on a small scale, with the object of finding some method by which the tannins might be artificially "mellowed," so that stronger infusions might be used with impunity and a quick penetration obtained. It has been pointed out by Procter that the presence of neutral salts in tan liquors is one of the important factors in producing mellowness, and it is now well-known that a preliminary mineral tannage materially assists the rate at which goods may be penetrated by the vegetable tannins, hence the experiments recorded below were made to investigate the effect of adding various mineral salts to tan liquor made entirely from mimosa bark. Small pieces of pelt from an ox-hide belly, measuring about 9 inches in length by 4 inches in width, were employed for this purpose, and were immersed in the tan liquors without any deliming other than a very short washing in water. These were tanned in porcelain pits of about 8 litres capacity, and in each pit the strength of the liquor was the same, and increased at the same rate. This was accomplished by pipetting into each pit, day by day, equal volumes of strong mimosa liquor. In each pit were placed 8 litres of $N/20$ acetic acid, and in this was dissolved the salt whose influence was being investigated. The barkometer strengths of each were then taken and increased 3° by the addition of the strong stock solution. The acidity of these liquors was then determined by Procter's lime water method, and the tannage commenced by inserting the goods. The tannage lasted altogether about two months; one month in "suspenders," increasing the strength of the liquors 1° Bkr. per day up to about 30° Bkr., and one month in "handlers," increasing the strength of the liquors 3° Bkr. every few days until a final strength of about 60° Bkr. was obtained. The pieces were then lightly oiled with cod oil, dried out, and finished. One experiment was carried out without the addition of any salts for the sake of comparison.

Salt employed.	Amount of salt in liquor per cent.	Strength in acetic acid.	No. of c.c. lime water required by 10 c.c. liquor.	Bkr. strength at start.
—	—	$N/20$	11·4	4°
Sodium acetate .	3	,,	11·7	13°
Calcium acetate .	3	,,	9·9	20°
Magnesium sulphate	3	,,	10·7	19°
Sodium sulphite .	3	,,	12·1	16½°
,, ,,	½	,,	11·2	6°
Potash alum	½	,,	3·5	5½°
Chrome alum	½	,,	12·2	6°
Sodium sulphite .	½	$N/10$	21·4	5½°
Magnesium sulphate	½	,,	22·2	6½°
Potash alum	½	,,	5·7	5½°

In all cases, the presence of salts caused a very distinct increase in the rate at which the pelt was struck through, a few days sufficing for all pieces except in that pit where no salts had been added. In all cases, also, when salts were employed, the pelt, after being just struck through, was extremely soft, the tannage being obviously unsuitable for sole leather. Where no salt was employed, however, the result was much firmer, and quite promising for sole leather goods. Each of the salts had also its effect upon the colour of the goods. The acetates of calcium and sodium gave a distinctly darker tinge than when no salt was used, and the chrome alum also gave a darker colour on account of the chrome absorbed. By the use of magnesium sulphate, potash alum, and sodium sulphite, however, some improvement in colour was obtained, especially in the case of the sulphite, which produced a much lighter coloured result in the early stages, but which, on the other hand, also yielded by far the softest result. When less sulphite was employed the effect both in lightening the colour and softening the goods was distinctly less. It was found, further, that the softness caused by the use of these salts could be partly eliminated by using handler liquors which contained none of the salt, but when this was done the colour of the goods rapidly became the same. In order, therefore, that the effect in improving the colour should be at a maximum, it is necessary that the salts should be in the liquors throughout the whole process. Another series of experiments was carried out in precisely the same way as described above, but with $N/_{10}$ acetic acid instead of $N/_{20}$, with the object of discovering whether the softness resulting from the use of sodium sulphite, &c., could be prevented by the use of more acid. In this series, 0·5 per cent. of sulphite, potash alum, and magnesium sulphate were used (see table above), and it was found that, in spite of the great increase in acidity, the difficulty was only partially overcome. Furthermore, in all cases the difference in colour became less as the tannage proceeded and in the finished goods was scarcely appreciable.

From these considerations, it is clear that the employment of these salts for improving the colour of mimosa tannages is of little practical value, and that their employment for "mellowing" the tannin, and assisting in a rapid tannage should also be marked by considerable caution, on account of their liability to give a soft result. The use of a very small amount of sodium sulphite to mellow a fresh mimosa liquor, into which green goods are to be placed, is perhaps the only opportunity where it would be wise to utilise these salts in the case of a sole leather tannage.

The results of the determination of the acidity of these liquors before use is also somewhat instructive as showing the effect of these salts on results obtained by Procter's lime water method. As saturated lime water is slightly weaker than $N/_{20}$, it was to be expected that rather more than 10 c.c. would be required to give a permanent turbidity with 10 c.c. of the liquor, and although this is usually the case, a curious anomaly occurs in the presence of potash alum, in which case a turbidity is obtained long before the acid present is neutralised. It has recently been shown (Collegium, 1908, 357) that tannin in the presence of sodium sulphate is an extremely sensitive reagent for the determination of aluminium salts, by the formation of a colloidal precipitate, and it may be that the turbidity here obtained is due to the precipitation of a similar compound.

The strong mimosa liquor used for strengthening the tanning liquors in the above experiments was obtained by leaching the mimosa bark in a battery of experimental leaches, consisting of six cylindrical copper vessels fitted together on the press leach system. The bark used was ordinary Natal bark, which, on analysis, gave the following results :—Tannin, 37·0 per cent. ; soluble non-tannins, 9·5 per cent. ; insoluble, 42·1 per cent. ; water, 11·4 per cent. Each leach vessel was filled with bark, and hot water was poured on to the first of the series from time to time, to press the liquor forward into the other leaches, which were filled at the rate of one per day. When all were full, the barkometer strengths of the liquors in each were taken, and found to be as follows :—

(1)	(2)	(3)	(4)	(5)	(6)
0°	2°	2°	7°	18°	50°

This shows how very rapidly the bark yields up its tannin to water, and hence permits the preparation of exceedingly strong liquors by leaching only. It was found that by continuing to press round over fresh material, it was possible to obtain with comparative ease liquors varying between 130° and 170° Bkr., and liquors obtained in this way were employed in the experiments recorded above. This point is of obvious practical importance, both to manufacturers of mimosa bark extract and to tanners who employ any considerable proportion of the bark. In spite of the apparent ease with which the material " spends " in leaching, however, it is an extremely curious fact of considerable economical significance, that the apparently spent bark still contains appreciable quantities of tannin, which can only be leached out with some difficulty. This is well illustrated in the spent tan from the hot water leach (vessel (1)), in the experiment recorded above, which would appear to be completely exhausted when judged by the strengths of the three weakest liquors, but which, on analysis, yielded the following results :—

	Analysis of spent tan.	Stated on original material.
	per cent.	per cent.
Tannin	5·8	2·6
Soluble non-tannins	1·0	0·5
Insoluble................	93·2	42·1
Water	0·0	11·4
Leached out		43·4
	100·0	100·0

The author now carried out a practical investigation in the experimental tannery on the manufacture of sole leather by means of this same bark. As the liquors had to be made up as required from fresh leach liquor, it was necessary to commence the tannage with very weak infusions just as in the laboratory experiments, but some mellowness was imparted by the addition of ½ per cent. and ¼ per cent. of sodium sulphite to the first and second suspenders respectively when they were first made up. There was nevertheless in each of the packs taken through a tendency to draw grain, especially in the offal, and contrary to what might be expected, the liquors did not seem to mellow in the slightest by passing goods through them. In an ordinary mixed tannage the astringent tannins are in preference absorbed by the hides, and hence as goods pass through, the liquors become increasingly mellow ; the fact that this does not happen with a pure mimosa tannage seems to indicate that mimosa bark contains only astringent tannins, and perhaps even only one chemical individual.

It also became evident that the pure mimosa liquors had little or no " souring " properties, *i.e.*, that the material had a very small capacity for producing organic acids by the fermentation of the sugary matters naturally associated with the bark. These acids swell the fibres and thus act in the opposite direction to the astringent tannins, so that it is important to have the correct ratio of acid to tan throughout the whole of the tanyard liquors. It was found that although the early liquors in the mimosa tannage were somewhat weak in tan, the great astringency of the mimosa tannin caused the necessity for an acidity appreciably greater than is now commonly found in the sole leather yards of this country, and as these acids were not developed in the liquors by natural fermentation, it was found necessary to add acid to the tan liquors throughout the whole process. A laboratory experiment showed that if acid be used to the requisite extent in the early stages and the goods be placed in stronger liquors which had not been artificially acidified, the leather soon became quite soft and flexible and quite unsuitable for sole purposes. Hence in the practical work acid was added to every tanning liquor. A good quality acetic acid was used for this purpose until the strength of the liquors in acid ranged from $N/_{23}$ up to $N/_{10}$ approximately. The necessity of this addition of acid is a serious disadvantage of the material and makes it quite out of the question to use mimosa bark alone when tanning on a large scale. It is probable that myrobalans would form an exceedingly good blend with mimosa, not only on account of its souring qualities, but also on account of its comparative mellowness and its beneficial effect on colour.

The tannage given by the author to the goods in this case was with mimosa bark only, and lasted about three months. The process is specified in the following table :—

Nature of liquor.	Time in each.	Barkometer strength.	No. of c.c. lime water required by 10 c.c. liquor.
1st suspender	3 days	6°	10
2nd ,,	3 ,,	10°	11
3rd ,,	3 ,,	15°	12
1st handler ..	7 ,,	22°	13
2nd ,, ..	10 ,,	27°	14
3rd ,, ..	14 ,,	32°	15
1st layer	1 week	50°	16
2nd ,, ...	2 weeks	60°	20
3rd ,, ...	3 ,,	70°	22

On coming from the last layer the goods were drained overnight, scoured, oiled, sammed, pinned by hand, lightly rolled, dried further, heavily rolled, and dried out. They were finally brushed by machine.

The resulting leather was firm and of good quality, and considering the red colour of the bark and of the liquors which are yielded from it, the colour of the goods was remarkably light, being only slightly pink. This pink can be partly eliminated by bleaching with sulphuric acid, but soon returns if the goods are exposed to light. An analysis of the finished leather gave the following results :—Hide substance, 34·5 per cent. ; tannin and organic matter, 51·2 per cent. ; ash, 0·3 per cent. ; moisture, 14·0 per cent. As would be expected from this analysis, the weights obtained were also good ; one butt, for example, gave a pelt weight of 28 lb. and a leather weight of 20 lb., which is a yield of 71·4 per cent.

The thanks of the author are due to Prof. H. R. Procter for suggesting this investigation and for much helpful criticism and advice during its execution.

Journal and Patent Literature.

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I.—PLANT, APPARATUS, AND MACHINERY.

Patents.

Volatile solvents ; Recovery of ——. C. Harrison, W. Bate, and W. G. Perks, Hayle, Cornwall. Eng. Pat. 23,888, Oct. 29, 1907.

The process described in Eng. Pat. 9941 of 1907 (see Fr. Pat. 381,529 of 1907 ; this J., 1908, 140) for recovering small quantities of volatile solvents diffused through large volumes of air, is modified by using oil or glycerin as an absorbent. After driving off the volatile solvents in a still, the absorbent may be used over again.—C. J. G.

Gases or vapours ; Subjecting —— *to the action of liquids.* C. H. Fowler and E. A. Medley, Liverpool. Eng. Pat. 27,391, Dec. 11, 1907.

This patent refers to improvements on the apparatus described in Eng. Pat. 22,282 of 1902 (this J., 1903, 1121), in which gas was subjected to the action of a spray of water projected from the circumference of a disc revolving within a closed cylindrical vessel. The claim is for the use of a number of these discs spaced close together, and giving a number of sprays instead of a single spray, and also for special segmental and annular openings in the partition between each set of discs for the better distribution of the liquid and gas.—C. J. G.

Scale in steam boilers ; Composition for preventing the formation of ——. G. Wegener, Miskolc, Hungary. Eng. Pat. 27,713 of 1907 ; date of application, June 2, 1908.

The composition is prepared " by stirring and boiling at a high pressure and extracting terra cutch with quercetin, oak bark, ratanhia root, and borax." It is introduced into the boiler along with the feed water, and is stated to possess the property of forming " soft, flocculent mud-like compounds " with the earth-metals (calcium, magnesium, etc.) and also with other metals such as iron, and of combining with and neutralising the acids occurring in water.—W. H. C.

[*Economisers, superheaters*]. *Apparatus for transmitting the temperature of one fluid to another.* M. R. Schulz, Braunschweig, Germany. Eng. Pat. 4270, Feb. 25, 1908.

The apparatus consists of a number of separately removable groups, 2, of water tubes supported on cross-bars, 16, in a flue, 1. Each group consists of a number of U-shaped tubes, 3, the upper ends of which are flanged on to parallel main tubes, 4 and 5. The tubes, 5, are provided with partitions, 6, and connected by bends, 19, the liquid in the tubes being thus caused to circulate through each set of U-shaped tubes as shown by the arrows, and in a direction opposite to that of the heating gases. It is claimed that the U-shaped tubes will act as spark arresters, and to facilitate the removal of ashes through the lateral doors, 22, cross walls, 20, are provided. The shape of the heating tubes, the number of partitions in the tubes, 5, and the means of connecting the latter may be varied ; also a method of constructing the partitions in the tubes, 5, is described.—C. J. G.

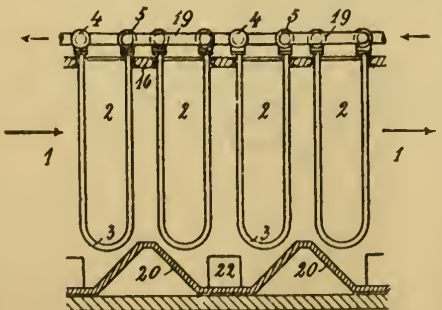


Fig. 1.

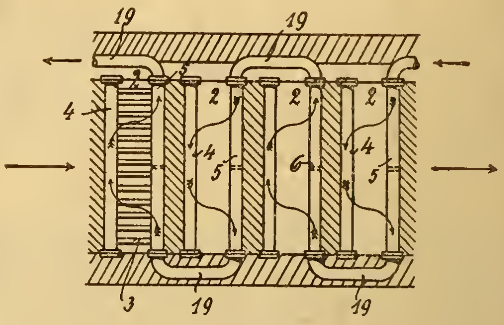


Fig. 2.

Cooling towers of the enclosed type. E. C. R. Marks, London. From Maschinenbau-Akt.-Ges. Balcke, Bochum, Germany. Eng. Pat. 11,393, May 26, 1908.

The cooling tower is divided into a number of sections by vertical partitions and air is separately conducted to the lower part of each section. The object is to ensure the access of air to all parts of the cooling tower, so that it may be built on a smaller ground space, and to prevent the excessive cooling of the air, whereby the draught would be spoilt.—W. H. C.

Pumps and compressors ; Rotary ——. Allgem. Elektricitäts Ges., Berlin. Eng. Pat. 21,168, Oct. 10, 1908. Under Int. Conv., Oct. 18, 1907. Addition to Eng. Pat. 25,404, Nov. 16, 1906 (this J., 1907, 1279).

The claim is for effecting the second and subsequent stages of the compression by means of " screw-pumps " instead of by centrifugal pumps as described in the original patent.—W. H. C.

Explosive gases ; Filling mass for receivers for storing ——. G. Dalén, Assignor to Aktiebolaget Gas Accumulator, Stockholm, Sweden. U.S. Pat. 904,183, Nov. 17, 1908.

The filling material consists of a mixture of pasty ceramic material and fibres of elastic material (*e.g.*, asbestos), to which may also be added charcoal, silicious earth, zinc oxide, and zinc chloride.—A. S.

Drying drums [*for potatoes, etc.*] *with lower receiving box.* Maschinenbau-Anstalt, Eisengiesserei und Dampfkessel-Fabr. H. Paucksch A.-G. Fr. Pat. 392,286, July 13, 1908.

In drying apparatus in which the materials are dried on the surfaces of two rotating, steam-heated drums, the claim is for the supply of a current of heated air to the upper part of the box which encloses the lower portion of the drums. The air is heated in a coil placed below the boiler which supplies the steam, and is conducted by a system of pipes, provided with suitable valves by which the temperature of the air is regulated, to the boxes. The heated air preserves the dried material from contact with the steam given off, and it is aspirated along with the latter from the bottom of the box.—W. H. C.

Drying apparatus for agricultural products and the like. H. von Schütz, Zoppat, Assignor to L. Gottscho, Berlin. U.S. Pat. 904,020, Nov. 17, 1908.

See Fr. Pat. 373,619 of 1907; this J., 1907, 710.—T. F. B.

II.—FUEL, GAS, AND LIGHT.

Coal; Processes for the carbonisation of ——. A. Peters. J. Gasbeleucht., 1908, 51, 1114—1118.

The results of experiments on different methods of carbonising coal, both on a small and on a large scale, are given. The oxygen-content of coal is stated to be more deleterious than the ash-content. The higher the proportion of oxygen, the lower are the yields of coke and gas, and the greater is the amount of heat required for carbonisation; the tar becomes richer in carbon, and thicker, and there is greater formation of scurf and risk of blocking of the ascension pipe. In the carbonisation of a small charge of coal in a gas-retort, the tar passes off from the charge with the gas and is decomposed on the superheated walls of the pipes. In a by-product coke oven or a large vertical retort, on the other hand, a dense layer of coke is produced on the wall of the retort, and carbonisation proceeds from this inwards, the tar and water being continually condensed in the inner layers of uncarbonised coal until the layer undergoing distillation has advanced to the centre; the gas escapes between the outer layer of coke and the wall of the retort. It is stated that in a coke oven in which it takes 30 hours to carbonise a charge of coal, the temperature of the core or central portion of the charge does not reach 100° C. until 15 hours from starting. Experimental tests of different methods of carbonising coal showed that when the conditions are such that the distillation products are neither condensed nor decomposed, the yield of coke and of gas is small, and that of tar high. If the distillation products pass over heated surfaces, the tar is partly decomposed, with formation of gas and solid products. If on the other hand, the coal is heated uniformly at a relatively low temperature, the yield of tar is high, and that of gas and of ammonia low, whilst the product left in the retort is identical with "coalite." The best conditions are those obtaining in the vertical retort or large coke oven. In the charge of coal the relative proportions of large and of small pieces should be such that all hollow spaces are filled as completely as possible. It is not advisable to make the retorts too high; 4 m. is more than sufficient. The attempt in England to work out a continuous process is regarded as irrational, since in order to obtain the most satisfactory results, a large heating surface is required and the charge must be at rest. Special stress is laid on uniform heating; in the case of vertical retorts, from below upwards.—A. S.

Coals; The humic matters of ——. O. Boudouard. Compt. rend., 1908, **147**, 986—988.

The author has extracted the humic matters of various lignites and coals, by treatment in some cases, with 5 per cent., and in others with 25 per cent. potassium hydroxide solution, and precipitation of the filtered solution with an acid. The coals were examined not only in their natural state, but also after exhaustion with alcohol, and after oxidation by nitric acid, which last treatment raises considerably the content of humic substances. The substances so obtained may be divided into four classes, of composition approximating to the formulæ, $C_{18}H_{14}O_6$, $C_{13}H_{18}O_9$, $C_{18}H_{14}O_9$, and $C_{18}H_{14}O_{11}$ respectively. The humic matter from artificially oxidised coals contains less carbon and hydrogen, and more oxygen, than that from natural coals.—J. T. D.

Patents.

Gas-producer. H. Mastaing and V. Wicart. Fr. Pat. 392,230, July 9, 1908.

The lower part of the generator chamber is surrounded by an annular iron chamber, the inner wall of which is provided with projecting wings to increase the heating surface. A pump driven from the shaft of the gas engine, forces water under pressure through a jacket surrounding the first gas washer, where it becomes heated, and then into the annular chamber surrounding the generator. The water enters through a number of perforations in the top and is at once converted into steam, which passes from the bottom of the annular chamber to a ring of injectors surrounding the generator; each injector is opposite to an opening into the body of the generator. Air is aspirated by the jets of steam and enters the generator with the latter. The gas generated by the air and steam partially compensates for the suction produced by the gas engine and lessens the work of the latter in aspirating air through the grate of the producer. Claim is also made for an indicator which shows when the generator requires fresh fuel, and for an arrangement of a retort for distilling combustible matter rich in volatile substances, which is placed centrally in the generator, and, from the bottom of which the residue from the distillation passes through a grid directly to the grate of the generator.
—W. H. C.

Gases, combustible, for working gas-engines; Purification of ——. Steinwerke Biesenthal H. Clasen und Merck. Ger. Pat. 203,440, March 2, 1907.

The gases after being passed as usual through a scrubber, coke filter, etc., are led first over alum, to which potassium permanganate may be added, and then over borax. They may further be passed over ferrous sulphate and finally over potassium permanganate. It is stated that gases which have been treated in this manner, burn without any formation of soot and do not attack metal surfaces.
—A. S.

Gases; Purification of —— *by mixing with water.* G. Marschner. Ger. Pat. 203,746, Oct. 11, 1906.

The patent relates to a process for removing dust from gases, *e.g.*, blast-furnace gas, by intimately mixing the gas with water. The gas is drawn into the centre of a casing in which a fan is rotated. The blades of the fan impart a violent whirling motion to the gas, and throw it against hollow "disintegrator-bars" through which water is introduced. The dust is thus removed from the gas and carried away by the water.—A. S.

Electric incandescent lamps; Manufacture of filaments for ——. "Z" Electric Lamp Syndicate, Ltd., London. From H. Zerning, Berlin. Eng. Pat. 20,223, Sept. 10, 1907.

Chemically pure tungsten trioxide, or the oxide of uranium or of a rare earth metal, is mixed with zinc dust and heated in hydrogen. The product is treated with hydrochloric acid to remove the zinc oxide, and then washed with water, alcohol, and ether successively. The product, which contains in the case of tungsten about 0·08 per cent. of hydrogen, is formed into a plastic mass with 12 to 16 per cent. of a binding agent prepared by dissolving dry nitrocellulose in amyl acetate and adding castor oil to the solution. The plastic mass is squirted into filaments and the filaments are heated in a non-oxidising atmosphere in closed iron vessels coated internally with a paste consisting of "zirconium hydride" and amyl acetate. The "zirconium hydride" is prepared by heating zirconium oxide with zinc dust in hydrogen, and removing the zinc oxide by means of acid. The filaments are finally heated in a non-oxidising atmosphere by the passage of an electric current.—A. T. L.

Incandescent electric lamps; Filaments for——. The British Thomson-Houston Co., Ltd., London. From the General Electric Co., Schenectady, U.S.A. Eng. Pat. 5416, Mar. 10, 1908.

The patent relates to the manufacture of "metallised" carbon filaments, *i.e.*, carbon filaments having a positive temperature coefficient, which are obtained by heating the filament, after flashing, in graphite in a carbon-tube electric furnace to the highest attainable temperature. The cellulose filaments are soaked in a 0·15 per cent. solution of sodium chloride before carbonising, and the filaments are carbonised, flashed, and metallised in the usual manner. They are more uniform and free from blisters than metallised filaments prepared in the ordinary way. The chlorides of potassium, calcium, magnesium, barium, and other metals may be used in place of sodium chloride.—A. T. L.

Electric glow lamps; Filament for ——. J. W. Ward and R. H. Stevens, Ilford. Eng. Pat. 10,098, May 9, 1908.

The incandescence material, which is a non-conductor and consists preferably of china-clay or other similar clay, is applied as a coating to a high resistance electric conductor.—W. H. C.

Tungsten oxide [*for incandescent lamp filaments*]*: Manufacture of plastic masses of* ——. C. Trenyen, Cologne. Eng. Pat. 14,850, July 13, 1908. Under Int. Conv., July 12, 1907.

Tungsten oxide, or hydrated tungstic acid, is treated with ammonia in the absence of any excess of water and at a temperature not above —20° C. The tungstic acid may be treated with gaseous ammonia whilst suitably cooled, and the resulting solution decomposed by absolute alcohol, or the acid may be suspended in absolute alcohol and gaseous ammonia passed into the cooled liquid. —A. T. L.

Electric incandescence lamp filaments; Process and apparatus for the formation of ——. Soc. franç. d'Incandescence par le Gaz (Système Auer). Fr. Pat. 392,454. July 18, 1908.

In the final treatment of electric incandescence lamp filaments by passing an electric current through them, the supports carrying the filament, and the surrounding tube or bulb, are frequently damaged by the high temperature. According to the present patent the electric current is passed through intermittingly in order to allow the filament to attain the required temperature during each passage without raising the temperature of the support and the surrounding tube too far. Two wheels, the one provided with one cam only, the other with several cams, act simultaneously on an interrupter. By this means the current may be cut off, reduced, or even reversed between the periods of normal passage. At the same time, cooling can be effected by passing a gas through or round the tube.—R. L.

Electric incandescence lamps. Process for the formation of metallic filaments for ——. Soc. franç. d'Incandescence par le Gaz (Système Auer). Fr. Pat. 392,455, July 18, 1908.

The removal of carbon from metallic filaments is effected by treating them with sulphur at a high temperature in the presence of hydrogen. The sulphur may be applied in the free state, or in the form of sulphuretted hydrogen, or other compounds, the sulphur combining with the carbon and the carbon bisulphide formed being volatilised. During the first period of the treatment a partly oxidising atmosphere may be maintained, whilst the final operation of rendering the decarbonised filament denser is carried out in a vacuum or in a reducing atmosphere.—R. L.

Electric lamps; Process for the manufacture of metallic filaments for ——. "Corona" Glühlampenfabr. G.m.b.H. Fr. Pat. 392,501, July 20, 1908.

A filament of collodion is first treated with ammonium hydrosulphide, and then thoroughly washed. It is next impregnated with a concentrated tungsten solution, dried, and carbonised. It may then be reduced and freed from carbon in the usual way.—R. L.

Electric incandescence lamps; Process for the removal of impurities from and producing a denser texture in metallic filaments for ——. W. Majert. Fr. Pat. 392,524, July 21, 1908. Under Int. Conv., March 4, 1908.

The filaments are heated by an electric current first at the atmospheric or a slightly higher or lower pressure, in the presence of inert gases, such as nitrogen, hydrogen, carbon monoxide, water gas, or ammonia, and subsequently *in vacuo*. By this means the time of treatment is considerably shortened as compared with heating *in vacuo* only, and the economy and life of the lamps are increased as compared with heating at atmospheric pressure only. —R. L.

Electric incandescence lamp filaments; Process for the manufacture of ——. Soc. Lacarrière pour la Fabr. des Lampes Electriques à Incandescence. Fr. Pat. 392,536, July 21, 1908.

To render the mass for the formation of the metallic filaments plastic, an addition of nitrocellulose is made. On heating, the nitrocellulose is decomposed. To prevent too violent a decomposition which might injure the texture of the filament, castor oil is also added, in the proportion of 10—33 parts per 67 to 90 parts of nitrocellulose. The nitrocellulose is used in amyl acetate solution.—R. L.

Coking oven. E. Ledoux, Sheffield, Assignor to Simon-Carvés Bye-Product Coke-Oven Construction and Working Co., Ltd., Manchester. U.S. Pat. 904,268, Nov. 17, 1908.

See Eng. Pat. 4996 of 1906; this J., 1906, 840.—T. F. B.

Combustion of fuel; Process for regulating the —— *and for preventing smoke.* The Coal Treating Co. Fr. Pat. 392,308, July 15, 1908.

See U.S. Pat. 894,110 of 1908; this J., 1908, 847.—T. F. B.

Smoke or gases; Apparatus for cleaning or washing ——. J. Black, A. H. and H. Lennox, Newcastle-on-Tyne. U.S. Pat. 903,832, Nov. 17, 1908.

See Eng. Pat. 15,172 of 1907; this J., 1908, 742.—T. F. B.

Smoke; Apparatus for cleaning or washing ——. J. Black, A. H. and H. Lennox, Newcastle-on-Tyne. U.S. Pat. 904,301, Nov. 17, 1908.

See Eng. Pat. 14,675 of 1907; this J., 1908, 617.—T. F. B.

Hydrocarbons; Liquid —— *or their mixtures applicable for motive power, heating, lighting, dissolving, etc.* F. G. Claussen and G. T. B. Cobbett. Fr. Pat. 392,175, July 6, 1908. Under Int. Conv., July 6, 1907.

See Eng. Pat. 15,593 of 1907; this J., 1908, 850.—T. F. B.

Gas; Manufacture of ——. J. Bueb, Dessau, Germany. U.S. Pat. 904,043, Nov. 17, 1908.

See Fr. Pat. 339,534 of 1904; this J., 1904, 709.—T. F. B.

Gas generator. E. N. Trump. Fr. Pat. 392,309, July 15, 1908.

See U.S. Pat. 893,114 of 1908; this J., 1908, 848.—T. F. B.

Filaments for lighting and heating; Process of making ——. G. Michaud and E. Delasson, Paris. U.S. Pat. 904,139, Nov. 17, 1908.

See Fr. Pat. 346,307 of 1904; this J., 1905, 125.—T. F. B.

Metallic filaments; Decarbonisation of —— *for electric lamps.* "Corona" Glühlampenfabr. G.m.b.H., Fr. Pat. 392,500, July 20, 1908.

See Eng. Pat. 15,079 of 1908; this J., 1908, 1145.—R. L.

Sand cores, briquettes, etc.; Binder for ——. U.S. Pat. 903,558. *See* IX.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

Patents.

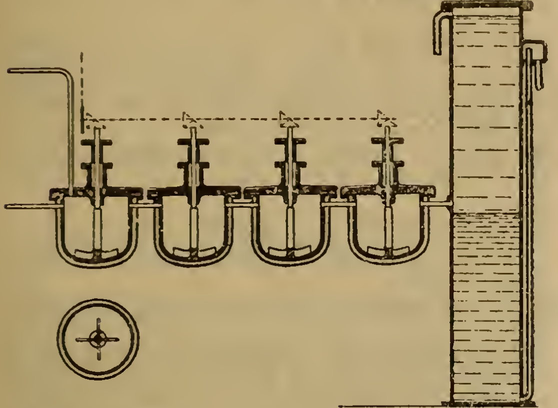
Drying [*and carbonising*] *peat and similar substances artificially.* F. Fritz, London. Eng. Pat. 24,351, Nov. 4, 1907.

The claim is for a process of drying peat combined with a process for distilling the same in a retort. The gas produced is first conducted through pipes arranged in a drying room containing wet peat, whereby the gas is cooled and the peat is partially dried. The cooled gas is then burnt around the retort to effect the distillation of the charge, and the products of combustion are passed directly through partially dried peat contained in a second drying chamber. From this chamber the gas, which is now saturated with moisture, is in part introduced into the retort in which dry peat from the second drying chamber is being distilled, with the object of increasing the yield of ammonia.—W. H. C.

Wood-distilling apparatus. G. Walker, New York. U.S. Pat. 904,165, Nov. 17, 1908.

The apparatus comprises a "reversible" cylindrical retort having lateral flanges on opposite sides. The heating chamber surrounding the retort has longitudinal plates projecting from its wall, and the retort is so mounted that the flanges rest on these projecting plates. The projecting plates and flanges thus form partitions dividing the heating chamber into upper and lower compartments, which open into a common flue at the back of the retort. The lower wall of the lower compartment is over the fire and is provided with openings, tangential to the wall of the retort, through which the fire gases pass into the lower compartment of the heating chamber. The waste gases are withdrawn from the upper compartment.—A. S.

Mono-nitrohydrocarbons; Process and apparatus for preparing aromatic ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 201,623, June 10, 1906.



The hydrocarbon to be nitrated and the nitrating acid, in equivalent proportions, are run continuously, in small quantities, into the apparatus shown in the figure, which consists of several jacketed vessels, provided with rapid stirring arrangements, leading into a separator, furnished with outlets at the top and bottom. It is stated that there is no risk, when using this process, of over-nitration when using the calculated quantity of nitric acid.—T. F. B.

Fluorene; Process for recovering —— *from materials containing it.* Ges. f. Teerverwertung m. b. H. Ger. Pat. 203,312, Feb. 11, 1908.

The material containing fluorene is heated with sodium, sodamide, or sodium and ammonia to 110°—250° C. The fluorene is converted into its sodium compound, which can be separated from unchanged hydrocarbons by known methods.—A. S.

Petroleum or benzine; Purification of —— *by means of spirit.* H. Guttmann. Ger. Pat. 202,776, May 18, 1907.

It is stated that by washing petroleum or benzine with denatured spirit, all the deleterious properties of the former are removed, and that the purified benzine can then be used in motors without producing any unpleasant odour. The mixing of the petroleum and spirit is effected in a vessel provided with an inlet at the top for the former, and one at the bottom for the latter. The vessel is furnished with a window at the level of the zone of separation of the two liquids, and with a tube for drawing off the turbid layer formed at this zone. Just above this level is the draw-off pipe for the purified petroleum; inside the vessel this pipe is bent upwards, whilst outside it has a U-bend, forming a trap, and then leads to a suitable receptacle. The pipe through which the spirit is introduced and removed enters the mixing vessel near the bottom and has an inverted U-shape inside the vessel.—A. S.

Ammonium sulphate; Manufacture of ——. Ger. Pat. 203,309. *See* VII.

IV.—COLOURING MATTERS AND DYESTUFFS.

Coupling reaction [Formation of azo compounds]; Mechanism of the ——. O. Dimroth and M. Hartmann. Ber., 1908, **41**, 4012—4028.

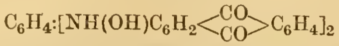
The authors' investigations show that when a diazonium salt acts on a phenol, an intermediate unstable diazo-oxy-compound is formed, which is more or less rapidly transformed into the hydroxyazo-compound. Unstable diazo-oxy-compounds are obtained by the action of diazobenzene, *p*-diazotoluene, and *p*-nitro-*anti*-diazobenzene hydroxide on *p*-nitrophenol. The substances evolve nitrogen readily when warmed or when added to alcohol, benzene, or ether, and they give azo-dyestuffs with naphthol and naphthylamine, but they are so unstable that the conversion to the isomeric hydroxyazo-compound cannot be effected. *p*-Bromobenzenediazo-oxy-*p*-nitrobenzene, $C_6H_4Br.N_2.O.C_6H_4.NO_2$, however, which is a brick red crystalline powder and gives the above reactions, can be transformed into *p*-bromobenzeneazo-*p*-nitrophenol, $C_6H_4Br.N_2.C_6H_3(OH).NO_2$, by warming it to 80° C. The latter compound forms brownish-red needles, m.pt. 197° C.—J. C. C.

Triphenylmethane dyestuffs; Bases of ——. E. Noelting and K. Philipp. Ber., 1908, **41**, 3908—3911.

In extension of their former work (this J., 1908, 327), the authors have prepared the colourless and coloured forms of pentamethyltriaminonaphthyldiphenylcarbinol. The imino-base $[(CH_3)_2N.C_6H_4]_2C:C_{10}H_6:N.CH_3$, is obtained as reddish brown leaflets; m.pt. 195.—196° C., by precipitating an aqueous solution of the dyestuff with sodium hydroxide. When the dyestuff is boiled with ammonia, the carbinol base $[(CH_3)_2N.C_6H_4]_2C(OH).C_{10}H_6.NH.CH_3$, is formed. This is obtained in colourless crystals, m.pt. 171—172° C. The carbinol is converted into the imide by heating it in glycerol with the addition of a few drops of potassium hydroxide, and the converse change is effected by boiling a solution of the imide in 40—50 per cent. alcohol with a little ammonia or potassium hydroxide for an hour. When a cold solution of Crystal Violet is treated with a large excess of aqueous potassium hydroxide, and the solution extracted at once with ether, reddish-brown crystals of the imino-base, m.pt. 191—194° C., are obtained; these pass very quickly into the carbinol (m.pt. 182° C.) on standing. The coloured base of Malachite Green passes much more quickly into the carbinol form than in the case of Crystal Violet, but the change is much slower when an ortho-substituent is present, a fact which explains the greater fastness towards alkalis and soap of the ortho-substituted triphenylmethane dyestuffs. The carbinol form of the *o*-chloro-derivative of Malachite Green (Setoglaucin) is prepared by adding ammonia to a solution of the dyestuff and allowing the mixture to stand for two days. It forms pale yellow crystals, m.pt. 155° C. A red precipitate is obtained when potassium hydroxide is employed instead of ammonia. With sodium methoxide, Setoglaucin forms a methyl ether, $[(CH_3)_2N.C_6H_4]_2C(O.CH_3).C_6H_4Cl$.
—J. C. C.

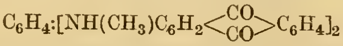
Dianthraquinonylphenylenediamine. E. Laubé and C. König. Ber., 1908, **41**, 3874–3879.

The authors have already shown (Ber., 1907, **40**, 3562) that *p*-dihalogen-derivatives of benzene condense with two molecules of aminoanthraquinone to form dianthraquinonyl-*p*-phenylenediamine and they have now extended the work. 1-*p*-Nitroanilido-2-hydroxyanthraquinone is prepared by boiling a mixture of 1-chloro-2-hydroxyanthraquinone (20 grms.), *p*-nitraniline (20 grms.), potassium carbonate (5 grms.), copper acetate (3 grms.), and nitrobenzene (300 c.c.) for 12 hours. After removing nitrobenzene by a current of steam, boiling out the residue with alcohol and then digesting with hot dilute hydrochloric acid, the substance is crystallised from pyridine, from which it separates as a dark brown powder, m.pt. 342° C. (corr.). When this is reduced by boiling with aqueous sodium sulphide, it is converted into 1-*p*-aminoanilido-2-hydroxyanthraquinone, which is a black powder. The latter (3 grms.) is boiled with chlorohydroxyanthraquinone (4 grms.), nitrobenzene (150 c.c.), and a little copper powder, for 30 hours. After filtering and cooling, 2 : 2′ - dihydroxy - 1 : 1′- dianthraquinonyl - *p* - phenylenediamine,



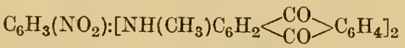
$$C_6H_4{:}[NH(OH)C_6H_2<\genfrac{}{}{0pt}{}{CO}{CO}>C_6H_4]_2$$

is obtained as a blackish brown powder, m.pt. above 360° C. With alkaline hydrosulphite it gives a coffee-brown vat from which cotton is dyed in the same shade: on soaping, the tint is changed to yellow. By boiling a mixture of 1-amino-2-methylanthraquinone (10 grms.), *p*-dibromobenzene (10 grms.), copper acetate (3 grms.), potassium carbonate (3 grms.), and nitrobenzene (150 c.c.) for 27 hours, a mixture of 1-*p*-bromoanilido-2-methylanthraquinone (scarlet red needles, soluble in alcohol) and 2:2′-dimethyl-1 : 1′-dianthraquinonyl-*p*-phenylene-diamine



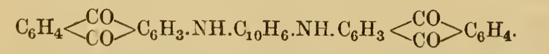
$$C_6H_4{:}[NH(CH_3)C_6H_2<\genfrac{}{}{0pt}{}{CO}{CO}>C_6H_4]_2$$

(black powder, insoluble in alcohol) is obtained. The latter gives, with alkaline hydrosulphite, a reddish-violet vat from which cotton is dyed in the same shade On washing and soaping, this is changed to a lilac. Similarly on condensing 1-amino-2-methylanthraquinone with 1 : 2-dichloro-4-nitrobenzene, coppery leaflets of 1-*p*-nitro-*o*-chloroanilido-2-methylanthraquinone, m.pt. 272—273° C. (corr.) are obtained, and this on being heated in a closed tube for 16 hours at 250° C., together with methylanthraquinone, naphthalene, potassium carbonate, and copper powder, furnishes 2 : 2′-dimethyl-1 : 1′-dianthraquinonyl-*p*-nitro-o-phenylenediamine,



$$C_6H_3(NO_2){:}[NH(CH_3)C_6H_2<\genfrac{}{}{0pt}{}{CO}{CO}>C_6H_4]_2$$

which with alkaline hydrosulphite gives a brown vat, from which cotton is dyed in brown shades, fast to soaping and alkali. If this compound is fused with potassium and sodium hydroxides, a new dyestuff is produced which dyes cotton in similar but much stronger shades. 1-*o*-Acetylaminonaphthylaminoanthraquinone (1-anthraquinonylacetyl-*o*-naphthylenediamine) is prepared as a brown powder by condensing 1-aminoanthraquinone with 2-chloro-1-acetylnaphthylamine: when heated in a sealed tube with concentrated hydrochloric acid, it yields 1 anthraquinonyl-*o*-naphthylenediamine, which, on condensation with 1-chloroanthraquinone, furnishes 1 : 1′-dianthraquinonyl-*o*-naphthylenediamine,



$$C_6H_4<\genfrac{}{}{0pt}{}{CO}{CO}>C_6H_3.NH.C_{10}H_6.NH.C_6H_3<\genfrac{}{}{0pt}{}{CO}{CO}>C_6H_4.$$

This is a brownish-black powder, m.pt. 350° C., giving with alkaline hydrosulphite a coffee-brown vat from which cotton is dyed yellowish-brown.—J. C. C.

PATENTS.

Halogen derivative of Indigo; Manufacture of a ——. Ges. für Chem. Ind. in Basel, Switzerland. Eng. Pat. 19,563, Sept. 17, 1908. Under Int. Conv., Nov. 11, 1907. Addition to Eng. Pat. 10,326 of 1907 (see U.S. Pat. 872,115 of 1907; this J., 1907, 1274).

MONOBROMOTRICHLOROINDIGO is prepared by heating a mixture of trichloroindigo (10 parts), nitrobenzene (100 parts), and bromine (5—6 parts), to 225°—230° C., for 1½ hours. The dyestuff gives with alkaline hydrosulphite a yellow vat from which cotton is dyed in clear blue shades fast to washing, chlorine, and light.—J. C. C.

Dyestuffs dyeing vegetable fibres without mordants. L. Haas. First Addition, dated June 29, 1908, to Fr. Pat. 390,715, Aug. 5, 1907 (this J., 1908, 1107).

THE procedure described in the chief patent for the preparation of sulphide dyestuffs from *oo*-dinitro-*mm*-dichlorodiphenyl is now applied to the case of 2 : 2′(*oo*)-dinitro-4 : 5 : 4′ : 5′-tetrachlorodiphenyl (m.pt. 186° C.), which is prepared by treating nitrotrichlorobenzene with copper powder.—J. C. C.

Disazo-dyestuffs; Manufacture of secondary, blue to violet ——. Kalle und Co. Fr. Pat. 392,589, July 23, 1908. Under Int. Conv., Nov. 18, 1907.

BLUE to violet disazo-dyestuffs are prepared by combining a diazotised 1-amino-5-naphtholsulphonic acid with a suitable amine, diazotising the product and combining it with 2-amino-5-naphthol-7-sulphonic acid or its aryl derivatives. In the example quoted, 1-amino-5-naphthol-3 : 7-disulphonic acid is diazotised and combined with *a*-naphthylamine, and the resulting aminoazo-dyestuff is diazotised and combined with 2-phenylamino-5-naphthol-7-sulphonic acid. The disazo-dyestuff so obtained dyes cotton in very fast, blue shades.—J. C. C.

Intermediate products and colouring matters containing sulphur [Thioindigo dyestuffs]; Manufacture of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 26,053, Nov. 25, 1907.

SEE Fr. Pat. 385,044 of 1907; this J., 1908, 497.—T. F. B.

Colouring matters of the anthracene series; Manufacture of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 3156, Feb. 12, 1908. Addition to Eng. Pat. 10,770, May 8, 1907.

SEE Eleventh Addition to Fr. Pat. 349,531 of 1904; this J., 1908, 800.—T. F. B.

Anthracene derivatives; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 28,104, Dec. 20, 1907.

SEE Fr. Pat. 385,358 of 1907; this J., 1908, 557.—T. F.B.

Anthracene derivatives; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 486, Jan. 8. 1908.

SEE Third Addition, dated Feb. 7, 1908, to Fr. Pat. 372,676 of 1906; this J., 1908, 800.—T. F. B.

Azo dyestuffs; Manufacture of new yellow ——. A. G. Bloxam, London. From Act.-Ges. f. Anilinfabr., Berlin. Eng. Pat. 2683, Feb. 6, 1908.

SEE Ger. Pat. 202,016 of 1907; this J., 1908, 1147.—T. F. B.

Dyestuffs capable of dyeing vegetable fibre without mordants. L. Haas, Paris. Eng. Pat. 15,417, July 21, 1908. Under Int. Conv., Aug. 5, 1907.

SEE Fr. Pat. 390,715 of 1907; this J., 1908, 1107.—T. F. B.

Sulphur [sulphide] dyestuffs; Process of making black ——. A. F. Poirrier, Assignor to Soc. Anon. des Mat. Col. et Prod. Chim. de St. Denis, Paris. U.S. Pat. 904,224, Nov. 17, 1908.

SEE Fr. Pat. 381,608 of 1906; this J., 1908, 219.—T. F. B.

[Sulphide] dyestuff and process of making same; Yellow-olive ——. E. Saul, Frankfort, Germany, Assignor to Cassella Color Co., New York. U.S. Pat. 904,809, Nov. 24, 1908.

SEE Eng. Pat. 3279 of 1907; this J., 1907, 1082.—T. F. B.

Vat dyestuff and process of making same; Violet ——. A. Grob, Assignor to Basle Chemical Works, Basle, Switzerland. U.S. Pat. 904,867, Nov. 24, 1908.

SEE Eng. Pat. 12,810 of 1908; this J., 1908, 894.—T. F. B.

Sodium arylamines; Process for preparing ——. Deutsche Gold- und Silber-Scheide-Anstalt vorm. Roessler. Fr. Pat. 392,405, May 23, 1908.

SEE Eng. Pat. 11,335 of 1908; this J., 1908, 893.—T. F. B.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

Patents.

Threads of artificial silk; Preparation of brilliant and supple —— from solutions of collodion in acetone, etc. Soc. Boullier et Lafais. Fr. Pat. 392,442, July 11, 1908. Under Int. Conv., July 15, 1907.

In order to ensure that the spinning of the filament is carried out at the proper temperature, a radiator consisting of a number of steam pipes is arranged behind the spinning frame and adjusted so as to produce around the newly spun filaments, the temperature which has been found to be most suitable.—P. F. C.

Artificial threads; Preparation of ——. F. Todtenhaupt. Ger. Pat. 203,820, Dec. 14, 1907. Addition to Ger. Pat. 170,051.

The fibres obtained according to the original patent (see Eng. Pat. 25,296 of 1904; this J., 1905, 1063) contained so much moisture that they readily adhered together. It is now found that pure casein, which dissolves in water to fairly clear solutions, can be converted into thick solutions which are readily formed into threads, by dissolving it in alcohol (80 parts) and water (20 parts) in presence of bases or basic salts; the solutions thus formed are said to contain 1 part of casein to 1·5 parts of solvent, and are sufficiently viscous to be formed into threads, which will not adhere together, without precipitation by acids.—T. F. B.

Textile fibres and cellulose from plants of all kinds; Process of obtaining ——. F. Fuchs. Ger. Pat. 204,412, July 11, 1907.

The essential feature of the process consists in the use of a solution of barium sulphide for removing the incrusting matters of the plants. It is stated that fibres can be readily obtained from rushes by this process.—A. S.

Hair-fibres, natural or artificial, which are added to the other fibres of a textile fabric to render the latter more rigid; Process for fixing in their positions ——. C. Roux. Fr. Pat. 392,179, July 9, 1908.

The strong fibres which are woven into fabrics to give them rigidity have a tendency to slide out of their positions. This defect can be remedied by applying, either to the stiffening fibres or to the whole fabric, a mixture which is prepared by dissolving gum-lac in warm alcohol and mixing the solution with a cold solution of sandarac.
—P. F. C.

Scouring, dyeing, and analogous machines. T. H. Fitchett, S. A. Pegg, C. R. Kershaw, and J. H. Abell, Leicester. Eng. Pat. 28,186, Dec. 21, 1907.

The material is fed on to an endless, travelling band, which, during its journey through the tank containing the liquor for the treatment, is made to pass underneath a series of scrubbing rollers. These rollers are made of wood and preferably have longitudinally fluted surfaces. On leaving the tank, the material is delivered on to a travelling platform, by which it is conveyed to the nip of a set of squeezing rollers. These rollers deliver the goods on to a second travelling platform above which a rinsing spray is arranged. After washing, the goods are led through a second set of squeezing rollers and delivered from the machine. Just before the goods enter the tank, they pass underneath a spray of the liquor which has been pumped from the delivery end of the tank. In this way they are thoroughly soaked, and the liquor is constantly circulated.—P. F. C.

Cleansing agent; Preparation of a ——. O. L. Benzinger, Fr. Pat. 392,483, July 20, 1908. Under Int. Conv., July 24, 1907.

An emulsion is prepared by mixing 200 grms. of a soap solution (10 per cent.), 20 grms. of oil of turpentine, 5 grms. of ammonia, and 4 grms. of ether. The soiled material is sponged with this emulsion and rinsed in clean water. The preparation is especially effective for woollen goods.—P. F. C.

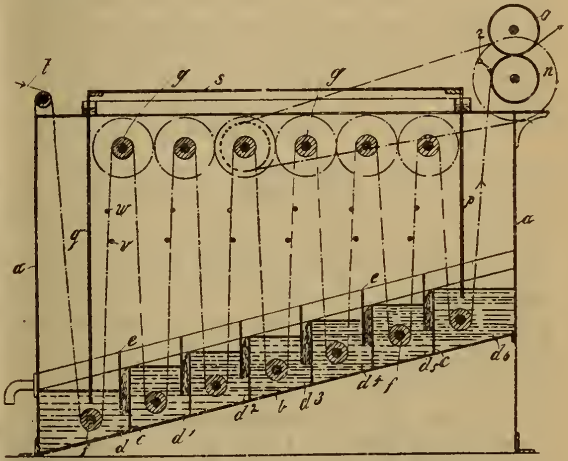
Cleansing product. P. Surcouf. Fr. Pat. 392,504, Sept. 26, 1907.

A mixture of carbon tetrachloride with the usual dry-cleaning agents, or with an extract of Panama wood, is employed.—P. F. C.

Textile materials; Process and apparatus for boiling, washing, bleaching, and otherwise treating —— in a circulating bath. R. Weiss, Kingarsheim, Germany. Eng. Pat. 15,284, July 18, 1908.

Textile materials are washed, boiled, and bleached by the use of two vessels, one or both of which may be charged with the material, and subjected to a reversible flow of the bleaching or other liquor. The liquid is first forced through the material preferably from below and then by reversing the course of the liquid, the material is drained. The two vessels used for the treatment are supplied with overflow pipes fitted with back action valves. These valves during periods of high and low pressure in the vessels are arranged so as not to interfere with the circulation of the liquid.—S. H. H.

Lyes employed in the impregnation [mercerisation] of fabrics; Process and apparatus for the extraction and recovery of ——. J. Matter. Fr. Pat. 392,400, April 15, 1908.



Inside a tank, *a*, is arranged a vessel, *b*, which has an inclined floor and is divided by vertical partitions, *c*, into compartments, *d*, d^1, d^2, etc. In these compartments are arranged partitions, *e*, which are slightly removed from the partitions, *c*, and from the floor of the compartments, so that the liquid can fall between two partitions, *c* and *e*, from a higher to a lower compartment. The machine is also provided with a number of rollers, *g* and *f*, arranged in the higher and lower parts of the machine respectively. Vertical walls, *p*, *q*, provided with a water-sealed cover, *s*, isolate and make airtight one part of the apparatus, by dipping into the liquid contained in the compartments, *d* and d^6. The fabric, *t*, coming from the mercerising machine, passes through the apparatus as shown in the figure, and then on to drying cylinders, *n*, *o*. The extraction of the lye from the cloth is effected in the sealed part of the machine. A series of tubes, *v*, arranged transversely in the machine, are so disposed that the cloth comes in contact with them and receives the full force of a steam blast, issuing from perforations in these tubes. Shortly after it has left each steam pipe, the cloth passes over a transversely arranged rod, *w*, which expresses the solution produced by the action of the steam on the lye contained in the cloth, and causes it to run down into one of the compartments, *d*, d^1, etc. Before reaching the drying cylinders, *n*, *o*, the cloth is subjected to a jet of water issuing from a pipe, *z*. This water subsequently runs down into the compartment, d^6, and travels through the apparatus till it reaches the compartment, d. By regulating the flow of water from the pipe, z, the strength of the solution which is finally drawn from the apparatus can be adjusted at will.—P. F. C.

Dyeing machines. J. Y. Johnson, London. From Hussong Dyeing Machine Co., Groveville, N.J., U.S.A. Eng. Pat. 11,637, May 28, 1908.

The invention relates to an improved means of circulating the liquor in the dye-vats described in Eng. Pats. 19,250 of 1900 and 15,207 of 1903 (this J., 1901, 247; 1903, 1083). A special cage which is filled with the material to be dyed and placed inside the dye-vat, is also described. This cage can be readily removed from the vat and emptied. —S. H. H.

Indigo dyeing; Preparation of the vat for ——. H. Chaumat. First Addition, dated Aug. 29, 1907, to Fr. Pat. 379,041, Aug. 28, 1906 (this J., 1907, 1196).

The vat is intended specially for use with an Indigo solution prepared electrolytically according to the main patent. The dye-vat consists of a vertical metal cylinder closed at the top by a movable cover. In this cylinder are placed a number of superimposed open work carriers, each composed of two concentric cylinders, between which is placed the material to be dyed. In the space enclosed by the inner cylinders is placed a pipe containing an Archimedean screw, which raises the dye-liquor and distributes it over the top of the material. The vat is heated by a steam coil. The carriers filled with material are placed in the vat, the cover replaced, and the air removed by a vacuum pump. The Indigo solution is then run in and circulated through the material by means of the screw. After a sufficient time, air is admitted, the cover raised, and the carriers removed preparatory to submitting the material to the oxidising process.—A. B. S.

Furs, hair, feathers and the like; Process for dyeing ——. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 392,228, July 10, 1908. Under Int. Conv., Oct. 8, 1907.

The material, mordanted or unmordanted, is treated for several hours with an aqueous solution of an ortho-diamino-derivative of benzene or toluene to which an oxidising agent such as hydrogen peroxide has been added. The shades obtained range from a light brown on unmordanted goods to a very dark brown with mordanted materials.—P. F. C.

Reserving the wool in mercerised union goods in dyeing with sulphide dyestuffs; Process for ——. Chem. Fabr. Griesheim-Elektron. Ger. Pat. 203,427, Oct. 27, 1907.

The wool in mercerised union goods is reserved by adding to each litre of the sulphide dye-bath at least 40 grms. of dextrin.—T. F. B.

Hanks and pieces; Apparatus for rinsing —— after dyeing, etc. L. Wallays. Fr. Pat. 392,128, July 8, 1908.

The hanks of yarn, or the pieces (hanging in loops from sticks) are arranged in a rectangular framework, which is lowered into and lifted out of the washing trough by suspending it from the end of a lever, or from an eccentric cam working on a revolving shaft. The washing vessel is rectangular in shape, and at one end and on the sides adjacent thereto, are chambers into which the water is first led. These chambers communicate near the base with the main vessel, but during the rinsing operation the connecting openings are closed by drop valves which work in grooves. The outside rims of these auxiliary chambers are slightly higher than that of the main vessel, so that the water overflows into this; it passes out at the base at the opposite end, into a small chamber and rising in this, flows over a partition (arranged to give a suitable depth of water in the main vessel) and is carried away. The rising and falling motion imparted to the frame, and the constant flow of fresh rinsing water, ensure a rapid cleansing of the material. The whole apparatus may be emptied for cleaning, etc., by lifting the drop valves and opening an outlet in the base of the main vessel.—F. M.

Chrome lakes of mordant dyestuffs; Process for producing —— on the fibre. Fabr. de Prod. Chim. de Thann et de Mulhouse. Ger. Pat. 203,131, May 24, 1907.

Fabrics are printed or padded with a mixture of the dyestuff, ammonium chromate, and glycerin or similar organic reducing agent, preferably in presence of ammonia, and then steamed.—T. F. B.

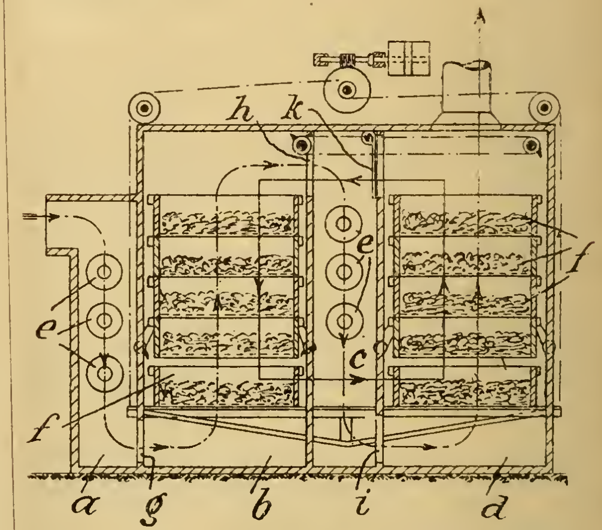
Waterproofing of fabrics; Process for the ——. A. Emmerling. Fr. Pat. 391,932, July 1, 1908.

The material is passed through a solution of a compound of some heavy metal, *e.g.*, zinc acetate, then dried and passed through a solution of a vegetable or animal colloid, *e.g.*, albumin, which possesses considerable affinity for the metal compound, and again dried. These two processes may be repeated if necessary. The material is finally passed through a 5 per cent. solution of formaldehyde which renders the colloid insoluble and so fixes the metallic compound on the fabric.—A. B. S.

Preservation of fabrics and other substances; Preparation for the ——. H. Dugour. Fr. Pat. 392,505, Sept. 26, 1907.

A mixture containing sulphuric ether, colophony, castor oil, nitrocellulose, denatured alcohol, and amyl acetate is applied to the material. If a mordant be added to this mixture, the material can be afterwards dyed.—P. F. C.

Textile fibres and other analogous products; Process and apparatus for drying ——. P. Klug. Fr. Pat. 391,941 July 1, 1908.



The apparatus comprises the heating chambers, a, c, fitted with closed steam pipes, e, and the drying chambers, b, d, containing trays, f, for holding the material. The heating chambers communicate with the drying chambers by the openings, g and i, respectively. The trays in b can be lowered and those in d raised, and the upper tray in d can be transferred to b by sliding it through the swinging door, k. The trays filled with wet material are introduced at the bottom of the chamber, d, and are gradually raised and transferred to b, their place being taken by freshly filled trays. The trays of dried material are removed at the bottom of the chamber, b. The hot air circulates in the direction of the dotted arrows. —A. B. S.

Mordanting fibrous material; Process of ——. F. Blumenthal, Biebrich, Germany. U.S. Pat. 903,833, Nov. 17, 1908.

See Fr. Pat. 373,706 of 1907; this J., 1907, 683.—T. F. B.

Fabrics and other material; Producing glossy or silky effects on ——. L. Lilienfeld, Vienna. U.S. Pat. 904,269, Nov. 17, 1908.

See Fr. Pat. 4597 of 1906; this J., 1907, 146.—T. F. B.

Multicoloured fabrics ; Manufacture of ——. M. Böhler, Wilhelmsbad, Germany, Assignor to Cassella Color Co., New York. U.S. Pat. 904,752. Nov. 24, 1908.

See Eng. Pat. 25,971 of 1906 ; this J., 1907, 1136.—T. F. B.

Textile materials ; Process and apparatus for treating —— by the circulation of liquids. R. Weiss. Fr. Pat. 392,357, July 16, 1908. Under Int. Conv., July 20, 1907.

See Eng. Pat. 15,284 of 1908 ; preceding.—T. F. B.

VII.—ACIDS, ALKALIS, SALTS, AND NON-METALLIC ELEMENTS.

Carbon dioxide under pressure ; Action of —— upon some metal hydroxides at 0° C. F. K. Cameron and W. O. Robinson. J. of Physical Chem., 1908, **12**, 561—573.

Known amounts of carbon dioxide, in small portions at a time, were forced into a small closed space containing the metal hydroxide and a known volume of water, and after each operation the pressure was measured when absorption was complete. In certain cases, also, after a known amount of carbon dioxide had been absorbed, the process was reversed, and carbon dioxide was allowed to escape gradually in measured quantities. In the case of magnesium hydroxide, the solid phase, after the absorption of carbon dioxide, was analysed. The results are given in tables and a curve-diagram. They show that definite carbonates of aluminium, ferric iron, and beryllium do not exist ; and that bicarbonates of ferrous iron and magnesium are not formed under pressures up to 5 atmospheres at 0° C. There is some evidence in accord with the view that calcium bicarbonate exists in the dissolved state, but the observed facts can be explained equally well as being due to the specific solvent power of the mixture of carbon dioxide and water on calcium carbonate.—A. S.

Alumina ; Preparation of fused —— in an amorphous condition, and production of the blue coloration of the sapphire. L. Paris. Compt. rend., 1908, **147**, 933—935.

Crystalline alumina coloured red by oxides of chromium, has long been known. When alumina is melted in the oxyhydrogen flame, a transparent product is obtained which rapidly crystallises, the superficial fused layer hardly exceeding a few tenths of a millimetre in depth. When chromic oxide is sprinkled on this, the red coloration diffuses not only through the fused mass but penetrates the greater part of the alumina, which has already solidified. Although chromium oxide possesses this affinity for alumina, oxides of cobalt and iron which give a blue coloration are not able to penetrate the crystalline mass, but remain as a surface layer on the fused layer without colouring it. Apparently, besides chromium only nickel oxide is able to colour pure alumina, the latter giving a greenish-yellow shade. When, however, the alumina contains small traces of an impurity such as lime, a blue coloration can be obtained with a number of oxides, particularly cobalt oxide, but in all such cases the coloured alumina obtained is amorphous, only the outer crust of the stones having a crystalline structure. The amorphous alumina has the sp. gr. 3·48, refractive index, 1·67, and a hardness slightly inferior to that of corundum. Its physical properties differ from those of the natural sapphire as those of fused silica do from quartz. The total amount of impurity in the alumina is less than 2 per cent. Experts are stated to find it difficult to distinguish between natural sapphires and these artificial stones, which are of a deep velvety blue colour. The preparation of large stones requires much care and experience.—E. F. A.

Arsenic ; Sublimation of ——. W. P. A. Jonker. Chem. Weekblad, 1908, **5**, 783—785. Chem. Zentr., 1908, **2**, 1713.

At 760 mm. pressure, sublimation of the metalloid arsenic was first perceived at 616° C.—A. S.

Patents.

Hydrochloric acid and magnesia ; Process for obtaining —— from hydrated magnesium oxychloride. O. Dieffenbach and W. Moldenhauer. Ger. Pat. 203,080, Dec. 8, 1906.

The object of the process is to effect the decomposition of the hydrated magnesium oxychloride under such conditions that the gas equilibrium above the material is not unduly disturbed. For this purpose the material, contained in a special receptacle, provided with a perforated cover, is heated rapidly to a temperature, *e.g.*, above 700° C., at which it has a strong tendency to yield hydrochloric acid, and then, if necessary, steam is introduced in order to decompose the last traces of magnesium chloride. Or, the material may be heated to 300°—700° C., then steam introduced, and the charge heated further. It is stated that by this method, hydrochloric acid gas almost free from water is obtained.—A. S.

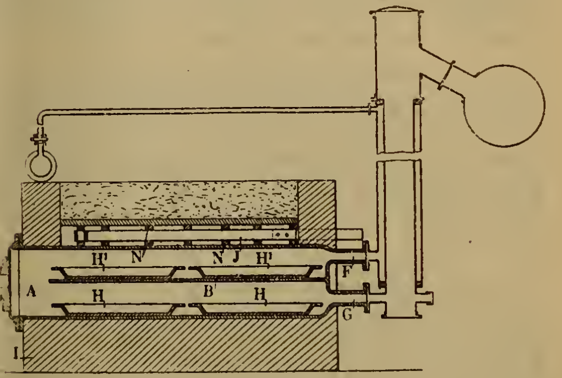
Salt ; Art of manufacturing ——, and salt-making machinery. P. L. Clifton, Assignor to The Pomeroy Salt Assoc. Co., Pomeroy, Ohio. U.S. Pats. 903,357 and 903,358, Nov. 10, 1908.

The process consists in first aerating the brine by means of an aerator adjacent to the outlet of the brine tank, and then heating it to about 180° F. in an open heater, from near the top of which it passes to the bottom of a closed evaporator, at a lower level, where it is heated to 212° F. or more, the heating in both cases being effected by steam coils. The unevaporated brine is tapped off near its surface, and gravitates through a filter to open evaporators and finally to a " grainer," the steam coils in which receive the steam generated in the closed evaporator.—F. Sodn.

Lead arsenate ; Process of making ——. E. F. Luther and W. H. Volck, Watsonville, Cal. U.S. Pat. 903,389, Nov. 10, 1908.

Lead arsenate is made by suspending basic lead carbonate in a solution of arsenic acid.—F. Sodn.

Alkali peroxides ; Process and apparatus for manufacturing ——. Soc. d'Electro-Chimie, and P. L. Hulin. Fr. Pat. 391,931, Sept. 10, 1907.



The horizontal, oblong, iron retort, A, is embedded in masonry and divided into two parts by a horizontal partition, B, which is joined to the retort at one end, but does not extend quite to the other. An air-tight door, E, serves for introducing the raw material and for discharging the finished product. Each chamber is provided with an opening, the one, G, communicating with a source of pure air, and the other, F, serving as exit for waste gases. Immediately above the retort, but separated from it and from the surrounding masonry by supports consisting of thin refractory plates, N, is fixed an electrical conductor, J, of laminated iron shaped like an elongated double horseshoe. Each retort chamber is provided with two rectangular, aluminium trays, H, and H¹, in which the oxidation of the alkali metal takes place. To prepare sodium peroxide, sodium is introduced into the two trays, H, in the lower section of the retort, the door closed, and an electric current of such strength passed through the conductor, J, as to produce a temperature of about 350° to 380° C. in the upper chamber. Partial conversion of the sodium into peroxide takes place with considerable evolution of heat, the latter being in part transferred to the upper chamber, and in part given up to the issuing waste gases, which may be used to pre-heat the entering air. After a few hours, the mixture of sodium and sodium peroxide is withdrawn from the lower chamber, thoroughly broken up, mixed, and transferred to the trays, H^1, in the upper chamber, a fresh supply of sodium being charged into the lower trays H. The reaction begun in the lower compartment is completed in the upper one, the discharge of finished product, the transference of partially oxidised sodium from the lower to the upper trays, and the introduction of fresh metal into the lower trays, following one another as rapidly as possible, each time the door, E, is opened.—O. R.

Silica contained in sodium aluminate ; Process for rendering insoluble the —— to be used for the manufacture of pure aluminium free from silicon. D. Péniakoff. Fr. Pat. 392,187, July 9, 1908. Under Int. Conv., April 24, 1908.

The aluminate of an alkaline-earth metal, *e.g.*, calcium aluminate, is added to the solution of sodium aluminate ; silica is precipitated as calcium silicate, the alumina formed, dissolving. An addition of a little sodium carbonate precipitates the excess of lime as carbonate. The operation is carried out under pressure in autoclaves provided with stirrers. Calcium aluminate is prepared by calcining together bauxite and calcium oxide, or, preferably, precipitated calcium carbonate obtained in causticising.—A. G. L.

Hydrogen peroxide solutions ; Rendering —— stable. E. Merck, Chem. Fabr. Ger. Pat. 203,019, Nov. 7, 1907.

The hydrogen peroxide solution is mixed with a small proportion (2 grms. per 60 litres) of uric acid, which has been prepared in a very finely-divided state by precipitating a solution of one of its salts with a suitable acid.—A. S.

Nitrogen compounds of the alkaline-earth metals ; Manufacture of —— by leading nitrogen over the corresponding carbides at a high temperature. Cyanid-Ges.m.b.H. Ger. Pat. 203,308, Sept. 11, 1907.

In order to obtain absorption of nitrogen at a lower temperature and to render such absorption more rapid, a quantity of a nitrogen compound produced from a carbide, *e.g.*, calcium cyanamide, is added to the alkaline-earth carbide. A mixture of 100 kilos. of calcium carbide with 10 kilos. of crude calcium cyanamide when heated at 900° C. in a current of nitrogen, yields in a comparatively short time, a product containing 20—24 per cent. of nitrogen.—A. S.

Ammonium sulphate ; Manufacture of ——. E. Erlenbach. Ger. Pat. 203,309, Jan. 11, 1908.

The essential feature of the process consists in passing the ammonia vapours first through a bath to which is added continuously a portion of the necessary acid, in a concentrated condition, and then through an absorption apparatus supplied with the remainder of the acid, in a dilute condition. For example, in a case where 10,000 kilos. of sulphuric acid of 60° B. are used in a daily production of 10,000 kilos. of ammonium sulphate, 8000 kilos. of the undiluted acid are run into the first bath, and the remaining 2000 kilos., diluted with 2400 kilos. of water, are supplied to the absorption apparatus.—A. S.

Zinc hyposulphite [hydrosulphite] and ammonium salts ; Process for the preparation of solid, stable, easily soluble compounds of ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 203,846, May 23, 1907.

Soluble double compounds of zinc hyposulphite with ammonium salts are obtained by the action of zinc dust on alkali bisulphite in presence of acids and an ammonium salt.—A. S.

Sulphuric acid ; Manufacture of ——. H. Petersen, Wilmersdorf, Germany. U.S. Pat. 904,147, Nov. 17, 1908.

See Fr. Pat. 377,567 of 1907 ; this J., 1907, 1046.—T. F. B.

Meta-silicate of soda and its amorphous and crystallised hydrates ; Process for the manufacture of ——. A. H. Verrier, Port Marly, France. Eng. Pat. 921, Jan. 14, 1908. Under Int. Conv., Jan. 24, 1907.

See Fr. Pat. 373,884 of 1907 ; this J., 1907, 761.—T. F. B.

Sodium perborate containing borax and method of producing same. F. Fritsche, Assignor to Stolle und Kopke, Rumburg, Austria-Hungary. U.S. Pat. 903,967, Nov. 17, 1908.

See Fr. Pat. 384,967 of 1907 ; this J., 1908, 503.—T. F. B.

VIII.—GLASS, POTTERY, AND ENAMELS.

Patents.

Glass making ; Fireclay pots for ——. C. W. Thomas, Stourbridge. Eng. Pat. 8838, April 23, 1908.

Fireclay pots for melting the ingredients used in glass manufacture are made in two pieces, the lower, "metal"-containing portion, constituting one piece, and the upper portion, or crown of the pot, constituting the other. A ring or cushion of asbestos is inserted between the internal faces of the joint, so as to prevent the ingress of extraneous matter into the pot, and to allow for expansion and contraction.—O. R.

Sheet glass ; Method of making plate or ——. T. Spillane, Kane, Pa. U.S. Pat. 904,158, Nov. 17, 1908.

A mass of glass is placed on a horizontal table and rolled into a plain flat sheet. This sheet is then mechanically gripped on both sides at points near its ends, turned into the vertical position, inserted into a furnace chamber, and moved about in this chamber until it is "fire-polished," the sheet being all the time held by the gripping mechanism.—A. G. L.

Mirrors ; Process of silvering ——. Chem. Fabrik von Heyden A.-G. Fr. Pat. 392,243, July 11, 1908. Under Int. Conv., July 18, 1907.

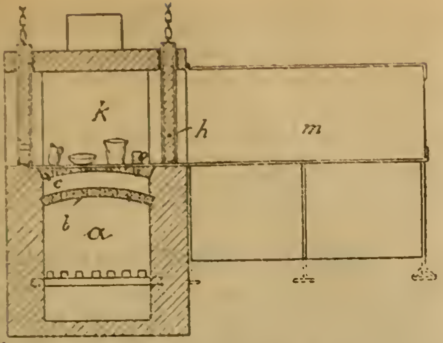
The glass to be silvered is polished, and is then rubbed over with a small quantity of an aqueous solution of silver nitrate mixed with formaldehyde solution and with glycerin, gum or sugar solution, to which a little acetone may be added, if necessary, to obtain a clear solution. The plate is then flooded with the same solution, the excess of which is allowed to drain off, and the plate exposed to gaseous ammonia, or immersed in a solution of ammonia in benzene. The plate is then washed, and the deposited silver covered with shellac as usual. Instead of proceeding as above, the plate may first be treated with a solution of silver nitrate containing ammonia, and then exposed to gaseous formaldehyde.—A. G. L.

Furnace ; Continuous —— for burning enamelled ware out of contact with flames. C. and P. Bouzel. Fr. Pat. 392,285, July 13, 1908. Under Int. Conv., Dec. 14, 1907.

A number of conduits are placed transversely in a reverberatory furnace, projecting at each end for a considerable distance. The flues through which the burnt gases from the furnace pass to the chimney, are placed so as to heat the parts of the conduits outside but adjacent to the furnace. The goods to be burnt travel through the conduits from end to end, the parts of the conduits outside the furnace serving as pre-heating and annealing chambers. Alternatively, the separate conduits may widen out into one large muffle chamber in the centre of the furnace. —A. G. L.

Kiln for enamelled articles, in which these do not come in contact with the flame. J. Klissner. Ger. Pat. 203,296, April 10, 1907.

The combustion chamber, *a*, (see fig.), has two arches, *b* and *c*, provided with openings through which the fire-



gases pass on their way to the kiln, *k*. The side walls of the kiln are removable, and one wall, *h*, allows of direct communication with the cooling chamber, *m*, so that the articles can be removed thereto without coming in contact with the air.—A. S.

Ceramic prints; Production of ——. F. Fuchs, Berlin. Eng. Pat. 13,830, June 30, 1908.

See Fr. Pat. 391,781 of 1908; this J., 1908, 1153.—T. F. B.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Mortar; Microscopic study of ——. G. Gallo. Gaz. chim. ital., 1908, **38**, II., 142—156.

The author's observations lead him to the following conclusions:—The absorption of carbon dioxide is intimately connected with the presence of a certain quantity of water in the mortar. The strength of mortar depends upon the cohesion of the crystalline compounds formed during the setting and upon their adhesion to one another and to the particles of sand with which they are mixed. The lime in mortar is present partly in the solid condition between the grains of sand, and partly in solution; carbon dioxide is absorbed by this solution, with formation of a thin, uniform skin of crystallised calcium carbonate, which, under certain conditions, prevents the absorption of further quantities of carbon dioxide. In a closed chamber, for instance, the absorption of carbon dioxide by fresh mortar soon comes to a standstill. In the air, on the other hand, in consequence of evaporation of some of the water, the coating of calcium carbonate is ruptured, thus permitting the further penetration of carbon dioxide into the mortar. The presence of magnesia in mortar has an injurious effect on the setting power, probably owing to the slight solubility of magnesia in water, and the small absorptive power of the resulting solution for carbon dioxide.—A. S.

Puzzuolana mortar; Microscopic study of ——. G. Gallo. Gaz. chim. ital., 1908, **38**, II., 156—204.

The author's results lead him to the following conclusions as to the setting of puzzuolana mortar:—In the first place the lime water that enters into the composition of the mortar brings about the hydration of the hydraulic silica and alumina, which in consequence of the resulting expansion, occupy the voids previously filled with water and air, forming an impermeable mass, which contributes greatly to the strength of the mortar. Then gradually soluble calcium aluminate is produced, which dissolves to a supersaturated solution, and finally, in presence of excess of lime, crystallises as the compound, $Al_2O_3,3CaO,10H_2O$. The limiting surfaces between the masses of crystals, and the voids left free, are the seat of capillary forces, by which the silica attracts the lime within its pores, causing it to slowly lose its water of hydration, with formation of "calcium monohydrate," whereby the separate particles are cemented together to form a compact and resistant mass, although no definite compound of lime and silica is formed. All these processes take place in the interior of the mortar, which is kept moist and protected from the atmosphere, by an insoluble coating of calcium carbonate (see preceding abstract).

With respect to the determination of the value of puzzuolana, the author recommends heating a weighed quantity of the sample with a 5 per cent. solution of sodium hydroxide on the water-bath for a quarter of an hour, whereby the greater part of the "active" silica and alumina is dissolved. The result of this test, together with determinations of the increase of volume on treatment with lime water, and of the electric conductivity (see Giorgis and Gallo, Gaz. chim. ital., 1906, **36**, 137) gives, it is stated, a reliable indication of the hydraulic value of a puzzuolana.—A. S.

Cement; Egyptian valuation tariff for ——. Board of Trade J., Dec. 10, 1908. [T.R.]

The Egyptian "Journal Officiel" for the 23rd November contains the following revised Valuation Tariff for use in assessing import duty on cement and hydraulic lime. This tariff, which came into force on the 23rd November, is to remain in operation for a period of twelve months or until denunciation:—

Articles.	Valuation per 1,000 kilogrammes.*	
	In barrels.	In bags.
	£E †	£E †
Artificial Portland cement—		
English	2·050	1·950
All other kinds	2·000	1·700
Natural cement—		
Belgian	1·550	1·300
All other kinds	1·700	1·400
"Valentine," "high Valentine," "Roquefort," "Bedoule," and other similar quick-setting cements, of any origin	1·300	1·000
Hydraulic lime of "Teil"	—	1·150
,, ,, Marseilles	—	0·880
,, ,, all other kinds	—	1·000

* Duty is leviable on these valuations at the rate of 8 per cent. † £E1 = £1 0s. 6d.

Patents.

Mica; Method of treating ——. J. P. W. Beckman, Parnassus, Pa. U.S. Pat. 903,949, Nov. 17, 1908.

Mica is rendered flexible by immersing it in a bath of molten metal (*e.g.* aluminium).—A. G. L.

Sand-cores, briquettes, etc.; Binder for ——. E. D. Frohman, Pittsburg, Pa. U.S. Pat. 903,558, Nov. 10, 1908.

The binder consists of the thick residue of plant-juices, or of a saccharine liquid, *e.g.*, molasses, treated with a small percentage of an alkaline substance, *e.g.*, lime.—A. G. L.

[Wood] Lumber; Method of drying and treating ——. A. J. Uphus, Seattle, and N. J. Chapman, Everett, Wash. U.S. Pat. 903,635, Nov. 10, 1908.

Resinous lumber is dried by exposing it to an atmosphere of steam, at atmospheric pressure, but superheated to a temperature at which the turpentine and other resin-solvents are expelled.—F. Sodn.

Wood; Process and apparatus for impregnating ——. J. Polifka and B. Hacker. Fr. Pat. 392,554, July 22, 1908.

Wood is impregnated, at a temperature of 100—130° C., with a mixture of oil from wood tar, rich in creosote oils, and mineral oil, in cylinders which can be placed under increased or diminished pressure. The hot oil is repeatedly forced into and out of the wood, by altering the pressure, the oil traversing the wood several times from end to end. —A. G. L.

Wood surfaces; Coating, polishing, varnishing, etc., of ——. P. Horn. Ger. Pat. 202,418, Nov. 17, 1907.

The essential feature of the process consists in the use of alcoholic or aqueous solutions of decomposition-products of proteins, *e.g.*, protalbin, albumose, etc. For instance, a solution of 120 grms. of protalbin and 60 grms.

of "cotton scarlet" in 1 litre of water, when applied to a smooth wood surface, yields after drying, a hard surface which is ready for varnishing, polishing, etc.—A. S.

Mortar; Preparation of ——. W. Olschewsky. Ger. Pat. 204,161, March 10, 1908.

The lime is slaked by mixing it with a "slip" prepared from plastic clay, and is then intimately mixed with the sand. Portland cement may be added, if desired, to the mixture of lime and clay. If a clayey sand is used, this may be mixed with water and used alone for slaking the lime.—A. S.

Cement; Magnesian ——. Soc. "Ortoclor" Impresa Litosilo Sbertoli. Fr. Pat. 392,328, July 15, 1908.

The magnesian cements claimed are oxychlorides of magnesium, corresponding to the formulæ: Mg_2OCl_2,H_2O; $Mg_2OCl_2,H_2O+3MgO$, ("ortoclor"); $Mg_2OCl_2,H_2O+7MgO$, ("litosilo"); and $Mg_2OCl_2,H_2O+10MgO$. The oxychloride, Mg_2OCl_2,H_2O, is first produced, either by treating magnesium oxide with hydrochloric acid gas, by heating crystallised magnesium chloride, or by treating magnesium chloride solution with magnesium oxide, and is then mixed with magnesium oxide, if the three last-named cements are to be prepared. The cements may be mixed with sawdust, asbestos, stone chips, colouring matters, etc., as usual.—A. G. L.

Stone; Artificial ——. S. W. Berglund, Stockholm. U.S. Pat. 904,923, Nov. 24, 1908.

See Fr. Pat. 366,830 of 1906; this J., 1906, 1081.—T. F. B.

Cement. B. Hövermann, Salzwedel, Germany. Eng. Pat. 15,797, July 24, 1908.

See Ger. Pat. 174,840 of 1905; this J., 1907, 1094. Magnesia and borax may also be added to the mixture. —T. F. B.

Cement from liquid blast furnace slag or its equivalent; Process for preparing ——. W. Lessing. Fr. Pat. 392,341, July 16, 1908.

See Eng. Pat. 19,070 of 1908; this J., 1908, 1153.—T. F. B.

X.—METALS AND METALLURGY.

Cast iron; Carbon and the properties of ——. H. M. Howe. Eng. and Min. J., 1908, **86**, 943—946.

The variations in the tenacity, hardness, and ductility of iron, caused by the presence of varying amounts of combined carbon, are illustrated by diagram (see Fig. 1). The difference in the properties of cast iron due to the distribution of its carbon between the graphitic and the combined state, is also clearly shown (see Fig 2). A series of irons, all containing 4 per cent. of carbon, is illustrated, ranging from soft grey iron containing no combined carbon, to a hard white iron containing no graphitic carbon. The graphite is enclosed as a skeleton in an iron matrix containing progressively more and more combined carbon as the percentage of graphite decreases, and curves are given (see Figs.) showing the relative hardness and ductility of the metallic matrix and of the iron as a whole. Notes are given on the usual means of controlling the distribution of the two states of carbon, and of the effect of sulphur, manganese, and phosphorus. —F. R.

Fig. 1.

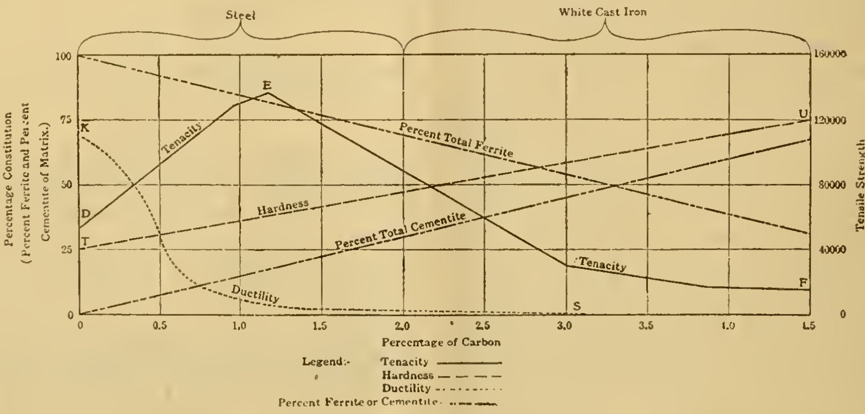
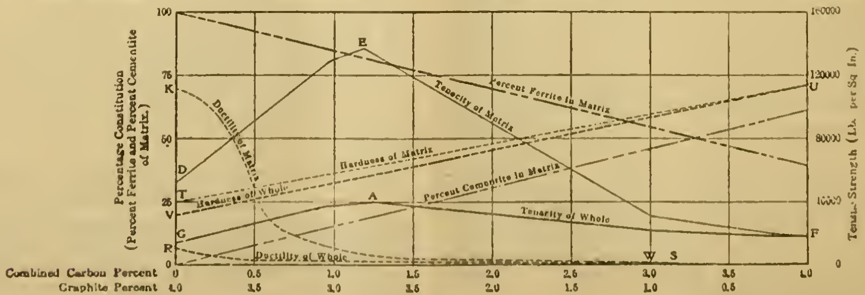


Fig. 2.

Name of matrix	Low carbon steel	Medium carbon steel	High carbon steel		White cast iron	
Name of the cast iron *i.e.*, of the whole	Very open grey or very graphitic cast iron			Close gray cast iron	Mottled cast iron	White cast iron



[*Iron smelting*]. *The Gayley dry blast at the Warwick furnaces, Pottstown, Pa.* E. B. Cook. Trans. Amer. Inst. Min. Eng., 1908, 917—934.

THE working of an iron blast-furnace is rendered more difficult by the varying amount of moisture contained in the ordinary air blast. In order to reduce and control the amount of moisture in the blast at the Warwick works, a Gayley dry-air plant was erected (see this J., 1904, 1148). The apparatus consists essentially of the necessary compressors, condensers, etc., and of an ammonia-brine plant for the cooling of a refrigerating chamber. The air, on its way to the blowing engine, passes through the refrigerating chamber, where its excess of moisture is deposited. Details are given of the initial difficulties encountered, but these were overcome by largely increasing the burden of the furnace, with a resulting greater output and a saving of fuel. The dry blast permits of the production of iron of more uniform composition, especially as regards the silicon and sulphur. On one occasion, when the drying plant was disconnected for ten hours, and the moisture rose from 0·63 to 4·08 grains per cb. ft., the silicon in the iron fell from 2·5 to 2 per cent. until the drying was renewed. It is estimated that a saving of 400 lb. of fuel and an increase of 350 tons of iron per week have been accomplished at these works through the use of the dry blast.—F. R.

Blast-furnace slags; Constitution of ——. M. Theusner. Metallurgie, 1908, 5, 657—673.

FOUR blast-furnace slags of different composition were examined, both in the slowly cooled and in the granulated state, as to their solubility in solutions of citric acid, ammonium citrate, and ammonium chloride. In the case of slags rich in lime, it was found that much lime and but little silica or alumina went into solution; the proportion of silica to alumina was practically the same in the residue as in the original slag. Less basic slags, on the other hand, were not denuded of lime to nearly the same extent, and apparently calcium silicate, as well as lime, dissolved. The granulated slag was always appreciably more soluble than the corresponding slowly cooled slag; after keeping for some time, however, the reverse was the case, the granulated slag passing into a third, crystalline, modification, considerably less soluble than the slowly cooled slag. Apparently, the granulated slag represents an unstable state of the slag, whilst both the other modifications are stable. Nine artificial slags, containing varying proportions of lime, silica, and alumina, were also prepared, and their melting-points (1300°—1650° C.) and behaviour towards water and solutions of ammonium chloride and ammonium citrate determined. From the results it appears that calcium aluminates are formed only if the quantity of lime present exceeds that necessary to form the compound, $2CaO,SiO_2$. All the slags rich in alumina or silica were but little attacked by the three solvents; slags containing 60 per cent. of lime were freely attacked, a great deal of lime going into solution. The salt solutions also dissolved considerably more silica than alumina, whilst pure water dissolved comparatively large quantities of alumina and only traces of silica. A portion of the dissolved alumina (according to Le Chatelier, that in excess of the compound $3CaO,Al_2O_3$.) separates from the solution on standing.—A. G. L.

Cupola gases; Sulphur-content of ——. O. Johannsen. Stahl u. Eisen, 1908, 28, 1753—1755.

OSANN has shown (Stahl u. Eisen, 1908, 1449) that in the cupola, the total sulphur introduced in the iron and the coke is not accounted for in the melted iron and the slag; and he assumes that beneath the slag there is a layer of matte rich in sulphide, containing most if not all of the remaining sulphur. The author has determined the sulphur content of the gases escaping from the furnace and finds on the average 1 grm. per cubic metre. Assuming 8 cb. m. of gas for each kilo. of coke burnt, containing 1—1·5 per cent. of sulphur, this represents a considerable proportion of the total sulphur of the coke. In a "sulphur balance sheet" of the furnace, the sulphur introduced was —in pig 22·88, in coke 25·35, in limestone 0·33, total 48·56 kilos.; and the sulphur taken out—in iron 23·23, in slag 5·55, in gases 17·73, total 46·51 kilos. There is thus practically no sulphur left to be removed in the form of Osann's hypothetical matte.—J. T. D.

(*Silver*) *Cyaniding in Mexico.* C. T. Rice. Eng. and Min. J., 1908, 86, 947—950.

DESCRIPTIONS are given of the silver cyaniding practice at three mills in Guanajuato, Mexico. The ore is crushed by 1050 lb. stamps, in a 0·1 per cent. cyanide solution, and then classified by means of cones and tables. The overflow from the tables is concentrated on a "planilla," a cement table 72 ft. wide and 27 ft. long in the direction of flow, having a slope of 1 in 100. The roughly concentrated sulphides from the "planilla" are re-treated on a frue vanner. Up to the present, the concentrates have been sent away to be smelted, but a cyanide plant is being erected to treat them. The sands are cyanided by percolation, and the slimes by agitation, decantation, and filter-pressing. Curves are given showing the rate of extraction in the slime treatment. The silver extraction was 74, 78·5, and 80 per cent. in 30, 40, and 50 hours respectively, the maximum gold extraction of 88 per cent. being obtained in 34 hours. The consumption of cyanide was 0·8 kilo. and of lead acetate 0·07 kilo. per ton (2000 lb.) of ore milled.—F. R.

Platinum in Douglas County, Oregon. H. P. Pulsifer. Eng. and Min. J., 1908, 86, 1003.

THE Cracker Jack Mine in Douglas County, has been worked for gold by the hydraulic process for about ten years, but till last season, no systematic saving of the platinum was attempted. During the season, 14,000 cb. yards of gravel were washed through the sluices and a total of ten tons of concentrates obtained. The concentrates were screened with plenty of water over ½ in.-mesh screen, and the mercury and amalgam caught in a trap below. The concentrates were then twice jigged by hand, reducing them to 1500 lb. and washed over a series of steep mercury troughs to remove the rusty gold and the last trace of mercury. The concentrates were further reduced to about 400 lb. of "almost pure black sand," by being passed through a small jig, having a 10 by 12 in. screen area. It had been expected that it would be impracticable to remove the platinum grains by simply panning with water, but on the contrary it was found that the grains of this rare metal settled readily, and hence half an ounce of clean white metallic grains were obtained. A recovery of 90 per cent. of the rare metals is said to be readily obtained with comparatively primitive plant.—F. R.

Copper-iron and copper-lead-iron mattes; Constitution of ——. C. H. Fulton and I. E. Goodner. Trans. Amer. Inst. Min. Eng., 1908, 959—995.

DETAILED descriptions are given of the metallic sulphides, and the binary systems of the metallic sulphides, entering into the constitution of copper-iron and copper-lead-iron mattes. The chief constituents are: (1), cuprous sulphide, which is capable of dissolving 25 per cent. of ferrous sulphide. At high temperatures, part of the sulphur is given off and the excess of copper and iron remain dissolved in the copper-iron sulphide. On cooling to 103° C., metallic copper separates from the solid mass in the form of "moss copper"; (2), ferrous sulphide which acts in a similar manner to copper sulphide, but can only dissolve about 5·2 per cent. of copper sulphide; (3), a cuprous and ferrous sulphide eutectic containing about 17 per cent. of copper and freezing at 895° C.; (4), metallic iron; (5), metallic copper; (6), probably nearly pure zinc sulphide; (7), probably slag crystals; (8), lead sulphide; (9), a lead and copper sulphide eutectic of unknown composition. Cuprous sulphide and lead sulphide have a strong solvent action on silver, while cuprous sulphide, metallic copper, and iron are solvents for gold. Hence cuprous sulphide should be present when it is desired to collect both the precious metals in the matte. A number of microphotographs and tables of curves are given, together with the tabulated results of the chemical composition and microscopical character of 39 mattes, taken from different smelting works.—F. R.

Nickel antimonide. Action of antimony trichloride on nickel. E. Vigouroux. Compt. rend., 1908, **147**, 976—978.

Nickel is heated to 800° C. in a porcelain boat in a glass or porcelain tube, and the vapour of antimony trichloride is passed over it. On cooling, the nickel chloride formed is washed out with water, and the residue is again heated at 800° C. in antimony trichloride vapour. These operations are repeated till no more nickel chloride is formed, when the residue is found to consist of the antimonide, NiSb. This is a crystalline, shining, violet-red powder, having a metallic appearance; it is non-magnetic, and has the sp. gr. 7·70. It fuses at 1100° C. and at 1400° C. decomposes, evolving antimony. It is attacked by chlorine or by oxygen at a low red heat, and at a still lower temperature by sulphur. Hydrochloric acid has no effect on it; sulphuric acid attacks it only when concentrated and hot. Hot dilute nitric acid attacks it; the concentrated acid or nitro-hydrochloric acid attacks it still more readily. Fused alkali hydroxides, carbonates, or nitrates, are practically without action on it, but potassium chlorate oxidises it readily. The same substance can be produced by the action on powdered nickel of either powdered metallic antimony or antimony vapour.—J. T. D.

Thorium. W. von Bolton. Z. Elektrochem., 1908, **14**, 768—770.

Thorium is obtained by heating the oxide, ThO_2, to a red heat in a stream of carbon tetrachloride vapour, and then reducing the crystalline and very hygroscopic chloride by heating with sodium, the excess of sodium being removed by alcohol, and the metal washed by boiling with water and dilute nitric acid; the yield is almost quantitative. Thorium melts at 1450° C. and resembles platinum in colour, ductility, and hardness. Its specific resistance is 0·401. The powdered metal burns readily in the air, and hydrochloric acid attacks it vigorously, but a grey residue which is a lower oxide of thorium remains insoluble to the extent of about 15 per cent. of the weight of the metal. The author believes that water is decomposed in the process of solution, part of the metal becoming thereby oxidised. When thorium powder is shaken with cold 5 per cent. hydrochloric acid, part of the metal dissolves; on heating the solution, or adding strong hydrochloric acid and boiling, there is precipitated a yellow or dirty green powder which is apparently of the formula, $(ThO_2)_{10},(HCl)_4$. Towards reagents, this does not behave like a compound of ordinary thorium, and the author names it "muriaticum-thorium." It is thus named because soluble in dilute hydrochloric acid, and again re-precipitated by strong hydrochloric acid. It is also quite soluble in water. With oxalic acid the solution in dilute hydrochloric acid, or water, gives a precipitate which is soluble in excess, whereas thorium chloride gives a precipitate insoluble in excess. By heating in carbon tetrachloride vapour, however, it furnishes ordinary thorium tetrachloride, and this, on reduction, gives normal thorium from which "muriaticum-thorium" may be separated again. The content of thorium in "muriaticum-thorium" amounts to about 10 per cent. The radioactivity of the two forms is identical.—F. Sodn.

Aluminium; Superheating phenomenon with ——. W. von Bolton. Z. Elektrochem., 1908, **14**, 766—767.

A piece of aluminium wire, when held in a Bunsen flame, melts, but retains its form, and likewise an electric current of 35 amps. may be maintained in a wire of 0·5 mm. diameter for some hours, the wire glowing all the time at a white heat. In such circumstances the wire becomes a tube of oxide enclosing molten metal, and this is proved by the mechanical and magnetic deformability of the wire. The alloy, magnalium, exhibits a similar phenomenon, and either direct or alternating current may be employed to produce the effect.—F. Sodn.

Carbides; Formation of some ——. J. N. Pring. Chem. Soc. Proc., 1908, **24**, 240—241.

An investigation has been made of the direct union of carbon with the elements aluminium, silicon, and iron in the absence of solid and gaseous impurities. Some preliminary experiments were also carried out with magnesium. An intimate mixture of the metal with highly-purified carbon, both in a very fine state of division, was heated in a suitable apparatus, enabling definite constant temperatures to be maintained over long intervals, and capable of being evacuated to a pressure below 0·01 mm. The direct union of pure silicon and carbon in a vacuum commences between 1250° and 1300° C., and the presence of iron does not apparently facilitate the reaction, nor does carbon monoxide exert any influence between the limits of atmospheric pressure and 0·03 mm. Aluminium unites directly with pure carbon in a vacuum at its melting point (650°), forming aluminium carbide, Al_4C_3, and the velocity of the reaction increases with the temperature, the reaction proceeding rapidly above 1400° C. Iron unites directly with carbon at about 700° under a pressure of about 0·05 mm. Magnesium shows evidence of forming a new carbide below 600°, this compound giving some saturated hydrocarbon on decomposition with water or acids.

Copper and brass from corrosion; Protection of ——. B. F. Isherwood. J. Amer. Soc. of Naval Eng., **19**, 601.

Experiments made with copper and brass in sea-water, showed that tar, paints, etc., fail to give adequate protection from corrosion. Uthemann (Engineering Council of the German Navy), found that a coating of iron, electro-deposited in the usual way upon a copper tube, entirely dissolved off in sea-water. It is well-known, however, that the copper or brass tubes of surface condensers with cast-iron shells, are but slowly attacked by sea-water; and Uthemann found copper or brass tubes can be adequately protected by means of a wire or band of iron or steel wound spirally round them. He observed that when copper or brass is thus wound with iron wire, and the whole then dipped in sea-water, a copious disengagement of gas in bubbles occurs, and the liquid becomes tinged reddish-yellow because of the "formation of oxide of iron at the expense of the metallic iron." At first the copper remains bright, then the oxidation of the iron follows, and the copper gets covered between the spirals (and, more slowly under the spirals) with oxide of iron which soon becomes adherent so as not to be swept off by even a very rapid current of water, thus affording perfect protection even after the removal of the iron spirals. This protection, moreover, is of like effect, whether in the case of copper or its alloys. (See also this J., 1905, 623 and 735.)

Mineral production of Spain. Board of Trade J., Dec. 10, 1908. [T.R.]

The following figures show the production of certain minerals in Spain during the years 1906 and 1907:—

—	1906.	1907.
	Metric tons.	Metric tons.
Antimony	180	92
Asphaltum	7,794	8,467
Mercury	26,186	12,620‡
Sulphur	28,965	26,632
Zinc	170,383	126,351§
Copper and copper pyrites	2,888,777	3,376,041
Tin	86*	294
Phosphorite	1,300	3,078
Graphite	—	2,473
Iron ore	9,448,533	10,072,709
Manganite	†	33,916
Silver	470	648
Lead	105,095	276,021
,, (argentiferous)	158,424	15.541
Wolfram	†	163

* Dressed ore. † Information not available. ‡ Except Almaden. § Blende and calamine.

Mercury production of the United States. U.S. Geol Survey, 1908. [T.R.]

In general the condition of the mercury industry in the United States showed but little improvement in 1907 over that of the previous year. For some time past the metallurgical processes for the recovery of gold and silver have been somewhat less dependent upon the use of this metal than in earlier years, and the demand for it has correspondingly decreased. Furthermore, with increase in recent years of economical methods, characteristic of modern metallurgy, there has been less waste of mercury than before. On the other hand, amalgamation mills have increased somewhat in number, and with the development of new goldfields the demand for mercury for amalgamation, for the manufacture of vermilion, and for less important use, will probably not fall much below the minimum of the last two or three years. The demand from China and Mexico resulted in considerably increased exports during 1907 over those of 1906, but the price obtained during the greater part of the year was not sufficiently attractive to stimulate greatly the industry.

The following table shows the production of mercury by States in flasks of 75 pounds each in the years 1906 and 1907:—

State.	1906.	1907.
	Flasks.	Flasks.
California	20,310	17,431
Oregon	3	—
Texas	4,761	3,686
Utah	1,164	450
Total	26,238	21,567

Patents.

Tungsten metal combinations; Preparation of ——. F. Harrison and C. H. Dorman, London. Eng. Pat. 23,988, Oct. 30, 1907.

Hydrogen, mixed with the vapour of an organic compound, such as alcohol, is passed over finely powdered tungstic acid at 400° to 500° C. The powder obtained is black and consists of: tungsten, 97 to 98; carbon, 2·5 to 1; and hydrogen, 0·4 to 1·5 per cent., and is claimed as a compound of tungsten, carbon, and hydrogen. Similar compounds can also be obtained by boiling very finely divided metallic tungsten with alcohol or other organic liquid for a considerable time.—O. R.

Blast-furnace slag; Treatment [desulphurisation] of ——. H. K. G. Bamber, Greenhithe, Kent. Eng. Pat. 2405, Feb. 3, 1908.

Small auxiliary tuyères are inserted in a blast-furnace, "immediately above the charge of the molten iron and below the surface of the molten slag." For short periods before drawing off the slag, part of the hot blast is diverted from the main tuyères, and forced through these auxiliary tuyères and through the molten slag. The sulphur contained in the latter is thereby oxidised, with formation of sulphur dioxide, which escapes, and of calcium sulphate, which is innocuous for the subsequent utilisation of the material. If desired, chlorates or other oxidising agents may be added to the molten slag to accelerate the oxidising process.—O. R.

Blast furnace dust, mineral dust or fine ores; Manufacture of briquettes from ——. W. Lessing. Fr. Pat. 392,289, July 13, 1908.

The binding agent employed is prepared from blast-furnace slag by pulverising it by means of a current of vapour, gas, or air charged with pulverulent substances such as lime, or by any other means. This product may be afterwards mixed, if desired, with a small quantity of some finely-powdered alkali or alkaline-earth salt. The greater part of the sulphur contained in the slag is removed during the pulverisation, so that, in the after treatment, it has no detrimental effect on the agglutinating properties of the binder.—C. A. W.

Copper and nickel ores; Treating pyritic ——. J. T. Carrick and B. S. Pattison, Johannesburg, Transvaal. Eng. Pat. 2971, Feb. 10, 1908.

Pyritic copper and nickel ores are smelted so as to yield a matte containing at least as much iron as valuable metal (copper, nickel, cobalt); iron pyrites may be added to the ore, if necessary. The slag produced, being poor in iron, is difficultly fusible; to prevent it from solidifying in the slag tap-hole during tapping, a damper is placed in the flue leading from the furnace, and means are provided for blowing fuel and air into the furnace close to the tap-hole during the tapping; the damper in the flue is closed during this operation, and flames are thus projected out of the tap-hole with the slag, and keep it liquid.—A. G. L.

Copper-leaching process. F. Laist, Butte, Mont. U.S. Pat. 903,732, Nov. 10, 1908.

Cuprous chloride is prepared from a solution of cupric chloride, by dissolving sulphur dioxide gas therein, and heating under pressure.—A. G. L.

Ore separators; Centrifugal ——. P. F. Peck, Chicago, U.S.A. Eng. Pat. 3682, Feb. 18, 1908.

A separating channel is formed between the inner surface of the frustum of a cone covered at the top and provided with a horizontal water-retaining plate at the bottom, and a similarly shaped internal deflector. A distributing device at the top of this deflector supplies ore mixed with water, or water only, from different parts. The outer separating surface, the inner deflector, and the distributing device are all rotated at different rates, and enough water is supplied to keep the annular separating channel completely filled with water, whereby the constituents of the ore are moved along the separating surface at different velocities, and are, at intervals, washed off this surface into separate launders, the openings to which can be closed during certain periods of the process.—A. G. L.

Steel; Converting iron into ——. E. Torrini, Paris, and M. Hoffmann, Courbevoie, France. Eng. Pat. 13,699, June 29, 1908.

Iron articles are converted into steel, by immersing them, without previous heating, in a bath consisting of "10—15 grms. of cryolite, 60 grms. of potassium cyanide, 30 grms. of potassium ferrocyanide, and 25 grms. of hydrocyanic acid," kept at a temperature of 900° C. The proportions of the various ingredients may be varied by about 20 per cent.—A. G. L.

Armour-plate, rails, etc.; Smelting ores, mattes, and metals for ——. W. E. Everette, Tacoma, Wash. U.S. Pat. 904,054, Nov. 17, 1908.

Ores, mattes, alloys, and metals are smelted with a flux composed of carbon and an alkali cyanide; the metal obtained is cast into moulds.—A. G. L.

[Copper-tin-lead] alloy [for bearings]. G. H. Clamer and J. G. Hendrickson, Assignors to Ajax Metal Co., Philadelphia, Pa. Reissue 12,880, dated Nov. 17, 1908, of U.S. Pat. 655,402, Aug. 7, 1900.

The alloy contains tin in the proportion of not more than 9 per cent. of the copper present, whilst the quantity of lead exceeds 20 per cent. of the total alloy. It is claimed that an alloy of tin and copper is formed within the mass, which, on cooling, rapidly solidifies at a high temperature, and thus forms a net-work within which the lead is held mechanically until solid.—A. G. L.

Metallic substances; Process of reducing —— *by volatilisation and precipitation, and method of reducing ores.* G. F. Rendall, New York, Assignor to American Reduction Co., N.J. U.S. Pats. 903,317 and 903,318, Nov. 10, 1908.

(1). The ore is heated in a closed chamber, and the volatile products evolved are mixed with "wood-gas" and passed to a condenser, wherein the reduced metallic particles are "precipitated." The gases leaving the condenser are subsequently treated for the separation of the lighter particles. (2). The ore is heated to a low red heat and reduced by a current of gases "containing more hydrogen than oxygen," obtained by distilling wood. The hot material is then discharged into water, crushed, and the product subjected to the action of ascending currents of water to eliminate the lighter silicious particles. —A. G. L.

[Sulphide ores] Materials; Process of treating [roasting] —— by the action of air or other gases. J. E. Greenawalt, Denver, Colo. U.S. Pat. 904,060, Nov. 17, 1908.

The materials (sulphide ores) to be treated are placed in a furnace on a porous bed, *e.g.*, of sand, and pre-heated gases (air) are forced through this porous bed into the material, a regulated volume of pre-heated gases (air) being also introduced into the furnace above the materials.—A. G. L.

Tin; Process and apparatus for obtaining pure metallic —— from impure [electrolytic] tin-sponge or slime. Soc. d'Electro-Métallurgie de Dives. Fr. Pat. 392,037, July 6, 1908.

Impure tin-sponge or slime (1000 kilos.), obtained electrolytically from scrap-tin, tin-ashes, etc., is treated for 3 hours with a 0·25 per cent. solution of potassium cyanide (750 litres), in an iron vessel provided with an agitator. The liquid, which contains iron, copper, and lead in solution, is then run through five settling tanks, in which the tin is collected in the form of small grains, which are washed, dried, and fused into ingots.—A. G. L.

Ore briquettes; Process of forming ——. J. Kraus. Fr. Pat. 392,155, June 1, 1908. Under Int. Conv., June 7, 1907.

The material to be treated is compressed into egg-shaped lumps capable of rolling, only such an amount of binding agent being employed as will secure their cohesion during the after process. These lumps are hardened by causing them to traverse a rotating cylinder or inclined flues, where they meet with gases containing carbon dioxide from a furnace.—C. A. W.

Antimony oxide; Reduction of ——. L. Le Meunier. Fr. Pat. 392,169, July 2, 1908.

Antimony oxide is intimately mixed with 10 to 15 per cent. of charcoal or anthracite, 2 to 5 per cent. of a flux such as sodium carbonate, and 12 to 15 per cent. of water, the mixture being afterwards agglomerated in a suitable machine. The product, in the form of lumps is melted in a cast iron crucible or reverberatory furnace while still wet. This last condition, while modifying the violence of the reaction, more than doubles its velocity. After the layer of slag has been removed, a mixture of oxide, 90, and carbonate, 10 per cent., is added so as to cover the charge, which is finally run into an ingot mould.—C. A. W.

Volatile metals and metalloïds, especially zinc, lead, arsenic, antimony, etc.; Recovery of —— from products containing them. W. Witter. Fr. Pat. 392,422, June 23, 1908. Under Int. Conv., July 2, 1907.

The molten slag or ore, mixed if necessary with a flux, is run into a receptacle, preferably a pot of the shape of an inverted cone fitted at the top with flues for the escape of gas. It is there subjected to the action of a current of air charged with powdered charcoal, so that the zinc and other volatile elements are first reduced by the latter and finally pass off in the form of oxide vapours which can be collected in suitable receivers. The combustion of the carbon, which may also be present in the form of small briquettes mixed with the mass before blowing in air, provides the heat necessary for the reaction.—C. A. W.

Furnace for treatment of complex zinciferous materials. E. F. Baraige. Fr. Pat. 392,590, July 23, 1908.

The upright cylindrical furnace chamber is provided, at different portions of its height, with tuyères, so that a high temperature can be maintained throughout and obstruction by zinciferous deposits prevented. By means of partitions at the top, the ore charge and fuel are caused to fall in separate columns, and the ore alone is subjected to the blast, which does not act directly on the fuel, until the level of the oxidising tuyères is reached. At this point a high temperature is obtained by the oxidation of the zinc vapours and combustible gases as they ascend from the lower portion of the furnace. The heated mixture of ore and fuel passing downwards reaches the reduction tuyères where a still higher temperature is obtained, the zinc passing off in the form of vapour to be finally collected as oxide in flues at the top of the furnace. Any iron or copper is collected beneath the slag at the bottom in the metallic condition or in the form of a matte.—C. A. W.

Chromium from commercial ferrochrome; Process for the production of pure ——. E. A. O. Viel, Paris. Eng. Pat. 24,875, Nov. 9, 1907.

See Fr. Pat. 381,266 of 1907; this J., 1908, 131.—T. F. B.

Case-hardening steel and iron articles. A. W. Machlet, Elizabeth, N.J., U.S.A. Eng. Pat. 25,087, Nov. 12, 1907.

See Fr. Pat. 389,547 of 1908; this J., 1908, 985.—T. F. B.

Aluminium or aluminium alloys, and silicides; Manufacture of ——. A. Sinding-Larsen, Christiania, Norway. Eng. Pat. 25,408, Nov. 16, 1907. Under Int. Conv., Nov. 17, 1906.

See Fr. Pat. 384,069 of 1907; this J., 1908, 409.—T. F. B.

Tin from tin plate waste; Apparatus for removing ——. H. Brandenburg, Kempen on Rhine, Germany. Eng. Pat. 2322, Feb. 1, 1908.

See Fr. Pat. 386,781 of 1908; this J., 1908, 813.—T. F. B.

Metals; Process of obtaining —— from their ores. K. Kaiser, Berlin. U.S. Pat. 904,263, Nov. 17, 1908.

See Fr. Pat. 367,969 of 1906; this J., 1907, 55.—T. F. B.

Homogeneous bodies from tantalum metal or other refractory metals; Process of making ——. W. von Bolton, Charlottenburg, Assignor to Siemens und Halske A.-G., Berlin. U.S. Pat. 904,831, Nov. 24, 1908.

See Fr. Pat. 337,607 of 1903; this J., 1904, 494.—T. F. B.

Gold from crushed ores; Apparatus for the extraction of ——. T. E. Beaumont, London. U.S. Pat. 905,048, Nov. 24, 1908.

See Eng. Pat. 23,319 of 1905; this J., 1906, 1225.—T. F. B.

Zinc furnaces; Apparatus for protecting the operatives of —— against heat, fumes, and dust. E. Dor-Delattre. Fr. Pat. 392,480, July 20, 1908. Under Int. Conv., Sept. 7, 1907.

See Eng. Pat. 15,228 of 1908; this J., 1908, 1069.—T. F. B.

Silica contained in sodium aluminate; Process for rendering insoluble the —— to be used for the manufacture of pure aluminium free from silicon. Fr. Pat. 392,187. *See* VII.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(*A*.)—ELECTRO-CHEMISTRY.

Ammonia; Formation and decomposition of —— by the silent electric discharge in a Siemens tube, with special regard to the applicability of the law of mass action. J. H. Davies. Z. physik. Chem., 1908, **64**, 657—685.

Experiments on the decomposition of ammonia in a Siemens tube under the influence of the silent electric discharge, showed that this corresponds fairly well with a reaction of the first order, but further results indicated that the decomposition under these conditions is not an ordinary chemical reaction. For instance, the temperature-coefficient is only about one-tenth as large, being about of the same order as that of photochemical reactions. In presence of excess of hydrogen, the rate of decomposition is reduced, whilst with excess of nitrogen, it is increased. When an alternating current is used, the rate of decomposition is practically independent of the frequency of the alternations. Equilibrium is attained with pure ammonia or with a stoichiometrical mixture of nitrogen and hydrogen when the resulting gas mixture contains 3 per cent. of ammonia. With mixtures containing excess of either hydrogen or nitrogen, the yield of ammonia is less. The equilibrium is affected only to a very slight extent by varying current strength. The law of mass action is not applicable to the reaction. The rate of formation of ammonia is very large at first, and then decreases fairly rapidly: it increases with increasing current strength.—A. S.

Patents.

Plates for storage batteries ; Process of forming ——. W. Morrison, Assignor to G. R. Coryell, Chicago, Ill. U.S. Pat. 903,752, Nov. 10, 1908.

Lead plates, for use in storage batteries, are superficially disintegrated, and provided with a crust or outer layer serving as the active material, by subjecting the plate to "electrochemical action in a solution formed by combining sulphuric acid, nitric acid and the oxygen-bearing salt of manganese that will travel toward the positive pole."—B. N.

Active materials in alkaline accumulators ; Process to prevent the fall of ——. L. Marseille and P. Gouin. Fr. Pat. 392,024, July 4, 1908.

The fall of active materials in alkaline accumulators is prevented by applying an anhydrous, adherent, conducting oxide of nickel, formed by the decomposition of nickel nitrate, to the external parts of the electrodes, the oxide stopping up the smallest interstices of the electrodes —B. N.

Electrolyte, with rapid and constant depolarisation. Soc. d' Etudes des Automobiles "Electron." Fr. Pat. 391,468, Aug. 29, 1907.

Organic compounds, easily reduced by hydrogen, such as nitro-aromatic or nitro-paraffin derivatives, nitriles, or ketones, are employed in primary or secondary batteries for the purpose of effecting depolarisation.—B. N.

Ozone ; [Electrical] Generator of ——. J. J. E. Douzal. Fr. Pat. 391,368, May 4, 1908.

The internal surface of a glass spiral acts as the dielectric, and a strip of tin foil or aluminium on the external surface as one of the electrodes. The second electrode consists of a metallic tube, arranged inside the spiral, the coils of the latter lying close together. Between the coils of the glass spiral, the inner metallic tube is perforated with a number of fine openings, air being drawn through these by the action of a water pump. Each opening is armed on its circumference with several points, inclining towards the apex of a cone, where the current density is therefore very great. The liquid to be treated is passed through the glass spiral from below upwards, thus cooling the latter and the electrodes, and at the same time is ozonised. From the top of the spiral the liquid passes into a long fall tube, connected below to an injector, of the form of a water-pump. The side tube of the injector is connected to the interior of the inner metallic tube near the bottom, so that the injector action of the falling liquid draws air into the metallic tube, which air is ozonised in its passage through the perforations, and is afterwards intimately mixed with the liquid in the injector.—B. N.

Furnace ; Electric resistance —— *with high pressure.* J. Josselin. Fr. Pat. 391,461, June 18, 1908.

The body of the furnace consists of a block of steel in the form of a vertical cylinder, in the centre of which is a cavity containing a carbon crucible, suitably supported between carbon electrodes to form the resistance. The cavity is closed above and below by pieces, bringing the current to the electrodes, which make a tight joint with the steel block. The pressure inside the cavity is obtained by means of a liquid, such as carbonic anhydride, this being compressed in the interior of the cavity by means of a hydraulic pump united in a convenient manner to the furnace. The cylindrical body of the furnace is cooled by water circulating through a copper casing, the latter being provided with vertical wing pieces for increasing the cooling surface, and the electrodes are similarly cooled by water circulating through the blocks into which they fit.—B. N.

Furnaces ; Electric induction ——. O. A. Zander. Fr. Pat. 391,483, June 19, 1908. Under Int. Conv., June 20, 1907.

The melting chamber is in the form of a crucible or shell, the material to be treated forming the secondary circuit. The crucible is directly surrounded by one or more primary induction windings, the furnace being without an iron core, so that the losses of the iron are avoided ; the construction is thus rendered as light as possible, so that the furnace may be easily moved.—B. N.

Furnace ; Electric —— *serving for the combustion of gases and the reduction of metallic oxides.* G. Brisset. Fr. Pat. 391,645, Sept. 2, 1907.

For the purpose of bringing about powerful reactions between gases, especially in the production of oxides of nitrogen, the electric arc is lengthened and flattened, by producing it between several zones of magnetic lines of force formed by one or several electromagnets. The electrodes, serving to conduct the discharge between the lines of force, are cooled by means of liquids circulating through auxiliary tubes. Several arcs may be produced V the same furnace, and may be of various dispositions, in-shaped, lozenge-shaped, etc. In order to drive the gases against the arcs, several supplementary currents of gas are introduced into the furnace, near to the exits for the gases. In the case of lozenge-shaped arcs, the gas is introduced into the central part of the lozenge, and additional currents of gas are arranged on the outside of the arcs, so as to maintain the latter against the outward thrusting of the internal current of gas. The electrodes may be placed parallel to the lines of force, or perpendicularly to the same. In the treatment of oxides, a distributor is placed in the upper part of the furnace, for the purpose of distributing the material on to the arcs.—B. N.

Gas reactions ; Apparatus for effecting —— *with the aid of the electric arc.* Aluminium-Ind. A.-G. Ger. Pat. 202,400, Jan. 22, 1907.

In apparatus of the type in which gas reactions are effected in several independent small elements by means of the electric arc or flame discharge, it is proposed to take the current independently from the conductors carrying the induced current of an alternating current generator or transformer (without collecting it as usual), and lead it directly to the several elements in which the discharge is effected. For example the current is led directly and independently from the several coils of an alternating current generator.—A. S.

Bodies capable of conducting electricity in a cold state ; Processes of manufacturing ——. E. von Seemen, Paris. Eng. Pat. 25,655, Nov. 19, 1907. Under Int. Conv., Nov. 19, 1906.

See Fr. Pat. 384,105 of 1907 ; this J., 1908, 453.—T. F. B.

Filaments for incandescent electric lamps. Eng. Pats. 5416 and 20,223. *See* II.

Plastic masses of oxide of tungsten [for incandescent lamp filaments] ; Manufacture of ——. Eng. Pat. 14,850. *See* II.

Filaments ; Process and apparatus for formation of electric incandescence lamp ——. Fr. Pat. 392,454. *See* II.

Metallic filaments ; Formation of ——. Fr. Pat. 392,455. *See* II.

Metallic filaments ; Manufacture of ——. Fr. Pat. 392,501. *See* II.

Metallic filaments ; Removal of impurities from ——, *etc.* Fr. Pat. 392,524. *See* II.

Filaments ; Manufacture of electric incandescence lamp ——. Fr. Pat. 392,536. *See* II.

(*B.*)—ELECTRO-METALLURGY.

Patents.

Separating electro-deposited metals from lead matrices; Method of ——. C. Reverdes, New York, Assignor to F. Wesel Manufacturing Co., Brooklyn, N.Y. U.S. Pat. 903,404, Nov. 10, 1908.

The surface of the lead matrix is treated with a gas, such as carbon dioxide, so as to form a film of a lead salt, such as lead carbonate; the metal is afterwards deposited electrolytically, and is easily separable from the lead matrix.—B. N.

Tin; Method and apparatus for recovery of pure —— *from tin-plate scrap and lead-tin alloy.* A. Nodon. First Addition, dated Sept. 7, 1907, to Fr. Pat. 386,499, April 11, 1907 (this J., 1908, 692).

The scrap, contained in small baskets of asbestos fibre, is washed in a cold solution of sodium carbonate and afterwards arranged so as to form the anode in an electrolyte of dilute sulphuric acid or a sulphate solution, the cathodes being formed of thin plates of tin, also contained in asbestos receptacles. When the tin has been completely dissolved, as shown by a brown tint on the surface of the scrap, the basket containing the latter is replaced by another filled in the same way and the process continued. The tin, deposited on the cathode in a pulverulent state, falls to the bottom and is removed by washing.—C. A. W.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

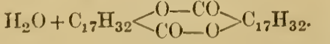
Sulphoricinoleic acid; Decomposition of —— *by means of dilute acids.* A. Grün and H. Wetterkamp. Z. Farb. Ind., 1908, **7**, 375—376.

The authors are unable to confirm Wagner's statement (this J., 1908, 949) that sulphoricinoleic acid is decomposed in aqueous solution into a dihydroxy-fatty acid, $C_{18}H_{34}O_4$, whilst sulphur dioxide is liberated. In their experiments the sulphuric acid was completely eliminated without liberation of sulphur dioxide, the neutralisation value of the substance meanwhile falling to about half that of ricinoleic acid (188·24). It is suggested that in this reaction 2 mols. of ricinoleic acid are linked up to form an acid ester as follows:—

$$2C_{17}H_{32}(OSO_3H)COOH+H_2O=$$
$$2H_2SO_4+C_{17}H_{32}(OH)COOC_{17}H_{32}COOH.$$

This should have a neutralisation value of 97·6, and the lower values obtained (90·8 to 91·1) are attributed to the presence of impurities. The silver salt, which was a white powder soluble in chloroform, but insoluble in the other ordinary solvents, had the composition $C_{36}H_{65}O_5Ag$. Analogous results were obtained on heating sulphoricinelaïdic acid in 10 per cent. aqueous solution, and the same tendency to intermolecular combination between the hydroxyl and carboxyl groups was shown by other sulphonated hydroxy-fatty acids such as dibromoricinoleic and trihydroxystearic acids. The decomposition of sulphoricinoleic acid and analogous compounds in aqueous solution is increased by the presence of a mineral acid. The neutralisation value then continues to fall slowly after the formation of the acid ester, which becomes partially converted into a neutral compound, probably the lactide of ricinoleic acid:—

$$C_{17}H_{32}(OH)COOC_{17}H_{32}COOH=$$



$$H_2O+C_{17}H_{32}\begin{matrix}\diagup O-CO \diagdown \\ \diagdown CO-O \diagup\end{matrix}C_{17}H_{32}.$$

—C. A. M.

Rubber-yielding Manihot; New species of ——. A. Zimmermann. *See* XIIIC.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(*A.*)—PIGMENTS, PAINTS.

Patents.

Paints or preservative compositions for marine use. C. H. Rowland, Liverpool, and D. Paton, Liscard. Eng. Pat. 17,105, Aug. 14, 1908.

Gas tar is mixed with creosote oil so as to yield a mass of the consistency of thick treacle, to which is added barium sulphate and zinc oxide. Special claim is made for a mixture containing 30 parts of a mixture of gas tar and creosote oil, 56 of barium sulphate, and 14 of zinc oxide. Poisonous substances such as compounds of arsenic or mercury, a volatile solvent, and "patent dryers" may be added to the composition if desired.—A. S.

Colour lakes applicable as body colours; Process for preparing ——. Ges. f. Chem. Ind. in Basel. Ger. Pat. 203,438, Aug. 25, 1907.

The condensation products of *o* hydroxycarboxylic acids with benzaldehyde or substituted benzaldehydes are combined with metallic oxides or hydroxides to form lakes: the products are stated to be bluish-red, violet, and blue in colour, and absolutely fast towards water and spirit. —T. F. B.

Soot free from oil; Device for the preparation of ——. F. Meiser. Ger. Pat. 203,711, July 25, 1906.

Above the pan or dish in which the oil is burnt, is arranged a smoke-collector, the inner surface of which has the same shape as the flame.—A. S.

(*B.*)—RESINS, VARNISHES.

Elemi; African ——. Bull. Imp. Inst., 1908, 6, 252—255.

Manila elemi is the oleo-resin collected from *Canarium luzonicum.* Specimens of elemi from Southern Nigeria and Uganda have been examined: the first was of unknown botanical origin, whilst the last-named was from *Canarium schweinfurthii.* These products resembled Manila elemi in character, but yielded less volatile oil. The total demand for elemi is small and appears to be fully met by the supplies from the Philippines.—A. S.

Patents.

Wood; Process of treating —— *to produce terpenes and wood-pulp.* W. J. Hough, Toledo, Ohio. U.S. Pat. 903,859, Nov. 17, 1908.

The wood is first treated with dry steam to remove the terpenes, then the moisture is expelled, and finally the wood is converted into pulp, all three operations being effected in the same receptacle.—A. S.

Pine oil; Process for preparing a resin distillation product, similar to turpentine oil, from ——. O. P. Pellnitz. Ger. Pat. 202,254, Sept. 21, 1907.

Purified pine oil is mixed with about 1 per cent. of acetic acid or "resin acid," and is then resinified by treatment with moist ozone or ozonised air under pressure; after addition of lime the product is distilled with steam. The resulting distillate is said to resemble closely turpentine oil.—T. F. B.

Aldehydes and phenols; Process of condensing —— *to obtain substitutes for resins and gums.* L. Helm. Fr. Pat. 392,395, Sept. 23, 1907.

See Eng. Pat. 25,216 of 1907; this J., 1908, 412.—T. F. B.

(*C.*)—INDIA-RUBBER, &c.

Rubber-yielding Manihot: New species of ——. A. Zimmermann. Der Pflanzer, 1908, **4**, 193; Gummi-Zeit., 1908, **23**, 214—215.

The species referred to are five in number :—(1). *Manihot dichotoma Ule* (*Jequié Manihot*), which occurs in the south-east of Bahia, in the neighbourhood of the town of Jequié. Although, according to Ule, the rubber from this tree is very resinous, a sample has been valued as high as 8 to 8½ marks per kilo., Parà being 9 marks per kilo. Samples from very young trees were found to become tacky in a few weeks, although carefully purified and dried. The seeds of this tree are valued in Brazil on account of the oil which they contain, and fetch as much as 2·5 marks per kilo. The oil is said to be useful as a substitute for linseed oil. The yearly production of rubber from this tree is estimated at 400—500 tons. (2). *Manihot heptaphylla Ule* (*Sao Francisco Manihot*), which flourishes on the right bank of the Rio Sao Francisco. The rubber is obtained as in the case of *M. piauhyensis*. A sample losing 24·5 per cent. on washing was valued at 6 to 6·5 marks per kilo. The yearly production is estimated at 500 tons. (3). *Manihot piauhyensis Ule* (*Piauhy Manihot*) is found in the eastern parts of the State of Piauhy, flourishing in a sandy soil. Its bark is not well adapted for the ordinary methods of tapping, and the method employed is the following. A hole, puddled with clay, is made in the ground at the base of the stem, and the bark of the stem is then scraped just above the hole, into which the latex is allowed to flow; the rubber is collected after one or two days, and allowed to dry for some time in the air before packing. A particularly good sample, which lost only 5·8 per cent. on washing, was valued at 7·5 marks per kilo. The amount of this rubber exported yearly is estimated by Ule at 1000 tons. (4). *Manihot violacea Müll. Arg.*, is of no commercial interest as a rubber-producer. (5). *Hotnima Teissonieri A. Chev.* (*syn. Manihot Teissonieri A. Chev.*). This is cultivated in the botanical gardens at Camayenne (French Guiana) from seeds obtained from Piauhy State. It is thought by Ule to be identical with *M. piauhyensis*, but there appear to be important differences between the two. The latex is yellow, and the rubber yellow, changing to dark brown on drying. The "nerve" of the rubber is equal to that of *M. Glaziovii* rubber.—E. W. L.

Rubber latex; Studies on the enzymes of ——. V. Cayla. Compt. rend. Soc. Biol., 1908, **65**, 128; Gummi-Zeit., 1908, **23**, 213.

The colour changes produced on adding ammonia, or sodium carbonate, to fresh latex from *Ficus vogelii*, *viz.*, through yellow and green to black, are seen, on microscopic examination to take place within the globules themselves, the mother-liquor remaining colourless. Examination of a series of rubber latices has shown that many of them contain oxidising enzymes, either oxygenase, peroxydase, or catalase. (See also this J., 1908, 633, 909.) —E. W. L.

Ceara rubber from Portuguese East Africa. Bull. Imp. Inst., 1908, **6**, 255—259.

Samples of rubber prepared by W. H. Johnson in the course of his experimental tappings of Ceara trees (see this J., 1908, 290), have been examined. The samples were prepared by slightly different methods, *viz.*, No. 1 (2 biscuits) and No. 2 (2 biscuits): a solution of 1 per cent. and 2 per cent. ammonia respectively placed in collecting cups. No. 3 (3 biscuits): a solution of 2 per cent. ammonia placed in collecting cups; 1 per cent. solution of creosote added to latex. No. 4 (3 biscuits), No. 5 (2 biscuits), No. 6 (6 biscuits), No. 7 (3 biscuits), and No. 8 (3 biscuits): 1, 2, 3, 4, and 5 per cent. solution respectively of formaldehyde placed in collecting cups; rubber smoked. No. 9 (2 biscuits): rubber smoked. No. 10: smoked "scrap." No. 11: "scrap." The physical properties of the specimens were satisfactory and no differences could be detected between the rubbers prepared with varying amounts of formaldehyde. The results of the chemical examination of four of the specimens are shown in the following table :—

	No. 1.	No. 3.	No. 4.	No. 8.
	per cent.	per cent.	per cent.	per cent.
Moisture	1·9	2·9	0·6	1·7
Caoutchouc	82·9	80·5	85·1	83·1
Resin	5·7	5·3	6·3	6·7
Proteins	8·1	9·1	6·1	6·9
Ash	1·4	2·2	1·9	1·6
*" Caoutchouc " insoluble in chloroform	1·0	1·6	0·7	0·2

* Calculated on dry rubber.

The commercial values of the different specimens, as compared with fine hard Para rubber at 4s. 1d., and fine plantation Para at 4s. 7d. to 4s. 8½d. per lb., were :—Nos. 1, 2, 3, and 4, 4s. 6d.; Nos. 5, 6, 7, 8, and 9, 4s. 7d.; No. 10, 3s. 6d.; and No. 11, 3s. 4d. to 3s. 5d. per lb.—A. S.

Phytosterol from African rubber. N. H. Cohen. Arch. Pharm., 1908, **246**, 592—593.

A comparison of the phytosterol isolated from so-called South African rubber with a specimen of pure *iso*cholesterol showed that the two substances are identical. There is thus no essential difference between animal and vegetable cholesterols or between cholesterols and phytosterols. (See this J., 1908, 1123.)—F. Shdn.

[Rubber] Tyres; Chemical and physical tests of ——. C. Beadle and H. P. Stevens. Commercial Motor, 1908, **8**, 180—181, 190—192.

The authors record the results of their examination of a further series of solid tyre samples (see this J., 1907, 935). The composition of the samples was as follows :—

Sample No.	5	6	7	8	9	10
India-rubber (by difference)	40·5	46·2	38·0?	37·0	6·5	46·8
Acetone extract (incl. free sulphur)	5·0	4·3	6·0	7·5	7·0	4·8
Mineral matter (ash)	41·5	39·1	48·0?	48·3	69·5	41·1
Substitutes	12·0	8·9	6·0	5·4	16·6	5·5
Combined sulphur	1·0	1·5	2·0	1·8	0·4	1·8
Specific gravity	1·51	1·46	1·46	—	2·29	1·50

In the next table are given figures for tensile strength and elongation of rings cut from sections of the original samples, both in a transverse direction and longitudinally, parallel to the flat base of the tyre, and also for the tensile strength and elongation after submitting the samples to a "moist heat test" for 4 hours at 320° F. :—

Sample No.	5	6	7	8	9	10
Mean strength in grms. per sq. mm.	590	617	488	478	290	584
Transverse strength in grms. per sq. mm.	625	616	490	497	314	—
Longitudinal strength in grms. per sq. mm.	554	618	487	459	267	—
Mean elongation at break (original=100)	424	474	439	428	311	459
Transverse stretch (original =100)	454	482	478	446	310	—
Longitudinal stretch (original =100)	426	466	400	410	312	—
After subjecting samples to moist heat test :—						
Mean strength in grms. per sq. mm.	304	376	350	317	228	—
Percentage loss of strength	48	39	28	34	22	—
Mean elongation at break (original=100)	392	544	268	220	160	—
Percentage loss of stretch	7	−15	39	49	49	—

It is pointed out, with reference to the first table, that a close relationship exists between the percentage of ash and the specific gravity, the actual ratios being 27·5, 26·8, 23·3, 30·4, 27·4. It would appear that the specific gravity of the mineral matter employed in most of the tyres is about 4. Sample 9 is considered quite useless for solid tyres on account of the low percentage of rubber; on the other hand nothing is gained by increasing the proportion of new rubber in a solid tyre mixing beyond a certain figure. The "coefficient of vulcanisation," which depends, to some extent, upon the presence of reclaimed rubber in the mixing, varies, in the samples examined between 2·3 and 6, the figures for samples 5, 6, 7, 8, 9, and 10 being 2·3, 3·2, 3·9, 3·8, 6·0, and 3·6 respectively. —E. W. L.

Patents.

Caoutchouc, india-rubber, and the like; Manufacture of an elastic and plastic substance, insoluble in water, and suitable for use as a substitute for ——. R. F. H. Suhr, London. Eng. Pat. 26,852, Dec. 4, 1907.

Carnauba wax or other wax-like substance is distilled with steam to expel volatile matter, and is then melted and intimately mixed with gum-like materials, such as gum tragacanth, resin, glue, varnish, etc., in the presence of water. After allowing the emulsified mass to cool somewhat, it is subjected to the action of steam, cooled to 50°—60° C., then kneaded in warm water at 50° C., and finally freed from adherent water in a centrifugal machine. —A. S.

Pará rubber; Manufacture of artificial ——. J. Blum, Brussels, Assignor to A. W. Carpenter, London. U.S. Pat. 904,470, Nov. 17, 1908.

Vegetable matter, such as peat, is mixed with water, and subjected to fermentation until "a mucilaginous mass containing a large percentage of isoprene" is formed. This is treated with a suitable solvent such as carbon bisulphide, the aqueous liquid separated, and the carbon bisulphide expelled from the solution, leaving behind the mucilaginous mass. The latter is treated with a nitrogenous derivative of irone, represented approximately by the formula, $C_{12}H_{17}(HNO)$, and with a small quantity of suitable mineral salts, in order to produce "synthetic Pará rubber."—A. S.

Rubber and gums; Apparatus for the extraction of ——. Nicolas et Cie. First Addition, dated July 2, 1908, to Fr. Pat. 387,243, Feb. 14, 1908 (this J., 1908, 820).

The present addition relates to improvements in the construction of the conveyor screws described in the main patent, and to the provision of scrapers, in order to accelerate the movement of the material through the drum.—A. S.

XIV.—TANNING, LEATHER, GLUE, SIZE.

Patents.

Quebracho extract; Manufacture of ——. A. Redlich, Vienna, and L. Pollak, Wilsdorf, Austria. Eng. Pat. 21,483, Oct. 10, 1908. Addition to Eng. Pat. 4358 of 1908 (this J., 1908, 696).

The whole of the slightly alkaline solution of the mud, obtained as described in the main patent, is mixed, while hot, with hot unclarified quebracho liquor of about 15° B., the mixture is allowed to cool, and stirred with a quantity of acid equivalent to the amount of alkali used for dissolving the mud.—A. S.

Leather; Treatment of ——. W. Petrie, Buckfastleigh. Eng. Pat. 13,517, June 25, 1908.

The patent relates to a new process for producing a marbling effect on leather. Rough-tanned skins are thoroughly wet back in water, and are painted unevenly with a solution of caustic alkali and tannin extract, with or without added colouring matter. After remaining for a short time on the skins, this mixture is washed off, and the skins are well slicked out, oiled, dried, shaved, again slicked out, and then dried out and glazed. The skins then possess the desired effect. The marbling effect is influenced by the proportions of the ingredients of the mixture, the age of the mixture, the amount of moisture on the surface of the leather, the time the mixture is allowed to remain on the leather, and the nature of the tannage. Satisfactory results may be obtained with a mixture of 3 parts of tannin extract with 1 part of caustic alkali, about 24—48 hours old, which is allowed to remain on the leather for a few minutes or up to an hour. —H. G. B.

Leather; Artificial ——. L. V. Guilleteau, Paris. Eng. Pat. 21,091, Oct. 6, 1908. Under Int. Conv., Oct. 9, 1907. Addition to Eng. Pat. 6216 of 1907 (this J., 1908, 347).

The composition consists essentially of vegetable fibres fixed by an agglomerant, the essential part of which is constituted by a mixture of dextrin, gelatin, balata, and gum lac. The liquor is stirred, kneaded, moulded, stoved, dried, and compressed at 100° C. as described in the main patent, and fixed in a mixture of 50 per cent. of formaldehyde and 50 per cent. of a saturated solution of barium chloride (or acetate of lead or hydrochloric acid). The product is then dried.—H. G. B.

"Piano leather"; Colouring and treating oil-dressed skins for the preparation of ——. F. Herzog. Ger. Pat. 203,578, Feb. 7, 1906.

The dressed skins, after the surplus oil has been removed, are introduced into a dye-bath, containing tanning extracts such as are used in the preparation of sole leather, but not decolorised, in place of the colouring matters usually employed. In order to prevent any tanning effect, the extracts are added to the bath in small quantities at a time. After the dyeing process, the skins are treated first in a bath of potassium bichromate, then in one of dilute acetic acid, and are afterwards dried and finished in the usual manner.—A. S.

Leather; Preparation of —— *from so-called goldbeaters' skin.* R. Weilbier. Ger. Pat. 203,585, Nov. 2, 1907.

The goldbeaters' skin after being cleansed by treatment in water and in a soap bath, is immersed in a cold 20 per cent. solution of an iron salt, to which has been added a solution of 10 grms. of picric acid in 250 c.c. of water. After about 2 hours, the skins are withdrawn, pasted together by means of a suitable adhesive, dried in the air, and finished in the usual manner. It is stated that a flexible leather, suitable for use in the construction of organ pipes, is obtained. For the preparation of the iron solution, 100 parts of ferrous sulphate, 61 parts of potassium nitrate, and 35 parts of concentrated sulphuric acid are dissolved separately in 120, 80, and 35 parts respectively of water, and the solutions are mixed together and heated until red fumes are evolved. A solution of 600 parts of ferrous sulphate in 1200 parts of water, is then added gradually, with heating.—A. S.

Tanning hides and making leather; Process of and apparatus for ——. A. J. Boult, London. From The International Process Tanning Co., Owensboro, Ky., U.S.A. Eng. Pat. 12,254, June 5, 1908.

See Fr. Pat. 391,170 of 1908; this J., 1908, 1125.—T. F. B.

Tannin extracts; Process of decolorising ——. A. Hugendubel, Assignor to C. Feuerlein, Stuttgart-Feuerbach, Germany. U.S. Pat. 904,483, Nov. 17, 1908.

See Fr. Pat. 383,890 of 1907; this J., 1908, 414.—T. F. B.

XV.—MANURES, &c.

Nitrogen as ammonia; Fixing of —— *by zeolites in the soil.* T. Pfeiffer, A. Hepner, and L. Frank. Mitt. Landwirts. Inst. Kgl. Univ., Breslau, 1908, **4**: Biedermann's Zentr., 1908, **37**, 722—724.

Earlier experiments of the authors have shown that ammonia absorbed by the zeolites in the soil is held so fast by the soil that part at all events of it is not available for the plant rootlets during the period of a single crop. The former experiments were open to the objections: (1), that an artificially prepared zeolite was used, having a slightly alkaline reaction, and that relatively large quantities were added to the sandy soil; (2), that in the control experiments it was omitted to add lime equivalent in calcium content to the zeolites. The experiments have now been repeated using apophyllite which, by continued treatment with 10 per cent. calcium chloride solution, had been converted into a calcium zeolite containing 6·49 per cent. of lime. The soil used was Oder sand to which a manure of ammonium and potassium sulphates and phosphate and magnesium chloride was added. To three series of pots different amounts of calcium zeolite were added, the controls containing equivalent quantities of calcium carbonate. The experiments were started with barley, but the crop failed, and the pots were replanted with oats at the end of June. The mean loss of nitrogen from the pots containing zeolites was 0·156 grm., from those containing chalk 0·423 grm. The experiments confirm those made formerly and prove that calcium zeolite retains ammonia in the soil.—E. F. A.

Calcium cyanamide, calcium nitrate, ammonium sulphate, and sodium nitrate as manures. V. Nazari. Atti R. Accad. dei Lincei, Roma, 1908, [5], **17**, II., 334—342. Chem. Zentr., 1908, **2**, 1785—1786.

It is confirmed that the manurial effect of calcium cyanamide is improved by the presence of organic matter in the soil. The best depth at which to apply calcium cyanamide is 20 cm.: at a greater depth (35 cm.) its effect is not so good owing to loss of nitrogen in the form of cyanamide or nitrate, easily soluble in water, and to the fact that at such a depth the conditions are not so favourable for the action of the micro-organisms which convert the calcium cyanamide into substances that can be assimilated by the plants. When acting conjointly with calcium cyanamide, bone phosphate is better than mineral phosphate or Thomas slag, potassium sulphate and leucite are about equal in value, and calcium sulphate is less effective than lime. Comparative experiments showed that calcium cyanamide is about as effective as ammonium sulphate, but not quite so good as calcium nitrate or sodium nitrate.—A. S.

Zinc; Occurrence and rôle of —— in plants. M. Javillier. Bull. d. Sciences Pharmacol., 1908, **15**, 559—565. Chem. Zentr., 1908, **2**, 1828.

Zinc, like iron and manganese, is a common constituent of plants. Apart from the so-called "calamine plants" and plants grown on zinciferous soils, most plants contain appreciable quantities of zinc. Zinc is present in all the organs of phanerogamous plants, moulds, and algæ, and its presence is especially common in conifers. The presence of zinc in the culture liquid causes a considerable increase in the growth of yeast, quite analogous to, although not quite so great as, the effect on *Aspergillus niger*. Zinc has no effect on the enzymes of yeast. In the case of phanerogamous plants, *e.g.*, cereals, an increased yield is produced by very small quantities of zinc.—A. S.

PATENTS.

Fertilisers [from night soil]; Method of making ——. W. P. Thompson, Liverpool. From A. Engle, Metz, and W. Walker and J. H. Main, Des Moines, Iowa, U.S.A. Eng. Pat. 13,198, June 20, 1908.

The fertiliser consists of about 300 gallons of night soil, 200 lb. of quicklime, and 2 gallons of tar. The night soil is mixed with the lime, and to the mixture, which becomes hot owing to the slaking of the lime, the tar is added. After thorough mixing, the mass is cooled, and ground. —A. S.

Fertiliser; Manufacture of a non-hygroscopic ——. G. Schreiber and M. Rathke. Ger. Pat. 203,085, Jan. 22, 1908.

Calcium nitrate is mixed with an equivalent quantity of an alkali sulphate, potassium-magnesium sulphate, or calcined kieserite.—A. S.

Superphosphate chambers; Process and apparatus for discharging ——. K. J. Beskow. Fr. Pat. 392,506, Sept. 26, 1907.

See Eng. Pat. 20,466 of 1907; this J., 1908, 821.—T. F. B.

XVI.—SUGAR, STARCH, GUM, &c.

Formaldehyde; Formation of —— in solutions of cane-sugar [sucrose], and its bearing on Hehner's test for formaldehyde in saccharine mixtures. R. A. Ramsay. *See* XVIIIA.

Sugar in molasses-fodder and in denatured sugars; Determination of ——. L. Vuaflart. Bull. Assoc. Chim. Sucr. et Dist., 1908, **26**, 339—341.

The determination of sucrose in molasses-fodder or denatured sugar by direct polarisation of the solution clarified with basic lead acetate, is liable to serious error if the material contains other optically-active substances, such as soluble starch, dextrins, or gums, which are not completely precipitated by the clarifying agent. Samples, which on microscopical examination, are found to contain linseed meal or starch, or which yield an aqueous extract precipitable by alcohol, should be treated as follows:—*Molasses-fodder.*—Six grms. of the sample are digested with 150 c.c. of cold water for several hours, with frequent shaking, made up to 200 c.c., and filtered. Fifty c.c. of the filtrate are heated with 1 c.c. of sulphuric acid to 100° C. for 15 minutes; the author considers that this insures inversion without appreciable hydrolysis of dextrin, etc. The solution is neutralised, made up to 150 c.c., and titrated with Fehling's solution. *Denatured sugar.*—Twenty-five grms. of the sample are treated with 40 c.c. of boiling water, neutralised if necessary, and allowed to stand in a warm place for half an hour. The solution is then heated nearly to boiling, about 250 c.c. of alcohol are added (so that the mixture may contain about 80 per cent. of alcohol) in small quantities, with shaking; the whole is allowed to stand until the next day, and then filtered, the residue being washed with 80 per cent. alcohol. The alcohol is expelled from the solution and the sucrose is determined by Clerget's method. A portion of the solution may be used for determining reducing sugars.—L. E.

Starch; Colloidal properties of —— and its spontaneous coagulation. E. Fouard. Compt. rend., 1908, **147**, 931—933. (See also this J., 1908, 238, 635.)

The changes which take place in a freshly prepared, partially demineralised pseudo-solution of starch have been described previously: in neutral, acid, or alkaline media, opalescence increases until a uniform compact coagulate of porcelain-like opacity is obtained. The change in such a neutral pseudo-solution containing 54·3 grms. of starch per litre at 15° C. was studied by removing a portion at various intervals of time, filtering through collodion membranes of like character, and determining the solid matter in the filtrate and its specific rotatory power. The results obtained were as follows:—

Duration of change in days	0	2·9	7·7	16·9
Extract in grms. per 1000 .	27·44	21·65	17·72	14·8
Specific rotatory power...	188°	184·1°	182·45°	181·3°
Duration of change in days	29·0	48·7	98	174
Extract in grms. per 1000	13·48	12·25	11·43	11·04
Specific rotatory power...	180·5°	180·24°	178·2°	178

The rotatory power of the solutions in each case remained unaltered on keeping for some weeks in the polarimeter tubes. The formation of jelly continued for some months. The results confirm the former view that starch in each state of molecular aggregation, has a definite and fixed rotatory power. During jelly formation the same membrane allows these aggregates to pass through according to definite order; those which are first checked are the most active towards polarised light. These undergo condensation and are then held back by the membrane. The aggregation does not continue in the filtrates, the rotatory power of which remains constant. The change is reversible. A similar pseudo-solution was allowed to filter at 20° C. for a week and samples of the filtrate examined as before.

Duration of filtration in hours	6	30	78	126
Extract in grms. per 1000	27·48	29·61	32·13	35·5
Specific rotatory power	188°	186·3°	184·15°	184°

The residual colloidal starch gelatinised on the filter during the sixth day owing to the increase in concentration, following which the amount of solid in the filtrate rapidly decreased. The rate of change observed is governed by two changes in opposite directions and to follow it completely one of these must be rendered negligible. The organic colloid starch is resolved in solution according to several reversible processes and differs markedly from the insoluble mineral colloids.—E. F. A.

Sugar cane; Utilisation of waste products from the ——. Internat. Sugar J., Dec., 1908. [T.R.]

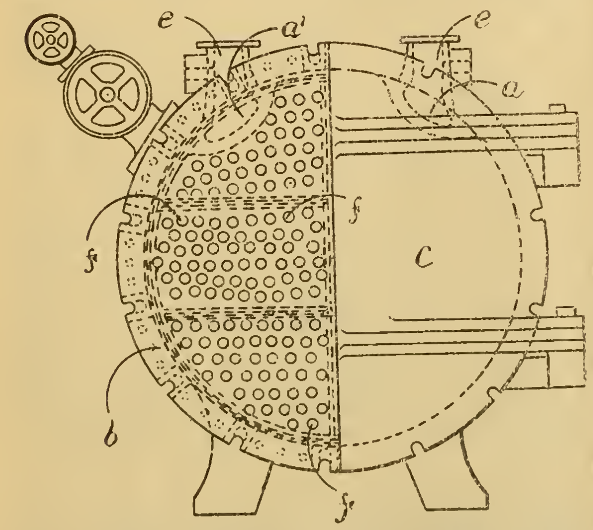
A Trinidad sugar planter has recently produced various grades of papers from mixtures of megass, bamboo, and Para grass, the megass amounting to about 65 per cent. of the mixture. In Java, several factories are extracting the wax from the dried filter-press cake by means of petroleum spirit: the dry cake contains up to 10 per cent. of wax, which is used in the manufacture of paraffin candles.

Calcium sucrate; Acetonedicarboxylic acid from ——. E. O. von Lippmann. *See* XXIV.

Starch factory effluents; Purification of —— *by the biological process.* C. Zahn. *See* XVIII*B*.

Patents.

Sugar juice and other liquids; Apparatus for heating ——. R. Harvey, Glasgow. Eng. Pat. 26,109, Nov. 26, 1907.



The intermediate castings or junction pieces usually provided at the ends of the juice-heater are dispensed with, and two pocket-chambers, *a* a^1, are cast on either side of one end of the heater shell, *b*. Dish-shaped doors, *c*, are provided at each end of the heater, on which are cast dividing partitions, dividing the bundle of circulating tubes, *f*, into two halves vertically and into a suitable number of compartments in a horizontal direction. The juice or other liquid is pumped into one of the pocket chambers, *a*, through the flanged opening, *e*, and is forced through the circulating tubes, *f*, in the several compartments of the heater until it arrives at the other pocket-chamber, a^1, at the top of the other side of the heater, whence it is discharged through the other flanged opening, *e*.—J. F. B.

Sugar-producing product [*Desiccated beetroot*]. G. W. McMullen, Chicago, Ill. U.S. Pat. 898,592, Sept. 15, 1908.

Sugar beets are sliced and desiccated under such conditions as to preserve their sugar-content in an uninverted state. For this purpose, the slices are spread in thin layers in a closed chamber in which a reduced pressure is maintained, and the water is evaporated at a temperature of about 155° F. The desiccated slices, which should contain less than 30 per cent. of moisture, are then reduced to the condition of a granular meal and may be preserved unchanged for an indefinite period.—J. F. B.

Vacuum pans for the sugar industry; Heating arrangements for ——. A. Gräntzdörffer. Fr. Pat. 391,846, July 1, 1908. Under Int. Conv., May 30, 1908.

In the vacuum pan the steam-pipes, or coils, are disposed in the form of a number of concentric rings of different diameters arranged each one a little higher than the next one, so as to form an inverted cone. Each ring is connected independently to a steam supply pipe and exhaust pipe. The rings possess cross-sections elongated in the vertical direction, and in order to avoid horizontal surfaces, the tops and bottoms of the cross-sections are either pointed at a sharp angle or domed.—J. F. B.

XVII.—BREWING, WINES, SPIRITS, &c.

Viscous fermentation. H. Van Laer. Chem.-Zeit., 1908, 32, 1177.

The author in 1900 (this J., 1900, 164), discovered a ferment which produces a viscous fermentation. In presence of this organism the clear liquid becomes turbid and attains an oily consistence, the viscosity reaching a maximum and afterwards decreasing. This *B. viscosus Bruxellensis* also produces acid, but its two functions are independent of each other. The author finds that the viscous fermentation is influenced by the reaction as regards alkalinity or acidity of the nutrient liquid; for any wort there is a reaction at which the maximum viscosity is attained, and another at which the viscous fermentation is inhibited without the acid production being affected. The addition of a small quantity of sodium carbonate to wort greatly increases the degree of viscosity which can be produced by the organism; acids, in similar quantity, may either restrain or stimulate the action. The similarities between this viscous fermentation and the coagulation and resolution of starch solutions in presence of diastase are emphasised. —R. L. S.

Fluorine; Presence of —— *in wine.* H. Maurel, Chem.-Zeit., 1908, 32, 1177.

During the past few years many wines have been condemned in France and Belgium on the score of their fluorine content. As it has repeatedly been shown that unsophisticated wines may contain as much as 0·01 grm. of fluorine per litre, the author considers this should be accepted as the maximum permissible. All additions of fluorides to wine should be prohibited.—R. L. S.

Invert sugar in wine; Detection of —— *by means of resorcinol and hydrochloric acid.* A. Kickton. Z. Unters. Nahr. Genussm., 1908, 16, 574—579.

The test proposed by Fiehe (this J., 1908, 1127) for the detection of invert sugar in honey, cannot be employed for detecting the presence of added invert sugar in wines. In the first place, fermentation partially destroys the products which yield the coloration, and secondly, sweet wines, such as port, sherry, tokay, malaga, etc., of undoubted purity invariably give a more or less positive reaction with the test.—W. P. S.

Alcohol from cellulosic materials; Production of ——. T. Koerner. Z. angew. Chem., 1908, 21, 2353—2359.

The most reliable of the data recorded in connection with the production of sugars (dextrose, &c.) and alcohol from wood and cellulose are those of Simonsen (this J., 1898, 365, 481, 1164). It is not, however, always correct to calculate the yield of sugars from the cupric-reducing power; the yield of alcohol obtainable is the only valid measure of the results. The author determined this by neutralising the hydrolysed extract with chalk, adding a little phosphoric acid to the filtrate, and fermenting with yeast. The alcoholic distillate, which also contains organic acids, is treated with chalk and redistilled. Comparative determinations, made under Simonsen's conditions, by digesting 40 grms. of the cellulosic material with 500 c.c. of 0·5 per cent. sulphuric acid for two hours under a pressure of 6—8 atmospheres, showed the following yields of alcohol per cent. of the dry materials:—sawdust, 6·02; sulphite-cellulose, 12·83; straw pulp, 9·56. These numbers are approximately proportional to the cellulose-contents of the various materials, and it may be concluded that the cellulose is the only source of the alcohol, the lignin playing no part in its production. Hydrocellulose prepared by Ulzer's method gave the highest yield, *viz.* 17·95 per cent. of alcohol. Classen (this J., 1900, 1028) has patented a process for the simultaneous use of sulphurous and sulphuric acids in the hydrolysis of wood, but the author's experiments established the fact that the use of sulphurous acid is in all cases accompanied by a serious decrease in the yield of alcohol. Experiments with oxidising agents, in conjunction with sulphuric acid, showed that when a 2 per cent. solution of hydrogen peroxide was substituted for the water, the yields of alcohol were largely increased, owing, in the author's opinion, to the intermediate production of hydrocellulose. The yields thus recorded were:—wood, 9—10·7 per cent; sulphite-cellulose, 14·64; straw pulp, 10·2 per cent. of alcohol; in the case of hydrocellulose itself, however, the yield was lowered to 11·1 per cent. by the presence of hydrogen peroxide. With potassium bichromate or potassium persulphate, in quantities equivalent to 2 per cent. of hydrogen peroxide, the oxidation was too intense, and the yields of alcohol were very considerably decreased. The treatment of the wood with ozone, according to the process of Roth and Gentzen, previous to hydrolysis, also lowered the yield of alcohol in proportion to the quantity of ozone employed. The author remarks that since the theoretical yield of alcohol from cellulose is 56·9 per cent., and since not more than 25 per cent. of this quantity has been obtained by methods of simple hydrolysis, it is possible that only a portion of the cellulose molecule is capable of conversion into fermentable sugar.—J. F. B.

Denatured alcohol in France; Production of ——. Oil, Paint, and Drug Rep., Nov. 30, 1908. [T.R.]

The total production of alcohol in France during the five years ending with 1907 has been as follows, the statistics being given in hectolitres, equal to 26·42 gallons:—

Year.	Total production.
	Hectolitres.
1903	2,047,000
1904	2,257,000
1905	2,609,000
1906	2,710,000
1907	2,514,810

The substances from which alcohol was prepared in 1907, and the proportion derived from each source, were as follows:—

Derivatives.	Hectolitres.	Gallons.
Grain	454,142	11,998,430
Molasses	466,608	12,327,783
Beets	1,145,433	30,262,339
Wines	239,877	6,337,550
Apples and pears	69,283	1,830,456
Grape skins and lees	122,608	3,239,303
Other fruits	16,658	440,104
Various substances	201	5,310
Totals	2,514,810	66,441,275

Besides the foregoing native supply, France imported in 1907, mainly from Great Britain and Germany, 153,766 hectolitres (4,062,497 gallons) of alcohol and exported 300,532 hectolitres.

Alcohol for industrial and other purposes is denatured in France, in presence of a Government official, by mixing with each hectolitre of spirit 15 litres of "methylene" (wood alcohol), ½ litre of heavy benzine, and 1 grm. of malachite green. The cost of these ingredients is about 19·86 francs. The consumption of denatured alcohol in France has grown from 146,529 hectolitres in 1897 to 593,836 hectolitres in 1907.

The various uses to which denatured spirit is applied and the relative proportion consumed in each during the past two years is shown by the following table, in which the statistics of consumption are given in hectolitres:—

	1906.	1907.
Heating and lighting	374,506	401,230
Varnish	13,444	13,386
Cabinet making	1,702	1,190
Celluloid, etc.	14,589	17,133
Hat manufacture	186	297
Dyes and colours	1,071	632
Rennet, liquid	139	178
Collodion	697	750
Chloroform	146	101
Chloral	227	155
Tanning	484	510
Chemicals, soap, etc.	6,865	10,400
Scientific uses	2,457	1,302
Ether, fulminates, and explosives	128,954	146,572
Total hectolitres	545,467	593,836

Alcohol production in Germany. Engineering, Dec. 11, 1908. [T.R.]

In the past year the following amounts of vegetable produce were consumed in Germany in the manufacture of alcohol:—Potatoes, 2,727,493 tons; barley, 172,201 tons; rye, 103,352 tons; corn, 104,347 tons; other grains, 23,772 tons; molasses, 32,244 tons; cherries, 12,684 gallons; plums, 64,638 gallons; other stone and kernel fruit, 43,116 gallons; berries, 2,927 gallons; wine-lees, 949,112 gallons; grape and other fruit marc, 272,207 gallons; grape skins, 6,757,190 gallons. From the 2,727,493 tons of potatoes, 296,949,000 litres of alcohol were produced. The total area now under potato cultivation is about 8,148,224 acres. This area produced a total crop of 45½ million tons, or 205·4 bushels per acre, only 6·4 per cent. of the produce being unsound or diseased.

Zinc; Occurrence and role of —— *in plants.* M. Javillier. *See* XV.

Patents.

Distillers washes; Method of utilising nitrogen contained in ——. J. Effront, Brussels. Eng. Pat. 28,108, Dec. 10, 1906.

Ninety-eight per cent. of the nitrogenous substances present in distillers spent wash may be recovered in the form of ammonia, by performing the operation in two stages. In the first treatment, the wash, previously concentrated to a density of 40° B., is treated with a predetermined quantity (1—4 per cent.) of an acid or acid salt, such as a bisulphate, superphosphate, or ordinary rosin. The mixture is heated in a stove for several hours at a temperature of 180°—200° C. in presence of superheated air. The liquid which distils is collected and has an acid reaction; it contains 50—70 per cent. of the total nitrogen in the form of ammonium salts. The residue is crushed, mixed with sufficient chalk for its neutralisation, and subjected to distillation in iron retorts at a temperature of 700° C. in presence of a current of superheated steam and air. The ammonia which passes over is absorbed in acid liquids; methyl alcohol is also produced. (See also this J., 1908, 763.)—J. F. B.

Grain ; Manufacture of alcohol from ——. J. Waterkeyn, Antwerp. Eng. Pat. 348, Jan. 6, 1908.

The wash, instead of passing directly from the mash tun to the fermentation vessel, is heated in a closed vessel at a high temperature and pressure. Thence it is discharged into a second closed vessel at a considerably lower pressure, in which it is heated for a further time. By the sudden reduction of the pressure, the residual starch granules are burst and are thus rendered soluble. From the second vessel the liquid is filtered, under the pressure of its own vapour, into the fermentation tun, and the escaping steam is utilised for sterilising the tun. The operation may, if desired, be restricted to the residual grain in the mash tun, which is mixed with water or spent wash and heated as above described. The wash is finally treated by the " amylo " process of fermentation.
—J. F. B.

Grape musts ; Apparatus for desulphitation and concentration of ——. Soc. Domerc et Estève. Fr. Pat. 391,772, June 29, 1908.

In apparatus for the desulphitation of grape musts and the concentration of these or other liquids liable to deteriorate by long heating, the bottom of the evaporation vessels is divided into a number of channels arranged on a slope. The liquid is caused to run rapidly along these channels and is heated either by steam pipes placed along the bottom of the channels or by a steam jacket surrounding their walls.—J. F. B.

Brewers' wort ; Production [filtration] of ——. H. Breker, Cologne, Germany. Eng. Pat. 25,356, Nov. 15, 1907.

See Fr. Pat. 385,574 of 1907 ; this J., 1908, 637.—T. F. B.

XVIII.—FOODS ; SANITATION ; WATER PURIFICATION, & DISINFECTANTS.

(*A.*)—FOODS.

Formaldehyde in milk ; Colorimetric method for the determination of ——. E. W. T. Jones. Chem. News, 1908, **98**, 247.

The reagent employed is prepared by dissolving 0·25 grm. of pure iron wire in hydrochloric acid, oxidising the ferrous chloride with nitric acid, and precipitating the ferric hydroxide with ammonia ; the precipitate is then washed and dissolved in 500 c.c. of concentrated hydrochloric acid. Ten c.c. of the sample of milk are placed in a test tube, and in each of two similar test-tubes are placed 10 c.c. of pure milk to which have been added 0·1 c.c. and 0·2 c.c. respectively of a standard solution prepared by diluting 1 c.c. of 40 per cent. formaldehyde to 1 litre. Ten c.c. of the iron reagent are then added to each of the three tubes, and the latter are placed in a water-bath at a temperature of from 80° to 85° C. for about 20 minutes. The contents of the tubes are next diluted with 30 c.c. of water, cooled, and filtered ; the precipitates are washed with 10 c.c. of water, and each filtrate is diluted to a volume of 100 c.c. The colorations of the solutions are then compared in the usual way.—W. P. S.

Coffee ; The caffeine-content of unroasted —— and a modification of Juckenack and Hilger's method for determining caffeine. R. Hefelmann. Z. öffentl. Chem., 1908, **14**, 448—450.

From 0·864 to 1·669 per cent. of caffeine was found in various samples of unwashed and unroasted coffee beans ; these figures closely agree with those laid down by the German Food Regulations, namely, 1 to 1·75, as the limits within which the percentage amount of caffeine in genuine coffee should lie. Attention is also drawn to the fact that coffee free from caffeine is now on the market (see this J., 1905, 900). It is considered advisable to mix the extracted residue obtained in the method described by Juckenack and Hilger (this J., 1897, 567) with moist magnesium oxide, dry the mass, and continue the extraction with carbon tetrachloride, in order to obtain the total quantity of caffeine in the sample.—W. P. S.

Chocolate ; Determination of fat in —— by means of chloral alcoholate. A. Kreutz. Z. Unters. Nahr. Genussm., 1908, **16**, 584—586.

From 2 to 3 grms. of the chocolate are heated on a boiling water-bath with 3 grms. of solid chloral alcoholate. The mixture, while still hot, is extracted with several successive quantities of ether and the ethereal extracts are filtered. The ether is evaporated from the filtrate, and the chloral alcoholate is removed by heating the residue at a temperature of 75° C. under reduced pressure. The residue, consisting of fat, colouring matters, &c., is treated with cold carbon tetrachloride, the solution is filtered, and, after evaporating the filtrate, the residue of pure fat is dried at 105° C., and weighed.—W. P. S.

Formaldehyde ; Formation of —— in solutions of cane sugar [sucrose], and its bearing on Hehner's test for formaldehyde in saccharine mixtures. R. A. Ramsay. Roy. Soc. N.S. Wales, Jour. and Proc., 1908, **41**, 172—175.

Trillat has shown that sucrose gives off formaldehyde when heated (this J., 1905, 901 ; 1906, 191). The author has now found that traces of formaldehyde are produced when aqueous solutions of sucrose are heated to 100°—103° C. Hence, Hehner's milk-sulphuric acid test (this J., 1895, 772 ; 1896, 382) cannot be trusted for the detection of added formalin in jam or saccharine beverages. On distilling a pure aqueous solution of sucrose it was found that both distillate and residual solution gave the reaction for formaldehyde with the above reagent, and confirmatory results were obtained with some other reagents ; no reaction was obtained with the Gayon-Saglien-Mohler reagent. The author also prepared jams from pure fruits, pure sucrose, and water ; the temperature reached in preparing these certainly never exceeded that reached in the preparation of jam on the manufacturing scale and there was no possibility of caramelisation. Portions of these jams were slightly acidified and distilled ; all the distillates gave a reaction for formaldehyde.—L. E.

Sugar in molasses fodder and in denatured sugars ; Determination of ——. L. Vuaflart. *See* XVI.

Patents.

Cream ; Colloidal —— and process of making the same. L. M. Rousseau. Fr. Pat. 392,253, Sept. 20, 1907.

A colloidal preparation of casein is first obtained by subjecting skimmed milk to centrifugal action ; this preparation contains about 66 per cent. of water, and a sufficient quantity of it is added to fresh cream to make the total amount of casein in the product equal to one-fourth of the weight of the fat present. The mixture is then heated to a temperature of from 60° to 70° C., homogenised under a pressure of from 150 to 300 kilos., and sterilised. It is important, in cases where the cream has to be kept, that the proportion of casein does not exceed one-sixth of the weight of the water in the cream.
—W. P. S.

Butterin ; Process of manufacturing ——. H. H. Schou, Copenhagen, and E. Schou, London. U.S. Pat. 904,231, Nov. 17, 1908.

See Eng. Pat. 16,886 of 1907 ; this J., 1908, 511.—T. F. B.

Yeast mixtures for bread ; Process of preparing liquid ——. W. J. Temple, Brookline, Mass. U.S. Pat. 904,573, Nov. 24, 1908.

See Eng. Pat. 14,067 of 1906 ; this J., 1907, 337.—T. F. B.

Flour ; Process and apparatus for bleaching —— by means of gaseous nitrosyl chloride. J. A. Wesener. Fr. Pat. 392,351, July 16, 1908.

See U.S. Pat. 863,684 of 1907 ; this J., 1907, 1025.—T. F. B.

Drying drums [for potatoes, etc.]. Fr. Pat. 392,286. *See* I.

(*B.*)—SANITATION; WATER PURIFICATION.

Percolation beds [*Sewage*]. W. Clifford. Proc. Inst. Civil Engineers, 1907–8, **172** [ii.]. (See also this J., 1908, 658.)

Experiments on the percolation of tap water through clean material of different kinds and grades, showed that the time of percolation varied inversely as the rate of sprinkling and directly as the amount of water in motion through the bed, the latter factor being found to be generally represented by the water in the interstices of the bed. Applying these results to the practical purification of sewage, it was found that considerable latitude could be allowed in any one of the factors of nature, size, and depth of material, and rate of sprinkling, provided the others were adjusted to give the time of percolation necessary for purification. The results of the analysis of the liquid can be correlated with the time of percolation, so as to enable the rates of purification, nitrification, etc., to be deduced; which permits of the classification of sewages according to the times of percolation required for a given purification.—J. H. J.

Starch factory effluents; Purification of —— by the biological process. C. Zahn. Mitt. k. Prüfungs-Anst. f. Wasserversorg., 1908, [10], 42—74. Chem. Zentr., 1908, 2, 1833.

It was found that the effluent from a potato-starch factory could be satisfactorily purified by means of a contact bed, preferably constructed of slag and sand. Materials (slags) containing iron, are generally unsatisfactory when used alone, and materials free from iron are preferable. The degree of purification shown by analysis is no safe criterion of the putrescibility or non-putrescibility of effluents of this kind. For instance, even when the dissolved organic matter has been reduced by 80 per cent., the purified effluent may still be putrescible. —A. S.

Cellulose [*sulphite*] *factories; Water pollution by* ——. A. Luerssen. *See* XIX.

Patents.

Water and sewage; Biological purification of waste ——. C. F. Losange, Laeken-lez-Bruxelles, Belgium. Eng. Pats. 25,362 of 1907 and 9656 of 1908; date of application, Nov. 15, 1907.

(1). The water or sewage is led into a chamber which is divided into four compartments. The water enters at the top of the first compartment, in which are a number of baffle-plates, and then passes under a partition plate into the second compartment; rising in this compartment, the water passes through a filter at the top, and thence into the third compartment which is filled with filtering material, a number of partition plates causing the liquid to take a long passage through the material. The fourth compartment serves as a collecting chamber for the liquid leaving the filter. From this compartment the liquid is delivered through a valved pipe into a tipping device which discharges on to a perforated plate divided into two parts by means of a partition and placed over a filter bed. (2). The filter beds are two in number, and the filtering material is so arranged that the denser portion is placed on the outside; the jacket surrounding the filtering material is composed of inclined plates and the beds are supported on gable-shaped bars. The jacket is enclosed by a casing which is solid at its upper part and perforated below. A current of air is circulated through and around the filter beds, a shaft being provided for causing the draught.—W. P. S.

Water and sewage; Apparatus for the mechanical purification of —— by means of inclined rotating sieves. O. Schumann. Fr. Pat. 392,517, July 21, 1908.

The apparatus consists of a number of conical sieves fixed to an inclined axle, the whole being mounted in a widened portion of the channel through which the water flows. The axle is so inclined that the uppermost sides of the sieves are horizontal. The solid matter which has collected on the sieves is removed by scrapers or brushes mounted on an endless moving band. A set of buckets mounted on a second moving band removes heavy impurities which settle at the bottom of the channel. The axle carrying the sieves is rotated by means of toothed-wheels and pinions.—W. P. S.

Water for industrial purposes; Apparatus for purifying ——. J. P. Lajoie, Tavernay, France. Eng. Pat. 19,648, Sept. 18, 1908. Under Int. Conv., Oct. 24, 1907.

See Fr. Pat. 383,266 of 1907; this J., 1908, 351.—T. F. B.

Water; Method of softening ——. A. Brandes, Assignor to C. Neff, Hanover, Germany. U.S. Pat. 904,114, Nov. 17, 1908.

See Eng. Pat. 12,258 of 1907; this J., 1907, 1129.—T. F. B.

Fertilisers [*from night soil*]; *Method of making* ——. Eng. Pat. 13,198. *See* XV.

(*C.*)—DISINFECTANTS.

Patent.

Disinfectant, germicide, and insecticide; Process of making a ——. Chem. Fabriks-Werke. Fr. Pat. 392,254, Sept. 20, 1907.

See Eng. Pat. 20,387 of 1907; this J., 1908, 1037.—T. F. B.

XIX.—PAPER, PASTEBOARD, &c.

Sulphate cellulose mills; Odours from ——. P. Klason. Wochenbl. Papierfabr., 1908, **39**, 3859—3861, 3963—3966.

The sulphate (sodium sulphide) process for the manufacture of wood pulp gives a higher yield and a stronger product than the ordinary soda process, but its development is hampered by the evil odours emitted, which under certain conditions may penetrate to a distance of several miles. The methoxyl compounds of the wood are converted during digestion into methyl alcohol and methyl mercaptan, and the latter is capable of further conversion into dimethyl sulphide. By conducting the steam blown off on discharging a digester of 24 cub. m. capacity, producing 1375 kilos. of dry cellulose, through an efficient condensing apparatus, the author ascertained, that the uncondensable gases contained not more than 20 grms. of methyl mercaptan. This quantity is quite sufficient to cause a nuisance. The best method of dealing with these gases is as follows: The steam from the digesters is condensed by means of a condenser which will liquefy the whole of the dimethyl sulphide (b.pt. 37° C.). This remains, in admixture with the oil of turpentine, floating on the aqueous condensate. The uncondensed gases are then passed into a battery of 3 absorption vessels containing a concentrated solution of sodium hydroxide. When this lye is saturated with the mercaptan, it is passed through the soda recovery plant. The yield of condensable oils from each digester amounted to 2 litres, from which 200 grms. of dimethyl sulphide were obtained, the rest being oil of turpentine. The condensed water contains about 5 kilos. of methyl alcohol; this water has a strong odour, principally that of trimethylamine; it should not be run to waste, but employed for preparing fresh lye; in this way the methyl alcohol is retained for subsequent recovery. The black lyes from the digesters yield on destructive distillation 11·2 per cent. of their dry substance in the form of gases. In a mill making 16·5 tons of dry cellulose per day, the gases obtainable by the destructive distillation of the black lyes would contain 412 kilos. of sulphuretted hydrogen and 380 kilos. of methyl mercaptan. These lyes yield no dimethyl sulphide. Analyses of the gases actually discharged at the base of the chimney showed 1·4 kilos. of sulphuretted hydrogen and 4·5 kilos. of mercaptan per day. The difference between these two sets of figures represents the combustion of sulphur gases taking place in the soda furnace. This combustion is accompanied by a loss of alkali by volatilisation, and it was calculated that, in addition to the quantities of odorous sulphur gases quoted above, the chimney discharged 2197 kilos. of sodium sulphite and 278 kilos. of free sulphur dioxide per day. The loss of alkali is made up by the addition of sodium sulphate to the lyes, and although the loss is very heavy, it presents the advantage of neutralising the sulphur dioxide and rendering it harmless to vegetation. The nuisance caused by sulphate pulp mills may be minimised :—(*a*) by perfect condensation of the steam from the digesters, care being taken to continue the discharge of steam until no more volatile sulphur compounds remain in the black lye; (*b*) by perfect combustion in the soda furnace, by employing a forced draught and admitting the evaporated lye to the furnace in as concentrated a condition as possible, so as to avoid lowering the temperature of combustion by the evaporation of water; (*c*), by preventing destructive distillation in the concentrating chamber, by revolving the "fanner blades" at a high speed.—J. F. B.

Cellulose [*sulphite*] *factories; Water pollution by* ——. A. Luerssen. Z. f. Hygiene, Leipzig, **58**, [1], 121; through Proc. Inst. Civil Eng., Abstracts, **172**, (ii.), 47.

THIS case, a very pronounced one, occurred at Wolfach, Baden. The effluent from the factory at Königsberg was discharged into the River Pregel. It had, since 1872, been observed that the river water during the hot months of the year became very offensive, the colour also assuming a deep brown or black tint. A searching inquiry, under the supervision of Prof. Pfeiffer, was made in 1905. It was shown that the organic matters from the cellulose works, especially in warm weather, underwent rapid putrefactive changes, which gave rise to the dark colour and the disgusting smell. The conclusion was drawn and the decision arrived at that this effluent must be emptied into the town sewers, and this was allowed on the condition that the liquid underwent a previous treatment with lime or other chemicals, and was thoroughly neutralised, so as to render the ligno-sulphites harmless. The acid present was not to exceed 0·06 per cent., and the water was to be cooled down in large tanks at the factory before admission to the sewers.

Blotting paper from peat fibre. Paper and Pulp, Dec., 1908. [T.R.]

MANY attempts to make superior papers from peat fibre have failed, owing to its brittleness and the impossibility of bleaching it. The fibre, however, should form an excellent material for making blotting paper, owing to its high absorbency. The old fibre, being very fragile, should be mixed in suitable proportions with the fibre from the moss; these latter fibres can, moreover, be bleached if necessary. The washings from the fibre may be utilised as fuel, especially when formed into briquettes with some cheap inflammable substance.

PATENTS.

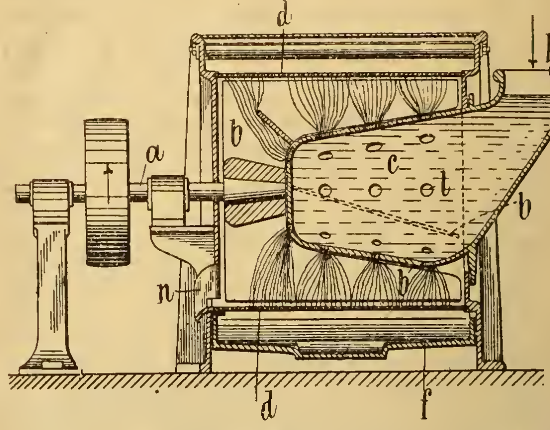
Paper or other material; Machine for coating ——. G. N. Pifer, Cleveland, Ohio, U.S.A. Eng. Pat. 28,756, Dec. 31, 1907.

THE machine for coating paper, particularly with photographic emulsions, is constructed in such a way that the paper itself forms the constantly moving bottom of a trough containing the coating medium. The web of paper passes over a feed-drum, and a delivery drum, so that the loop of paper between the two drums forms a trough. The ends of the trough are closed by rotating discs, against which the edges of the paper are pressed by endless guide-bands. The quantity of coating applied to the paper depends on the fluidity of the composition, and the speed of the paper. The movement of the paper provides a constant agitation of the coating material, and this is kept at a uniform temperature either by means of a hot water box immersed in the emulsion or by an external hot water box on the under side of the paper. If the coating is to be applied in strips, intermediate discs or cylinders are arranged between the two end discs. —J. F. B.

Wood pulp; Preparation of ——. C. G. Schwalbe. Ger. Pat. 204,460, June 11, 1907.

THE wood is ground as finely as possible and then treated with gases containing oxides of nitrogen, until these are no longer absorbed. After standing for about 3 hours, the treated wood is introduced into a 2 per cent. solution of caustic soda. On boiling, the wood is rapidly disintegrated to a fibrous pulp. The waste liquor is precipitated with milk of lime, the calcium oxalate filtered off, and the solution used over again.—A. S.

Lignin, cellulose, etc.; Horizontal centrifugal separating machine for ——. P. Priem, Heidenheim on the Brenz, Germany. U.S. Pat. 897,144, Aug. 25, 1908.



A HORIZONTAL type of centrifugal strainer for mechanical wood and other pulps is described (see fig.). This consists of a horizontal perforated separator-drum, *d*, in which is a propeller, *b*, rotating on the shaft, *a*. The crude pulp enters the apparatus at *k*, and is distributed by a special distributing arrangement, *c*, through the holes, *l*. The distributor is so constructed that the hydrostatic pressure is equal in all parts, and equal quantities of pulp are discharged uniformly from all the holes in all directions. The blades of the propeller are cut away as to make room for the pulp distributor. The latter may lie either in the axis of the propeller shaft, as shown, or else eccentrically. The pulp discharged from the holes of the distributor is struck violently in a direction at right angles to that of the jets and is thrown in a fine spray against the sieve, *d*. The strained pulp is collected in the space, *f*, and flows away, whilst the coarse particles are discharged from the drum by the channel, *n*.—J. F. B.

Cellulose compounds [*Impervious plastic composition*]; *Method of producing* ——. J. Kitsee, Philadelphia, Pa. U.S. Pat. 900,744, Oct. 13, 1908.

NITROCELLULOSE is gelatinised, preferably by distilling on to it the vapours of a solvent; it is then mixed with resin, preferably Burgundy pitch, also dissolved in a solvent. "Asbestos flour" is dehydrated by boiling with an equal weight of castor oil and the paste is incorporated with melted sulphur and ammonium phosphate. This mixture is then milled with the nitrocellulose mixture until a homogeneous mass is obtained; this is rolled into sheets or moulded into jars, etc., and the solvent is evaporated at the ordinary temperature. Finally the articles are vulcanised at a temperature of 150°—200° C. —J. F. B.

Cellulose films; Manufacture of ——. Soc. Civile des Pellicules Nouvelles pour Cinématographes et autres Usages. Fourth Addition, dated Aug. 31, 1907, to Fr. Pat. 384,111, Jan. 25, 1907 (this J., 1908, 471).

FILMS of cellulose are liable to "cockle" during drying; this is prevented by clamping the edges of the moist sheet on a frame or table. The dried films may be varnished and printed. Films may be joined together by stitching, and afterwards cementing the stitches by a suitable varnish.—J. F. B.

Celluloid; Process for preparing masses resembling ——. B. Szelinski. Ger. Pat. 202,720, Dec. 28, 1907.

THE compounds obtained by the action of organo-magnesium compounds on hydro-aromatic, unsaturated ketones (*e.g.*, carvone, pulegone, cyclohexenone) are worked up with nitro- or acetyl-cellulose, with or without camphor or camphor substitutes, in presence of suitable solvents, to form products resembling celluloid. For example, 100 parts of acetylcellulose are heated for some hours with a solution of 55 parts of benzyldihydrocarvone in acetone and chloroform or alcohol, and the solvent is removed.—T. F. B.

Cellulose ; Method of eliminating copper from coagulated ——. E. Crumière, Paris. U.S. Pat. 904,684, Nov. 24, 1908.

See Fr. Pat. 375,827 of 1907 ; this J., 1907, 922.—T. F. B.

Wood ; Process of treating —— to produce terpenes and wood pulp. U.S. Pat. 903,859. *See* XIII*B*.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, & EXTRACTS.

Corydalis cava ; Alkaloids of the tubers of ——. E. Schmidt. Arch. Pharm., 1908, **246**, 575—582.

As protopine has been found amongst the alkaloids of *Corydalis ambigua* (this J., 1908, 873), the author has examined the tubers of *Corydalis cava* for the same alkaloid, but without success. This alkaloid is also not present in the leaves or seeds. The following alkaloids were found to be present in the tubers :—Bulbocapnine, dehydrocorydaline, and corytuberine.—F. Shdn.

Hemlock (Conium maculatum) ; Physiological action of the alkaloids of ——. J. M. Albahary and K. Löffler. Compt. rend., 1908, **147**, 996—999.

A study of the physiological action of the hemlock alkaloids, showed that conhydrine and *pseudo*conhydrine produced similar effects, differing only in intensity, namely, lowering of the temperature and paralysis of the lower extremities. The alkaloid, β-coniceine, obtained by the removal of the elements of water from conhydrine is very toxic, producing paralysis of the lower extremities and subsequently death. *pseudo*Coniceine produces the same effects only in a less degree. *d*-Conicine and *l*-conicine are similar to each other in their action and are toxic, and like results were obtained with *pseudo*conicine, a base produced by the reduction of *pseudo*conhydrine. All these substances produce a lowering of the body-temperature. The authors conclude that the introduction of a double-bond increases the physiological effect, whilst the introduction of a hydroxyl-grouping diminishes the activity.—F. Shdn.

Meteloidine : a new solanaceous alkaloid. F. L. Pyman and W. C. Reynolds. Chem. Soc. Proc., 1908, **24**, 234.

Datura meteloides yields 0·4 per cent. of total alkaloid, from which 0·13 per cent. of hyoscine, 0·03 per cent. of atropine, and 0·07 per cent. of a new alkaloid, *meteloidine*, have been obtained. Meteloidine, $C_{13}H_{21}O_4N$, crystallises in tabular needles, melting at 141—142° C. The hydrobromide, $C_{13}H_{21}O_4N,HBr,2H_2O$ (needles, m.p. 250°), aurichloride, $C_{13}H_{21}O_4NHAuCl_4,\frac{1}{2}H_2O$ (hexagonal plates, m.p. 149—150°), and picrate (hexagonal plates, m.p. 177—180°) of the alkaloid have been prepared. The alkaloid is optically inactive, and has no marked physiological action. It is readily hydrolysed by hot aqueous barium hydroxide, with the formation of tiglic acid and a new base, *teloidine*, according to the equation : $C_{13}H_{21}O_4N + H_2O = C_5H_8O_2 + C_8H_{15}O_3N$. Teloidine crystallises from moist acetone in needles, which contain one molecule of water of crystallisation, and, after drying at 120°, melts at 168—169° C. It forms crystalline salts, of which the hydrochloride, $C_8H_{15}O_3N,HCl$ (prisms, m.p. above 300°), hydrobromide, $C_8H_{15}O_3N,HBr$ (hexagonal plates, m.p. 295°), and aurichloride, (hexagonal plates, m.p. 225°) $C_8H_{15}O_3N,HAuCl_4,\frac{1}{2}H_2O$ have been characterised. Attention is drawn to the similarity of the properties of teloidine with those of tropine and oscine.

Alkaloids ; Affinity of certain —— for hydrochloric acid. V. H. Veley. Chem. Soc. Proc., 1908, **24**, 234—235.

Determinations have been made of the affinity values of the nitrogen atoms or amino-groups of certain alkaloids, which, although containing more than one atomic proportion of nitrogen, yet form stable combinations with one molecular proportion of hydrogen chloride, the dihydrochlorides being produced only under special conditions, or not, as yet, having been obtained. It was shown by the application of the methyl-orange method that in all cases the affinity values of these amino-groups are of a widely different order. In the case of the cinchona alkaloids, the affinity value of one amino-group is rather less than that of a hydropyridine, whilst that of the other is rather lower than that of quinoline. These results are in accordance with the accepted constitution of these alkaloids and the thermo-neutrality values obtained by addition of one and two molecular proportions of hydrogen chloride respectively. In the case of pilocarpine, the value of one grouping is intermediate between that of ammonia and the limit value of the methyl-orange method, whilst that of the other is equal to those of true amphoteric electrolytes. A methylglyoxaline was examined on account of the relationship of pilocarpine to these compounds ; the value of the two amino-groups and its general behaviour correspond with a diamino-base of the type of hydrazine. Of the *Nux vomica* alkaloids, strychnine and brucine were examined ; in both cases, the affinity value of one amino-group was beyond the limit value of the methyl-orange method, whilst that of the other corresponded with the betaines, which is in accordance with the views held regarding their constitution.

Saponin from fruit shells of Nephelium lappaceum. J. Dekker. Pharm. Weekblad, 1908, **45**, 1156. Apoth.-Zeit., 1908, **23**, 850.

The dry, powdered material was macerated three or four times, at the ordinary temperature, with 60 per cent. alcohol. The dark red extract was treated with magnesia, added a little at a time, with thorough agitation, until the solution showed a greenish colour. The filtered solution was then evaporated to dryness, and the residue dissolved in methyl alcohol. The filtered methyl alcohol solution gave a precipitate on adding ethyl acetate. This was removed, and the filtrate evaporated to dryness. The residue was again dissolved in methyl alcohol, and the crude saponin precipitated by the addition of ether. Nephelium-saponin is toxic, has an acrid taste, and dissolves in sulphuric acid with a yellow colour, changing to purple, then forming a purple precipitate. When a solution of the saponin in glacial acetic acid is floated on strong sulphuric acid, a brown ring is formed. The products of hydrolysis by boiling with dilute acids are a white crystalline precipitate and a soluble reducing substance.—J. O. B.

Saponin from leaves of Polyscias nodosa. Van der Haar. Pharm. Weekblad, 1908. [40] ; Pharm. Zeit., 1908, **53**, 900.

This saponin has the formula, $C_{25}H_{42}O_{10}$. On hydrolysis with mineral acids it yields sapogenin, together with *l*-arabinose and *d*-glucose in equimolecular proportions. This is the first recorded instance of an arabinose occurring among the decomposition products of a saponin and indicates a connection between the saponins and gums. —J. O. B.

"Oleuropein" from olive leaves ; Some observations regarding ——. F. B. Power and F. Tutin. Pharm. J., 1908, 81, 714—715.

Bourquelot and Vintilesco (this J., 1908, 1038) claim to have isolated a relatively pure glucoside, "oleuropein," from the leaves and young fruit of the olive tree. The authors have repeated this work, and further subjected the glucosidal substance so obtained to different fractionation processes. The results show that "oleuropein" is not an individual substance, but a very complex mixture of amorphous products. (See also this J., 1908, 640, 641.) —A. S.

Carbamino reaction ; Applicability of the ——. H. Liebermann. Z. physiol. Chem. 1908, **58**, 84—91.

Organic nitrogen compounds of the aromatic series, and containing nitrogen in the nucleus, are treated in the following way. The substance is dissolved in water and a little phenolphthalein added. Milk of lime is next added and carbon dioxide passed through till the liquid is no longer alkaline, the temperature being kept at 4° C. These operations are repeated. Excess of milk of lime is now added, the liquid shaken and filtered. The clear filtrate is diluted with freshly boiled water, placed in a flask fitted with a soda-lime tube, and allowed to stand for 20 hours at 20° C. During this time the calcium carbaminate decomposes into calcium carbonate. The precipitate is collected and weighed, and the amount of nitrogen in the filtrate determined by Kjeldahl's method. From these results the ratio CO_2 : N is determined, and is as follows for these substances :—piperazine, 1 : 0·95 ; piperidine, 1 : 0·93 ; coniine, 1 : 1·56 ; tetrahydroquinoline, 1 : 4·07 ; tryptophan, 1 : 1·55 ; glucosamine, 1 : 0·99 ; taurine, 1 : 0·93.—F. Shdn.

Geranium oil. Bull. Imp. Inst., 1908, **6**, 295—300.

The article deals with the production, constituents, and chemical and physical characters of rose geranium oil, and with the cultivation of the plant. The plants are cultivated in France, Reunion Island, Algeria, Spain, and also on a smaller scale in Austria and Central Germany. At the present time, Algeria stands first and Reunion Island second with respect to the production of the oil. The exports from these two sources for the past three and two years respectively are shown in the following table :—

	Algeria.	Reunion Island.
	cwt.	cwt.
1905	1035	—
1906	1075	623
1907	761	615

The Spanish oil commands the highest price, and the French and Algerian oils stand next ; the Reunion oil is of somewhat lower value. The cultivation of *Pelargonium odoratissimum* is being carried on experimentally in Cyprus.—A. S.

The saponin and cholesterol series ; Compounds of ——. Relations between poison and antidote in the case of these compounds. A. Windaus. Z. Elektrochem., 1908, **14**, 783.

It was already known that cholesterol is an antidote for saponins, but no well-defined compounds of these two classes of substances were known. The author has found that on mixing dilute alcoholic solutions of cholesterol and digitonin, a crystalline compound is obtained, containing equimolecular proportions of the two constituents. The same compound was obtained by crystallising the flocculent precipitate obtained on mixing colloidal solutions of the two substances ; this precipitate has hitherto been looked upon as an " adsorption-compound." The new compound is only very slightly soluble in alcohol, and the dissolved portion is only very slightly dissociated into its components. Acetic anhydride removes the cholesterol from the compound in the form of cholesteryl acetate. Other saponins yield similar compounds with cholesterol, some of which are more readily dissociated than the digitonin compound. The degree of action of cholesterol as an antidote on various heart-poisons is in direct relation to the degree of dissociation of the double compounds produced. Therefore the saponin-cholesterol reaction, which according to some writers is analogous to the toxin-antitoxin reactions, consists of a state of equilibrium between the double-compound and its components.—E. F.

Diazoantipyrine-dimethylamine. F. Stolz. Ber., 1908, **41**, 3849—3854.

Aminoantipyrine was dissolved in dilute hydrochloric acid, and diazotised with sodium nitrite. The diazo-solution was allowed to flow into an ice-cold aqueous solution of dimethylamine, care being taken that the liquid always remained alkaline. On adding excess of common salt, diazoantipyrine-dimethylamine, $C_{13}H_{17}ON_5$, separated. This substance crystallises from benzene in brownish-yellow leaflets, which melt at 107° C. when heated rapidly, and at 110°—112° C. when heated slowly. It is soluble in alcohol and dilute acids, and is precipitated from the latter by the addition of ammonia and common salt. When heated above its melting-point, or boiled in xylene, it loses dimethylamine and passes into phenylmethylpyrazopyrazolone, $C_{11}H_{10}ON_4$. Diazoantipyrine-diethylamine forms light-brown prisms melting at 111°—112° C. ; it also passes into phenylmethylpyrazopyrazolone on heating. This pyrazopyrazolone crystallises from 50 per cent. alcohol in orange-coloured crystals and melts at 173° C. It is hardly soluble in water, but dissolves in concentrated hydrochloric acid and in sodium hydroxide solution. The acetyl derivative melts at 202°—203° C.
—F. Shdn.

Bismuth carbonate and oxalate. L. Vanino and E. Zumbusch, Ber., 1908, **41**, 3994—3999.

Bismuth nitrate and mannitol are rubbed together in equivalent proportions, when a mass is obtained which dissolves in water to form a clear liquid. This aqueous solution is cooled to 0° C. and treated with an equivalent amount of potassium carbonate dissolved in a small quantity of water. The precipitate is collected, washed with water and alcohol, and dried. The substance thus obtained has the composition $(BiO)_2CO_3$. The same compound is produced when a hot bismuth-mannitol solution is precipitated with ammonium carbonate. Bismuth oxalate, $Bi_2(C_2O_4)_3$, is prepared by adding the calculated amount of oxalic acid to the bismuth-mannitol solution heated to 25° C. or 65° C., and washing the precipitate with water, alcohol, and ether. The basic oxalate, $Bi(OH)C_2O_4$, is prepared in a similar way but using less oxalic acid.—F. Shdn.

Phytosterol from African rubber. N. H. Cohen. *See* XIII*C*.

Indicator highly sensitive to alkalis. E. Rupp and R. Loose. *See* XXIII.

Patents.

Lymph for preventative and curative purposes ; Manufacture of ——. S. Krafft, München, Germany. Eng. Pat. 13,210, June 20, 1908. Under Int. Conv., June 29, 1907.

Cultures or triturations of bacteria, *e.g.*, of swine fever, hog-cholera, or septicæmia, are treated with heavy metals in the form of powder or granules at the temperature most favourable to the growth of the bacteria. After several hours' contact, glycerol and phenol are added, and the liquid is filtered. The metal employed is preferably one of which the soluble salts are not poisonous to the animal to be treated. The quantity of metal used varies with the conditions ; generally for 500 c.c. of culture liquid, 7·5 grms. of zinc or copper, 10 grms. of tin, or 5·5 grms. of silver are sufficient.—J. F. B.

Formic esters of borneol and isoborneol ; Preparation of —— and of borneol and camphor. O. L. A. Dubosc. Second Addition, dated June 19, 1908, to Fr. Pat. 370,293, Oct. 6, 1906 (this J., 1907, 278 ; 1908, 296).

Only the solid hydrochloride of pinene is useful for the manufacture of borneol and camphor. This hydrochloride is quite insoluble in formic acid, and since the formic esters are liquids, the disappearance of all traces of the suspended pinene hydrochloride serves as an indication of the end of the reaction. The formic esters produced, though liquid, are likewise insoluble in the formic acid medium, and may be separated by simple decantation from the excess of formic acid used in the reaction.—J. F. B.

Camphor ; Process for converting borneols and isoborneols into ——. G. Austerweil. Fr. Pat. 392,011, July 4, 1908. Under Int. Conv., May 13, 1908.

Borneols or *iso*-borneols are readily oxidised to camphor by heating, under a reflux condenser, with nitric acid

(37°—40° B.) in presence of small quantities of vanadic acid or a vanadate, a current of air or oxygen being passed through the liquid during the process. It is stated that the temperature and the amount of air used can be so adjusted that the atmospheric oxygen acts as the oxidising agent, all nitric acid reduced being re-oxidised by the vanadic acid. Vanadic acid may also be used as catalyser in the electrolytic oxidation of borneol or *iso*-borneol. —T. F. B.

Iodo-fatty acids; Process for preparing stable esters and salts of high molecular —— free from chlorine. J. D. Riedel A.-G. Ger. Pat. 202,790, June 14, 1905.

Fats or other esters of high-molecular, unsaturated fatty acids, or their salts, are converted into the corresponding iodo-compounds by treatment with iodine and water, in presence of substances which form hypoiodous acid with iodine and water.—T. F. B.

Dimethylamino-1-*phenyl*-2.3-*dimethyl*-5-*pyrazolone; Process for preparing ——.* Soc. Chim. de l'Avanchet. Ger. Pat. 203,753, Dec. 3, 1907.

The amino group of 1-phenyl-2.3-dimethyl-4-amino-5-pyrazolone is converted into a dimethylamino group by heating it with nitrosodimethylamine in an autoclave or in an open vessel. The reaction proceeds according to the equations:—

$$C_{11}H_{11}N_2O.NH_2 + NO.N(CH_3)_2 = C_{11}H_{11}N_2O.N:N.N(CH_3)_2 + H_2O.$$

$$C_{11}H_{11}N_2O.N:N.N(CH_3)_2 = C_{11}H_{11}N_2O.N(CH_3)_2 + N_2.$$

—T. F. B.

Oxidation of organic compounds by means of oxygen or air in presence of coal, lignite, or peat; Process for ——. M. Dennstedt and F. Hassler. Ger. Pat. 203,848, Feb. 24, 1907.

This process, which is applicable to the oxidation of alcohols and hydrocarbons, and especially to borneol and *iso*borneol, is carried out by oxidising the substance with air or oxygen, at a temperature of 150°—300° C., in presence of coal, lignite, or peat; the addition of ferric oxide increases the catalytic action of the carbonaceous substance. A preliminary heating and treatment of the contact substance with air may be given.—T. F. B.

Santalyl halides; Process for preparing ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 203,849, March 17, 1907.

Santalol or sandal-wood oil is treated with halogen compounds, such as those of phosphorus, which will replace hydroxyl groups by halogens (the use of the halogen acids is excepted): santalyl halides are also obtained by treating santalol with carbonyl halides, such as phosgene, in presence of bases, or by heating santalol-halogen carbonates. If santalol is heated with hydrochloric acid, a small amount of santalyl chloride is formed, but the greater part of the substance is resinified. —T. F. B.

Alkylthiosalicylic acids and their esters; Process for preparing ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 203,882, Aug. 23, 1906.

Alkylthiosalicylic esters are obtained by the action of dialkyl sulphates on thiosalicylic acid in the cold, in alkaline solution, whilst alkylthiosalicylic acids result when alkylsulphuric acids are heated with thiosalicylic acid in alkaline solution.—T. F. B.

Camphene; Manufacture of ——. Dr. Schmitz und Co., Düsseldorf, Germany. Eng. Pat 25,453, Nov. 16, 1907. Under Int. Conv., Dec. 8, 1906.

See Fr. Pat. 384,955 of 1907; this J., 1908, 522.—T. F. B.

Cantharidinic acid derivatives containing iodine and mercury; Process for the production of ——. A. Klein, Berlin. Eng. Pat. 25,458, Nov. 16, 1907.

See Ger. Pat. 193,219 of 1906; this J., 1908, 713.—T. F. B.

Cream of tartar; Manufacture of ——. G. Tassopoulos. Fr. Pat. 392,273, July 11, 1908.

See Eng. Pat. 16,047 of 1907; this J., 1908, 876.—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Patents.

Photographic or blue print paper and the like; Method of producing paper to be used as ——. M. Roth, Elberfeld, Germany. Eng. Pat. 26,445, Nov. 29, 1907.

See Fr. Pat. 384,327 of 1907; this J., 1908, 471.—T. F. B.

Photographic dry plates. Bremer Trockenplattenfabrik B. Klatte, Bremen, Germany. Eng. Pat. 11,341, May 25, 1908. Under Int. Conv., Feb. 22, 1908.

See Fr. Pat. 390,572 of 1908; this J., 1908, 1178.—T. F. B.

Paper or other material; Machine for coating ——. Eng. Pat. 28,756. *See* XIX.

XXII.—EXPLOSIVES, MATCHES, &c.

Patents.

Volatile solvents; Recovery of ——. Eng. Pat. 23,888. *See I.*

Nitrated explosives; Process for preventing the spontaneous explosion of ——. J. C. E. Bouchaud-Praceiq, Paris. Eng. Pat. 10,129, May 9, 1908. Under Int. Conv., May 10, 1907.

See Fr. Pat. 387,612 of 1907; this J., 1908, 877.—T. F. B.

Nitrated explosives; Warning protector against the spontaneous explosion of ——. J. C. E. Bouchaud-Praceiq, Paris. Eng. Pat. 10,965, May 20, 1908. Under Int. Conv., May 22, 1907.

See Fr. Pat. 388,142 of 1907; this J., 1908, 961.—T. F. B.

Powder; Smokeless ——. A. T. Cocking, Four Oaks, near Birmingham. U.S. Pat. 903,958, Nov. 17, 1908.

See Eng. Pat. 15,564 of 1905; this J., 1906, 497.—T. F. B.

Detonator casings; Charge for ——. L. Wöhler, Karlsruhe, Germany. U.S. Pat. 904,289, Nov. 17, 1908.

See Ger. Pat. 196,824 of 1907; this J., 1908, 593.—T. F. B.

Blasting composition. W. Eberle. Fr. Pat. 392,378, July 17, 1908.

See Eng. Pat. 15,195 of 1908; this J., 1908, 1000.—T. F. B.

Solvent used in the manufacture of explosives; Apparatus for distilling off and recovering the ——. W. Nikolsky, St. Petersburg. U.S. Pat. 904,636, Nov. 24, 1908.

See Eng. Pat. 3661 of 1906; this J., 1906, 868.—T. F. B.

XXIII.—ANALYTICAL CHEMISTRY.

INORGANIC—QUANTITATIVE.

Indicator highly sensitive to alkalis, for use with hundredth-normal solutions. E. Rupp and R. Loose. Ber., 1908, **41**, 3905—3908.

The indicator used by the authors is *p*-dimethylamino-azobenzene-*o*-carboxylic acid, and is styled by them "methyl red." It is prepared by diazotising *o*-amino-benzoic acid, and treating the product with dimethylaniline. "Methyl red" is almost insoluble in water, and moderately soluble in alcohol. A 0·2 per cent. solution in alcohol is used for the titrations. It is faintly yellow in alkaline and neutral solutions, and violet-red in acid solutions. This indicator can be used to titrate ammonia even in $N/100$ solution, also for certain alkaloids, such as quinine. —F. Shdn.

Potassium ; Determination of —— as phosphomolybdate. A. Schlicht. Chem.-Zeit., 1908, **32**, 1125—1126, 1138—1140.

Under proper conditions the proportion of potassium phosphomolybdate obtained by the action of phosphomolybdic acid on potassium sulphate is so constant that the method may be used for the determination of potassium. The mixture of potassium salt and phosphomolybdic acid (at least 10 c.c. of the reagent for 0·1 grm. of potassium sulphate) is evaporated to dryness, and the residue washed by adding a quantity of boiling 5 per cent. magnesium sulphate solution equal to that of the reagent used, and stirring for 2—3 minutes during cooling. When cold, the mixture is filtered through a Gooch crucible and the residue washed, three times with 5 c.c. of 5 per cent. magnesium sulphate solution and three times with 5 c.c. of 5 per cent. ammonium nitrate solution ; it is then gently ignited, or washed with alcohol and ether and weighed without ignition. 0·1 grm. of potassium sulphate gives 0·8071 grm. of dried residue, or 0·7860 grm. after ignition. The reagent is made as follows :—100 grms. of molybdic acid are dissolved in sodium carbonate solution (230 grms. of crystallised sodium carbonate), the solution is evaporated to dryness, and the residue heated for 2 hours at 150° C. ; it is then dissolved in water and made up to 500 c.c. Six grms. of magnesium pyrophosphate are dissolved in *aqua regia*. the solution is evaporated several times with nitric acid, and the residue taken up with a little nitric acid and then made up to 500 c.c. with nitric acid (sp. gr. 1·36). Into this solution is run the sodium molybdate with constant stirring, 500 c.c. of water are added, and the solution filtered after standing for 2 days.—F. Sodn.

ORGANIC—QUALITATIVE.

Formaldehyde ; Formation of —— in solutions of cane sugar [sucrose], and its bearing on Hehner's test for formaldehyde in saccharine mixtures. R. A. Ramsay. *See* XVIII*A*.

Invert sugar in wine ; Detection of —— by means of resorcinol and hydrochloric acid. A. Kickton. *See* XVII.

ORGANIC—QUANTITATIVE.

Malic acid ; Determination of ——. E. Pozzi-Escot. Bull. Soc. Chim. Belg., 1908, **22**, 413—414.

The author states that the method proposed by Cowles (this J., 1908, 912) cannot be trustworthy, since calcium acetate is insoluble in 85 per cent. alcohol and will be precipitated with the malate, which itself is appreciably soluble in alcohol of this strength. He recommends precipitating the malic acid with a saturated solution of barium bromide in 96 per cent. or absolute alcohol, which has been rendered faintly ammoniacal. The liquid containing the malic acid is first concentrated to a syrup and neutralised ; precipitation is effected in presence of a large excess of alcohol.—A. S.

Sugar in molasses fodder and in denatured sugars ; Determination of ——. L. Vuaflart. *See* XVI.

Formaldehyde in milk ; Colorimetric method for the determination of ——. E. W. T. Jones. *See* XVIII*A*.

Coffee ; The caffeine-content of unroasted —— and a modification of Juckenack and Hilger's method for determining caffeine. R. Hefelmann. *See* XVIII*A*.

Chocolate ; Determination of fat in ——. A. Kreutz. *See* XVIII*A*.

Carbamino reaction ; Applicability of the ——. H. Liebermann. *See* XX.

XXIV.—SCIENTIFIC & TECHNICAL NOTES.

Hydrosols ; Precipitation of —— by freezing. A. Lottermoser. Ber., 1908, **41**, 3976—3979.

Freshly prepared hydrosols containing considerable amounts of electrolyte, such as preparations of silicic acid and of ferric hydroxide (by precipitation of ferric chloride solutions with a small amount of ammonia whilst hot) are not precipitated by freezing and re-melting. If such hydrosols are dialysed, coagulation is produced by freezing, after a certain degree of purity has been obtained ; this coagulation is not necessarily complete at first, but becomes so when the amount of electrolyte is sufficiently reduced. The author is of opinion that it is not the amount of diminution of temperature, but the complete crystalline solidification of the solution which determines the precipitation of the colloid from the hydrosol on remelting. He has come to this conclusion after studying the behaviour of colloidal gels on freezing. If the gel of silicic acid, for instance, as obtained either from the hydrosol or from sodium silicate solution and the right amount of acid, is freed from the greater portion of any electrolytes by decantation and pressed between filter-paper, an apparently dry product is obtained, which, however, still contains much water. If this gel is now kept for some time in a freezing-mixture of ice and common salt, and then brought to the ordinary temperature, a large amount of aqueous liquid separates and the bottom of the receptacle is covered with a magma of small, glistening scales, which are seen under the microscope to be quite irregular in shape. The author believes that these are formed by the expansion of the water on freezing, which causes the small hollow cells, of which the gel is composed, to burst ; the liberated particles of colloid are then pressed into plates in the interstices between the ice-crystals. It is suggested that these phenomena may find analytical application, in the direction of increasing the grain of amorphous precipitates.—E. F.

Calcium sucrate ; Acetonedicarboxylic acid from ——. E. O. von Lippmann. Ber., 1908, **41**, 3981—3982.

An earlier observation (Ber., 1893, 3057) to the effect that calcium sucrate may sometimes decompose with formation of acetonedicarboxylic acid, is confirmed. A flask containing pure tribasic calcium sucrate was left to stand for some years ; on opening the flask, a strong odour of acetone was observed, and, from the material, was isolated a crystalline substance which proved to be the above-mentioned acid.—L. E.

Patent Law Decision.

Foreign patents in England : Decisions under the new Act. Times, Dec. 12, 1908.

The decision of the Comptroller-General in the first two applications for revocation of patents under Section 27 of the Patents and Designs Act, 1907, has been delivered. The invention protected by the patents was a process of manufacturing thin imitation stone slabs or tiles, the main process being that a fibrous material is mixed with an adhesive substance, and then operated upon by machines used in cardboard manufacture. The invention is in operation in Germany, France, and Belgium under licences from the grantee, and an exclusive licence in this country was granted to a Belgian company in June, 1906, but the process has been carried on exclusively outside the United Kingdom. The principal reasons given by the Belgian company for not carrying on the invention in this country were that the company's factory in Belgium is sufficient to deal with the whole of its trade, both in the United Kingdom and elsewhere, and that the production of the articles in the United Kingdom could not be effected as cheaply as is now done abroad owing to the increased cost both of labour and materials. It was also urged that the company had inserted advertisements in various trade journals intimating that the owners of the patents were willing on reasonable terms to dispose of the patents or to enter into a working arrangement with firms in Great Britain likely to be interested in the process, and had communicated with various British firms for the purpose of granting licences under the patents or of selling the latter, but that no offer had been received in response.

The Comptroller-General, in his decision, stated that the mere fact that it would be more profitable or convenient to a patentee to manufacture abroad than in this country could not be regarded as a satisfactory reason for not taking the necessary steps for introducing the manufacture into this country. On the evidence, he could find no inherent reason why the patented process should not be carried on commercially in this country. It appeared that there was little, if any, difference in the prices at home and abroad of the materials used, or in the facilities for obtaining them, and if the reason that wages were lower in other countries than in England was an insuperable bar to the introduction of the industry to this country, it was difficult to understand how many industries which were carried on successfully in the United Kingdom continued to be carried on. As to the question of the advertisements and offers to sell the patent rights, he could not regard the fact that no answers were received as a satisfactory reason for not manufacturing in this country. It seemed impossible to hold that a patentee could relieve himself from the duty of manufacturing in this country by the mere insertion at any time of a few advertisements and the sending round to manufacturers of a few circulars to which no replies were received. The advertisements and offers in this case were of the vaguest description, and gave no intimation of the terms on which the owners of the patents were prepared to treat, beyond the statement that such terms would be reasonable. Dealing with a suggestion that patentees who had taken out their patents before the passing of the Act should be treated with greater leniency than those who had since taken out patents, the Comptroller-General pointed out that a year of grace had already been allowed under the Act, and said that he could find nothing in the Act which would justify him in lengthening it. He therefore ordered that the patents be revoked forthwith.

New Books.

CHEMIKER-KALENDAR, 1909. Ein Hilfsbuch für Chemiker, Physiker, Mineralogen, Industrielle, Pharmazeuten, Hüttensmänner, u.s.w. Von Dr. RUDOLF BIEDERMANN. 30'ster Jahrgang. In zwei Teilen. Julius Springer's Verlag, Monbijouplatz 3, Berlin. 1909. Price M.4. Bound in leather, M.4.51.

PART I.—Arranged as a pocket-book, strongly bound in waterproof cloth. It contains an almanac for 1909, together with a table of the more frequently used atomic weights and their multiples. The general text refers principally to matters of purely chemical interest. I. Atomic and molecular weights. II. Different properties of chemical substances. III. Gas and vapour densities. Specific gravities. (1) Alkalis. (2) Acids. (3) Salts. (4) Alcohols, etc. IV. Solubility. V. Analysis. VI. Volumetric analysis. VII. Electrochemical analysis. VIII. Gas analysis. IX. Spectrum analysis. The matter in these various groups is chiefly composed of tables. A note-book calendar with blank pages is arranged for the different days of the year. The subject-matter, exclusive of the calendar and the blank pages for notes, fills 384 pages. A railway map of Germany appears as an appendix, followed by a tabular arrangement of the relative coinage values of the world. One side of the external cover is utilised as a centimetre scale measure.

PART II.—This supplementary volume is of similar size to the pocket-book, but is unbound, and is more directly concerned with chemical technology. It contains tables relating to:—I. Physics and physical chemistry. II. Mineralogy. III. Technical-chemical analysis and investigation. Besides the tabulated matter, however, there are concise descriptive paragraphs of introductory character, with descriptions of analytical methods. The sub-divisions are the following:—(1) Water. (2) Assaying. (3) Fuels. (4) Sulphuric acid. (5) Alkali. (6) Bleaching powder. (7) Nitre and explosives. (8) Ceramics. (9) Glass. (10) Mortar and cement. (11) Illuminants. (12) Starch and sugar. (13) Fermentation industries. (14) Fats and oils. (15) Tanning agents. (16) Textile fibres, and paper. (17) Photography. (18) Dyestuffs, colours, and pigments. (19) Physiological chemical analysis. Appendix with various recipes, etc. The subject-matter fills 556 pages.

DIE ANALYSE DES KAUTSCHUKS, DER GUTTAPERCHA, BALATA UND IHRER ZUSAETZE. Mit Einschluss der Chemie der genannten Stoffe. Von Dr. RUDOLF DITMAR. A. Hartleben's Verlag, Wien und Leipzig. 1909. Price M.10.

8vo volume, containing 281 pages of subject matter, with 41 illustrations, and the alphabetical indexes of authors' names, and subjects, followed by a series of microphotographic plates representing rubber structure, etc. The text is classified according to the following scheme:—I. Theory of caoutchouc. II. Theory of gutta-percha. III. Theory of balata. IV. The additional components of the commercial articles. V. Analysis of caoutchouc. VI. Analysis of gutta-percha. VII. Analysis of balata. VIII. Physico-chemical and physical tests of india-rubber and its added constituents. IX. The microscopical study of india-rubber and india-rubber goods.

THE BRITISH JOURNAL PHOTOGRAPHIC ALMANAC, 1909. Edited by GEORGE E. BROWN. H. Greenwood and Co., 24, Wellington Street, London, W.C. Price 1s. (cloth, 1s. 6d.).

8vo volume of 1336 pages, containing a list of Photographic Societies and Bodies, an article on reflex cameras, an epitome of photographic progress during the year, a collection of formulæ for the various photographic processes, a list of the principal text books on photography, legal information bearing on the subject, and a number of chemical, optical, and other tables.

Patent List.

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

APPLICATIONS.

25,829. Marks (U.S. Liquid Air and Oxygen Co.). Liquefaction of gases, especially air, and the separation of air into oxygen and nitrogen.* Nov. 30.

25,881. Fothergill and Clark. Mechanical filters. Dec. 1.

26,038. Strange and Graham, Ltd., and Pim. Apparatus for agitating, dissolving, mixing, etc. Dec. 2.

26,068. Hodgkinson. Apparatus for evaporating brine and other solutions. Dec. 3.

26,152. Hommel, and Metals Extraction Corporation. *See under* X.

26,257. Eckford. Apparatus for transferring pulverulent materials and treating them with air, chlorine, etc. Dec. 4.

26,301. Perks. Continuous distillation of liquids. Dec. 4.

26,537. Suzuki. Continuous crystallising pan.* Dec. 8.

26,561. Hinman. Means for measuring or analysing gaseous mixtures. Dec. 8.

26,577. Traun. Manufacture of vessels capable of resisting chemical action. Dec. 8.

26,661. Biddle. Filters. Dec. 9.

26,684. Sprague. Treatment of corrosive gaseous fumes or smoke. [U.S. Appl., April 7, 1908.]* Dec. 9.

26,768. Mycock and Redfern. Drying machines. Dec. 10.

26,843. Lake (Reif). Manufacture of chemical products in granulated, powdered, flaked, or similar condition.* Dec. 10.

27,000. Bovone. Kilns.* Dec. 12.

Complete Specifications Accepted.

27,019 (1907). Hommel, and Metals Extraction Corporation. Apparatus for dissolving gases in liquids. Dec. 9.

5224 (1908). Wärd and Wärd. Apparatus for separating solid particles from a fluid and from each other. Dec. 9.

5944 (1908). Feix. Filter press frames. Dec. 16.

13,563 (1908). Dudgeon (Soc. Anon. John Cockerill). Centrifugal apparatus for purifying gases. Dec. 9.

II.—FUEL, GAS, AND LIGHT.

Applications.

25,781. Dixon, and Gas Power and Bye-Products Co. Gas producers. Nov. 30.

25,854. Siemens und Halske A.-G. Manufacture of electric incandescent filaments from tungsten, etc. [Ger. Appl., Dec. 11, 1907.]* Nov. 30.

25,868 to 25,871. British Thomson-Houston Co. and Robertson. Production of coherent conductors for incandescent lamps, etc. Nov. 30.

25,948. Cowper-Coles. Process for consuming fuel. Dec. 1.

26,121. Ely and Rollason. Treatment of cokes. Dec. 3.

26,146. Lemoult, and Poulenc frères. *See under* XXIII.

26,199. Farnham. Suction gas producer for use with bituminous coal. Dec. 4.

26,447. Wust. Gas producers.* Dec. 7.

26,475. Koller. Distilling gas from brown coal and lignite.* Dec. 7.

26,586. Davis. Means for extracting tar from gas. Dec. 8.

26,825. British Thomson-Houston Co. (General Electric Co.). Production of coherent conductors of refractory material for incandescent electric lamps. Dec. 10.

26,990. Dempster and Moore. Process for producing coke. Dec. 12.

27,010. Bates. Treatment of combustion or other gaseous products. Dec. 12.

27,045. Sabatier. Apparatus for making methane or mixtures of methane and hydrogen. [Comprised in No. 14,971, July 14, 1908.]* Dec. 12.

Complete Specifications Accepted.

26,644 (1907). Barker. Apparatus for making producer gas. Dec. 9.

28,387 (1907). Kirkham, Hulett, and Chandler, Ltd., and Hersey. Washer-scrubbers for purifying coal and other gases. Dec. 16.

1917 (1908). Smith and Harmes. Incombustible, incandescent fuel. Dec. 9.

5415 (1908). British Thomson-Houston Co. (General Electric Co.). Incandescing or heating bodies containing zirconium for incandescent electric lamps, etc. Dec. 9.

6495 (1908). Jones, and Kynoch, Ltd. Gas producers. Dec. 9.

8729 (1908). McIlhenny. Scrubbing, cooling, or otherwise treating coal gas or water gas. Dec. 9.

19,311 (1908). Siemens und Halske A.-G. Manufacture of electric incandescence bodies of tungsten. Dec. 16.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

Applications.

26,027. A.-G. f. Kohlendestillation. *See under* VII.

26,296. Lodigiani. Process for obtaining strong aqueous solutions of creosote. Dec. 4.

26,586. Davis. *See under* II.

IV.—COLOURING MATTERS AND DYESTUFFS.

Applications.

25,816. Newton (Bayer und Co.). Manufacture of azo dyestuffs. Nov. 30.

25,839. Johnson (Badische Anilin und Soda Fabrik). Manufacture of halogenated indigo colouring matters. Nov. 30.

26,023. Newton (Bayer und Co.). Manufacture of azo dyestuffs. Dec. 2.

26,478. Johnson (Badische Anilin und Soda Fabrik). Manufacture of azo colouring matters. Dec. 7.

Complete Specifications Accepted.

26,811 (1907). Ransford (Cassella und Co.). Manufacture of trisazo dyestuffs. Dec. 9.

27,187 (1907). Johnson (Badische Anilin und Soda Fabrik). Manufacture of colouring matters of the anthracene series. Dec. 9.

1822 (1908). Newton (Bayer und Co.). Manufacture of anthracene derivatives. Dec. 16.

4423 (1908). Newton (Bayer und Co.). Manufacture of indigo compounds. Dec. 9.

8381 (1908). Imray (Meister, Lucius, und Brüning). Manufacture of products from thioindigo dyestuffs. Dec. 9.

12,067 (1908). Durand, Huguenin, et Cie. Manufacture of condensation products of gallocyanines with ammonia. Dec. 9.

13,057 (1908). Imray (Soc. Chem. Ind. in Basle). Manufacture of sulphurised vat dyestuffs of the anthracene series. Dec. 16.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

Applications.

25,813. Schirp. Device for dyeing or bleaching textiles. Nov. 30.

25,993. Rothwell-Jackson and Edge. Kiers for bleaching and the like. Dec. 2.

26,184. Philip. Treatment of certain fibres. Dec. 4.

26,460. Newton (Bayer und Co.). Dyeing with oxyanthraquinone dyestuffs. Dec. 7.

26,531. Gray. Fabric mercerising and washing plants. Dec. 8.

26,616. Boult (Esser et Cie. Textil-Maschinen und Tuchschermesserfabr.). Dyeing yarns in strands.* Dec. 8.

26,626. Frank. Dyeing with sulphide dyestuffs. Dec. 8.

26,885. Platt. Apparatus for dyeing or otherwise treating yarn, slubbings, etc., with liquids or fluids. Dec. 11.

Complete Specifications Accepted.

10,922 (1908). Hindley. Process for obtaining variegated colour effects on fabrics. Dec. 16.

17,734 (1908). Ashworth. Manufacture of reducing agents and method of printing with their aid. Dec. 16.

21,285 (1908). Follet and Ditzler. Treatment of artificial threads Dec. 16.

VII.—ACIDS, ALKALIS, AND SALTS.

Applications.

25,829. Marks (U.S. Liquid Air and Oxygen Co.). *See under* I.

25,965. Meyer. Manufacture of zinc sulphide. [Swiss Appl., Dec. 3, 1907.]* Dec. 1.

26,027. A.-G. f. Kohlendestillation. Recovery of ammonia from gases produced in dry distillation. [Ger. Appl., July 10, 1908.]* Dec. 2.

26,068. Hodgkinson. *See under* I.

26,258. Eckford. *See under* XIII*A*.

26,259. Barton. *See under* XIII*A*.

26,581. Tcherniac. Manufacture of sodium cyanide.* Dec. 8.

26,644. Stonier. Manufacture of crystallised sodium carbonate and other highly soluble crystallised chemicals. Dec. 9.

26,720. Hazard-Flamand. Dividing air into its elements by fractional distillation. [Fr. Appl., Dec. 10, 1907.]* Dec. 9.

26,726. Caro and Scheele. Manufacture of ammonium phosphate. [Ger. Appl., Jan. 24, 1908.]* Dec. 9.

26,826. British Thomson-Houston Co. (General Electric Co.). *See under* X.

27,045. Sabatier. *See under* II.

Complete Specifications Accepted.

24,847 and 27,506 (1907). Thwaites. Treating or utilising liquors obtained from pyrites, pyrites cinder, etc. Dec. 16.

26,949 (1907). Fraser. Fixing ozone in liquids. Dec. 16.

17,734 (1908). Ashworth. *See under* V.

VIII.—GLASS, POTTERY, AND ENAMELS.

Applications.

25,901. Rembaux. Glass and other furnaces.* Dec. 1.

26,284. Barrett, and Leeds Fireclay Co., Ltd. Manufacture of architectural terra-cotta.* Dec. 4.

Complete Specifications Accepted.

27,141 and 27,354 (1907). Yarrow and Co. (Bolton), and Yarrow. Manufacture of earthenware pipes, retorts, etc. Dec. 9.

27,501 (1907). Payne. Gas kiln for firing and bending large plates of glass, firing china, enamels, and ceramic ware. Dec. 16.

16,215 (1908). Arrowsmith and Johnson. Manufacture of earthenware articles. Dec. 9.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Application.

25,833. Mecke. Making cement, mortar, and concrete watertight. [Ger. Appl., Feb. 14, 1908.]* Nov. 30.

X.—METALS AND METALLURGY.

Applications.

25,804. Pryor. Extraction of silver from its ores.* Nov. 30.

25,949. Stobie. Recovery of metals. Dec. 1.

26,101. Gutensohn. Metallic alloy. Dec. 3.

26,152. Hommel, and Metals Extraction Corporation. Apparatus for use in solution and precipitation processes, particularly for extracting zinc from its ores and compounds. Dec. 3.

26,176. Lawrence and Knight. Process of hardening aluminium. Dec. 3.

26,263. Lockwood and Samuel. Treatment of ores, etc. Dec. 4.

26,264. Lockwood and Samuel. *See under* XII.

26,380. Landenberger. Manufacture of alloys.* Dec. 5.

26,493. Churchward. Alloy for use in making projectiles. Dec. 7.

26,521. Langbein-Pfanhauser-Werke. Process for rust prevention on iron and steel. [Ger. Appl., Dec. 22, 1907.]* Dec. 8.

26,711. Williams and Bradley. Obtaining zinc from complex ores, etc. Dec. 9.

26,826. British Thomson-Houston Co. (General Electric Co.). Silicon alloys. Dec. 10.

26,831. Williams. Appliances employed in lixiviation processes for the extraction of metals.* Dec. 10.

26,849. Sulman, and Metals Extraction Corporation. Roasting sulphide ores. Dec. 10.

26,850. Sulman, and Metals Extraction Corporation. Treatment of ores with sulphurous acid. Dec. 10.

26,851. Schumacher. Process for briquetting ores.* Dec. 10.

26,852 and 26,853. Minerals Separation, Ltd. (Higgins). Concentration of ores. Dec. 10.

27,025. Frölich. Cementation of copper. [Ger. Appl., Jan. 28, 1908.]* Dec. 12.

27,034. Vollert. *See under* XI.

Complete Specifications Accepted.

23,901 (1907). Hommel and Sulman. Separation of zinc from its ores or compounds. Dec. 9.

27,142 (1907). Thwaites. Wet methods of separating metallic compounds. Dec. 16.

28,191 (1907). Ruthenburg. Ore separating process. Dec. 9.

11,684 (1908). Dallemagne and Dallemagne. Ore concentrating and separating apparatus. Dec. 16.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

Applications.

25,899. Brown. Electrodeposition of metals. Dec. 1.

26,356. Bingham. Electric furnaces. Dec. 5.

27,034. Vollert. Electrolytic process for cleaning metal objects to be galvanised or nickelled. Dec. 12.

Complete Specifications Accepted.

27,559 (1907). Murphy. *See under* XVIII*B*.

27,830 (1907). Gibbs. Electrolytic cells. Dec. 16.

7923 (1908). Nathusius, and Westdeuts. Thomasphosphatwerke. Electric furnaces. Dec. 9.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

Applications.

26,133. Lindemann. Manufacture of pulverised soap or other washing material. [Addition to No. 25,276 of 1907.]* Dec. 3.

26,264. Lockwood and Samuel. Treatment of oils and oily liquids, applicable to the treatment of ores. Dec. 4.

26,857. Jaeckels. Manufacture of soap. Dec. 10.

26,948. Green. Lubricant or grease. Dec. 11.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(*A*.)—Pigments, Paints.

Applications.

26,258. Eckford. Manufacture of red lead. Dec. 4.

26,259. Barton. Manufacture of red lead. Dec. 4.

26,714. Johnson (Badische Anilin und Soda Fabrik). Manufacture of colouring matter suitable for use as a pigment or lake.* Dec. 9.

(*B*.)—Resins, Varnishes.

Applications.

25,840. Strange, Pim, and Burrell. Manufacture of varnishes. Nov. 30.

27,024. Pellnitz. *See under* XX.

(*C*.)—India-Rubber.

Applications.

25,852. Wallace, Reynaud, and Morton. Production of india-rubber or caoutchouc. Nov. 30.

26,643. Hutchinson, Milne, and Hutchinson. Reclaiming or re-manufacturing vulcanised rubber. Dec. 9.

Complete Specification Accepted.

11,031 (1908). Pilgram. Production of a siccative. Dec. 9.

XIV.—TANNING, LEATHER, GLUE, SIZE, &c.

Application.

26,593. Müller. Production of imitation leather. Dec. 8.

Complete Specification Accepted.

4536 (1908). Woosnam (Oesterr. Pluviusin A.-G.). Manufacture of artificial leather. Dec. 16.

XV.—MANURES, &c.

Applications.

25,958. Soc. Gen. des Engrais Organiques. Conversion of refuse and sewage into manure. [Fr. Appl., Dec. 4, 1907.]* Dec. 1.

26,829. Ortmann. Preserving the nitrogen in liquid farmyard manure.* Dec. 10.

26,950. Schreiber and Rathke. Manufacture of non-hygroscopic manure. Dec. 11.

XVI.—SUGAR, STARCH, GUM, &c.

Application.

26,457. Rivière. Clearing or refining juices and other sugared liquids by hydrofluosilicic acids and soluble fluo salts. [Belg. Appl., Dec. 7, 1907.]* Dec. 7.

XVII.—BREWING, WINES, SPIRITS, &c.

Application.

26,619. Cie. Indus. des Alcools de l'Ardèche. Saccharifying apparatus. [Fr. Appl., June 9, 1908.]* Dec. 8.

Complete Specification Accepted.

13,811 (1908). Hampton. Extracting yeast from waste liquors of breweries or distilleries to render such liquors suitable for treatment by any process of sewage disposal. Dec. 9.

XVIII.—FOODS; SANITATION, WATER PURIFICATION; AND DISINFECTANTS.

(*A.*)—Foods.

Applications.

26,003. Dreaper. Manufacture of food products. Dec. 2.

26,155. Chavassieu. Dissolution and subsequent coagulation of proteids. Dec. 3.

Complete Specification Accepted.

12,516 (1908). Bergell and Wülfing. Manufacture of milk for infants. Dec. 16.

(*B.*)—Sanitation; Water Purification.

Applications.

25,958. Soc. Gen. des Engrais Organiques. *See under* XV.

26,013. Maccormac. Apparatus for the bacteriological treatment of sewage and other polluted liquids.* Dec. 2.

Complete Specification Accepted.

27,559 (1907). Murphy. Electrode for use in purifying water and other liquids. Dec. 16.

XIX.—PAPER, PASTEBOARD, &c.

Applications.

26,573. Pearson. Manufacture of paper. Dec. 8.

26,682. Simmons (Field). Production of celluloid sheets. Dec. 9.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

Applications.

26,075. Belart, and Digit Disinfectant Co. Production of compounds for internal use. [Addition to No. 9246 of 1908.] Dec. 3.

26,708. Zimmermann (Chem. Fabr. auf Actien, vorm. E. Schering). Manufacture of camphor. Dec. 9.

26,939. Lake (Soc. Anon. des Tabacs Désintoxiqués) Removal of nicotine from tobacco.* Dec. 11.

27,024. Pellnitz. Manufacture from terpenes of a resinous distillation product similar to turpentine oil. [Addition to No. 19,833 of 1908.]* Dec. 12.

27,038. Knoll und Co. Pharmaceutical preparation. [Ger. Appl., Dec. 23, 1907.]* Dec. 12.

Complete Specifications Accepted.

9680 (1908). Imray (Meister, Lucius, und Brüning). Manufacture of dioxyphenylethanolamines. Dec. 9.

14,937 (1908). Meister, Lucius, und Brüning. Manufacture of homologues of *p*-aminophenylarsinic acid. Dec. 9.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Application.

26,803. Thornley. Photographic plates. Dec. 10.

Complete Specification Accepted.

9275 (1908). Zimmermann (Chem. Fabr. auf Actien, vorm. E. Schering). Silver photographic papers. Dec. 16.

XXII.—EXPLOSIVES, MATCHES, &c.

Complete Specifications Accepted.

26,823 (1907). South African Maganite Explosives Synd., and Bloxam. Manufacture of explosives. Dec. 9.

13,178 (1908). Walsh. Safety matches. Dec. 9.

XXIII.—GENERAL ANALYTICAL CHEMISTRY.

Applications.

26,146. Lemoult, and Poulenc frères. Measuring the calorific power of gaseous combustibles.* Dec. 3.

26,561. Hinman. *See under* I.

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Liverpool :

Chairman .. Dr. Jas. T. Conroy, Adirondack, Grassendale Park, near Liverpool.

Secretary .. W. Roscoe Hardwick, 13, Batavia Buildings, Hackins Hey, Liverpool.

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Chairman .. Dr. J. Lewkowitsch, 71, Priory Road, N.W.

Secretary .. Julian L. Baker, Stainesbury Holt, Kingston Road, Staines.

Manchester :

Chairman .. R. H. Clayton, Woodleigh, Blackfield Lane, Kersal, Manchester.

Secretary .. Julius Hübner, Ash Villa, Cheadle Hulme, Cheshire.

Newcastle :

Chairman .. N. H. Martin, Northumberland Road, Newcastle-on-Tyne.

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Chairman .. F. E. Atteaux, 176, Purchase Street, Boston, Mass., U.S.A.

Secretary .. Alan A. Claflin, 7, Sears Street, Boston, Mass., U.S.A.

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Secretary .. Dr. C. E. Fawsitt, The University, Glasgow.

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Chairman .. Dr. R. Greig Smith, Linnæan Society's House, Elizabeth Bay, Sydney.

Secretary .. T. U. Walton, Colonial Sugar Refining Co., O'Connell Street, Sydney.

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Chairman .. F. W. Branson, Wynneholme, Far Headingley, Leeds.

Secretary .. Thos. Fairley, 17, East Parade, Leeds.

Honorary Treasurer.

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Honorary Foreign Secretary.

Dr. Ludwig Mond, F.R.S., 20, Avenue Road, Regent's Park, London, N.W.

General Secretary.

Chas. G. Cresswell, Palace Chambers, Westminster, S.W. (Telegraphic address:—59. Palatable, London. Telephone No. 715, Victoria.)

Editor.

Watson Smith, 34, Upper Park Road, Haverstock Hill, London, N.W.

LIST OF MEMBERS.

THE MEMBERSHIP ON FEBRUARY 29, 1908 = 4445.

NOTE: "O.M." MEANS "ORIGINAL MEMBER."

A

1903. Abraham, Herbert, 13, West 89th Street, New York City, U.S.A., Chemist.
1902. Acker, Chas. E., 1, West 121st Street, New York City, U.S.A., Manufacturer.
1903. Ackermann, Franz W., 86, Pierrepont Street, Brooklyn, N.Y., U.S.A., Chemist.
1903. Acton, J. Rowland, India Store Depot, Belvedere Road, London, S.E., Civil Servant.
1907. Adam, Wm. A., c/o Mander Bros., Wolverhampton, Chemist.
1892. Adams, Arthur, Kelvin House, Edgbaston Road, Smethwick, near Birmingham, Science Lecturer.
1897. Adams, Thos. H., Endon Villa, Victoria Avenue, Borrowash, near Derby, Analyst.
1905. Adams, William W., Norwood, Mass., U.S.A., Leather Works Manager.
1895. Adamson, G. P., c/o The Baker and Adamson Chemical Co., Easton, Pa., U.S.A., Manufacturing Chemist.
1891. Adcock, S. R., St. Helens Smelting Co., Atlas Court, St. Helens, Lancashire, Analytical Chemist.
1901. Addison, Leonard, c/o Messrs. Burt, Boulton, and Haywood, Selzaete, Belgium, Chemist.
1898. Adgate, M., Naugatuck, Conn., U.S.A., Chemist.
1898. Adiassewich, Alex. V., 14, Addison Park Mansions, Kensington, W., Oil Engineer.
1896. Adler, Dr. Leon N., Adler Colour and Chemical Works, 100, William Street, New York City, U.S.A., Manufacturing Chemist.
1907. Adley, Geo. S., Storer's Wharf, Poplar, London, E., Varnish Manufacturer.
1888. Adriance, Dr. John S., The Union League Club, New York City, U.S.A., Analytical Chemist.
1899. Adrot, Léon, Woodside, Long Island, N.Y., U.S.A., Chemist.
1891. Airedale, Rt. Hon. Lord, Gledhow Hall, and (Jnls.) Monkbridge Iron and Steel Co., Ltd., Leeds, Iron and Steel Manufacturer.
1886. Aitken, J. B., Gerard's Fold Chemical Works, Widnes, Chemical Manufacturer.
1884. Akitt, Thos., Mijnbouw Maatschappij Katahoen, Lebong Soelit, Benkoelen, Sumatra, Chemist.
1883. Albright, G. S., Bromesberrow Place, Ledbury, Chemical Manufacturer.
O.M. Albright, W. A., 29, Frederick Road, Edgbaston, Birmingham, Chemical Manufacturer.
1906. Alcock, Frank H., 9, Broad Street Corner, Birmingham, Analyst.
1907. Alcock, J. E., 51, Gill Street, Moston Lane, Blackley, Manchester, Chemist.
1891. Alcock, Jno. W., Central Brewery, Mott Street, Birmingham, Maltster and Brewer.
1902. Alden, Frederick, 342, 22nd Avenue, Milwaukee, Wis., U.S.A., Chemist.
1898. Alden, John, Chemical Laboratory, Pacific Mills, Lawrence, Mass., U.S.A., Chemist.
1906. Alder, H. W., 12, Beacontree Road, Leytonstone, N.E., Works Chemist.
1900. Aldrich, Roger C., c/o Franklin H. Kalbfleisch Co., Elizabeth, N.J., U.S.A., Mechanical Engineer.
1890. Aldrick, Edwin John, 53, Alpha Road, West Ferry Road, Millwall, E., Works Sub-Manager.
1905. Aleon, Armen P., 372/4, Atlantic Avenue, Boston, Mass., U.S.A., Dyestuff and Chemical Merchant.
1899. Alexander, D. Basil W., 1020, Date Street, Los Angeles, Cal., U.S.A., Chemist.
1900. Alexander, Jerome, c/o National Gum and Mica Co., 502–510, West 45th Street, New York City, U.S.A., Chemist.
1883. Alexander, W. T., Crumnock, Eccles, Manchester, Drysalter.
1906. Allan, David, c/o Price's Patent Candle Co., Ltd., Belmont Works, Battersea, S.W., Chemist.
1891. Allan, F. H. Tielke, c/o Brotherton & Co., Haigh Park Chemical Works, Stourton, near Leeds, Analytical Chemist.
1898. Allan, John, 55, Northen Grove, West Didsbury, near Manchester, Chemist.
1907. Allard, M. L., c/o Gutta Percha and Rubber Manufacturing Co., O'Hara Avenue, Toronto, Canada, Chemist.
1902. Allbright, Wm. B., 5139, Lexington Avenue, Chicago, Ill., U.S.A., Chemical Engineer.
O.M. Alldred, C. H., 8, St. Margaret's Road, Plumstead Common, Kent, Analytical Chemist.
1907. Alleby, W. S., 3, Regent Street, Birmingham, Metal Merchant.
1898. Alleman, Dr. Gellert, Swarthmore College, Swarthmore, Pa., U.S.A., Professor of Chemistry.
1903. Allen, Chas. A., 95, Manor Road, Darwen, Lancashire, Chemist.
1902. Allen, Chas. D., jun., 475, Fourth Street, Brooklyn, N.Y., U.S.A., Chemist.
O.M. Allen, J., 164, Upper North Street, Poplar, E., Manufacturing Chemist.
1907. Allen, J. Fenwick, 147, Withington Road, Whalley Range, Manchester.
1901. Allen, R. F., 1241, South 47th Street, Philadelphia, Pa., U.S.A., Chemist.
1889. Allen, R. L., Hillside, and (Journals) c/o Brunner, Mond and Co., Ltd., Sandbach, Cheshire, Analytical Chemist.
1900. Allen, Wilfrid T., Allington, Bexley, Kent, Director.
1893. Allerton, Rt. Hon. Lord, F.R.S. (Journals), Allerton Hall, near Leeds; and c/o W. L. Jackson and Sons, Ltd., Buslingthorpe, Leeds, Tanner.
O.M. Allhusen, A., Gateshead-on-Tyne, Chemical Manufacturer.
1886. Allibon, G. H., Mayfield, Balmoral, Belfast, Ireland, Chemical Works Manager.
1887. Alliott, J. B., Messrs. Manlove, Alliott, and Co., Ltd., Nottingham, Mechanical Engineer.
1895. Allison, Wm. O., 100, William Street, New York City, U.S.A., Publisher of "Oil, Paint and Drug Reporter."
1905. Allpass, Jas., c/o The Clayton Aniline Co., Ltd., Clayton, Manchester, Secretary.
1904. Alpers, Wm. C., Broadway and 31st Street, New York City, U.S.A., Manufacturing Chemist.
1889. Alpiar, Agop, Smyrna, Asia Minor, Morphia Manufacturer.
1899. Alsop, Wm. K., 137, Grove Street, Stamford, Conn., U.S.A., Chemist.
1901. Alston, Robt. A., c/o Glencairn Main Reef G. M. Co., P.O. Box 191, Germiston, Transvaal, Mining Engineer.

1904. Alton, W. Lester, 11, Briar Walk, Putney, S.W., Chemist.
1898. Ambler, Chas. Taaffe, Dharhara Station, E. I. Ry., Bengal, India, Mine Owner and Contractor.
1905. Amory, L. H., c/o Messrs. J. Heathcoat and Co., Tiverton, Devon, Lace Manufacturer.
1900. Anderson, Jas. W., The Paddock, Lower Halling, near Rochester, Kent, Analytical Chemist.
1889. Anderson, Robt. T. R., 42, Roslea Drive, Dennistoun, Glasgow, Technical Chemist.
1894. Anderson, Dr. W. Carrick, 7, Scott Street, Garnet Hill, Glasgow, Consulting Chemist and Metallurgist.
1905. Andreae, Dr. E. P., Crestalta, Champion Hill, London, S.E., Chemist.
1907. Andrews, Chas. T., Estacao de Miguel Burnier, E.F.C.B., Minas Geraes, Brazil, Chemist.
1889. Andrews, Clement W., c/o The John Crerar Library, Wabash Avenue and Washington Street, Chicago, Ill., U.S.A., Librarian.
1904. Andrews, Geo. D., c/o J. & J. Colman, Ltd., Carrow Works, Norwich, Chemist.
1903. Andrews, Wm. H., 79, Tonawanda Street, Buffalo, N.Y., U.S.A., Manager (Varnish Works).
1903. Anfilogoff, N. A., St. Vincent's, Orsett Road, Grays, and (Journals) Central Wharf, Bow, E., Chemist.
O.M. Angell, J., 6, Beaconsfield, Derby Road, Withington, Manchester, Chemical Lecturer.
1892. Annandale, C. J. R., 94, Blackburn Road, Darwen, Lancs., Paper Maker.
1883. Annandale, Jas. H., Polton Paper Works, Midlothian, N.B., Paper Maker.
1887. Annison, R. H., 16, Water Lane, Great Tower Street, London, E.C., Master Lighterman.
1894. Ansbacher, L. A., 253, Broadway, New York City, U.S.A., Colour Manufacturer.
1907. Anthony, Fredk. W., The Gotham Co., Ltd., Bentinck Buildings, Nottingham, Secretary.
1902. Anthony, John, 82, Bay Street, Toronto, Canada.
1899. Appleby, C. W., Farnworth, near Widnes, Lancashire, Pith and Size Manufacturer.
1904. Appleby, Jos., Farnley, Moor Lane, Great Crosby, Liverpool, Flour Miller.
1906. Appleby, L. C. B., c/o Messrs. R. Bishop & Sons, Newark-on-Trent, Maltster.
1895. Appleby, Prof. W. R., 911, 5th Street S.E., Minneapolis, Minn., U.S.A., Professor of Mining and Metallurgy.
1907. Appleton, Francis H., jun., P.O. Box 815, Franklin, Mass., U.S.A., Rubber Manufacturer.
1894. Appleton, H. A., 63, Rosedale Road, Forest Gate, E., Analytical Chemist.
1900. Appleyard, Geo. H., Cleveland Oil Refinery, 147, Cleveland Street, Hull, Chemist.
1905. Appleyard, Jas. R., Royal Technical Institute, Salford, Lecturer.
1903. Arbogast, Ralph, c/o Edison Storage Battery Co., Silver Lake, N.J., U.S.A., Chemist.
O.M. Archbutt, Leonard, The Yews, Madeley Street, Derby, Analytical Chemist.
1899. Archdale, T. Henry, 77, Queen's Road, Blackburn, Manager of Tar and Ammonia Works.
1904. Archdale, Wm., 21, Oldham Road, Miles Platting, Manchester, Manager of Chemical Works.
1901. Ardagh, Edw. G. R., School of Practical Science, Toronto, Canada, Chemist.
1900. Ardern, Edw., Greengates, Davyhulme, Urmston, Manchester, Chemist.
1907. Armstrong, Chas. F., Champarun Sugar Factory, Barrah Chakiah P.O., Tirhoot State Railway, India, Technical Chemist.
1902. Armstrong, Edward E., Pennsylvania Salt Manufacturing Co., Natrona, Pa., U.S.A., Manufacturing Chemist.
1905. Armstrong, Dr. E. Frankland, 98, London Road, Reading, Works Chemist.
1899. Armstrong, Richard, Saul Street Soap Works, Preston, Lancashire, Soap Manufacturer.
1905. Armstrong, Theodore, 115, Chestnut Street, Philadelphia, Pa., U.S.A., President, Penn. Salt Manufacturing Co.
1907. Armstrong, Wm., 25, Holten Street, Peabody, Mass., U.S.A., Leather Manufacturer.
1905. Arnold, Frank L., 32, School Street, North Woburn, Mass., U.S.A., Chemist.
1901. Arnold, G. Edmund, 6, Kingsfield Terrace, Faversham, Kent, Manager (Cotton Powder Co., Ltd.).
1899. Arnott, Dr. G. W. Campbell, Agricultural Chemist.
1903. Arnott, J. S., Moros, 42, 2°, Gijon, Spain, Chemist and Metallurgist.
1901. Arundel, Arthur S. D., Penn Street Works, Hoxton, N., Paper Box Manufacturer.
1901. Asano, K., 25, Kitachonyacho, Kyobashi, Tokyo, Japan, Mining Chemist.
1906. Ash, Chas. S., 180, Townsend Street, San Francisco, Cal., U.S.A., Chemist.
1903. Ashley, Frank R., P.O. Box 1605, Denver, Colo., U.S.A., Chemist.
1900. Ashley, Harrison Everett, Newell, West Va., U.S.A., Metallurgical Chemist.
1900. Ashton, Jas., Rhodes Farm, Whitefield, Manchester, Chemist and Manager.
1890. Ashton-Bost, W. D. *See* Bost, W. D. Ashton.
1885. Ashwell, J. H., 117, Waterloo Crescent, The Forest, Nottingham, Bleacher and Dyer.
1894. Ashworth, Arthur, Fernhill Chemical Works, Bury, Lancs., Chemical Manufacturer.
1903. Ashworth, Jno. B., 11, The Promenade, Egremont, Cheshire, Manager.
1907. Aspey, Urban, jun., New Station Soap Works, School Close, and (Journals) 11, Neville Street, Leeds, Works Manager and Chemist.
1898. Aspinall, Thos., 62, Gilnow Road, Bolton, Analytical and Manufacturing Chemist.
1900. Aston, Bernard C., Agricultural Department, Wellington, New Zealand, Chemist.
1891. Atkins, C. E., Teigngrace, Bycullah Park, Enfield, N., Chronometer Maker.
1885. Atkinson, A. J., 44, Stuart Street, Cardiff, Analytical Chemist.
1905. Atkinson, James P., Dept. of Health, Foot of East 16th Street, New York City, U.S.A., Chemist.
1900. Atkinson, Jno. W., Betteravia, Cal., U.S.A., Chemist.
1905. Atteaux, F. E., 176, Purchase Street, Boston, Mass., U.S.A., Dyestuff Importer.
O.M. Attfield, Dr. J., F.R.S., Ashlands, Watford, Herts.
1900. Atwood, Frank W., 216, Milk Street, Boston, Mass., U.S.A., Chemist.
1895. Auchterlonie, Wm., jun., c/o Clark Thread Co., Newark, N.J., U.S.A., Dyeworks Manager.
1907. Auchu, Henry, Emporium, Pa., U.S.A., Explosives Manufacturer.
1901. Auden, Dr. H. A., Westwood, Grassendale, Liverpool, Chemist.
1897. Auger, Chas. L., 425, Park Avenue, Paterson, N.J., U.S.A., Silk Dyer.
1902. Austin, J. H., Allscott, Wellington, Shropshire, Analytical Chemist.
1901. Auty, Albert M., c/o John Smith and Sons, Ltd., Field Head Mills, Bradford, Chemist.
1902. Avery, D., Working Men's College, Melbourne, Vic., Australia, Teacher of Chemistry.
1890. Aykroyd, H. E., Scaitcliffe, Queen's Road, Ilkley, Yorks, Dyer.
1899. Aylsworth, Jonas W., 223, Midland Avenue, East Orange, N.J., U.S.A., Chemist.
1903. Ayres, W. J., P.O. Box 187, Pernambuco, Brazil, Sugar Expert.

B

1904. Babb, Edward E., 41, Central Wharf, Boston, Mass., U.S.A., Food Analyst.
1895. Bacon, Nathaniel T., Peace Dale, Rhode Island, U.S.A., Chemical Engineer.
1903. Bacon, R. A., Richmond Hill, Long Island, N.Y., U.S.A., Manufacturing Chemist.
1897. Bacon, Wm., 4, New Court, Lincoln's Inn, W.C., Chemist.

1897. Badock, Stanley H., Holmwood, Westbury on Trym, near Bristol, Smelter.
1898. Baekeland, Dr. Leo, Snug Rock, North Broadway, Yonkers, N.Y., U.S.A., Manufacturing Chemist.
1902. Baer, Dr. Samuel H., 212, South 7th Street, St. Louis, Mo., U.S.A., Consulting Chemist.
1903. Bailey, Prof. E. H. S., The Library, Kansas State University, Lawrence, Kas., U.S.A., Professor of Chemistry.
1885. Bailey, Edwin M., Almond Hill, Pumpherston, Mid-Calder, N.B., Technical Chemist.
1883. Bailey, Dr. G. H., Marple Cottage, Marple, Cheshire, Chemical Lecturer.
1903. Bailey, Harold J., Maritime Coke Works, Pontypridd, S. Wales, Chemist.
1906. Bailey, Ralph W., c/o Messrs. Stillwell & Gladding, 55, Fulton Street, New York City, U.S.A., Chemist.
1888. Bailey, Dr. T. Lewis, Wilford, Dornoch Terrace, Brisbane, Queensland, Australia, Chemist.
1888. Bailey, Walter P., Empresa de Gas, 13, San Roque, Seville, Spain, Chemical Engineer and Manager.
1902. Bain, Jas. Watson, Faculty of Applied Science, The University, Toronto, Ont., Canada, Chemist.
1890. Baird, H. Harper, 14, Cross Street, Hatton Garden, London, E.C., Laboratory Furnisher.
1902. Baird, Dr. Julian W., Massachusetts College of Pharmacy, Boston, Mass., U.S.A., Professor of Chemistry.
1891. Baird, Wm., c/o Lewis Berger and Sons, Ltd., Homerton, N.E., Technical Chemist.
1895. Baird, W. Raymond, 271, Broadway, New York City, U.S.A., Patent Lawyer.
1890. Bairstow, John, Burley, Queen's Park, Chester, Chemical Works Manager.
1903. Baker, Arthur, 103, Lynwood Avenue, Darwen, Lancs., Chemist.
1902. Baker, Chas. F., Technical College, Sunderland, Lecturer in Chemistry.
1901. Baker, F. Guy Stirling, Marryatt's Lodge, The Forest, Snaresbrook, Essex, Student.
1883. Baker, Harry, Epworth House, Moughland Lane, Runcorn, Analytical Chemist.
1899. Baker, H. Fenimore, c/o Thomsen Chemical Co., Baltimore, Md., U.S.A., President.
1904. Baker, John T., c/o J. T. Baker Chemical Co., Phillipsburg, N.J., U.S.A., Manufacturing Chemist.
1892. Baker, Julian L., Stainesbury Holt, Kingston Road, Staines, Brewing and Sugar Chemist.
1886. Baker, Theodore, Fabr. Nacional de Polvoro sensa Fasende de Limeira Fumaca, near Lorena, Est. de Sao Paulo, Brazil, Analytical Chemist.
1898. Baldwin, Abram T., Solvay Process Co., Syracuse, N.Y., U.S.A., Alkali Manufacturer.
1903. Baldwin, F. H., Bergenport Chemical Works, Bayonne, N.J., U.S.A., Superintendent.
1903. Baldwin, Dr. H. B., 927, Broad Street, Newark, N.J., U.S.A., Chemist (Dept. of Public Health).
1903. Ball, S. F., Hull Avenue and 209th Street, New York City, U.S.A., Analytical Chemist.
1889. Ballantyne, Horatio, 75, Chancery Lane, London, W.C., Analytical and Consulting Chemist.
1903. Ballantyne, W. H., 111, Hatton Garden, London, E.C., Patent Agent's Assistant.
O.M. Ballard, Edw. G., 7, Godstall Chambers, Chester, Alkali Works Inspector.
1891. Ballinger, Jno., Free Library, Cardiff, Librarian.
O.M. Bamber, H. K., 9, Victoria Street, London, S.W., Consulting Chemist.
1894. Bamber, H. K. G., Ingress House, Greenhithe, Kent, Cement Works Chemist and Manager.
1898. Bamford, Harry, 70, Duckworth Terrace, Bradford, Yorks., Dyer.
1905. Bampton, Geo. F., Room 24, 68, Essex Street, Boston, Mass., U.S.A., Chemist.
1906. Bancroft, John, Wilmington, Del., U.S.A., Bleacher and Dyer.
O.M. Banister, H. C., Elmhurst, Blundellsands, near Liverpool, Chemical Works Manager.
1890. Banks, Jno. H., c/o Ricketts and Banks, 104, John Street, New York City, U.S.A., Mining Engineer.
1895. Bannan, John F., 59, Court Street, North Andover, Mass., U.S.A., Chemist (Woollen Mill).
O.M. Bannister, R., 59, Tregunter Road, South Kensington, S.W., Analytical Chemist.
O.M. Bannister, W., Victoria Lodge, Cork, Ireland, Manufacturing Chemist.
1901. Barber, Capt. René R., Georgetown, Ont., Canada, Analytical Chemist.
1906. Barbour, Robt. B., Eclipse Chemical Manufacturing Co., Chelmsford, Mass., U.S.A., Manager.
1892. Barden, Alf., Far Bank, Shelley, near Huddersfield, Glue and Size Maker.
1907. Bardorf, C. F., c/o St. Lawrence Sugar Refining Co., Maisonneuve, P.Q., Canada, Chief Chemist.
1895. Bardwell, Fred. L., Massachusetts Institute of Technology, Boston, Mass., U.S.A., Assistant Professor of Chemistry.
1903. Baringer, Fred. J., Eagle White Lead Works, 1020, Broadway, Cincinnati, Ohio, U.S.A., Chemist.
1902. Barker, Hugh S., 32, Cumberland Avenue, Sefton Park, Liverpool, Laboratory Furnisher.
1905. Barker, Perry, Chemist.
1895. Barlow, Clinton W., 234, Paulison Avenue, Passaic, N.J., U.S.A., Merchant.
1908. Barlow, Lt.-Col. Sir Hilaro W. W., Bart., R.A., 84, Shooter's Hill Road, Blackheath, S.E., Superintendent (Royal Laboratory, Woolwich).
1901. Barlow, John J., 177, Manchester Road, Accrington, Calico Printer's Chemist.
1899. Barlow, Wm., 2, Delamere Street, Higher Openshaw, Manchester, Analytical Chemist.
1906. Barnes, A. G., Grassmoor Collieries, Chesterfield, Colliery Proprietor.
1891. Barnes, Edward A., Sundalen, Aasenfjorden, Norway, Technical Chemist.
1901. Barnes, Fred., 2, Fairview, Canterbury Road, Sittingbourne, Kent, Paper Mill Chemist.
1905. Barnes, F. V., 44, Lucknow Avenue, Nottingham, Gas Works Chemist.
1884. Barnes, H. J., Phœnix Chemical Works, Hackney Wick, N.E., Manufacturing Chemist.
1884. Barnes, Jonathan, 301, Great Clowes Street, Manchester, Analytical Chemist.
O.M. Barnes, Jos., Green Vale, Westhoughton, near Bolton, Lancashire, Analytical Chemist.
1902. Barnett, Marcus S., Colonial Sugar Refining Co., Ltd., O'Connell Street, Sydney, N.S.W., Australia, Sugar Works Chemist.
1897. Barnett, Robt. E., 9, Virginia Road, Leeds, Headmaster (Leeds Technical School).
1904. Baron, Wm. Briscoe, c/o The Fuel Saving and Water Treating Co., Ltd., 2, Booth Street, Albert Square, Manchester, Chemist.
O.M. Barr, J., Dinting Vale, Dinting, near Manchester, Chemical Manager.
1905. Barraclough, C. E., 2, Wood View Terrace, Manningham, Bradford, Chemist.
1890. Barraclough, Wm. H., Beechwood, Mortomley, near Sheffield, Analytical Chemist.
1896. Barratt, J. Treeby, Bronheulog, Mostyn, North Wales, Chemist and Manager.
1890. Barrett, Arthur A., 5, Strada del Pozzo Leone, Messina, Sicily, Manufacturer of Essential Oils.
1907. Barrett, John H., 215, Carlton Street, Toronto, Canada, Superintendent.
1907. Barrett, Maurice, The Leeds Fireclay Co., Ltd., Burmantofts Works, Leeds.
1890. Barrie, D. McLaurin, P.O. Box 193, Germiston, Transvaal, Analytical Chemist.
1900. Barrow, Jos., 13, The Grove, Bebington, Cheshire, Chemist.
1906. Barrs, Chas. E., 20, Carlingford Road, Hampstead, N.W., Analyst.
1905. Barry, Eugene, Ayer, Mass., U.S.A., Leather Manufacturer.
1893. Barton, G. E., c/o Whitall, Tatum, and Co., Flint Glass Works, Millville, N.J., U.S.A., Technical Chemist.

1903. Bartripp, Geo. F., 20, Grove Road, Wanstead, Essex, Analytical Chemist.
1905. Barnch, Edgar, c/o Alta California Beet Sugar Co., Hamilton, Glenn Co., Cal., U.S.A., Chemical Engineer.
1895. Baskerville, Dr. Chas., College of the City of New York, New York, U.S.A., Professor of Chemistry.
1884. Bassett, H., 26, Belitha Villas, Barnsbury, N.
1908. Bassett, Henry, jun., Chemical Department, University of Liverpool, Assistant Lecturer.
1899. Bassett, Wm. H., 146, Litchfield Street, Torrington, Conn., U.S.A., Chemist.
1890. Bate, William, "Ladbroke," Hayle, Cornwall, Technical Chemist (National Explosives Co., Ltd.).
1903. Bateman, A. H. 34, Bridge Avenue, Hammersmith, W., Chemist.
1885. Batty, R. B., Wharncliffe, Erdington, near Birmingham, Nickel Works Manager.
1903. Baty, E. J., British Insulated and Helsby Cables, Ltd., Prescot, Lancs., Chief Chemist.
1903. Bauer, Geo. W., 632, Sacramento Street, San Francisco, Cal., U.S.A., Vice-President and Chemist (Hop and Malt Co.).
1900. Baur, Jacob, 67, Wells Street, Chicago, Ill., U.S.A., Liquid Carbonic Acid Manufacturer.
1898. Baxter, John G., Riverview, Burch Road, Rosherville, Gravesend, Kent, Chemist.
O.M. Baxter, W. H., Nuthurst, High Road, Streatham, S.W., Brewery Director.
1899. Bayly, Francis W., Church Cobham, Surrey, Assayer.
1904. Bayly, Harold G., Usine Ste. Madeleine, San Fernando, Trinidad, Analytical Chemist.
O.M. Baynes, J., Royal Chambers, Scale Lane, Hull, County and Borough Analyst.
1897. Beadle, Alec A., Greenheys, Granville Road, High Barnet, Herts., Electro-Chemist.
1886. Beadle, Clayton, Halewood, Sidcup, Kent, Consulting Chemist.
1908. Bealey, Herbert C., c/o A. C. Bealey & Son, Radcliffe, near Manchester, Bleacher and Chemical Manufacturer.
O.M. Beanes, E., Moatlands, Paddock Wood, Kent, Manufacturing Chemist.
1908. Beardmore, Walter W., Acton West, Ont., Canada, Leather.
1907. Beardsley, Dr. Alling P., 165, Minerva Street, Derby, Conn., U.S.A., Chemist (New Haven Gas Co.).
1908. Beasley, Fred. G., Clift Cottage, Cheshyres Lane, Weston, near Runcorn, Metallurgical Chemist.
1905. Beasley, Jno. K., 29, Lamont Road, Chelsea, S.W., Metallurgical Chemist.
1883. Beaven, E. S., 5, Boreham Terrace, Warminster, Wilts., Maltster.
1897. Beaver, Chas. J., Holme Lea, Ashley Road, Hale, Cheshire, Chemist.
1898. Beck, Herbert H., 105, South Queen Street, Lancaster, Pa., U.S.A., Chemist.
1905. Beckers, Dr. Wm., 66, Lafayette Street, New York City, U.S.A., Chemist.
O.M. Beckett, G. H., Hartford, South Beach Avenue, Ardrossan, Scotland, Analytical Chemist.
1898. Beckett, Jos. H., 41, Serpentine Road, Egremont, Cheshire, Analytical Chemist.
1899. Bedford, Alf. C., 26, Broadway, New York City, U.S.A., Chemical Merchant.
1891. Bedford, Chas. S., Rocella, Weetwood, Headingley, Leeds, Manufacturing Chemist.
1891. Bedford, Jas. E., Messrs. Wood and Bedford, Airedale Chemical Works, Leeds, Manufacturing Chemist.
O.M. Bedson, Prof. P. Phillips, Armstrong College, Newcastle-on-Tyne, Professor of Chemistry.
1901. Beebe, Murray C., University of Wisconsin, Madison, Wis., U.S.A., Engineer.
1901. Beevers, Clifford J., c/o Brotherton and Co., Ltd. Holmes Street, Dewsbury Road, Leeds, Analyst.
1899. Behr, Dr. Arno, 432, Arlington Court, Pasadena, Cal., U.S.A., Chemist.
1903. Behrend, F., 54, Front Street, New York City, U.S.A., Importer of Chemical Stoneware.
O.M. Beilby, George T., 11, University Gardens, Glasgow, Chemical Engineer.
1902. Bek, Lars P., Goondi, Johnston River, North Queensland, Australia, Analytical Chemist.
1906. Belden, A. W., Fuel Testing Plant, U.S. Geological Survey, Denver, Colo., U.S.A., Coke Expert.
1902. Bell, Edwin L., Chesterwald, The Drive, Coulsdon, Surrey, Manager.
1906. Bell, H. N., Tay Street, Invercargill, New Zealand, Company Manager.
1884. Bell, Sir Hugh, Bart., Middlesbrough-on-Tees, Soda and Iron Manufacturer.
1900. Bell, Hugh P., 3, Mincing Lane, London, E.C., Chemist.
O.M. Bell, J. Carter, Bank House, The Cliff, Higher Broughton, Manchester, Public Analyst.
1886. Bell, J. Ferguson, Derby Gas Light and Coke Co., Derby, Gas Engineer.
1907. Bell, Marcus, Explosives Dept., 423, Flinders Lane, Melbourne, Victoria, Chemist.
1905. Bell, Miss M. M., Tulane University Library, New Orleans, La., U.S.A., Librarian.
1903. Bell, P. Carter, Millburn, N.J., U.S.A., Chemical Manufacturer.
1902. Bement, Alburto, American Trust Building, Chicago, Ill., U.S.A., Consulting Mining Engineer.
O.M. Bendix, D., 371, Romford Road, Forest Gate, E., Managing Chemist, British Alizarin Co., Ltd.
1897. Benfey, Dr. Hans, 65, Birchfields Road, Rusholme, Manchester, Manufacturing Chemist.
1907. Bengough, Guy D., 25, Huskisson Street, Liverpool, Lecturer on Metallurgy (Liverpool University).
1903. Benham, Keith, Deans Hill, Stafford, Analytical and Consulting Chemist.
1902. Benjamin, Albert, Springbrook Works, Middleton Road, Oldham, Bleach and Dyeworks Manager.
O.M. Benjamin, Dr. M., Smithsonian Institution, Washington, D.C., U.S.A., Consulting Chemist.
1904. Benn, R. H. D., 16, Springfield Avenue, Westmount, Montreal, Canada, Analytical Chemist.
1899. Bennett, Alex. H., c/o G. H. Ogston & Moore, Messina, Sicily, Chemist.
1901. Bennett, Arnold, c/o Montreal Steel Works, Ltd., Canal Bank, Point St. Charles, Montreal, Canada, Chemist.
1906. Bennett, Arthur E. J., 55, Pleasant Street, Woburn, Mass., U.S.A., Leather Manufacturer.
1907. Bennett, H. Garner, Leather Industries Dept., The University, Leeds, Leather Chemist.
1884. Bennett, Thos., Birch Vale, near Stockport, Calico Printer.
1902. Bennie, P. McN., P.O. Box 29, Niagara Falls, N.Y., U.S.A., Consulting Chemist.
1906. Benson, Richard W., c/o Geo. Craddock & Co., Wakefield, Yorks, Analytical Chemist.
1905. Bentley, Prof. W. B., 42, Morris Avenue, Athens, Ohio, U.S.A., Professor of Chemistry.
1901. Bentley, Wm. H., 6, Woodbine Terrace, Irlam, near Manchester, Technical Chemist.
1890. Bentz, Ernest, 107, Shaw Lane, Dinting, near Manchester, Lecturer on Dyeing.
1905. Berge, Henry vom, c/o Schoellkopf & Co., Perry and Mississippi Streets, Buffalo, N.Y., U.S.A., Manager.
1884. Beringer, J. J., Basset Road, Camborne, Cornwall, Metallurgist.
1893. Berk, Fred. W., 1, Fenchurch Avenue, London, E.C., Chemical Manufacturer.
1907. Berk, Paul F., 1, Fenchurch Avenue, London, E.C.
1900. Bermingham, Jno., jun., California Powder Works, Pinole, Contra Costa Co., Cal., U.S.A., Superintendent.
1889. Bernard, Jas., jun., Ranipet, North Arcot, Madras Presidency, India, Chemical Works Manager.
1900. Berolzheimer, D. D., c/o Arlington Chemical Co., Yonkers, N.Y., U.S.A., Chemist.
1897. Berry, Albert E., 62, Claremont Road, Forest Gate, Essex, Works Manager.

1906. Berry, Arthur J., 5, University Gardens, Glasgow, Student of Chemistry.
1883. Berry, E. E., Bordighera, Italy, and (Journals) c/o C. H. Grinling, 17, Rectory Place, Woolwich, S.E., Technical Chemist.
1889. Berry, G. F., Atlas Chemical Works, West Ferry Road, Millwall, E., Manager.
1903. Berry, W. G., 329, West 83rd Street, New York City, U.S.A., Chemist.
1886. Best, Dr. T. T., Hardshaw Brook Chemical Works, St. Helens, Lancashire, Technical Chemist.
1907. Bettermann, Heinrich, Doemitz-on-Elbe, Germany, Explosives Works Manager.
1901. Betts, Anson G., Troy, N.Y., U.S.A., Chemist.
O.M. Bevan, E J., 4, New Court, Lincoln's Inn, London, W.C., Public Analyst and Consulting Chemist.
1900. Bevan, Jno. W., Risedale, St. James' Crescent, Swansea, Manager of Metallurgical Works.
O.M. Beveridge, Jas., c/o Miramichi Pulp and Paper Co., Ltd., Chatham, N.B., Canada, Pulp and Paper Manufacturer.
1893. Bhaduri, Prof. K., Canning College, Lucknow, India, Professor of Chemistry.
1898. Bhattacharyya, Haripada, Gun and Shell Factory, Ishapore, Bengal, India, Chemist.
1902. Biach, Dr. Ludwig K., 223, Central Avenue, Norwich, Conn., U.S.A., Chemist and Colorist.
1907. Bianchi, Harold, c/o L. M. Booth Co., 136, Liberty Street, New York City, U.S.A., Analytical Chemist.
1896. Bibby, John, c/o J. Bibby & Sons, Formby Street, Liverpool, Student.
O.M. Bickerdike, W. E., Bryer's Croft, Wilpshire, near Blackburn, Manufacturing Chemist.
1907. Bickerstaffe, Robt., The Anchorage, Union Road, Marple, Cheshire.
1901. Bielecki, Dr. Jan, 66, Krakowski Przedmiéscie, Warsaw, Poland, Chemist.
1903. Bierwirth, L. W., P.O. Box 863, Rio de Janeiro, Brazil, Civil Engineer.
1884 Biggart, J. Wm., 29, Cathcart Street, Greenock, N.B., Analytical Chemist.
1891. Biggart, Wm. L., Rossarden, Kilmalcolm, N.B., Public Analyst.
O.M. Biggs, B., 110, Cannon Street, London, E.C., Chemical Merchant.
O.M. Billing, H. S., 42, Kingsley Road, Mutley, Plymouth, Analytical and Managing Chemist.
1896. Billings, Edgar F., 178, Freeport Street, Dorchester, Mass., U.S.A., Manufacturing Chemist.
1896. Billington, Chas., jun., Heimath, Porthill, Longport, Staffordshire, Metallurgist.
1902. Binning, Stevenson, 101, Shooter's Hill Road, Blackheath, S.E., Technical Chemist.
1903. Binns, John H., Thornfield, Mystic Pond, Methuen, Mass., U.S.A., Dyer and Finisher.
1896. Bird, Arthur W., c/o S. Berger & Co., Bromley-by-Bow, E., Works Engineer.
1907. Bird, Charles S., jun., East Walpole, Mass., U.S.A., Paper Maker.
1896. Bird, Jno. B., Minver House, 61, Bateman Street, Cambridge, Manure Manufacturer.
1907. Bird, Dr. R. M., University of Virginia, Charlottesville, Va., U.S.A., Professor of Chemistry.
1902. Bird, W. Robt., 217, Newport Road, Cardiff, Oil Merchant.
1895. Bird, Wm. R., (communications) 125, Goddard Avenue; (Journals) Laboratory, G.W.R. Works, Swindon, Wilts, Analytical Chemist.
1885. Birley, R. K., c/o Chas. Macintosh and Co., Ltd., Cambridge Street, Manchester, India-rubber Manufacturer.
1883. Bishop, A. Conway, Three Mills Lane, Bromley-by-Bow, E., Manufacturing Chemist.
1884. Bishop, Fred, c/o Burmah Oil Co., P.O. Box 67, Rangoon, Burmah, Technical Chemist.
1903. Bishop, Howard B., 609, Greene Avenue, Brooklyn, N.Y., U.S.A., Chemist.
1903. Bishop, J. T. F., Chemical Club, Victoria Hotel, Manchester, Secretary.
1905. Bixby, Willard G., 194, Hester Street, New York City, U.S.A., Blacking Manufacturer.
1905. Bjerregaard, August P., c/o Emil Calman & Co., Long Island City, N.Y., U.S.A., Varnish Chemist.
1904. Black, J. Wyclif, 20, Mardale Crescent, Edinburgh, Analytical Chemist.
1902. Black, W. Geoffrey, The Limes, New Street, Braintree, Essex, Chemist.
1894. Blackmore, H. S., 206, South Ninth Avenue, Mount Vernon, N.Y., U.S.A., Chemist (Pure Aluminium and Chemical Company).
1899. Blackwell, G. G., 44–47, The Albany, Liverpool, Mineral and Metal Merchant.
1896. Blagden, Victor, 50–51, Lime Street, London, E.C., Chemical Merchant.
1883. Blagden, W. G., The Manor House, Harting, near Petersfield, Chemical Merchant.
1897. Blair, Andrew A., 406, Locust Street, Philadelphia, Pa., U.S.A., Analytical Chemist.
1884. Blake, Jas., Thames Sugar Refinery, Silvertown, E., Manager.
1902. Blakemore, Geo. H., Great Cobar Copper Mining Syndicate, Lithgow, N.S.W., Australia, Metallurgist.
1890. Blakey, A. J., Dudbridge Mills, Stroud, Gloucestershire, Dyer.
1893. Blears, John, c/o Langworthy Bros. and Co., Ltd., Greengate Mills, Salford, Dyer and Calico Printer.
O.M. Bles, A. J. S., 32, Chorlton Street, Manchester, Chemical Merchant.
1905. Bliss, H. J. W., c/o The Thames Varnish Co., Island Wharf, Rainham, Essex, Chemist.
1889. Bloede, Victor G., Station D., Baltimore, Md., U.S.A., Manufacturing Chemist.
1891. Bloomer, Fred. J., Penpont, Clydach, R.S.O., Glamorgan, Nickel Works Manager.
1886. Blount, Bertram, Laboratory, 76 and 78, York Street, Westminster, S.W., Analytical Chemist.
1888. Bloxam, A. G., 105, Birkbeck Bank Chambers, Holborn, W.C., Chemist and Patent Agent.
1890. Bloxam, W. Popplewell, Clothworkers Research Laboratory, The University, Leeds, Research Chemist.
1903. Blumenthal, Lionel, The Lindens, Stanley Road, Broughton Park, Manchester, Chemist.
1886. Blundstone, E. R., 77, York Street, Westminster, S.W., and (Journals) Heathfield, Park Road, Hampton Hill, Middlesex, Consulting Chemist.
1908. Blyth, Jas. R., Craiglea, Stamford Road, Audenshaw, near Manchester, Leather Trades Chemist.
1906. Blyth, M. Wynter, 3, Upper Gloucester Place, London, N.W., Analytical and Consulting Chemist.
1905. Blyth, Thomas R., Uphall Chemical Works, Ilford, Essex, Analytical Chemist.
O.M. Boake, A., Warton Road, Stratford, E., Manufacturing Chemist.
1888. Boake, Edmund J., Aberffraw, Nursery Road, Loughton, Essex, Manufacturing Chemist.
1899. Boehm, Fred., 16, Jewry Street, London, E.C., Chemical Agent and Merchant.
1898. Bogert, Prof. Marston T., Department of Organic Chemistry, Columbia University, New York City, U.S.A., Instructor in Organic Chemistry.
1903. Boissevain, Chas. E. H., 92, van Eeghenstraat, Amsterdam, Holland, Chemical Manufacturer.
1903. Bolam, Dr. H. W., 2, Summerfield, Leith, N.B., Lecturer on Chemistry.
1907. Boley, Walter, 84, Sheen Park, Richmond, S.W., Manufacturing Chemist.
1901. Bolton, E. Richards, 16, Flanchford Road, Ravenscourt Park, W., Manufacturing Chemist.
1905. Bond, John, Crowlands, Southport, Engineer.
1905. Bond, Josiah, Patagonia, Arizona, U.S.A., Mining Engineer.
1905. Bone, Dr. W. A., F.R.S., West House, Lidgett Park Road, Roundhay, Leeds, Lecturer in Chemistry and Metallurgy.
1892. Bookman, Dr. S., 9, East 62nd Street, New York City, U.S.A., Chemist.

1888. Boor, Leonard G., 21, Mincing Lane, London, E.C., Chemical Merchant.
1896. Boot, John C., Engineer's Office, Delft, Holland, Chemist.
1904. Booth, N. Parr, Laboratory, Cadbury Bros., Ltd., Bournville, near Birmingham, Chemist.
1894. Booth, Robt., 110, Cannon Street, London, E.C., Engineer.
1891. Boothby, Chas., (Journals) 10, Church Row, Limehouse, E., and Sleepy Nook, Englefield Green, Surrey, Chemist.
1903. Boral, Robin, Rhodes Mount, Rhodes, near Manchester, Works Manager.
1897. Borland, C. R., P.O. Box 683, Concord, Mass., U.S.A., Smokeless Powder Manufacturer.
O.M. Borland, W. D., Beacon Lodge, Bean, *via* Dartford, Kent, Manufacturer of Explosives.
1906. Bornett, S., 19, St. Dunstan's Hill, London, E.C., Technical Chemist.
1903. Boroschek, Dr. L., 24, West 82nd Street, New York City, U.S.A., Chemist.
1903. Bossi, Dr. Arnold L., Arnold Print Works, North Adams, Mass., U.S.A., Assistant Manager.
1890. Bost, W. D. Ashton, Cartvale Chemical Works, Paisley, N.B., Chemical Manufacturer.
O.M. Bothamley, C. H., Weston-super-Mare, Somerset, County Director of Technical Instruction.
1890. Bott, Dr. W. Norman, 16, St. Helen's Place, London, E.C., Consulting Chemist.
1884. Böttinger, Dr. H. T., Elberfeld, Germany; and (subs.) c/o The Bayer Co., Ltd., 19, St. Dunstan's Hill, E.C., Colour Manufacturer.
O.M. Bottle, Alex., 4, Godwyne Road, Dover, Pharmaceutical Chemist.
1901. Bottomley, Dr. J. Frank., c/o The Thermal Syndicate, Ltd., Neptune Road, Wallsend-on-Tyne, Consulting Chemist.
1906. Bottomley, W., c/o The United Alkali Co., Ltd., Fleetwood Salt Works, Fleetwood, Engineer.
O.M. Boulton, H. E., 64, Cannon Street; London, E.C., Chemical Manufacturer.
1890. Boulton, James, Crayford Mills, Stratford, E., Manufacturing Chemist.
O.M. Boulton, Sir Samuel B., Bart., 64, Cannon Street, London, E.C., Chemical Manufacturer.
1883. Boulton, T. S., 14, Freegrove Road, Caledonian Road, N., Manager.
1905. Bourne, Lyman M., 820, Nostrand Avenue, Brooklyn, N.Y., U.S.A., Chemist.
1906. Boutwell, Arthur T., c/o Smith & Dove Manufacturing Co., Andover, Mass., U.S.A., Bleacher and Dyer.
1884. Bow, R. H., 7, South Gray Street, Edinburgh, Civil Engineer.
1904. Bowden, Thos., Durn Lea, Todmorden Road, Littleborough, Lancs., Dyer and Chemist.
1905. Bowen, Henry, 28, Norwood Avenue, Buffalo, N.Y., U.S.A., Secretary.
1906. Bowen, Ralph A., c/o National Aniline & Chemical Co., 36, Purchase Street, Boston, Mass., U.S.A.
1885. Bowen, S. B., Brickfield Chemical Works, Llanelly, South Wales, Chemical Manufacturer.
1888. Bower, Frank, Brewery House, Spitalfields, E., Analytical Chemist.
1897. Bower, Wm. H., 29th Street and Gray's Ferry Road, Philadelphia, Pa., U.S.A., Chemical Manufacturer.
1906. Bowers, H. L., Port Hope, Ontario, Canada, Chemist and Metallurgist.
1892. Bowes, Harry, Staveley, Broomfield Road, Heaton Moor, Stockport, Analytical Chemist.
1903. Bowey, John, jun., 567, Dufferin Avenue, London, Ont., Canada, Chemist.
1889. Bowing, Jno., 101, North Street, Wandsworth, S.W., Consulting Chemist.
1883. Bowley, Jos. John, Wellington Works, Battersea Bridge, and (Journals) 64, Redcliffe Gardens, London, S.W., Chemical Manufacturer.
1899. Bowley, J. Plunkett, 1, Wellington Road, Battersea, and (Journals) 64, Redcliffe Gardens, London, S.W., Varnish Manufacturer.
1883. Bowman, Dr. F. H., 4, Albert Square, Manchester, Chemical Manufacturer.
1894. Bowman, Jas. H., Canada Chemical Manufacturing Co., London, Ont., Canada, Chemist.
1884. Bowman, R., c/o Bowman's Ltd., Lythgoe's Lane, Warrington, Chemical Manufacturer.
1907. Bowman, Richard S., Sea View Terrace, Seaton Carew, Co. Durham, Chemist.
1896. Bowman, Walker, 39, Cortlandt Street, New York City, U.S.A., Chemist.
1904. Boyce, Framroze H., near Fire Brigade Station, Fort, Bombay, India, Technical Chemist.
1893. Boyce, Frank, c/o Goodall, Backhouse, and Co., White Horse Street, Leeds, Technical Chemist.
O.M. Boyd, W., P.O. Box 212, Germiston, Transvaal, Technical Chemist.
1899. Boyes, Herb. J., c/o Boyes & Kirk, Fabrica de Tecidos, Belemzinho, Sao Paulo, Brazil, Chemist.
1905. Brabrook, G. Hale, Box 333, Taunton, Mass., U.S.A., Manufacturer.
1906. Bracegirdle, Harold W., 1, Mytton Street, Hulme, Manchester, Chemist.
1885. Bradburn, J. A., 311, Montgomery Street, Syracuse, N.Y., U.S.A., Manufacturing Chemist.
1883. Bradbury, A., Queen Buildings, 11, Dale Street, Liverpool, Chemical Broker.
1902. Bradbury, S., Ferncliffe, Milton Grove, Glebelands Road, Ashton-on-Mersey, Chemist.
1895. Bradford, Henry, St. Margarets, Paignton, Devon, Analytical Chemist.
1896. Bragg, Everett B., 1838, Chicago Avenue, Evanston, Ill., U.S.A., Manufacturing Chemist.
1891. Braithwaite, Isaac, Holly Croft, Kendal, Westmoreland, Drysalter.
1897. Braithwaite, Jno. O., Holme Lacey, Warren Road, Chingford, Essex, Pharmaceutical Research Chemist.
1903. Brame, J. S. S., 5, Coleraine Road, Blackheath, S.E., Demonstrator in Chemistry.
O.M. Bramham, W., Bank Chambers, 300, Mare Street, Hackney, N.E., Chemical Engineer.
O.M. Bramwell, G. H., Cowley Hill, St. Helens, Lancashire, Alkali Manufacturer.
1904. Brandeis, R., Oesterreichischer Verein f. Chem. und Metall. Produkte, Aussig, Austria, Chemical Manufacturer.
1902. Branegan, Jas. Aug., 555, North 16th Street, Philadelphia, Pa., U.S.A., Chemical Salesman.
O.M. Branson, F. W., Wynneholme, Far Headingley, Leeds, Pharmaceutical Chemist.
1903. Brassard, Fred. à, 46, Vicar Lane, Bradford, Yorks, Aniline Dyestuff Importer.
1901. Brearley, Harry, c/o Thos. Firth & Sons, Sheffield, Analytical Chemist.
1906. Breckenridge, John E., American Agricultural Chemical Co., Carteret, N.J., U.S.A., Chemist.
1888. Breffitt, Wm., Glasshoughton, Castleford, Yorks., Glass Manufacturer.
1905. Brettell-Vaughan, E., 15, Queen Street, London, E.C., Storage Battery Analyst.
1901. Brewer, Dr. C. E., Wake Forest, N.C., U.S.A., Professor of Chemistry.
1900. Brewis, E. T., 31, Belgrave Road, Leyton, E., Chemist.
1907. Brewster, Theodore J., Pinole, Cal., U.S.A., Chemist.
1894. Breyer, Theodor, 603, Central Avenue, Wilmette, Ill., U.S.A., Chemist.
1885. Briant, L., 24, Holborn Viaduct, London, E.C., Analytical Chemist.
1890. Brierley, J. T., Highfield, Golden Hill, Leyland, near Preston, Lancs., Analytical Chemist.
1894. Briggs, J. Burnett, Vauxhall Soap Works, 6, Blackstock Street, Liverpool, Soap Manufacturer.
1893. Briggs, J. F., 2, Frankfort Road, Herne Hill, S.E., Technical Chemist.
1885. Briggs, T. Lynton, 188, Central Avenue, Flushing, Long Island, N.Y., U.S.A., Technical Chemist.
1890. Brindley, G. F., 3, Itchome, Uchisaiwai Cho, Kojimachi-Ku, Tokio, Japan, Chemical Engineer.

1905. Bristol, Dr. H. Stanley, U.S. Dept. of Agriculture, Forest Service, Washington, D.C., U.S.A., Chemist.
1886. Bristow, G. W., c/o Walter J. Crook, 10, Philpot Lane, London, E.C., Chemical Manager.
1887. Broadbent, H., c/o Goodall, Backhouse, and Co., Sovereign Street, Leeds, Chemist.
1896. Broadhurst, W. Homer, 290, Lafayette Avenue, Brooklyn, N.Y., U.S.A., Chemist.
1889. Brock, Arthur, Firework Factory, Sutton, Surrey, Firework Manufacturer.
O.M. Brock, J., Gwern-Tyno, Colwyn Bay, North Wales, Chairman of United Alkali Co., Ltd.
1905. Broemmel, G. M., 2501, California Street, San Francisco, Cal., U.S.A., Chemist.
1896. Brooke, C. B., jun., Colne House, Brantham, near Manningtree, Xylonite Manufacturer.
1900. Brooke, Jno. R., Government Laboratory, Singapore, S.S., Chemist.
1884. Brookes, E. A., c/o The Chilian Mills Co., Ltd., Chiguayante, Concepcion, Chile, Chemist.
1895. Brookman, Fred W., 6, West Street, Rochdale, Manure Works Manager.
1906. Brooks, Cecil J., c/o The Borneo Co., Ltd., Kuching, Sarawak, Metallurgist.
1907. Broome, James S., 18, Seedley Park Road, Pendleton, Manchester, Science Lecturer.
1901. Broome, Jos., 5, Webster Terrace, Roselle Park, N.J., U.S.A., Chemical Engineer.
O.M. Brotherton, E. A., M.P., Commercial Buildings, Leeds, Ammonia Distiller.
1884. Brown, Prof. A. Crum, F.R.S., 8, Belgrave Crescent, Edinburgh, Professor of Chemistry.
1905. Brown, Prof. Adrian J., West Heath House, Northfield, near Birmingham, Professor of Brewing.
1902. Brown, A. H. M., 133, Kent Street, London, Ont., Canada, Metallurgist.
1891. Brown, Cæsar R., 23, Gower Road, Forest Gate, E., Works Foreman.
O.M. Brown, D., 93, Abbey Hill, Edinburgh, Chemical Manufacturer.
O.M. Brown, D., Donaghmore, Tyrone, Ireland, Soap Manufacturer.
1890. Brown, Edw. Hilton, c/o W. Ropes and Co., St. Petersburg, Russia, Analytical Chemist.
1903. Brown, Frank C., P.O. Box 211, Framingham, Mass., U.S.A., Foreman.
1908. Brown, Francis Harmar, 33, Thornhill Road, Handsworth, Birmingham, Engineer.
1894. Brown, Geo. E., c/o "The British Journal of Photography," 24, Wellington Street, Strand, London, W.C., Chemist.
1905. Brown, Harold G. S., c/o Messrs. G. H. Ogston and Moore, Largo del Campo 5, Messina, Sicily, Analyst.
1906. Brown, Harry F., Room 917, Du Pont Building, Wilmington, Del., U.S.A., Chemist.
1905. Brown, Hawthorne J., Oak Villa, Elton, Bury, Lancs., Paper Maker.
O.M. Brown, Henry, Benskin's Brewery, Watford, Herts., Brewing Chemist.
1899. Brown, Dr. Henry C., The Chemical Works, King's Lynn, Chemical Manufacturer.
O.M. Brown, Dr. Horace T., F.R.S., 52, Nevern Square, Kensington, S.W., Brewing Chemist.
1905. Brown, Hugh B., c/o Jas. Robertson & Sons, Ltd., Thrushgrove Works, Paisley, Chemist.
O.M. Brown, Dr. J. Campbell, 8, Abercromby Square, Liverpool, Professor of Chemistry.
1891. Brown, J. Henry, Minas d'Aljustrel, Alemtejo, Portugal, Technical Chemist.
1901. Brown, Jos., Ashleigh House, Saville Town, Dewsbury, Manufacturing Chemist.
1905. Brown, Nicol, 4, The Grove, Highgate, N., Mining Director.
1906. Brown, Percy S., c/o Western Electric Co., West and Bethune Streets, New York City, U.S.A., Chemist.
1892. Brown, Reginald B., c/o Badische Co., Ltd., 2, Samuel Ogden Street, Manchester, Technical Chemist.
1889. Brown, Robt., The Firs, Hartford, Northwich, Engineer.
1901. Brown, Samuel B., Ruthven, Bowden Lane, Marple, Cheshire, Calico Printer.
O.M. Brown, Walter, c/o Jas. H. Dennis and Co., Ltd., Widnes, Technical Chemist.
1900. Brown, Walter B., Victor Chemical Works, 89, Board of Trade Building, Chicago, Ill., U.S.A., Chemist and General Superintendent.
1901. Browne, Dr. Arthur L., 213, Courtland Street, Baltimore, Md., U.S.A., Analytical Chemist.
1906. Browne-Cave, E. J. C., "Strathallan," Bootle, Liverpool, Works Chemist.
1905. Browning, Prof. K. C., Medical College, Colombo, Ceylon, Professor of Chemistry.
O.M. Browning, W., Broad Oak, Accrington, Calico Printer.
1901. Brownlie, David, 31, India Street, Alexandria, Dumbartonshire, Chemist.
1902. Brownrigg, Marcus P., Colonial Sugar Refining Co., Ltd., O'Connell Street, Sydney, N.S.W., Australia, Analytical Chemist.
1902. Brownsdon, Dr. H. W., King's Norton Metal Co., Ltd., Abbey Wood, Kent, Works Chemist.
1902. Bruce, Alex., Laboratory, Hyde Park Corner, Colombo, Ceylon, Chemist.
1890. Bruce, Jas., Craik, Saskatchewan, Canada, Distiller.
1900. Bruce, Wm. T., c/o Hugh Wallace and Co., Ltd., 5, Fenchurch Street, London, E.C., Director.
1892. Bruckmann, G. T., 192, 18th Street, Brooklyn, N.Y., U.S.A., Chemical Engineer.
1905. Bruinier, A. G., 534, Canal Street, New York City, U.S.A., Agent for Kalle and Co.
O.M. Brunner, H., Holly Mount, Tarbock Road, Huyton, near Liverpool, Chemical Manufacturer.
1894. Brunner, H. Bertram, Winnington Park, Northwich, Chemist and Electrician.
1887. Brunner, J. F. L., M.P., c/o Brunner, Mond and Co., Ltd., 39, Victoria Street, London, S.W., Chemical Manufacturer.
O.M. Brunner, Sir J. T., Bart., M.P., Druid's Cross, Wavertree, Liverpool, Chemical Manufacturer.
1902. Brunner, Roscoe, The Winnington Hall Club, Winnington, Northwich, Alkali Manufacturer.
1905. Brunt, R. A., Box 71, Windsor, Ont., Canada, Sugar Chemist.
1894. Brunton, J. Dixon, Wire Mill, Musselburgh, N.B., Wire Manufacturer.
1904. Bryant, Arthur P., c/o Clinton Sugar Refining Co., Clinton, Iowa, U.S.A., Chemist.
1903. Bryant, V. Seymour, Trelawne, Crowthorne, Berks., Analytical Chemist.
1905. Bryce, Clarence H., c/o Benj. Moore and Co., 244, Water Street, Brooklyn, N.Y., U.S.A., Factory Superintendent.
1894. Bryce, Thos., Tharsis Mines, Huelva, Spain, Chemist.
1897. Bryson, Jas., Pumpherston Oil Works, Midcalder, N.B., Oil Works Manager.
1892. Buchanan, D. G., (Subs.) 40, St. Vincent Place, Glasgow, and (Journals) c/o Gibbs and Co., Iquique, Chili, Analyst.
1908. Buchanan, Duncan G., 24, Gwynne Avenue, Parkdale, Toronto, Canada, Chemist (Rubber Works).
1904. Buchanan, E. F., 128, East Crescent Street, Marquette, Mich., U.S.A., Chemist.
1888. Buchanan, Jas., jun., Caledonia Foundry, Brasenose Road, Liverpool, Engineer.
1904. Buchanan, J. L., 3, The Wiend, Lower Bebington, Cheshire, Analytical Chemist.
1904. Buchanan, Joshua D., c/o Nobel's Explosives Co., Ltd., Polmont Station, N.B., Chemist.
1897. Buck, Chas. A., 521, Locust Street, South Bethlehem Pa., U.S.A., Chief Chemist (Bethlehem Iron Co.).
1906. Buckie, Robert H., c/o West Virginia Paper and Pulp Co., Mechanicville, N.Y., U.S.A., Works Chemist.
1897. Bucknill, Jno. A., King's Advocate, Nicosia, Cyprus, Barrister-at-Law.
1900. Bull, Dr. Benjamin S., 104, Humber Road, Blackheath, S.E., Technical Chemist.

1902. Bull, Irving C., 100, Maiden Lane, New York City, U.S.A., Chemist.

1899. Bult, Herbert J., 18, Billiter Street, London, E.C., Chemist.

1907. Bult, Stanley R., 18, Billiter Street, London, E.C., Chemist.

O.M. Bumby, H., Coltness Ironworks, Newmains, N.B., Ironworks Manager.

O.M. Bunker, H. E., 19, Napier Street, Toronto, Ont., Canada, Technical Chemist.

1901. Bunting, Henry H., Oficina de Ensayes F. C. C. del P., Callao, Peru, Analyst.

1894. Bunting, W. Lightfoot, Forest Bank, Crawshawbooth, near Manchester, Calico Printer.

1893. Burbridge, Jas., India-rubber Mills, Tottenham, N., India-rubber Manufacturer.

1886. Burdekin, G., jun., 10, Clifton Terrace, St. Helens, Lancashire, Chemical Works Manager.

1896. Burford, Samuel F., Beechworth, Stoneygate Road, Leicester, Analytical Chemist.

1889. Bürger, Dr. J., 1, Birch Avenue, Talbot Road, Old Trafford, Manchester, Technical Chemist.

1901. Burgess, Prof. C. F., University of Wisconsin, Madison, Wis., U.S.A., Electro-chemical Engineer.

1889. Burgess, Geo., Pittville, Hale Road, Ditton, Widnes, Chemist.

1889. Burgess, Wm. T., 20, Priory Road, Bedford Park, London, W., Analytical Chemist.

1902. Burkard, Dr. Ernst, The Heyden Chemical Works, Garfield, N.J., U.S.A., Chemist.

1899. Burkhardt, Dr. G. A., c/o Bohrgesellschaft Erkelenz, Erkelenz, Rheinland, Germany, Chemist.

1897. Burland, Lt.-Col. Jeffrey H., 824, Sherbrooke Street, Montreal, Canada, Paper and Card Manufacturer.

1897. Burls, Frank B., 4, Dyer's Hall Road, Leytonstone, Essex, Chemist.

1898. Burls, Herbert T., (Journals) c/o Royal Societies Club, St. James Street, S.W., and (communications) c/o H. S. King & Sons, Cornhill, E.C., Mechanical Engineer.

1901. Burnand, Sydney, Manbre Saccharine Co., Ltd., Hammersmith, W., Manager.

O.M. Burnard, R., Plymouth Chemical Works, Plymouth, Chemical Manufacturer.

1891. Burnet, Henry K., North Brook Vitriol Works, Bradford, Yorks., Sulphuric Acid Maker.

1897. Burnet, Jno. Jas., 18, University Avenue, Glasgow, Architect.

1907 Burnham, Frank E., c/o Avery Chemical Co., 7, Sears Street, Boston, Mass., U.S.A., Chemist.

1893. Burnham, J. C., Cordite Factory, Aruvankad, Nilgiri Hills, India, Analytical Chemist.

1900. Burnside, Chas. F., Haskell, N.J., U.S.A., Chemist.

1900. Burr, Edmund C., 1722, Vallejo Street, San Francisco, Cal., U.S.A., Manufacturer.

O.M. Burrell, B. A., 8, Springfield Mount, Leeds, Analytical Chemist.

1906. Burrough, Ernest J., Cale Street Distillery, Chelsea, S.W., Rectifier.

1892. Burrough, Horace, jun., 509, West Lombard Street, Baltimore, Md., U.S.A., Technical Chemist.

1888. Burrows, Edw., Home Villa, Low Fell, Gateshead-on-Tyne, Alkali Works Manager.

1901. Burton, Alf., 44, York Street, Toronto, Canada, Dyer and Finisher.

1905. Burton, Jas. K., Grand and 20th Avenues, Nashville, Tenn., U.S.A., Consulting Chemist

1903. Burton, Jno., 2, Green Street, Bethnal Green, E., Dye and Chemical Manufacturer.

1904. Burton, T. R., c/o Scott, Greenwood and Son, 8, Broadway, Ludgate Hill, London, E.C., Technical Journalist.

1889. Burton, Wm., The Hollies, Clifton Junction, near Manchester, Potter's Chemist.

1897. Burwell, A. W., Box 1193, Helena, Montana, U.S.A., Consulting Chemist.

1906. Busby, Fred. E., Arnold Print Works, North Adams, Mass., U.S.A., Chemist.

1897. Bush, J. M., c/o W. J. Bush and Co., Ltd., Ash Grove, Hackney, E., Manufacturing Chemist.

1897. Butler, David B., 41, Old Queen Street, Westminster, S.W., Cement Expert.

1903. Butler, Fredk., Ash Tree Lane, Hough Green, near Widnes, Manager (Ditton Copper Works).

1890. Butler, Paul, Lowell, Mass., U.S.A., Ammunition Manufacturer.

1885. Butler, Samuel, The Cedars, Compton, Wolverhampton, Brewer.

1905. Butler, T. H., c/o Frau Wenzel, Forstweg 14, Jena, Germany, Chemical Student.

1886. Butler, W. W., c/o Mitchells & Butlers, Ltd., The Brewery Library, Cape Hill, Birmingham, Brewer.

1903. Buttenshaw, E. L., Thurleigh, Priory Road, Sale, Cheshire, Analytical Chemist.

O.M. Butterfield, J. C., 79, Endlesham Road, Balham, S.W., Analytical Chemist.

1892. Butterfield, W. J. A., 66, Victoria Street, Westminster, S.W., Analytical Chemist.

1897. Butters, Charles, 54, New Broad Street, London, E.C., and (Journals) Roselawn, Berkeley, Cal., U.S.A., Metallurgist.

1900. Butterworth, Elwell R., c/o Reversible Collar Co., 111, Putnam Avenue, Cambridge, Mass., U.S.A., Chemist.

1902. Butterworth, F. J., P.O. Box 54, Newark, N.J., U.S.A., Chemist.

1892. Buttfield, Horace V., 13, Wellington Road, Bush Hill Park, Enfield, N., Chemical Demonstrator.

O.M. Byard, A. G., c/o Burt, Boulton, and Haywood, Apartado 8, Bilbao, Spain, Technical Chemist.

1905. Byrne, F. A., 2, Ludgate Hill, Birmingham, Director of Chemical Co.

1899. Byrnes, Dr. Eugene A., 918, F. Street N.W., Washington, D.C., U.S.A., Patent Lawyer.

1893. Byrom, T. H., Laboratory, Wigan Coal and Iron Co., Wigan, Analytical Chemist.

1887. Bythway, M., 44, Lloyd Street, Albert Square, Manchester, Drysalter.

C

1884. Cabot, Godfrey L., 82, Water Street, Boston, Mass., U.S.A., Chemist.

1907. Cabot, Samuel, 141, Milk Street, Boston, Mass., U.S.A., Chemical Manufacturer.

1906. Caddick, Arthur, 119, Monks Road, Lincoln, Works Chemist.

1889. Cadett, Jas., Ashtead, Surrey, Chemical Engineer.

1902. Cady, Walter B., c/o Peninsular Portland Cement Co., Cement City, Mich., U.S.A., Chemist.

1905. Cain, Dr. J. C., 28, Pembury Road, Lower Clapton, N.E., Colour Chemist.

1891. Caines, G. S. A., 7, Rochester Terrace, Camden Road, London, N.W., Analytical Chemist.

1907. Cairncross, W. M., c/o Manica Copper Development Co., Macequece, Portuguese East Africa, Mining Engineer.

1897. Cairns, Wm., 5, Carlton Place, Glasgow, Plumber.

1907. Caistor, J. W. Y., Morro Velho, Villa Nova de Lima, Minas Geraes, Brazil, Chemist.

1891. Caldecott, W. Arthur, Box 1167, Johannesburg, Transvaal, South Africa, Metallurgist.

1905. Calder, Prof. Edwin E., Long Meadow, R.I., U.S.A., Professor of Chemistry.

1897. Calder, W. A. S., Ormidale, Little Moor Hill, Smethwick, Birmingham, Chemical Manufacturer.

1888. Caldwell, Wm., Murray Street, Paisley, N.B., Drysalter.

1902. Calm, Dr. Chas. E., 41–43, Warren Street, New York City, U.S.A., Manufacturing Chemist.

1904. Calvert, Dr. Harry T., West Riding of Yorkshire Rivers Board, Wakefield, Chemist.

1895. Cambier, Jacob, 910, Spruce Street, Pueblo, Colo., U.S.A., Chemist.

1894. Cameron, Alex., Whitcher Place, Rochester Road, Camden Road, N.W., Chemical Engineer.

1891. Cameron, Jas., 70, Old Chester Road, Woodhey, Rock Ferry, Cheshire, Manufacturing Confectioner.
1904. Cameron, Walter S., 239, West 136th Street, New York City, U.S.A., Manufacturing Perfumer.
O.M. Cammack, J., 34, Wolseley Road, St. Helens, Lancashire, Technical Chemist.
1886. Campbell, Andrew, c/o Burmah Oil Co., Ltd., Dunneedaw, Rangoon, Burmah, Analytical Chemist.
O.M. Campbell, Archibald, Berry Lodge, Rugeley, Staffordshire, Technical Chemist.
1902. Campbell, Ashley, Colonial Sugar Refining Co., Ltd., Pyrmont Refinery, Sydney, N.S.W., Australia, Analytical Chemist.
1908. Campbell, Fred. A., The Working Men's College, Latrobe Street, Melbourne, Victoria, Australia, Principal.
1906. Campbell, Geo. H., 75, Yonge Street, Toronto, Canada, Manufacturing Chemist.
1904. Campbell, J. H., 176, State Street, Brooklyn, N.Y., U.S.A., Chemist.
1907. Campbell, John A., c/o British South African Explosives Co., Modderfontein, Transvaal, Chemist.
1901. Campbell, Kenneth F., M.Inst.C.E., 1, Peel Street, Huddersfield, Civil Engineer.
1904. Campion, A., Laboratory, 144, Wellington Street, Glasgow, Chemist and Metallurgist.
1897. Canfield, F. D., jun., c/o Cuban Sugar Refining Co., Cardenas, Cuba, Sugar Refiner.
1893. Cannon, J. C., Staverton House, Shoreham, Sussex, Analyst.
O.M. Cannon, M., 25, Stormont Road, Clapham Common, S.W., Vinegar Works Manager.
1891. Canziani, Enrico, 3, Palace Green, Kensington, W., Civil Engineer.
1891. Carden, Albert J., Dunster House, 12, Mark Lane, London, E.C., Distiller.
1904. Carel, Prof. Hubert C., Laboratory, University of Minnesota, Minneapolis, Minn., U.S.A., Chemist (State Board of Health).
1893. Carey, Arthur, The Groves, Grassendale Park, near Liverpool, Chemist.
O.M. Carey, Eustace, The United Alkali Co., Ltd., 30, James Street, Liverpool; and (Journals) The Groves, Grassendale Park, near Liverpool, Chemical Manufacturer.
1907. Carey, Walter, 11, West Albert Road, Sefton Park, Liverpool, Engineer.
1906. Carey, William G., Moulton Settlement, Leysian Mission, City Road, London., E.C., Chemist.
1904. Cargill, J. T., c/o Finlay, Fleming and Co., Rangoon, Burmah, East India Merchant.
1907. Carlitz, Joseph S., 1017, Callowhill Street, Philadelphia, Pa., U.S.A., Chemist.
1907. Carlson, Oscar F. T., Fosfatbolaget, Stockholm, Sweden, Works Manager.
1895. Carlsson, Hugo, Fagersta, Sweden, Analytical Chemist.
1896. Carmichael, Herbert, Bureau of Mines, Victoria, British Columbia, Public Analyst and Assayer.
1884. Carmody, Prof. Patrick, Government Laboratory, Port of Spain, Trinidad, Analytical Chemist.
1903. Carneiro da Cunha, J. M., Comp. Agricola and Mercantil, Rua do Apollo 28, Pernambuco, Brazil, Manager.
1897. Carnell, Wm. C., c/o Tacony Chemical Works, Bridesburg, Philadelphia, Pa., U.S.A., Chemist.
O.M. Caro, Dr. H., C. 8 N. 9, Mannheim, Baden, Germany, Technical Chemist.
1906, Caro, Dr. Nikodem, Meinekestrasse 20, Berlin, Germany, Analytical Chemist.
1893. Carpenter, C. C., South Metropolitan Gas Co., 709A, Old Kent Road, London, S.E., Civil Engineer.
1900. Carpenter, Frank B., 11, South 12th Street, Richmond, Va., U.S.A., Chemist.
1900. Carpenter, Harry B., c/o Lister's Agricultural Chemical Works, Newark, N.J., U.S.A.
1903. Carpenter, H. C. Harold, 11, Oak Road, Withington, Manchester, Chemist and Metallurgist.
1906. Carpenter, P. H., Cawnpore Sugar Works, Cawnpore, India, Analyst.
O.M. Carpenter, R. Forbes, Prestwich, Greencroft Gardens, West Hampstead, N.W., Chief Inspector under the Alkali, &c., Works Acts.
1904. Carr, Francis H., Kelvin, Church Avenue, Sidcup, and (Journals), Burroughes, Wellcome and Co., Ltd., Dartford, Kent, Manufacturing Chemist.
1907. Carrier, C. F., jun., 511, Union Place, Elmira, N.Y., U.S.A., Manufacturing Chemist.
1904. Carroll, Jno. L., 23, Division Place, Newark, N.J., U.S.A., Secretary (American Oil and Supply Co.).
1885. Carruthers, J. G., Burnbrae House, Milngavie, N.B., Dyeworks Manager.
1901. Carson, Geo. C., Hotel Broadway, Denver, Colo., U.S.A., Mining Engineer.
1906. Cart, John Trevor, c/o Messrs. C. A. Parsons and Co., Heaton Works, Newcastle-on-Tyne, Chemist.
O.M. Carteighe, M., Oriel, Goring-on-Thames, Pharmaceutical Chemist.
1904. Carter, A., Cuba Street, Petone, Wellington, New Zealand, Works Manager.
1905. Carter, Robert A., c/o Roessler and Hasslacher Chemical Co., Box 68, South Amboy, N.J., U.S.A., Chemist.
1895. Carter, Stewart F., Glenlyon Dyeworks, Saylesville, R.I., U.S.A., Technical Chemist.
1903. Carter, Thomas, 322, Scarr Hill, Bradford, Yorks, Works Chemist.
1886. Carter, W. Chas., c/o Dominion Iron and Steel Co., Sydney, C.B., Canada, Analytical Chemist.
1889. Carulla, F. J. R., 84, Rose Hill Street, Derby, Chemical Manufacturer.
1906. Carveth, Dr. H. R., Niagara Electrochemical Co., Niagara Falls, N.Y., U.S.A., Works Manager.
1906. Casaburi, Dr. V., c/o Ford Morocco Co., Wilmington, Del., U.S.A., Leather Chemist.
1903. Caspari, Dr. W. A., 28, Coleshill Road, Teddington, Chemist and Physicist.
1895. Catlin, Chas. A., 133, Hope Street, Providence, R.I., U.S.A., Chemist (Rumford Chemical Works).
1896. Caven, Robt. M., University College, Nottingham, Lecturer in Chemistry.
O.M. Cawley, G., 25, Victoria Street, Westminster, S.W., Chemical Engineer.
O.M. Cawley, J., 278, Passaic Street, Newark, N.J., U.S.A., Analytical Chemist.
1897. Cawley, Thos. A., British Gelatin Works, New Bedford Road, Luton, Gelatin Manufacturer.
1900. Cayvan, Llewellyn L., 516, Pleasant Street, Oak Park, Ill., U.S.A., Chemist.
1902. Cerasoli, Alburto, c/o Dr. L. Mond, 18, Avenue Road, Regent's Park, N.W., Engineer.
1906. Chadsey, S. B., c/o International Harvester Co., Hamilton, Ontario, Canada, Chemist.
1891. Chadwick, Walter M., Royal Hotel, South Shields, Chemical Works Manager.
1894. Chaloner, G. W., 26, Eagle Wharf Road, Hoxton, N., Chemical Manager.
1901. Chamberlain, G. E., 103, South Kensington Avenue, La Grange, Ill., U.S.A., Chemist.
1902. Champion, Edmund C., 510, South Washington Avenue, Iola, Kansas, U.S.A., Chemist.
O.M. Chance, A. M., Chemical Works, Oldbury, near Birmingham, Chemical Manufacturer.
O.M. Chandler, Dr. C. F., Columbia University, West 116th Street, New York City, U.S.A., Professor of Chemistry.
1907. Chaney, Walter, The Gas Works, Nechells, Birmingham, Gas Engineer.
1893. Chaplin, Dr. Edw. M., Public Analyst's Laboratory, Wakefield, Yorks., Analytical Chemist.
1906. Chaplin, Wm. H., 13, Penywern Road, Earl's Court, London, S.W., Wine Merchant.
1890. Chapman, Alf. C., 8, Duke Street, Aldgate, E.C., Analytical Chemist.
1906. Chapman, Arthur J., Baronsmere, Stanhope Avenue, Church End, Finchley, N., Analytical Chemist.

1906. Chapman, E. A., Broad Plain Soap Works, Bristol, and (Journals) 96, Henley Road, Ilford, E., Works Chemist.

1903. Chapman, Geo. W., Swift Fertilizer Works, 912, Prudential Building, Atlanta, Ga., U.S.A., Superintendent.

O.M. Chapman, Spencer, 36, Mark Lane, E.C., Chemical Manufacturer.

1894. Charlier, A. C. J., 6, Talbot Road, South Tottenham, N., Consulting Chemist.

1902. Charlton, Thos., 252, Irvington Place, Denver, Colo., U.S.A., Manufacturing Chemist.

1900. Chase, March F., c/o Mineral Point Zinc Co., Depue, Ill., U.S.A., Chemist.

1889. Chase, R. L., Arnold Printworks, North Adams, Mass., U.S.A., Manager.

1898. Chattock, Herbert E., 23, Apsley Road, Clifton, Bristol, Oilcake Manufacturer.

1905. Cheesman, Frank P., 100, William Street, New York City, U.S.A., Paint Manufacturer.

1901. Cheetham, Howard, 18, St. Ann Street, Manchester, Chartered Patent Agent.

1894. Cheney, J. P., c/o Cheney Bros., South Manchester, Conn., U.S.A., Silk Manufacturer's Chemist.

1905. Chick, Oliver, 52, High Street, Hornsey, N., Analytical Chemist.

1907. Chickering, H. G., c/o E. I. du Pont de Nemours Powder Co., Lewisburg, Ala., U.S.A., Chemist.

1902. Chilwell, John, Post Office, Auckland, New Zealand, Analyst.

1906. Chittenden, George, The Francis Frost Co., Ltd., Toronto, Canada, Chemist.

1893. Cholerton, A. F., 40½, Belgrave Gate, Leicester, Manufacturing Chemist.

1890. Chorley, Jno. C., Bewsey, Oxford Road, Birkdale, Lancs., Analytical Chemist.

O.M. Christie, J., Levenfield, Alexandria, N.B., Dyer and Printer.

1903. Christie, John, c/o The New Explosives Co., Ltd., Stowmarket, Suffolk, Analytical Chemist.

1908. Christie, Malcolm, Ardenlea, Portland Road, Hamilton, N.B., Analytical Chemist.

1906. Christie, Dr. W. A. K., Technical Chemist.

1898. Christison, Geo., 13, Cambridge Drive, Glasgow, Engineer.

1907. Christopher, George, Walkden Works, Verney Road, South Bermondsey, S.E., Consulting Chemist.

1907. Christopher, J. E., Solvay Coke Works, Kirkless, Wigan, Assistant in Charge.

O.M. Chrystal, W. J., 7, West George Street, Glasgow, Chemical Manufacturer.

1904. Chubb, H. M., Wharfedale Villas, Tadcaster, Yorks., Brewery Chemist.

O.M. Church, Professor A. H., F.R.S., Shelsley, Kew, Surrey, Professor of Chemistry in the Royal Academy.

1890. Church, Elihu D., jun., 63, Wall Street, New York City, U.S.A., Soda Manufacturer.

1906. Church, Sumner R., c/o Barrett Manufacturing Co., 17, Battery Place, New York City, U.S.A., Chemical Engineer.

1907. Churchill, Wm., Corning Glass Works, Corning, N.Y., U.S.A., Chemist.

1896. Claflin, Alan A., (Communications) Box 1189, Boston; and (Journals) Littleton, Mass., U.S.A., Manufacturing Chemist.

1900. Clamer, Guilliam H., 46, Richmond Street, Philadelphia, Pa., U.S.A., Chemist.

1885. Clanahan, H. C., 79, Mosley Street, Manchester, Chemical Merchant.

1901. Clapham, Henry E., Laurel Bank, Wilsden, near Bradford, Technical Chemist.

1905. Clapp, Geo. A., 503, Walnut Street, Newtonville, Mass., U.S.A., Chemist.

1891. Clapp, Ralph R., c/o Standard Ammonia Co., Ltd., Iceland Wharf, Old Ford, E., Ammonia Works Manager.

1889. Clapperton, J., jun., Analytical Chemist.

1903. Clare, Henry, Hepscott, Morpeth, Northumberland, Schoolmaster.

1905. Clark, Alfred N., Box 168, Wallaceburg, Ont., Canada, Technical Chemist and Engineer.

1906. Clark, Allan J., c/o Homestake Mining Co., Lead, S. Dakota, U.S.A., Metallurgist.

1904. Clark, Arthur W., c/o Johnson and Johnson, New Brunswick, N.J., U.S.A., Chemist and Bacteriologist.

1896. Clark, Donald, School of Mines, Bendigo, Victoria, Australia, Director.

1904. Clark, Prof. Friend E., Central University of Kentucky, Danville, Ky., U.S.A., Professor of Chemistry.

1900. Clark, Jno., Broadway Works, Millwall Dock, London, E., Manufacturing Chemist.

1906. Clark, M. H., c/o Boston Rubber Shoe Co., Malden, Mass., U.S.A., Chemist.

1902. Clark, Robt. M., 138, Bath Street, Glasgow, Chemist.

1903. Clark, T. W. Firth, 24, Witherington Road, Highbury, N., Analyst.

1906. Clark, Wm. B., 42, Robertson Street, Greenock, Chemist.

1907. Clark, Wm. H., 152, Newport Road, Middlesbrough, Analytical Chemist.

1903. Clark, Dr. W. Inglis, 104, South Canongate, Edinburgh, Manufacturing Chemist.

1902. Clark, Wm. Linus, Champion Coated Paper Co., Hamilton, Ohio, U.S.A., Chemist.

1904. Clarke, Alfred R., 613–617, Eastern Avenue, Toronto, Canada, Leather Manufacturer.

1908. Clarke, Arthur F., 13, Sloane Street, London, S.W., Analytical Chemist.

1907. Clarke, Herbert W., 13, Adlington Road, Bollington, near Macclesfield, Calico Bleacher.

1903. Clarke, Robt. W., 3, Aberdeen Villas, Chase Road, Southgate, N., Analyst.

1897. Clarke, Wm. B., c/o Edison-Swan U.E.L. Co., Ltd., Ponders End, N., Electro-Chemist.

O.M. Claudet, A. C., 6 & 7, Coleman Street, E.C.; and (Journals) 12, Fitzjohn's Avenue, Hampstead, N.W., Metallurgist.

1889. Claus, Wm. H., c/o Claus and Ree, Clayton, Manchester, Manufacturing Chemist.

O.M. Clayton, E. G., Chemical Laboratory, 23, Holborn Viaduct, London, E.C., Consulting Chemist.

1895. Clayton, Dr. G. C., Etonfield, Wavertree, Liverpool.

1891. Clayton, J. W., c/o Clayton and Jowett, Ltd., 3, Concert Street, Liverpool, Essence Distiller.

1894. Clayton, Robt. H., Woodleigh, Blackfield Lane, Kersal, Manchester, Chemist.

1905. Clayton, W. E., Royal Victoria Yard, Deptford S.E., Superintendent.

1907. Clement, Leonard, Beamsley, Fairhaven, near Lytham, Lancs., Chemist.

1893. Clemes, J. H., Cheriton, Newquay, Cornwall.

1886. Cleminshaw, E., Alkali Works, Oldbury, near Birmingham, Technical Chemist.

1883. Clemons, G. H., Cudbear Street, Hunslet Road, Leeds, Dyeware Manufacturer.

1884. Clerk, Dugald, 18, Southampton Buildings, Chancery Lane, W.C., Engineer.

1899. Cleveland, D. B., 1403, First National Bank Building, Cincinnati, Ohio, U.S.A., Chemist.

1907. Cleverly, Herbert N., c/o International Pavement Co., Hastings-on-Hudson, N.Y., U.S.A., Chemist.

1905. Clexton, Thos. J., 285, Congress Street, Boston, Mass., U.S.A., Manager (A. Klipstein & Co.).

1906. Clifford, Jos., Ivy House, Prestbury, near Macclesfield, Chemist.

1900. Clifford, Wm., Sewage Outfall Works, Wolverhampton, Sewage Works Manager.

O.M. Cloud, T. C., 4, Lloyd's Avenue, Fenchurch Street, London, E.C., Metallurgist.

O.M. Clowes, Dr. F., 40, Craven Street, Charing Cross, W.C.; and the Grange, College Road, Dulwich, S.E., Chief Chemist (L.C.C.).

1891. Clutton, J. H., Elliott's Metal Co., Ltd., Burry Port, R.S.O., Carmarthenshire, Assayer.

1900. Clymer, Wm. R., 1426, West 107th Street, Cleveland, Ohio, U.S.A., Chemist.

1899. Coates, Chas. E., jun., Louisiana State University, Baton Rouge, La., U.S.A., Professor of Chemistry.
1888. Coats, Jno. T., 105, Broughton Street, Edinburgh, Manufacturing Chemist.
1893. Cobb, Jno. W., Farnley Ironworks, near Leeds, Technical Assistant to Managing Director.
1904. Coblentz, Lambert, 1708, Sutter Street, San Francisco, Cal., U.S.A., Chemist.
1894. Coblentz, Dr. Virgil, College of Pharmacy, 115, West 68th Street, New York City, U.S.A., Professor of Chemistry.
1899. Cochran, Alfred, 559, Madison Street, Brooklyn, N.Y., U.S.A., Chemist.
1901. Cockburn, John A., c/o Japanese Explosives Co., Ltd., Hiratsuka, Sagami, Japan, Analytical Chemist.
1902. Cocking, Allan T., Carhampton House, Four Oaks, Sutton Coldfield, Ammunition Manufacturer.
1905. Coes, Chas. S., 119, East River Street, Hyde Park, Mass., U.S.A., Oil Chemist.
1906. Coffman, Herbert, c/o B. S. Cushman, 109, Elston Place, Ithaca, N.Y., U.S.A., Cement Works Chemist.
1903. Cofman-Nicoresti, J., 24, St. Gabriel's Road, Cricklewood, N.W., Chemist.
1903. Coggeshall, Dr. G. W., Chestnut Street, Dedham, Mass., U.S.A., Chemical Manufacturer.
1887. Coghill, P. de G., Borax Works, Old Swan, Liverpool, Technical Chemist.
1884. Cogswell, W. B., Syracuse, N.Y., U.S.A., Chemical Engineer.
O.M. Cohen, Dr. J., 13, Cardigan Road, Leeds, Analytical Chemist.
1897. Cohn, Alfred J., 122, East 74th Street, New York City, U.S.A., Chemist.
1901. Cohn, Sigmund, 13, Dutch Street, New York City, U.S.A., Metallurgical Chemist.
1904. Cohoe, Prof. W. P., 110, Park Road, Toronto, Canada, Professor of Chemistry.
1903. Colbert, W., British S.A. Dynamite Factory, Modderfontein, Transvaal, Analytical Chemist.
1891. Colby, Albert L., 217, West 110th Street, New York City, U.S.A., Metallurgical Engineer.
1899. Colby, E. A., Baker Platinum Works, Newark, N.J., U.S.A., Metallurgical Chemist.
O.M. Colby, W. H., Carreg-wen, Aberystwith, Wales.
1893. Coleman, W. H., 18, Egerton Road, Fallowfield, Manchester, Tar Works Chemist.
O.M. Collens, E., Vinegar Works, Stourport, Worcestershire, Manager.
1905. Collett, John H., Hillfield, Gloucester, Chemical Manufacturer.
1887. Collett, J. M., Hillfield, Gloucester, Chemical Manufacturer.
1901. Colley, Bernard T., c/o Velardena M. and S. Co., Velardena, Durango, Mexico, Assayer.
1903. Collier, Pierre, Companhia Industrial Pernambucana, Pernambuco, Brazil, Civil Engineer.
1893. Collin, Dr. C. A., Ferguslie Threadworks, Paisley, N.B., Textile Chemist.
1898. Collingridge, Frank, 73, Fountain Road, Edgbaston, Birmingham, Chemist.
1883. Collins, J. H., Crinnis, Par Station, Cornwall, Technical Chemist.
1899. Collins, S. Hoare, Armstrong College, Newcastle-on-Tyne, Agricultural Chemist.
1888. Collins, W. Hepworth, c/o Edw. Wihl & Co., 17, Nicholas Street, Manchester, Analytical Chemist.
1899. Collis, Walter T., 89, Greenfield Road, Harborne, Birmingham, Chemist.
1891. Colman, Dr. H. G., Elmside, Worcester Park, Surrey, Analytical Chemist.
1892. Colquhoun, Ludovic, c/o South African Explosives Co., Modderfontein, Transvaal, Analytical Chemist.
1894. Colquhoun, W., Plas Penyddol, Bersham, near Wrexham, North Wales, Engineer.
1901. Colwell, J. Kear, Finsbury Town Hall, Rosebery Avenue, E.C., Analytical and Consulting Chemist.
1906. Comber, A. W., Suramangalam, Salem District, South India, Manager (Magnesite Works).
1900. Comey, Arthur M., 12, Pearl Street, Boston, Mass., U.S.A., Technical Chemist.
1906. Compton, Miss N. J., Library, University of Nebraska, Lincoln, Neb., U.S.A., Librarian.
1906. Condit, Louis C., Chemical Laboratory, B. and O. R. R., Mount Clare, Baltimore, Md., U.S.A., Chemist.
1901. Connah, Jas., 12, Kiddepore Gardens, Hampstead, N.W., Government Analyst.
1905. Conner, Arthur B., 1070, Fort St. West, Detroit, Mich., U.S.A., Chemist.
1883. Connor, C. C., 10, College Gardens, Belfast, Ireland, Chemist.
1891. Conradson, Pontus H., Galena Oil Works, Franklin, Pa., U.S.A., Analytical Chemist.
1906. Conrau, Oliver, Sugar Estate "La Grange," St. Croix, Danish West Indies, Administrator.
1889. Conroy, Dr. Jas. T., Adirondack, Grassendale Park, Liverpool, Chemist.
1887. Constable, W. H., (Journals) Australian Alum Works, Runcorn; and (communications) Riversdale, Dee Banks, Chester, Analytical Chemist.
1902. Converse, W. A., Rooms 226—224, Postal Telegraph Building, Chicago, Ill., U.S.A., Chemist.
O.M. Cook, H. J., The Firs, Woodford Green, Essex, Soap Manufacturer.
1903. Cook, Jas. W., London and Provincial Dye Works, Hackney Wick, N.E., Dyer.
1899. Cook, Robt. A., New Brunswick, N.J., U.S.A., Chemist.
1898. Cook, Thos. Alex., East London Soap Works, Bow, E., Soapmaker.
1899. Cook, Walter G., 9, Hendon Lane, Finchley, N., Analytical Chemist.
1891. Cooke, Arthur W., c/o Brotherton and Co., Ltd., Holmes Street, Dewsbury Road, Leeds, Analytical Chemist.
1907. Cooke, J. J. Verdin, 9, James Street, Liverpool, Salt Manufacturer.
1904. Cooke, W. Ternent, The University, Adelaide, South Australia, Lecturer in Chemistry.
1901. Cooper, T. S., 36, Demesne Road, Alexandra Park, Manchester, Calico Printing Chemist.
1891. Cooper, Walter J., The Elms, Lavernock, South Wales, Cement Works Manager.
1906. Cooper, William, Glentwood, Winter Road, Southsea, Hants, Analytical Chemist.
1907. Cooper, W. F., Research Laboratory, Water Lane, Watford, Synthetic Chemist.
1897. Cooper, Wm. R., 113, Tulse Hill, S.W., Electrical Engineer.
1890. Corcoran, Bryan, 31, Mark Lane, London, E.C., Chemical Engineer.
1887. Cordner-James, J. H., Finsbury House, Blomfield Street, London, E.C., Mining Engineer.
1905. Cormack, Wm., c/o G. Nelson, Dale and Co., Ltd., Emscote Mills, Warwick, Chemist.
1899. Cornelison, Dr. Robt. W., Bloomfield, N.J., U.S.A., Consulting Chemist.
1906. Cornwell, R. de Vere, Salisbury, Rhodesia, Chemist.
1889. Corrie, David, c/o Nobel's Explosives Co., Ltd., Polmont Station, N.B., Technical Chemist.
1903. Cortright, R. M., 20, South Centre Street, Bethlehem, Pa., U.S.A., Chemist.
1894. Coste, J. H., 40, Craven Street, W.C., and (Journals) 54, Alconbury Road, Upper Clapton, N.E., Analytical Chemist.
1891. Cotton, W. F., Hollywood, Dundrum, Co. Dublin, Gas Works Manager.
1906. Coupe, Miles, Rosebank, Thornfield Road, Waterfoot, near Manchester, Chemist.
1898. Coupe-Annable, H. W., c/o Tungsten and Rare Metals Co., Queen's Road, Battersea, S.W., Chemist.
1894. Court, Heywood, Staveley, Chesterfield, Analytical Chemist.
1898. Courtney, Samuel, 37, The Mount, Belfast, Ireland, Manager.

1894. Cousins, W. J., 17, Temple Chambers, Temple Avenue, E.C., Consulting Chemist and Director.

1903. Cowan, A. Wallace, c/o Redpath, Brown, & Co., Ltd., Riverside Works, East Greenwich, S.E., Analytical Chemist.

1906. Cowan, George D., Bridge House, Bridge Road, Millwall, E., Manager, Desilverising Works.

1893. Cowan, W. J., 12, Park Avenue, Wood Green, N., Fine Colour Manufacturer.

1897. Cowburn, Arthur W., 29, Princess Street, Manchester, Chemical Merchant and Analytical Chemist.

1907. Cowburn, J. Robert, Belmont Villa, Birkbeck Grove, Acton, W., Technical Chemist.

1904. Cowee, Harvey D., 161, River Street, Troy, N.Y., U.S.A., Chemist.

1905. Cowles, Horace W., jun., Box 225, Hinsdale, Du Page Co., Ill., U.S.A., Assistant Chemist.

1891. Cownley, A. J., 225, Barry Road, Dulwich, S.E., Analytical Chemist.

1891. Cowper-Coles, Sherard Osborn, Grosvenor Mansions, Victoria Street, Westminster, S.W., Metallurgical Engineer.

1905. Cox, Harold N., c/o Lalance & Grosjean Mfg. Co., Woodhaven, N.Y., U.S.A., Chemist.

1884. Craig, Geo., Chemical Laboratory, 95, Bath Street, Glasgow, Technical Chemist.

1895. Craig, Thos. J., c/o Peter Spence & Sons, Ltd., Alum Works, Manchester, Chemist.

1904. Cramer, A., jun., 882, East 29th Street, Paterson, N.J., U.S.A., Chemist.

1901. Crane, Fred. D., 28, Hillside Avenue, Montclair, N.J., U.S.A., Consulting Chemist.

1902. Crane, Jasper E., c/o The Arlington Co., Arlington, N.J., U.S.A., Chemist.

1898. Cranfield, Wm., 11, Avondale Place, Halifax, Yorks., Teacher of Chemistry.

1903. Cranmer, Ridgeway, 170, 88th Street, Bay Ridge, Brooklyn, N.Y., U.S.A., Chemist.

1902. Craven, Alfd. B., 20, Edinborough Road, Upper Armley, Leeds, Analytical Chemist.

1899. Craven, Jas, c/o Columbia Creosoting Co., Shirley, Ind., U.S.A., Chemist.

1906. Craven, J. A., 119, Town Street, Armley, Leeds, Chemist.

1891. Craven, Jno., jun., c/o Dominion Tar and Chemical Co., Ltd., Sydney, C.B., Canada, Chemist.

1906. Craven, John I., 141, Wilmer Road, Heaton, Bradford, Chemist and Salesman.

1885. Craw, John, 15, Cadogan Street, Glasgow, Drysalter.

O.M. Crawford, D., Langdale's Chemical Manure Co., Ltd., St. Lawrence, Newcastle-on-Tyne, Manager.

1890. Crawshaw, E., 25, Tollington Park, London, N., Dye Merchant.

O.M. Cresswell, C. G., Ermyngarth, Ashtead, Surrey; and 9, Bridge Street, Westminster, S.W., Chemist.

1901. Cribb, Cecil, 136, Shaftesbury Avenue, London, W., Analytical and Consulting Chemist.

1908. Crighton, Adam M., Wood Cottage, Middleton, Manchester, Calico Printer's Chemist.

1905. Crighton, W. H., c/o Ore Concentration Co., Ltd., Glebe Road, Kingsland Road, London, N.E., Chemist.

1890. Criper, Wm. R., c/o Messrs. D. Weldie and Co., Konnagar, near Calcutta, India, Manufacturing Chemist.

1902. Croasdale, Dr. Stuart, 1574, York Street, Denver, Colo., U.S.A., Mining Engineer and Metallurgist.

1908. Crombie, W. A. E., The United Cellulo Silk Spinners, Ltd., St. Nicholas Road, Great Yarmouth, Consulting Engineer.

1889. Cronquist, Prof. A. Werner, Storksund, Stockholm, Sweden, Inspector General of Explosives.

1901. Cronquist, G. W., Hyllinge, Grufva, Sweden, Fire Brick Works Manager.

O.M. Crookes, Sir Wm., F.R.S., 7, Kensington Park Gardens, Notting Hill, W., Analytical Chemist.

1896. Crosby, Thos., Llanelly Steelworks, Llanelly, South Wales, Metallurgist.

O.M. Crosfield, A. L., 46, Bidston Road, Oxton, Birkenhead, (Journals) c/o Prof. B. Moore, Biochemical Dept., The University, Liverpool, Analytical Chemist and Assayer.

1896. Crosfield, Capt. G. R., Volunteer Quarters, Sankey Street, Warrington, Soap Manufacturer.

1884. Cross, C. F., 4, New Court, Lincoln's Inn, London, W.C., Analytical Chemist.

1894. Crossley, Prof. Arthur W., Pharmaceutical Society, 17, Bloomsbury Square, London, W.C., Professor of Chemistry.

1904. Crossley, T. Linsey, c/o Nashua River Paper Co., East Pepperell, Mass., U.S.A., Analytical Chemist.

1892. Crossman, Tom, Albion Brewery, Coldhurst Street, Oldham, Brewing Chemist.

1894. Crow, Henry W., 94, Romford Road, Stratford, E., Tar Distiller.

1884. Crow, Dr. J. K., Ivydene, Westcombe Park Road, Blackheath, S.E., Technical Chemist.

1893. Crowther, Edw., Woodland Dyeworks, Headingley, Leeds, Dyer.

1883. Crowther, Horace W., The Beeches, West Bromwich, Technical Chemist.

1899. Crowther, J., Tenuta Etrusca Miniere, Campiglia Marittima, Toscana, Italy, Metallurgist.

1906. Crowther, R. E., c/o Mark Fletcher and Sons, Ltd., Moss Lane, Whitefield, Manchester, Chemist.

1884. Crowther, Walter M., Chemical Works, Gomersal, near Leeds, Manufacturing Chemist.

1884. Crumbie, W. D., 146, Washington Street, East Orange, N.J., U.S.A., Analytical Chemist.

1906. Cruser, Dr. Fred. Van D., c/o Union Metallic Cartridge Co., Bridgeport, Conn., U.S.A., Chemical Engineer.

1902. Crush, E. H., Talara, Peru, South America, Technical Chemist.

1892. Cullen, Wm., Dynamite Factory, Modderfontein, Transvaal, Chemist.

1903. Cullen, W. H., The Castner-Kellner Alkali Co., Ltd., Wallsend-on-Tyne, Engineer.

1897. Culmann, Dr. Julius, c/o G. Siegle und Co., 79, Duane Street, New York City, U.S.A., Chemist and Colourist.

1905. Culver, Ralph F., 108, Church Street, North Adams, Mass., U.S.A., Chemist.

1883. Cuming, James, jun., Chemical Works, Yarraville, Melbourne, Australia, Chemical and Fertiliser Manufacturer.

1905. Cuming, R. Burns, Currie Street, Adelaide, South Australia, Manufacturing Chemist.

1897. Cunliffe, Albert J., Claytonfield, Clayton-le-Woods, Chorley, Lancashire, Calico Printer.

1907. Cunningham, James E., Minas Peña del Hierro, Provincia de Huelva, Spain, Analytical Chemist.

1906. Cunnington, Alfred V., c/o Brunner, Mond and Co., Ltd., Northwich, Cheshire, Chemical Works Manager.

O.M. Curphey, W. S., 7, Derby Crescent, Kelvinside, Glasgow, Alkali Works Inspector.

1902. Currier, Edw. Eug., 74, Fremont Avenue, Everett, Mass., U.S.A., Chemist.

1898. Curtis, Marvin, 108, Front Street, San Francisco, Cal., U.S.A., Wine Chemist.

1903. Cushing, Robt. P., c/o Kistler, Lesh & Co., Lock Haven, Pa., U.S.A., Chemist.

1902. Cutbush, Chas. G., 149, Westcombe Hill, Blackheath, S.E., Electrical Engineer.

1899. Cutler, Fred. F., 183, Essex Street, Boston, Mass., U.S.A., Publisher.

1904. Cutts, Henry E., 55, Fulton Street, New York City, U.S.A., Technical Chemist.

D

O.M. Dacie, J. C., Soap Works, Putney, S.W., Soap Manufacturer.

1907. Daggett, Arthur P., c/o Magnus Mabee and Reynard, Chester, Conn., U.S.A., Manager, Essential Oil Works.

1907. Daggett, W. W., c/o New Jersey Zinc Co., 71, Broadway, New York City, U.S.A., Chemical Engineer.

1906. Dains, F. B., Washburn College, Topeka, Kas., U.S.A., Professor of Chemistry.

1897. Dains, Herbert H., c/o J. E. Ferguson, 2, Union Court, London, E.C., Analytical Chemist.

1905. Dalal, Vasanji Premji, Nepean Sea Road, Malabar Hill, Bombay, Lecturer on Chemistry.

1904. Dale, G., Waverley Terrace, Hood Lane, Warrington, Technical Chemist.

1908. Dale, H. Gordon, Belmore, New Barnet, Herts, Analytical Chemist.

1907. Dalley, Henry, 9, East 69th Street, New York City, U.S.A., President.

1905. Dampney, Gerald F., Hunter's Hill, Sydney, N.S.W., Australia, Paint Manufacturer.

1884. Daniell, Louis C., (Journals) Royal Standard Brewery, Tamworth, New South Wales; and (subs.) c/o W. T. Allen and Co., 132, Queen Victoria Street, London, E.C., Brewer.

1904. Danker, Dan. J., 247, Atlantic Avenue, Boston, Mass., U.S.A., Dyestuff and Chemical Manufacturer.

1905. Danker, Fred. E., 73, Sawyer Avenue, Dorchester, Mass., U.S.A., Salesman (Oakes Manufacturing Co.).

1903. Dannenbaum, Dr. H., c/o National Ammonia Co., Frankford, Philadelphia, Pa., U.S.A., Secretary and Treasurer.

1902. Danziger, Jos. L., 259, West 112th Street, New York City, U.S.A., Analytical Chemist.

1885. Darby, Jno. H., Brymbo Hall, near Wrexham, Ironmaster.

1894. Darling, G. A., P.O. Box 3720, Johannesburg, Transvaal, S.A., Metallurgical Chemist.

O.M. Darling, W. H., 26, Dover Street, Manchester, Analytical Chemist.

1887. Davenport, Dr. B. F., 161, Tremont Street, Boston, Mass., U.S.A., Consulting Chemist.

1900. Davidson, Alex., jun., 8, Traquair Park, Corstorphine, Midlothian, N.B., Analytical Chemist.

1899. Davidson, Charles, 328, Golfhill Drive, Dennistoun, Glasgow, Analytical Chemist.

1901. Davidson, G. M., Chicago and N.W. Railroad Shops, P.O. Station E., Chicago, Ill., U.S.A., Chemist.

1883. Davidson, J. E., 40, Percy Gardens, Tynemouth, Chemical Manufacturer.

1891. Davidson, Richard, 133, Victoria Road, Dundee, Oil Merchant's Clerk.

O.M. Davidson, R. Holden, c/o United Alkali Co., Ltd., Ammonia Soda Works, Fleetwood, Manager.

1904. Davidson, Robert, c/o Dalgety and Co., Ltd., 15, Bent Street, Sydney, N.S.W., Australia.

1905. Davidson, Thos. A., c/o Naylor Bros., Varnish Works, Southall, Middlesex, Chemist.

1905. Davidson, Dr. Wm. B., City Gas Works, Saltley, Birmingham, Chemist.

1889. Davies, G. W., 8, Spring Hill, Stockport, Chemical Lecturer.

1906. Davies, Harry R., 58, Hamilton Street, Readville, Mass., U.S.A., Chemist.

1898. Davies, Herbert E., The Laboratory, 28, Chapel Street, Liverpool, Analytical Chemist.

1907. Davies, James, 221, Malpas Road, Brockley, London, S.E., Scientific Apparatus Maker.

1896. Davies, Llewellyn J., 103, Bute Road, Cardiff, Analytical and Consulting Chemist.

1886. Davies, M. Lloyd, North American Chemical Co., Bay City, Mich., U.S.A., Alkali Works Manager.

1897. Davies, Saml. H., c/o Rowntree and Co., Ltd., Cocoa Works, York, Research Chemist.

1903. Davies, Thomas, 56, Wellesley Street, Toronto, Ont., Canada, Manufacturer.

O.M. Davis, A. R., Fern Bank, Hawarden, Flintshire, Analytical Chemist.

1901. Davis, Bernard F., c/o H. F. Collins, Cerro Muriano, Cordoba, Spain, Metallurgical Engineer.

1902. Davis, Charles B., c/o National Brewers' Academy, 402, West 23rd Street, New York City, U.S.A., Technical Chemist.

1902. Davis, Emerson, 30, Watson Street, Detroit, Mich., U.S.A., Chemist.

1893. Davis, Fred., 51, Imperial Buildings, Ludgate Circus, London, E.C., Consulting Chemist.

O.M. Davis, H. W., Government Laboratory, Clement's Inn Passage, Strand, W.C., Analytical Chemist.

1907. Davis, Robt. W., jun., c/o E. I. du Pont de Nemours Powder Co., Haskell, N.J., U.S.A., Chemist.

1906. Davis, V. P., c/o American Sheet and Tin Plate Co., Vandergrift, Pa., U.S.A., Chemist.

1897. Davis, Wm. A., 2, Ashgrove Road, Bromley Road, Catford, S.E., Chemist.

1905. Davison, Alex. Young, 219, Pleasant Street, Winthrop, Mass., U.S.A., Dyestuff and Chemical Merchant.

1900. Daw, Fred W., Duffryn House, Ebbw Vale, Mon., Metallurgical Chemist.

1908. Daw, Hilder, 790, City Hall Avenue, Montreal, P.Q., Canada, Civil Engineer.

1903. Dawes, Arthur W., 3, Madison Place, Albany, N.Y., U.S.A., Chemist.

O.M. Dawson, C. A., 40, Russell Road, Sefton Park, Liverpool, Technical Chemist.

1886. Dawson, W. Haywood, British Alizarin Co., Ltd., Silvertown, E., and (Journals), 187, Eglinton Road, Woolwich, S.E., Technical Chemist.

1901. Day, Dr. David T., U.S. Geological Survey, Washington, D.C., U.S.A., Geologist.

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O.M. Deakin, H. T., Dewhurst, Egerton, near Bolton, Dyer.

1903. Dean, Harry, 23, Spinkfield Road, Birkby, Huddersfield, Chemist.

1906. Dean, Harry, Armstrong College, Newcastle-on-Tyne, Demonstrator.

1899. Deane, Leopold M., c/o Lancashire Explosives Co., Withnell, near Chorley, Lancs., Explosives Chemist.

1905. Dearman, E., c/o The Lavers Manufacturing Co., Ltd., Woolwich, N.S.W., Australia, Tar Distiller.

1892. Deaville, B., Beech Avenue, Nottingham, Manufacturing Chemist.

1908. Deavitt, Henry M., 56, Fifth Avenue, Chicago, Ill., U.S.A., Analytical and Consulting Chemist.

1903. De Blois, W. H., c/o General Chemical Co., Hudson Heights, N.J., U.S.A., Chemist.

1899. De Castro, J. Paul, Laboratory, Effingham House, Arundel Street, Strand, W.C., Consulting Chemist and Assayer.

1902. De Cew, J. A., 14, Sun Life Building, Montreal, Canada, Chemist.

1893. De Clerck, Maurice, Heule-lez-Courtrai, Belgium.

1884. Deering, W. H., Chemical Department, Royal Arsenal, Woolwich, S.E., Analytical Chemist.

1900. Deerr, Noel, Experiment Station, Hawaian Sugar Planters' Association, Honolulu, H.I., U.S.A., Analytical Chemist.

1902. Deghuée, Dr. Jos. A., 247, Harrison Street, Brooklyn, N.Y., U.S.A., Chemist.

1901. De Jonge, Cornelius, 36, Doughty Street, Brooklyn, N.Y., U.S.A., Pharmaceutical Chemist.

1893. Delahaye, Philibert, 105, Rue St. Lazare, Paris (IX.), Gas Engineer.

1901. Delany, Chas., c/o Elliott Bros., Ltd., O'Connell Street, Sydney, N.S.W., Australia, Chemist.

1888. Dempsey, Geo. C., 165, Market Street, Lowell, Mass., U.S.A., Chemist.

1904. Dempwolf, Chas., jun., 713, South George Street, York, Pa., U.S.A., Chemical Manufacturer.

1907. Demuth, Rudolf, 200, Worth Street, New York City, U.S.A., Chemist.

1899. Denham, Wm. S., 2, Kelvinside Terrace North, Glasgow, Chemist.

1891. Denison, Joseph R., Lingholme, Heaton, Bradford, Yorks., Analytical Chemist.

1907. Dennison, Henry S., South Framingham, Mass., U.S.A., Manufacturer.

1898. Dent, Dr. Frankland, Government Analyst's Dept., Singapore, S.S., Government Analyst.

1905. Derby, Wallace G., c/o Nichols Copper Co., Laurel Hill, New York City, U.S.A., Assayer.

1901. Devas, Dr. Ernest W., Fairview, Halo Grove, Edgware, N.W., Technical Chemist.

1906. Deverell, Louis C., c/o Straits Trading Co., Ltd., Singapore, S.S., Chief Chemist.

1908. Dew, Joseph A., 8, New Fillebrook Road, Leytonstone, Essex, Varnish Manufacturer.

1898. Dewar, Alex. H., c/o The Linoleum Manufacturing Co., Staines, Middlesex, Chemist.

O.M. Dewar, Sir J., F.R.S., Royal Institution, Albemarle Street, W. (Journals); and 1, Scroope Terrace, Cambridge, Professor of Chemistry and Physics.

1889. Dewey, Fred. P., Lanier Heights, Washington, D.C., U.S.A., Metallurgist.

1904. Dewhirst, J. A., Borough Laboratory, Halifax, Yorks., Analyst.

1891. De Wilde, Prof. P., 1, Quai du Léman, Geneva, Switzerland, Professor of Chemistry.

1903. Diamond, Wm., c/o Simon-Carves, Ltd., Barrow Collieries, near Barnsley, Yorks., Works Manager.

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1897. Dick, Jno., c/o Jno. Dick, Ltd., 77, York Street, Toronto, Ont., Canada, Manufacturer.

1902. Dick, Jno., Wharf Road, Cubitt Town, London, E., Manager and Chemist.

1904. Dick, W. D., c/o Hugh Baird and Sons, 29, St. Vincent Place, Glasgow, Analytical Chemist.

1898. Dickenson, F. M., c/o Broken Hill Proprietary Co., 3, Great Winchester Street, London, E.C., Secretary.

1904. Dickenson-Gair, C. J., 55, Lyham Road, Brixton, S.W., Analytical Chemist.

1902. Dickerman, Prof. Judson C., 1110, Mound Street, Madison, Wis., U.S.A., Professor of Chemistry.

1893. Dickerson, E. N., 141, Broadway, New York City, U.S.A., Lawyer.

O.M. Dickinson, A. J., 57, Lewisham High Road, New Cross, S.E., Tar Distiller.

1905. Dickinson, Cyril, Abbotsford, Hollycroft Avenue, Hampstead, N.W., Analytical Chemist.

1898. Dickson, Samuel, 2, Broadway, Westminster, S.W., Analytical Chemist.

1899. Dieckmann, Dr. Otto, 1182, Harrison Avenue, Cincinnati, Ohio, U.S.A., Chemist.

1901. Diehl, Oscar C., c/o Saginaw Salt Co., St. Charles, Mich., U.S.A., Chemist.

1908. Diekman, Dr. George C., 115, West 68th Street, New York City, U.S.A., Professor of Pharmacy.

1907. Dielman, Louis H., 106, West Mulberry Street, Baltimore, Md., U.S.A., Pharmaceutical Chemist.

1894. Diestel, Wm., 66, Lafayette Street, New York City, U.S.A., Dyestuff Importer.

1906. Dillon, Fred N., 16, Prospect Street, Fitchburg, Mass., U.S.A., Engineer.

1898. Dillon, Wm., Highfield, Wetherby, Yorks, Oil, Colour, and Varnish Manufacturer.

O.M. Divers, Dr. E., F.R.S., 3, Canning Place, Palace Gate, Kensington, W., Professor of Chemistry.

1903. Divine, Robt. E., Chemist.

1899. Dixon, Fred W., 557, West 144th Street, New York City, U.S.A., Dyer.

1888. Dixon, Prof. Harold B., F.R.S., Owens College, Manchester, Professor of Chemistry.

1884. Dixon, Wm., 102, Spring Street, Bury, Lancashire, Science Master.

1902. Dixon, Wm. A., 97, Pitt Street, Sydney, N.S.W., Australia, Public Analyst and Assayer.

1892. Dobb, Thos., c/o J. T. Dobb & Son, West Bar, Sheffield, Pharmaceutical Chemist.

O.M. Dobbie, Dr. J. J., F.R.S., Royal Scottish Museum, Chambers Street, Edinburgh, Director.

1901. Dobbie, Jas., Laurel Bank, Broomfield Road, Ayr, N.B., Tanner.

O.M. Dobbin, Dr. L., Chemical Laboratory, University, Edinburgh, Professor of Chemistry.

1906. Dobson, Samuel, 22, Dangan Road, Cambridge Park, Wanstead, N.E., Paint Works Manager.

1907. Dodd, Arthur, Lyndhurst, Woolwich Road, Belvedere, Kent, Assistant Works Manager.

1890. Dodd, A. J., Heathfield House, Belvedere, Kent, Works Manager.

1889. Dodd, W. Ralph, Trederwen, Village Road, Enfield, Middlesex, Chemical Works Manager.

1906. Dodds, Thos., c/o Reckitt & Sons, Ltd., and (Journals) 3, Morrill Street, Holderness Road, Hull, Works Manager and Chemist.

1900. Dodge, Dr. Francis D., 291, Henry Street, Brooklyn, N.Y., U.S.A., Chemist.

1907. Dodge, Frank E., 7347, I Street, Fox Chase, Philadelphia, Pa., U.S.A., Chemist.

1906. Dodsworth, Walter A., Journal of Commerce, 32, Broadway, New York City, U.S.A., Editor.

1897. Doerflinger, Wm. F., c/o Moanad Color Co., 347-351, Classon Avenue, Brooklyn, N.Y., U.S.A., Research Chemist.

1897. Dohme, Dr. Alf. R. L., Messrs. Sharp and Dohme, Baltimore, Md., U.S.A., Manufacturing Chemist.

1905. Dolan, H., Dunesk, Grappenhall Road, Stockton Heath, Warrington, Chemist.

1897. Dolge, Carl B., Westport, Conn., U.S.A., Manufacturer of Instruments and Antiseptics.

1903. Donald, Dr. Jas. T., 112, St. François Xavier Street, Montreal, Canada, Consulting Chemist.

1906. Donald, Richard A., 16, King Street West, Toronto, Canada, Wood Distiller.

O.M. Donald, W., Saltcoats, N.B., Analytical Chemist.

1900. Donald, Wm., Ridgefield Park, Bergen Co., N.J., U.S.A., Assayer and Chemist.

1902. Donaldson, Thos., c/o South African Explosives Co., Ltd., Modderfontein, Transvaal, Chemist.

1905. Donnan, Prof. F. G., Physico-Chemical Laboratory, The University, Liverpool, Professor of Physical Chemistry.

1886. Doolittle, Orrin S., 476, Warburton Avenue, Yonkers, N.Y., U.S.A., Chemist.

1905. Doolittle, Roscoe E., 109, Hillside Avenue, Glen Ridge, N.J., U.S.A., Chemist.

1890. Dore, Jas., Copper Works, High Street, Bromley-by-Bow, E., Distiller's Engineer.

1896. Doremus, Dr. Chas. A., 55, West 53rd Street, New York City, U.S.A., Professor of Chemistry.

O.M. Dott, D. B., 10, Abbey Mount, Edinburgh, Analytical Chemist.

1906. Doty, Henry S., c/o Manhattan Rubber Manufacturing Co., Passaic, N.J., U.S.A., Chemist.

1897. Douglas, Geo., Heather Bank, Bingley, Yorks., Dyer.

1894. Douglas, Loudon M., 3, Lauder Road, Edinburgh, Chemical Manufacturer.

1884. Douglas, William, Diamond Plantation, Demerara, British Guiana, Chemical Engineer.

1900. Doulton, H. Lewis, Royal Doulton Potteries, Lambeth, S.E., Potter.

1900. Dow, Allan W., 24, East 21st Street, New York City, U.S.A., Chemical Engineer.

1898. Dow, Herbert H., Midland, Mich., U.S.A., Manufacturing Chemist.

1905. Dowbiggin, James, Craiglands, Albert Park, Lancaster, Chemist.

1907. Downing, Richard, jun., East Norwich, Long Island, N.Y., U.S.A.

1885. Dowson, J. Emerson, 39, Victoria Street, Westminster, S.W., Civil Engineer.

1901. Doxrûd, Christian, Technical School, Christiania, Norway, Professor of Chemical Technology.

1907. Doyle, B. W., 11, Pine Street, Leominster, Mass., U.S.A., Manufacturer.

1902. Drake, Bryant S., 1121, Eighth Avenue, Oakland, Cal., U.S.A., Chemist.

1885. Drake, Chas. A., Three Mills Distillery, Bromley-by-Bow, E., Brewer.

1886. Dreaper, W. P., 41, Quilter Road, Felixstowe, Suffolk, Technical Chemist.

1907. Dreverhoff, Max, Dresden, Saxony, Filter-paper Maker.

O.M. Drew, D., Lower House Print Works, near Burnley, Calico Printer.

1906. Drew, W. Newton, Raincliffe, Ecclesfield, near Sheffield, Chemical Manufacturer.
1896. Drewsen, Dr. Viggo B., 5, Beekman Street, New York City, U.S.A., Wood Pulp and Paper Expert.
O.M. Dreyfus, Dr. C., Clayton Aniline Co., Ltd., Clayton, Manchester, Dye Manufacturer.
1905. Dreyfus, Dr. Isaac, c/o Schoellkopf & Co., Perry and Mississippi Streets, Buffalo, N.Y., U.S.A., Chief Chemist.
1904. Dreyfus, Dr. L. A., c/o The Muralo Co., New Brighton, N.Y., U.S.A., Chemist.
1893. Dreyfus, S., 1, Sunnyside Terrace, North Road, Clayton, Manchester, Chemist.
1899. Dreyfus, Dr. Wm., 56, East 96th Street, New York City, U.S.A., Chemist.
1899. Drobegg, G., 81, Maiden Lane, New York City, U.S.A., Superintending Chemist.
1889. Drummond, Hon. Sir George, K.C.M.G., 448, Sherbrooke Street West, Montreal, Canada.
1898. Drummond, Dr. Isaac W., 436, West 22nd Street, New York City, U.S.A., Chemist.
1904. Dubois, Dr. Norman A., 22, Hawthorne Avenue, Yonkers, N.Y., U.S.A., Research Chemist.
1903. Dubuque, Edwin D., 400, Euclid Avenue, Elmira, N.Y., U.S.A., Chemist.
1899. Ducas, B. P., 151, Front Street, New York City, U.S.A., Chemical and Dyestuff Importer.
1907. Ducca, Dr. Wilhelm, c/o Dodge & Olcott Co., 69, Avenue A, Bayonne, N.J., U.S.A., Chemist.
1905. Duché, E., 6, Eastcheap, London, E.C., Merchant.
1897. Duckham, Alex., Phœnix Wharf, West Ferry Road, Millwall, E., Works Chemist.
1905. Duckworth, Harry S., Hamilton Printworks, Lowell, Mass., U.S.A., Printworks Chemist.
1890. Dudley, Dr. C. B., 1219, 12th Avenue, Altoona, Pa., U.S.A., Analytical Chemist.
1887. Dudley, Prof. W. L., Vanderbilt University, Nashville, Tenn., U.S.A., Professor of Chemistry.
1899. Duff, Wm. S., Sebert Villa, Bushwood, Leytonstone, Essex, Manufacturing Chemist.
1905. Duffus, W. B., Las Minas de Rio Tinto, Prov. de Huelva, Spain, Chemist.
1901. Dufty, Lawrence, 119, Rustlings Road, Sheffield, Analytical Chemist.
1905. Duggan, Edw. J., The Charles E. Sholes Co., 164, Front Street, New York City, U.S.A., Vice-President.
O.M. Duggan, T. R., 60, Foyle Road, Blackheath, S.E., Analytical Chemist.
1898. Duisberg, Dr. Carl, The Bayer Co., Ltd., (Journals) Elberfeld, Germany; (subscriptions) 19, St. Dunstan's Hill, E.C., Chemist.
1905. Dukes, Bernhard, 1, Great James Street, Bedford Row, London, W.C., Patent Agent.
1888. Dukes, T. William, Box 10, Vryheid, South Africa, Merchant.
1906. Duncalfe, Roger, Forge Mills, Bestwood Colliery, Nottingham, Glue Manufacturer.
1889. Duncan, Arthur W., 1, Trafalgar Road, Higher Benteliffe, Pendleton, Manchester, Analytical Chemist.
1904. Duncan, R. A., P.O. Box 509, Honolulu, Hawaii, Chemist.
1904. Duncan, Wm. Wheeler, 77, Brighton Avenue, Allston, Mass., U.S.A., Chemist.
1906. Dunford, Jno. H., Trent Side Bone Works, Nottingham, Assistant Manager.
1898. Dunham, Dr. E. K., Seal Harbour, Hancock Co., Maine, U.S.A., Professor of Bacteriology and Hygiene.
1905. Dunlop, Harry, c/o R. R. Tatlock & Thomson, 156, Bath Street, Glasgow, Chemist.
1892. Dunn, Fred., 193, Collins Street, Melbourne, Victoria, Australia, Analytical Chemist.
O.M. Dunn, Dr. J. T., 10, Dean Street, Newcastle-on-Tyne, Consulting Chemist.
O.M. Dunn, P., Northern Assurance Buildings, Albert Square, Manchester, Chemical Merchant.
1902. Dunning, David M., jun., Auburn, N.Y., U.S.A., Gas Engineer.
1901. Dunsford, Geo., Laboratory, Wigan Coal and Iron Co., Ltd., Wigan, Analytical Chemist.
1907. Dunstan, A. E., Technical College, East Ham, E., Head of Chemical Department.
1907. Dupré, F. H., 2, Edinburgh Mansions, Howick Place, S.W., Analytical Chemist.
1907. Dupré, P. V., 2, Edinburgh Mansions, Howick Place, S.W., Analytical Chemist.
1905. Durand, Halsey, Dept. of Health, 55th Street and 6th Avenue, New York City, U.S.A., Chemist.
1897. Durant, H. T., Metallurgist.
1905. Durfee, Winthrop C., 516, Atlantic Avenue, Boston, Mass., U.S.A., Manufacturing Chemist.
1897. Durkee, Frank W., Tuft's College, Medford, Mass., U.S.A., Professor of Chemistry.
1907. Durrans, Thos. H., 1, Cornwall Terrace, Regent's Park, London, N.W., Chemist.
1899. Duryea, Chester B., c/o Edwardsburg Starch Co., Cardinal, Ont., Canada, Starch Manufacturer.
1906. Dushman, Saul, School of Practical Science, Toronto, Canada, Electrochemist.
1891. Dvorkovitz, Dr. P., 45, St. Mary Axe, London, E.C., Technical Chemist.
1903. Dyck, George E., c/o Virginia Carolina Chemical Co., Station C., Memphis, Tenn., U.S.A., Analytical Chemist.
O.M. Dyer, Dr. B., 17, Great Tower Street, London, E.C., Analytical and Consulting Chemist.
1907. Dyes, Dr. W. A., 18, Exchange Street, Manchester, Seller of Patents and Processes.
O.M. Dyson, C. E., Flint, North Wales.
1902. Dyson, George W., 89, Cowlishaw Road, Sheffield, Analyst.
1892. Dyson, Septimus, Conishead Priory, near Ulverston, Lancs., Manufacturing Chemist.

E

1905. Eager, Chas. E., 77, Pearl Street, Boston, Mass., U.S.A., Merchant.
1904. Eames, Charles J., 99, Water Street, New York City, U.S.A., Consulting Chemist.
1899. Earnshaw, Edward H., 575, Broad Street, Newark, N.J., U.S.A., Chemist.
O.M. Earp, W. R., c/o Rowland A. Earp, Buckfastleigh, Devon, Chemical Manufacturer.
1902. Easterbrooks, Frank D., Raritan Copper Works, Perth Amboy, N.J., U.S.A., Chemist.
1884. Eastick, C. E., 7, King Edward Street, Whitechapel, E., Sugar Works Manager.
O.M. Eastick, J. J., 2, St. Dunstan's Hill, London, E.C., Analytical and Consulting Chemist.
1890. Eastlake, A. W., Grosmont, Palace Road, Streatham Hill, S.W., Petroleum Works Manager.
1891. Eastwick, Jos. H., 2216, North 51st Street, Philadelphia, Pa., U.S.A., Chemist.
1885. Eastwood, Edw., 7, Bolton Road, Port Sunlight, Birkenhead, Soapmaker.
1902. Eastwood, Robert F., 90, Peel House Lane, Widnes, Chemist.
1906. Eaton, B. J., Institute of Medical Research, Kuala Lumpur, Selangor, Fed. Malay States, Government Chemist.
1903. Eaton, Edward N., Room 1240, 334, Dearborn Street, Chicago, Ill., U.S.A., Chemist.
1902. Eckel, Edwin Clarence, U.S. Geological Survey, Washington, D.C., U.S.A., Geologist.
1907. Eckenstein, Thos. C., 101, Kingsley Road, Prince's Park, Liverpool, Analytical Chemist.
1892. Eddy, Harrison P., Sewage Purification Works, Worcester, Mass., U.S.A., Superintendent.
1901. Eddy, W. Clifton, corner of Glover and Penn Streets, Woodbury, N.J., U.S.A., Chemist.
1894. Ede, Henry E., 10, Violet Bank, Nether Edge, Sheffield, Chemist.

1885. Edge. Anthony, 79, Milton Street, Readville, Mass., U.S.A.. Chemist.

1900. Edgerley, Daniel W., Chilton Paint Co., 120, High Street, Boston, Mass., U.S.A., Chemist.

1902. Edison, Thos. Alva, Edison Laboratory, Orange, N.J., U.S.A., Inventor and Manufacturer.

1908. Edmunds, Wm. T., Church Road, Burry Port, Carmarthenshire, Assayer.

1902. Edwards, H. Seaton, 19, Park Road, Port Sunlight, Cheshire, Analyst.

1906. Egleson, J. E., Capelton, Quebec, Canada, Chemist.

1895. Ehrenfeld, Prof. Chas. H., York Collegiate Institute, York, Pa., U.S.A., Professor of Chemistry.

1896. Ehrhardt, Ernest F., Badische Anilin und Soda Fabrik, Ludwigshafen a/Rhein, Germany, Research Chemist.

1895. Ekenberg, Dr. M., Fairlawn, Clarence Road, Clapham Park, S.W., Technical Chemist.

1885. Elborough, T., 59, Mark Lane, London, E.C., Manure Manufacturer.

1901. Elkan, Leo A., 594, Dearborn Avenue, Chicago, Ill., U.S.A., Tanner.

1901. Elkins, Arthur W., 520, Park Avenue, East Orange, N.J., U.S.A., Civil Engineer.

1884. Elliott, Dr. A. H., Consolidated Gas Co., 4, Irving Place, New York City, U.S.A., Chemist.

1907. Elliott, George K., c/o Lunkenheimer Co., Cincinnati, Ohio, U.S.A., Chief Chemist.

1896. Elliott, Dr. J. F., c/o Grimwade and Co., 6, Trinity Square, E.C.; and (Journals), O'Connell Street, Sydney, N.S.W., Manufacturing Chemist.

1902. Elliott, Victor G., Chemical Works, Rozelle, Sydney, N.S.W., Australia, Manufacturing Chemist.

1906. Ellis, Arthur E., 317, West 56th Street, New York City, U.S.A., Chemist.

1905. Ellis, Carleton, Hommock Road, Larchmont, N.Y., U.S.A., Chemical Engineer.

1903. Ellis, Chas. E., Iowa State College, Ames, Iowa, U.S.A., Agricultural Chemist.

1885. Ellis, C. J., Almorah Villa, Milngavie, near Glasgow, Technical Chemist.

1893. Ellis, E. Victor, 7, Hillside Crescent, Edinburgh, Analytical Chemist.

1894. Ellis, G. Beloe, 70, Chancery Lane, London, W.C., Patent Agent.

O.M. Ellis, H., 120, Regent Road, Leicester, Chemical Merchant.

1907. Ellis, Theodore H., 641, Calvert Building, Baltimore, Md., U.S.A., Oil Refiner.

1891. Ellis, Prof. W. Hodgson, 74, St. Alban Street, Toronto, Ont., Canada, Professor of Applied Chemistry.

1891. Ellison, Henry, Northfield, Cleckheaton, Yorks., Manufacturing Chemist.

O.M. Elmore, A. S., 4, Broad Street Place, London, E.C., Electro-Metallurgist.

1907. Elms, Jas. W., c/o E. I. du Pont de Nemours Powder Co., Haskell, N.J., U.S.A., Chemist.

1907. Elsden, A. Vincent, 88, Elliscombe Road, Charlton, S.E., Analytical Chemist.

1904. Elson, J. Hugh, Monroe Drug Co., Quincy, Ill., U.S.A., General Manager.

1902. Emery, Arthur L., c/o Smith, Emery and Co., 651, Howard Street, San Francisco, Cal., U.S.A., Chemical Engineer.

1899. Emery, E. G., Pinole, Contra Costa Co., Cal., U.S.A., Technical Chemist and Engineer.

1907. Emmons, Frank W., c/o Washburn Crosby Co., Minneapolis, Minn., U.S.A., Chemist.

1907. Emrich, Horace H., Perth Amboy Plant, Am. S. and R. Co., Mauser, N.J., U.S.A., Mining Engineer.

1907. Emslie, B. Leslie, 1102-1105, Temple Building, Toronto, Canada, Agricultural Chemist.

1897. Enequist, Erik W., 1651, New York Avenue, Brooklyn, N.Y., U.S.A., Chemist.

1894. Enequist. John, 3710, Avenue J., Brooklyn, N.Y., U.S.A., Chemical Engineer.

1904. Englehard, Charles, 41, Cortlandt Street, New York City, U.S.A., Platinum Importer.

1895. English, Frank H., 47, Shelley Avenue, East Ham, E., Analytical Chemist.

1899. Enright, Bernard, c/o St. Louis Portland Cement Co., St. Louis, Mo., U.S.A., Chemist.

1906. Ephraim, Dr. Julius, Königgraetzerstrasse 69, Berlin, S.W., 11, Germany, Chemist and Patent Agent.

1904. Erdmann, Prof. Dr. H., Bismarck Strasse 11$^{\text{II.}}$, Charlottenburg, Berlin, Professor of Inorganic Chemistry.

1907. Erdocs, Julius, 242, East 122nd Street, New York City, U.S.A., Chemical Engineer.

1902. Erhart, Wm. H., 81, Maiden Lane, New York City, U.S.A., Manufacturing Chemist.

1907. Ericsson, A. D., Grafton, Ill., U.S.A., Chemist.

1904. Ermen, Walter F. A., 10, Marsden Street, Manchester, Analytical Chemist.

1905. Ernst, C. A., Lansdowne, Pa., U.S.A., Chemist.

1888. Erskine, J. K., P.O. Box 88, Benoni, Transvaal, Analytical Chemist.

1897. Escher, Paul, c/o Smith, Emery and Co., 1068, Broadway, Oakland, Cal., U.S.A., Chemist.

1884. Esilman, A., 25, Roe Lane, Southport, Lancashire, Analytical Chemist.

O.M. Estcourt, C., 5, Seymour Grove, Old Trafford, Manchester, Consulting Chemist.

1905. Etheridge, Arthur T., Reid's Villa, Stevenston, Ayrshire, N.B., Chemist.

1903. Euler, C. G., 18–20, Platt Street, New York City, U.S.A., Agent for Essential Oils.

1883. Evans, Enoch, 660, Coventry Road, Birmingham, Accountant.

1898. Evans, Ernest D., The Western Tanning Co., Bedminster, Bristol, Tanner.

1903. Evans, F. Sparke, Avonside Tannery, Bristol, Tanner.

1905. Evans, Geo. A., 832, Yonge Street, Toronto, Canada, Pharmacist.

1905. Evans, Jacob V. R., Ridgway, Pa., U.S.A., Chemist.

1904. Evans, James Rittenhouse, 19, High Street, Pottstown, Pa., U.S.A., Chemist.

1883. Evans, Sir John, K.C.B., F.R.S., Britwell, Berkhamsted, Herts, Paper Maker.

1905. Evans, John, 67, Surrey Street, Sheffield, Analytical Chemist.

1889. Evans, R. E., 3, Glencoe, Stratford-on-Avon, Brewing Chemist.

1903. Evans, Wm. J., 91, Fulton Street, New York City, U.S.A., Manufacturing Chemist.

1898. Evans, Wm. Perceval, Canterbury College, Christchurch, New Zealand, Professor of Chemistry.

1904. Everitt, Walter, Norwood Wharf, Southall, Middlesex, Analyst.

O.M. Evershed, F., c/o Clarke, Nickolls and Coombs, Hackney Wick, N.E., Chemist.

1907. Eves, Archie P., 762, East Buchtel Avenue, Akron, Ohio, U.S.A., Chemist.

1894. Ewan, Dr. Thos., c/o Cassel Cyanide Co., Shuna Street, Maryhill, Glasgow, Chemist.

1904. Ewing, Dr. A. Ramsay, 1, Alton Gardens, Hillhead, Glasgow, Technical Chemist.

1892. Exley, Arthur, Braemore, Vesper Road, Kirkstall, Leeds, Tanner.

1905. Eynon, Lewis, 57, Darenth Road, Stamford Hill, N., Chief Chemist (London Beetroot Sugar Association).

F

1898. Fadé, Louis, c/o Dr. F. Stockhausen, Weissfrauenstrasse 7-9, Frankfort a/M., Germany, Chemist and Director.

O.M. Fahlberg, Dr. C., Nassau a/Lahn, Germany, Manufacturing Chemist.

1902. Fahrig, Dr. Ernst., 3642, Old York Road, Philadelphia, Pa., U.S.A., Consulting Chemical Engineer.

1902. Faill, Jas., 51, Partickhill Road, Glasgow, Technical Chemist.

1902. Fairchild, Benj. T., P.O. Box 1120, New York City, U.S.A., Manufacturing Chemist.

1905. Fairchild, Jno. G., 150, Rodney Street, Brooklyn, N.Y., U.S.A., Chemist.

1903. Fairhall, E. J., c/o A. Boake, Roberts & Co., Ltd., 4, Rue Lamartine, Lille (Nord), France, Chemist.

O.M. Fairley, T., 17, East Parade, and (Communications) 8, Newton Grove, Leeds, Analytical Chemist.

1901. Fairlie, Jas., Camelon Chemical Works, Falkirk, N.B., Manufacturing Chemist.

1894. Fairweather, Wallace, 62, St. Vincent Street, Glasgow, Patent Agent.

1902. Fairweather, Wallace C., 65–66, Chancery Lane, W.C., Engineer.

1898. Falding, F. J., 55, Broadway, New York City, U.S.A., Chemical Engineer.

1897. Farmer, John E., Bletsoe, New Road, Mitcham Junction, Surrey, Assistant Manager (Sewage Works).

O.M. Farrant, N., c/o J. Nicholson and Sons, Chemical Works, Hunslet, Leeds, Chemist.

1897. Farrell, Frank J., 44, Prince of Wales Mansions, Battersea Park, S.W., Analytical Chemist.

O.M. Farrington, T., 5, Summerhill Terrace, Cork, Ireland, Chemical Engineer.

1902. Fasnacht, E. A., The Hollies, Clayton Bridge, Manchester, Technical Chemist.

1884. Fawsitt, C. A., Atlas Chemical Works, East Nelson Street, Glasgow, Chemical Manufacturer.

1903. Fawsitt, Dr. Chas. E., 9, Foremount Terrace, Glasgow, Assistant in Chemistry.

1906. Feeley, Edward J., 88, Broad Street, Boston, Mass., U.S.A., Aniline Colour Dealer.

1903. Feilmann, Dr. M. E., 92, Victoria Street, Westminster, S.W., Chemist.

1892. Feld, Walther, Hauptstrasse 14, Zehlendorf-Wannseebahn, Germany, Chemical Works Director.

1905. Felton, Herbert L., 524, East Second Street, South Boston, Mass., U.S.A., Distiller.

1899. Ferguson, Geo., Gleniffer Soap Works, Paisley, N.B., Soap Manufacturer.

1900. Ferguson, Geo. A., 121, West 42nd Street, New York City, U.S.A., Professor of Analytical Chemistry.

O.M. Ferguson, Prof. J., The University, Glasgow, Professor of Chemistry.

1896. Ferguson, J. Hart, Loch Katrine Distillery, Camlachie, Glasgow, Distillery Manager.

1907. Ferguson, Wm., 34, St. Peter Street, Montreal, Canada, Chemical Agent.

1902. Fergusson, Donald M., c/o Acadia Sugar Refining Co., Halifax, N.S., Canada, Analytical Chemist.

1883. Fergusson, H., Prince Regent's Wharf, Victoria Docks, E., Technical Chemist.

1908. Fernbach, Dr. R. Livingston, 26, Broad Street, Boston, Mass., U.S.A., Chemist.

1905. Fernberger, Harry M., 1939, North 12th Street, Philadelphia, Pa., U.S.A., Chemist.

1905. Fiebiger, Peter, 530, Canal Street, New York City, U.S.A., Colour Chemist.

1893. Fiebing, John H., 644, 28th Street, Milwaukee, Wis., U.S.A., Leather Trade Chemist.

1905. Field, Charles, III., 57, Waban Hill Road, Chestnut Hill, Mass., U.S.A., Research Chemist.

1885. Field, E. W., Cloud House, Sandiacre, near Nottingham, Brewer.

1907. Field, Jno. K., 25, Red Lion Street, London, W.C., Chemist.

1887. Field, S. S., 3, Glenluce Road, Blackheath, S.E., Manufacturing Chemist.

1891. Field, Wm. Eddington, Martin Street, Elsternwick, Melbourne, Victoria, Chemist.

1884. Filcock, P., Sunny Bank, Prestbury Road, Macclesfield, Analytical Chemist.

1900. Fillis, Frank, Brookland, London Road, Neath, South Wales, Cement Works Manager.

1907. Finch, Archibald M., Vitriol and Chemical Works, Cwmbran, R.S.O., Monmouthshire, Chemical Manufacturer.

1904. Finch, Martin L., Vitriol and Chemical Works, Cattedown, Plymouth, Chairman of Directors.

1907. Finch, Wm. J., c/o Dominion Tar and Chemical Co., Box 599, Sydney, N.S., Canada, Works Chemist.

1905. Findlay, Dr. Alex., The University, Birmingham, Lecturer on Physical Chemistry.

1899. Fingland, Jno. J., Sandon, B.C., Canada.

1899. Finley, Norval H., 7229, Hermitage Street, Belmar Station, Pittsburg, Pa., U.S.A., Chemist.

1904. Finn, Cornelius P., Pontefract Road, Castleford, Yorks, Technical Chemist.

1903. Fischer, Dr. Carl, 213–215, Water Street, New York City, U.S.A., Chemist.

1903. Fish, Chas. C. R., 10, Park Square, Boston, Mass., U.S.A., Chemist.

1905. Fish, Chas. H., Cocheco Manufacturing Co., Dover, N.H., U.S.A., Textile Manufacturer.

1900. Fisher, Henry, 57, East 83rd Street, New York City, U.S.A., Teacher of Chemistry.

O.M. Fisher, W. W., 5, St. Margaret's Road, Oxford, Chemical Lecturer.

1906. Fiske, Aug. H., 141, Milk Street, Boston, Mass., U.S.A., Chemist.

1895. Fison, Jno., Messrs. Jas. Fison and Sons, Thetford, Norfolk, Chemical Manufacturer.

1904. Fitch, A. J., 1, Summerlands Mansions, Muswell Hill, N., Brewer's Chemist.

1897. Fitzgerald, Francis A. J., Fitzgerald and Bennie Laboratories, P.O. Box 29, Niagara Falls, N.Y., U.S.A., Chemical Engineer.

1902. FitzGibbon, Thos., 115, Harbord Street, Fulham, S.W., Analytical Chemist.

1907. Fitzhardinge, R. B., Keba, Louisa Road, Balmain, Sydney, N.S.W., Analyst.

1900. Fitz-Randolph, R. B., State Laboratory of Hygiene, Trenton, N.J., U.S.A., Bacteriologist and Chemist.

1896. Flammer, E., c/o Kraemer und Flammer, Heilbronn a/N., Germany, Manufacturing Chemist.

1901. Flavelle, Jos. W., Toronto Technical School, College Street, Toronto, Canada, Chemist.

1892. Fleming, J. Arnold, Britannia Pottery, 136, Glebe Street, Glasgow, Potter.

1903. Fleming, Jno. A., 1757, Willard Street, N.W., Washington, D.C., U.S.A., Engineer.

O.M. Fletcher, A. E., Coombe Lea, Dorking, Surrey, Ex-Chief Inspector Alkali, &c., Works.

1893. Fletcher, E. Morley, 3, Woodhouse Cliff, Leeds, Alkali Works Inspector.

O.M. Fletcher, F. W., c/o Fletcher, Fletcher & Co., Ltd., Holloway, N., Manufacturing Chemist.

1907. Fletcher, Henry T., c/o Aluminium Corporation, Ltd., Wallsend-on-Tyne, Works Manager.

1891. Fletcher, R. Jaques, North Geelong, Victoria, Manufacturing Chemist.

1904. Fletcher, Wm. E., Box 83, Tamaqua, Pa., U.S.A., Chemist.

1899. Focht, Louis, 105, E. Hanover Street, Trenton, N.J., U.S.A., Civil Engineer.

1890. Foden, Alfred, 19, Lancaster Avenue, Sefton Park, Liverpool, Metallurgical Chemist.

1900. Foersterling, Dr. H., c/o Roessler Hasslacher Chem. Co., Perth Amboy, N.J., U.S.A., Chemist.

1900. Fogetti, Lucien, 702, Wilson Avenue, Chicago, Ill., U.S.A., Chemist.

1895. Fogg, Chas. A., Graythorne, Albert Road, Bolton-le-Moors, Lecturer on Chemistry.

1901. Folsom, Herbert A., 112, Water Street, Boston, Mass., U.S.A., Textile Chemist.

1900. Forbes, Eli, Clinton, Mass., U.S.A., Chemist.

1895. Forbes, Paul R., 15, William Street, New York City, U.S.A., Chemist and Assayer.

1893. Ford, J. B., jun., Michigan Alkali Co., Wyandotte, Mich., U.S.A., Secretary and Treasurer.

1889. Ford, Jno. S., Abbey Brewery, Edinburgh, Analyst.

1905. Foregger, Dr. R. von, c/o Roessler & Hasslacher Chemical Co., 100, William Street; and (Journals) P.O. Box 1999, New York City, U.S.A., Chemist.

1899. Forel, Geo., 212, Route de Vienne, Lyon (Rhône), France, Chemist.

1885. Formoy, J. Arthur, Oil Expert.
1904. Forrest, Chas. N., Maurer, N.J., U.S.A., Chemist.
1898. Forrest, J. Kerr, 271, Carlisle Street, St. Kilda, Victoria, Australia, Manufacturing Chemist.
1890. Forrester, A. M., c/o Richmond Guano Co., Richmond, Va., U.S.A., Analytical Chemist.
1905. Forrester, H. A., Usina de Gas, Retiro, Buenos Ayres, S. America, Chemical Works Manager.
1902. Forstall, Alf. E., 58, William Street, New York City, U.S.A., Consulting Gas Engineer.
1901. Forster, Miss E. L. B., King's College, Strand, London, W.C., Analyst.
1902. Forster, Ferdinand E. P., c/o Messrs. Bass and Co., 19, Guild Street, Burton-on-Trent, Chemist.
1907. Forster, Francis, Tyne Lead Works, Hebburn-on-Tyne, Lead Manufacturer.
1899. Forster, Dr. M. O., F.R.S., Royal College of Science, South Kensington, S.W., Demonstrator of Chemistry.
1884. Forster, Ralph C., c/o Messrs. Bessler, Waechter, and Co., 18 and 19, Fenchurch Street, London, E.C., Chemical Merchant.
1884. Forth, Henry, Meadowcroft, Marple, Cheshire, Drysalter.
1907. Forward, Charles C., Iroquois, Ontario, Canada, Chemist.
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1903. Fotheringham, John, Lochaber, Lake Takapuna, Auckland, New Zealand, Chemist.
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1907. Fowler, Chas., Liversedge Vicarage, Yorks., Colour Makers' Representative.
1891. Fowler, Dr. Gilbert J., Broad Oak, Urmston, near Manchester, Consulting Chemist (Manchester Corporation Rivers Committee).
1898. Fowler, Theo. V., P.O. Box 168, Buffalo, N.Y., U.S.A., Chemical Works Manager.
1896. Fox, A. Stanley, Rosehurst, Athelstan Road, Faversham, Kent., Chemist (Cotton Powder Co., Ltd.).
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1905. France, Edward W., Philadelphia Textile School, Broad and Pine Streets, Philadelphia, Pa., U.S.A., Director.
1899. Franchot, Stanislaus P., c/o National Electrolytic Co., Niagara Falls, N.Y., U.S.A., Chemist.
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1904. Frankl, A., Clotilde Chemical Works, Nagy Bocskó, Hungary, Chief Manager.
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1900. French, Thos., 1, Kelvinside Terrace West, Glasgow, Chemist.
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1898. Frith, J. Mason, Linden Lodge, Runcorn, Cheshire, Lime Burner.
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1899. Fuller, W. M., c/o Morris and Griffin, Maindee, Newport, Mon., Chemical Manufacturer.
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1890. Gajjar, T. K., Techno-chemical Laboratory, Girgaum, Bombay, India. Consulting Chemist.
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1901. Gansser, Dr. A., c/o Messrs. Lepetit, Dollfus & Gansser, Garessio-Ponte (Provincia di Cuneo), Italy, Chemical Engineer.
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1900. Garrigues, W. E., Foot of Lieb Street, Detroit, Mich., U.S.A., Chemical Engineer.
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1895. Gate, Tom Erskine, (Journals) The Santubong Cutch and Tanning Extract Co., Ltd., Santubong, Sarawak, Borneo, and (subscriptions) Calder House, Dewsbury, Yorks., Manufacturing Chemist.
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1883. Gibbs, D. Cecil, Soap Manufacturer.
O.M. Gibbs, Wm. P., Cyanamidfabriken, Odda, Hardanger, Norway, Analytical Chemist.
1893. Gibbs, W. T., Buckingham, Prov. Quebec, Canada, Manufacturing Chemist.
O.M. Gibson, Dr. J., 20, George Square, Edinburgh, Chemical Lecturer.
O.M. Gibson, J. M., c/o Buckley Brick and Tile Co., Buckley, *via* Chester, Brick and Tile Manufacturer.
1905. Gibson, John, Victorian Portland Cement Works, Burnley Street North, Richmond, Vic., Australia, Manager.
1906. Gibson, Robt. R., Boise, Idaho, U.S.A., Chemist.
1905. Gibson, Wm. F., 60, The Terrace, Gravesend, Kent, Works Chemist.
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1899. Gifford, Wm. E., 408, New Jersey Railroad Avenue, Newark, N.J., U.S.A., Chemist.
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1884. Gilchrist, Peter S., Charlotte, N.C., U.S.A., Chemical Engineer.
1900. Gildersleeve, W. H., Middlesboro', Ky., U.S.A., Chemist.
O.M. Giles, W. B., The Grange, Leyton, Essex, Chemical Manufacturer.
1886. Gill, Dr. Aug. H., Massachusetts Institute of Technology, Boston, Mass, U.S.A., Assoc. Professor of Technical Analysis.
1901. Gill, Wm. S., c/o Farquhar and Gill, North of Scotland Colour Works, Aberdeen, Colour and Varnish Manufacturer.
1903. Gillean, R. Hampson, c/o General Chemical Co., Bayonne, N.J., U.S.A., Chemist.
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1906. Gillies, Donald B., Tonopah, Nevada, U.S.A., Mining Engineer.
1888. Gillman, Gustave, Ferrocarril de Murcia á Granada, Aguilas, Prov. de Murcia, Spain, Civil Engineer.
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1889. Glaser, Chas., 22, South Gay Street, Baltimore, Md., U.S.A., Consulting Chemist.
1906. Glass, A. Melville, 37, Chancery Lane, London, W.C., Patent Agent.
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1900. Glendenning, Arthur, 31, Bright Street, Middlesbrough, Analytical Chemist.
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1894. Greaves, Wm., Powell-Duffryn Co., Ltd., Bye Product Works, Bargoed, near Cardiff, South Wales, Chemical Engineer and Chemist.
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1890. Griffin, Jno. R., Kemble Street, Kingsway, W.C., Chemical Apparatus Maker.
1886. Griffin, Martin L., Mechanicville, Saratoga Co., N.Y., U.S.A., Consulting Chemist.
1902. Griffiths, Manfred E., 4, Temple Road, Stowmarket, Suffolk, Explosives Chemist.
1894. Griffiths, Thos., The Cedars, Clapham Common, S.W., Manufacturing Chemist.
1902. Grimwade, Wilfrid R., 335—343, Spencer Street, West Melbourne, Vic., Australia, Manufacturing Chemist.
1900. Grimwood, Robt. G., 43, Leaside Avenue, Muswell Hill, N., Analytical Chemist.
O.M. Grindley, J., Upper North Street, Poplar, London, E., Tar Distiller.
1905. Grip, August E., 495, Columbia Street, Brooklyn, N.Y., U.S.A., Chemical Engineer.
1888. Gripper, Harold, Great Central Railway, Gorton, Manchester, Analytical Chemist.
1906. Groenewoude, Sidney H., 36, Grosvenor Road, Highbury, N., Analytical Chemist.
1897. Gronemeyer, Herman H., 1887, East 93rd Street, Cleveland, Ohio, U.S.A., Chemical Superintendent.
O.M. Grossmann, Dr. J., Northern Assurance Buildings, Albert Square, Manchester, Consulting Chemist and Chemical Engineer.
1896. Grosvenor, W. M., jun., 1123, Broadway, New York City, U.S.A., Consulting Chemical Engineer.
O.M. Groves, C. E., F.R.S., 352, Kennington Road, London, S.E., Chemist (Thames Conservancy).
1907. Groves, J. Stuart, 908, Adams Street, Wilmington, Del., U.S.A., Chemist.
1903. Grundy, F. Barnes, Victoria Mills, Bredbury, near Stockport, Technical Chemist.
1899. Gudemann, Dr. Edw., 903, Postal Telegraph Building, Chicago, Ill., U.S.A., Chemist.
1906. Guess, Geo. A., c/o Tennessee Copper Co., Copperhill, Tenn., U.S.A., Chemist.
1898. Guess, Harry A., c/o Federal Lead Co., Flat River, Mo., U.S.A., Chemist and Manager.
1899. Guest, Edw. Graham, 5, Newbattle Terrace, Edinburgh, Cereals Chemist.
1899. Guild, Frank N., University of Arizona, Tucson, Arizona, U.S.A., Professor of Chemistry.
1906. Gulline, Percy, Merrimack Manufacturing Co., Lowell, Mass., U.S.A., Printworks Superintendent.
1905. Gummere, W., 125, East Hanover Street, Trenton, N.J., U.S.A., Chemist.
1904. Gundlach, Walter, 370, St. Nicholas Avenue, New York City, U.S.A., Superintendent of Colour Works.
1905. Gundlich, Dr. Charles, c/o Thorium Chemical Co., Maywood, N.J., U.S.A., Technical Chemist.
1903. Gunn, Gilbert, 181, Bury New Road, Heywood, Lancs., Paper Mill Chemist.
1900. Günther, Chas. E., Liebig's Extract of Meat Co., Ltd., 4, Lloyd's Avenue, London, E.C., Merchant.
1902. Günther, Wm. J. W., c/o Colonial Sugar Refining Co., Ltd., 1, O'Connell Street, Sydney, N.S.W., Australia, Inspector.
1907. Gurgenianz, Dr. Gregor, Oilport, San Luis Obispo Co., Cal., U.S.A., Petroleum Refiner.
1894. Gurney, J. Clare, Fundicion de Plomo de D. Miguel Zapata, Portman, Prov. de Murcia, Spain, Analytical Chemist.
1899. Gutcher, Wm., Singapore Oil Mills, Singapore, S.S., Superintendent Engineer.
1903. Guthrie, Alan, c/o Cooper, Allen and Co., Cawnpore, India, Leather Chemist.
1903. Guthrie, Alex., Inglewood, Eaton Road, Coventry, Manager.
1901. Guthrie, John M., 199, Ferry Road, Leith, N.B., Analytical Chemist.
1903. Guttmann, Dr. Leo F., College of the City of New York, New York City, U.S.A., Research Chemist.
1892. Guttmann, Oscar, 60, Mark Lane, London, E.C., Consulting Chemical Engineer, M.Inst.C.E.
1904. Gyr, Dr. K. H., Zug, Switzerland, Analytical Chemist.

H

1902. Haas, Herbert, c/o Union Ironworks Co., 207, James Flood Building, San Francisco, Cal., U.S.A., Metallurgical Engineer.
O.M. Habirshaw, W. M., 341, Madison Avenue, New York City, U.S.A., Chemical Engineer.

1904. Hacking, D. H., c/o East Lancashire Soap Co., Ltd., Clayton-le-Moors, near Accrington, Lancs., Soap Manufacturer.
1883. Hacking, W. H., The Grange, Clayton-le-Moors, near Accrington.
1900. Haddock, Arthur G., 60, Highbury, Newcastle-on-Tyne, Technical Chemist.
1907. Haddock, Franklin, 27, Marion Street, West Lynn, Mass., U.S.A., Leather Manufacturer.
1898. Haddow, Geo., Parkview, Redding, Polmont Station, N.B., Chemist.
1887. Hadfield, R.A., Hecla Works, Sheffield ; 28, Hertford Street, Mayfair, London, W., and (Journals) Parkhead House, Sheffield, Steel Founder.
1884. Hadkinson, F., Pamphila Oil and Soap Works, Mitylene, Mediterranean, Oil Refiner and Soap Manufacturer.
O.M. Hadkinson, R., Smyrna, Asia Minor, Oil Refiner.
1904. Hadley, Geo., 58, Halesowen Street, Blackheath, Staffs., Spelter Works Manager.
1906. Haefele, J. E., 44, Randolph Avenue, East Rutherford, N.J., U.S.A., Chemist.
1902. Haff, Max M., Laboratory, 188, Metcalfe Street, Ottawa, Canada, Chemist.
1906. Hagen, Dr. Carl, 47, Victoria Street, London, S.W.
1887. Haig, Robert, Dollarfield, Dollar, N.B., Chemical Engineer.
1904. Haigh, B. Wilson, 4, York Street, Barnsley, Yorks., Chemical Engineer.
1896. Haigh, De Laguel, 33, Norwood Avenue, Summit, N.J., U.S.A., Chemist.
1888. Hailes, A. J. de, 15, Red Lion Square, London, W.C., Analytical Chemist.
1905. Haines, Harold W., 153, West 121st Street, New York City, U.S.A., Chemist.
1889. Haines, Reuben, Haines Street, near Chew Street, Germantown, Philadelphia, Pa., U.S.A., Analytical Chemist.
O.M. Hake, C. N., 423, Flinders Lane, Melbourne, Victoria, Australia, Inspector of Explosives.
1903. Halbert, Thos., c/o British South African Explosives Co., Modderfontein, Transvaal, Chemist.
1888. Hale, Edw. P., Endmoor, near Kendal, Analytical Chemist.
1903. Hale, Dr. Frank E., Mount Prospect Laboratory, Flatbush Avenue and Eastern Parkway, Brooklyn, N.Y., U.S.A., Chemist.
1887. Hall, Allan T., c/o Sissons Bros. and Co., Ltd., Hull, Oil Refiner and Varnish Manufacturer.
1905. Hall, Archibald A., Armstrong College, Newcastle-on-Tyne, Demonstrator in Chemistry.
1886. Hall, Archibald D., 7, Fenchurch Avenue, London, E.C., Analytical Chemist
1898. Hall, Clarence A., 216, Penna. Arcade Building, Philadelphia, Pa., U.S.A., Chemist.
O.M. Hall, Edgar, Silver Spur, Stanthorpe, Queensland, Australia, Technical Chemist.
1902. Hall, Henry, c/o Booth and Co., Irk Vale Works, Middleton, Lancashire, Dyer and Finisher.
1893. Hall, Jas. W., Bombay, Baroda and Central India Railway, Sabarmata, near Ahmedabad, India, Linseed Oil Mills Manager.
1885. Hall, Jno. A., Victoria Chemical Works, Victoria, British Columbia, Analytical Chemist.
1908. Hall, John S., Manor House, Overseal, Ashby-de-la-Zouch, Chemical Student.
1900. Hall, Jos. J., 810, Sixth Avenue East, Cedar Rapids, Iowa, U.S.A., Chemist.
1896. Hall, S. Godfrey, East London Soap Works, Bow, E., Soap Maker.
1886. Haller, Geo., Sussex House, 52, Leadenhall Street, London, E.C., Chemical Merchant.
1893. Haller, H. Loft, 26, Scale Lane, Hull, Analytical Chemist.
1895. Halliwell, Edw., c/o Ribble Joint Committee, 2, Stanley Place, Preston, Chief Inspector.
1900. Hallock, Dr. Albert P., 440, First Avenue, New York City, U.S.A., Chemist.
1892. Hamaguchi, Gihei, Hiro Mura, Arida Gori, Wakayama Ken, Japan, Soy Manufacturer.
1904. Hamblet, Abel Martin, c/o Oxford Paper Co., Rumford Falls, Maine, U.S.A., Chemist.
1897. Hambly, Fred. J., Buckingham, Quebec, Canada, Chemist.
1901. Hambuechen, Carl, c/o Aluminium Co. of America, East St. Louis, Ill., U.S.A., Electro-Chemist.
1904. Hamilton, E. H., 515, Victoria Avenue, Westmount, Montreal, Canada, General Superintendent.
1885. Hamilton, Oswald, Lancaster Cottage, Old Stratford, near Stony Stratford, Chemical Engineer.
1892. Hamilton, Robt., 40, Sefton Terrace, Beeston Hill, Leeds, Analytical Chemist.
1884. Hamilton, Robert, Glengarnock Chemical Co., Ltd., Glengarnock, N.B., Works Manager.
1898. Hammersley, W. Stanley, 5, Rue Scaffart, Soignies, Belgium, Tanner.
O.M. Hammill, M. J., The Gables, St. Helens, Alkali Manufacturer.
O.M. Hammond, J., Gas Works, Eastbourne, Sussex, Gas Manager.
1902. Hampson, B. A., Hampson's Collieries, Waschbank, Natal, S. Africa, Assayer.
1906. Hancock, H. Irving, Blue Point, N.Y., U.S.A., Chemist.
1905. Hancock, Thos. J., 29th Street and Bond Avenue, East St. Louis, Ill., U.S.A., Chemist.
1900. Hancock, Walter C., 10, Upper Chadwell Street, Myddelton Square, London, E.C., Chemist.
1896. Hand, Daniel, 30, Mount Pleasant Avenue, Newark, N.J., U.S.A., Chemist.
1889. Handy, Jas. O., 109, South Graham Street, Pittsburg, Pa., U.S.A., Chemist.
1888. Hanks, Abbot A., 425, Washington Street, San Francisco, Cal., U.S.A., Assayer.
1901. Hanna, Charles E., P.O. Box 2572, Montreal, Canada, Secretary.
1899. Hanna, Dillinger C., 4262, Parkside Avenue, Philadelphia, Pa., U.S.A., Chemist and Superintendent.
1905. Hanna, W. W., 109, North Water Street, Philadelphia, Pa., U.S.A., Aniline Colour Manufacturer.
1905. Hanson, H. Norman, Field Head, Brighouse, Yorks., Research Assistant.
1908. Hanson, W. G., c/o United States Glue Co., Milwaukee, Wis., U.S.A.
1905. Harcourt, Prof. R., Ontario Agricultural College, Guelph, Ont., Canada, Professor of Chemistry.
1904. Hard, Dr. James M. B., 2A, del Canadá, Colonia de Sta. Julia, Mexico, D.F., Chemist and Pathologist.
1901. Hardcastle, G. Fred., 29, Normanton Road, Leicester, Teacher of Science and Technology.
1894. Harden, Dr. Arthur, 2, Marlborough Road, Richmond, Surrey, Lecturer in Chemistry.
1900. Hardwick, W. Roscoe, 13, Batavia Buildings, Hackins Hey, Liverpool, Chemist.
1905. Hardy, Chas. H., c/o Reckitt & Sons, Ltd., Hull, Chemist.
1902. Hardy, G. D., P.O. Box 33, Cobalt, Ont., Canada, Metallurgist.
1907. Harfeld, Louis E., 10, Elsworthy Terrace, London, N.W., Merchant.
1906. Hargreaves, Frank, c/o The Electrolytic Alkali Co., Ltd., Middlewich, Cheshire, Chemist.
1896. Hargreaves, Jas., May Villa, Peel House Lane, Widnes, Lancashire, Chemical Engineer.
O.M. Hargreaves, Jno., Widnes, Alkali Manufacturer.
1904. Harker, Dr. George, 35, Boulevarde, Petersham, Sydney, N.S.W., Australia, Chemist.
O.M. Harland, R. H., Plough Court, 37, Lombard Street, London, E.C., Consulting Chemist.
1904. Harley, B., Braeside, Camelon Road, Falkirk, N.B., Analytical Chemist.
1893. Harlock, E. B., Newton House, Middlewich, Chemical Manufacturer.
1898. Harman, Edw. A., Gas Works, Huddersfield, Gas Engineer, M.Inst.C.E.
1905. Harper, Dr. Henry W., University of Texas, 2208, San Antonio Street, Austin, Texas, U.S.A., Professor of Chemistry.
1905. Harrington, John H., 139, High Street, Perth Amboy, N.J., U.S.A., Chemist.

O.M. Harrington, W. B., Leeview, Montenotte, Cork, Ireland, Chemical Manufacturer.
1893. Harris, Arthur, 22, Marsh Gate Lane, Stratford, E., Soap Maker.
1885. Harris, Booth, jun., Beeleigh, Victoria Road, Buckhurst Hill, Essex, Soap Maker.
O.M. Harris, David, F.R.S.E., Lyncombe Rise, Prior Park Road, Bath, Chemical Manufacturer.
1897. Harris, Fred. W., Corporation Chemical Department, 26, John Street, Glasgow, Public Analyst.
1907. Harris, John B., Danforth Avenue, Toronto, Canada, Manufacturer of Glues and Fertilisers.
1906. Harris, Jonathan W., 259, South Clinton Street, Chicago, Ill., U.S.A., Chemist.
1900. Harris, L. A., 18, North 18th Street, East Orange, N.J., U.S.A., Chemist.
1907. Harris, Thos. E., c/o The Union Acid Co., 17, Cooper Street, Manchester, Chemical Merchant.
1906. Harris, Wm. G., jun.. 25, William Street, Toronto, Canada, Metallurgist.
O.M. Harrison, A., Thames Sugar Refinery, Silvertown, London, E., Sugar Works Chemist.
1905. Harrison, E. F., Langholm, Purley Oaks Road, South Croydon, Analytical Chemist.
1883. Harrison, G. Herbert, Hagley, Stourbridge, Chemist.
1904. Harrison, H. E., 1688, Buckingham Place, Chicago, Ill., U.S.A., Chemist.
1892. Harrison, Prof. John B., C.M.G., Government Laboratory, Georgetown, Demerara, British Guiana, Government Analyst.
1907. Harrison, W., Allencroft, Birkenshaw, Bradford, Yorks., Chemist.
1898. Harrison, Wm. H., Coimbatore, India, Agricultural Chemist (Government of Madras).
1896. Hart, Bertram, c/o Tennants and Co., Clayton, Manchester, Analyst.
1886. Hart, Bertram H., Rosslyn, High Street, Sidcup, Kent, Analytical Chemist.
O.M. Hart, Dr. E., Gayley Hall, Lafayette College, Easton, Pa., U.S.A., Professor of Chemistry.
1905. Hart, George Adam, Sewage Engineers' Office, Municipal Buildings, Leeds, Civil Engineer.
1890. Hart, H. W., 5, Cambridge Road, Ansdell, Lytham, Lancashire, Analytical Chemist.
1897. Hart, Wm. Beamont, Manchester Laboratory, 8, Exchange Street, Manchester, Consulting Chemist.
1883. Hartley, Joseph, 25, Richmond Grove East, Longsight, Manchester, Technical Chemist.
1889. Hartley, R. Kent, Springwood House, Middleton Junction, near Manchester, Chemical Works Manager.
O.M. Hartley, Prof. W. N., D.Sc., F.R.S., Royal College of Science, Dublin, Professor of Chemistry.
1897. Hartmann, Ernest E., c/o United Club, No. 4, Yokohama, Japan, Chemist.
1892. Hartridge, Jas. Hills, The Croft, Redington Road, Hampstead, N.W., Manufacturing Chemist.
1905. Hartshorne, Wm. D., 40, Pleasant Street; and (Journals) Arlington Mills, Methuen, Mass., U.S.A., Agent.
1901. Hartwell, S. Warren, 119, West Walnut Lane, Germantown, Philadelphia, Pa., U.S.A., Chemist.
1901. Hartzell, Harry S., 126, North 4th Street, Allentown, Pa., U.S.A., Chemist.
1885. Harvey, Ernest W., Stoneleigh, Grove Road, Clapham Park, S.W., A.R.S.M., Engineer.
1891. Harvey, Sidney, South-Eastern Laboratory, Canterbury, Analytical Chemist.
1899. Harvey, Thos. F., 84, Henry Road, West Bridgford, Nottingham, Analyst (Drug Co.).
1883. Harvey, T. H., Cattedown, Plymouth, Chemical Manufacturer.
1903. Hasenclever, Max, Chemische Fabrik Rhenania, Aachen, Prussia, Chemical Manufacturer.
1906 Haskell, Walter F., 234, Bridge Street, Westbrook, Maine, U.S.A., Textile Chemist and Colourist.
1900. Haslwanter, Chas., 447, Spruce Street, Richmond Hill, Long Is., N.Y., U.S.A., Analytical Chemist.
1897. Hasslacher, Jacob, P.O. Box 1999, New York City, U.S.A., President, Roessler-Hasslacher Chemical Co.
1903. Hasting, J. J., c/o Louis Leavitt, North 11th Street and Driggs Avenue, Brooklyn, N.Y., U.S.A., Chemist.
1903. Hatschek, Emil, c/o S. Bornett and Co., Ltd., 19, St. Dunstan's Hill, London, E.C., Engineer.
1887. Hatton, Wm. P., c/o W. R. Hatton and Sons, Wormwood Scrubs, W., Starch Works Manager.
1906. Hattrick, J. M., 7, Bridge Street, Sydney, N.S.W., Australia, Local Manager (Potash Syndicate).
1900. Havens, Dr. F. S., 1434, Pine Street, Philadelphia, Pa., U.S.A., Silk Conditioner.
1906. Havercroft, Arthur E., 3, Carlton Terrace, Hornsea, Yorks, Chemist.
1899. Hawdon, H. S., Cleadon, near Sunderland, Manager.
1895. Hawker, E. W., Adelaide Club, Adelaide, South Australia, Metallurgist.
1902. Hawkins, Clement C., c/o The Chatfield Manufacturing Co., Carthage, Ohio, U.S.A., Chemist.
1897. Hawkins, Ernest M., Dog House Farm, Stone Street, Petham, Canterbury, Chemist.
1905. Hawkins, Henry, Moyola Villa, Lansdown, Limerick, Ireland, Gas Engineer.
1893. Hawkins, J. Dawson, c/o U. S. Reduction and Refining Co., Colorado Springs, Colo., U.S.A., President and General Manager.
1905. Hawley, Fred G., Capote Assay Office, La Cananea, Sonora, Mexico, Assayer and Chemist.
1887. Hawliczek, Josef, c/o United Alkali Co., Sullivan Works, Widnes, Consulting Chemical Expert.
1899. Haworth, Dr. Edw., Sunnyside, Norman Road, Runcorn, Cheshire, Chemist.
1903. Haworth, Herbert, Crown Works, Appley Bridge, near Wigan, Director (Grove Chemical Co.).
1904. Hawthorn, J. H., Municipal Technical School, Leicester, Head Master.
1895. Hay, Alex. B., Kelvindock Chemical Works, Maryhill, Glasgow, Manufacturing Chemist.
1898. Haycraft, Jos. H., St. Peter's, Adelaide, South Australia, Metallurgical Chemist.
1904. Hayman, Jack V. J., 6, York Road, Dartford, Kent, Chemist.
1894. Haynes, David O., 90, William Street, New York City, U.S.A., Proprietor, "Pharmaceutical Era."
1902. Hays, B. F., c/o E. R. Squibb and Sons, 80, Beekman Street, New York City, U.S.A., Chemist.
1906. Hayworth, W. P., 119, Clapton Common, London, N.E., Chemist.
1905. Hazard, Fred. R., P.O. Box 2, Syracuse, N.Y., U.S.A., President (Solvay Process Co.).
1903. Hazen, Chas. R., 258, Prince Albert Avenue, Westmount, Quebec, Canada, Chemist.
1894. Heal, Carlton, Dalston House, Dumfries, N.B., Tanner.
1903. Heald, Henry I., Hove House, Adwick Road, Mexborough, near Rotherham, Yorks, Manager of Earthenware Factory.
O.M. Heath, R. C., Myton Grange, near Warwick, Chemical Manufacturer.
1905. Heathcote, Henry L., Warwick Avenue, Earlsdon, Coventry, Research Chemist.
1904. Heaton, Noel, 20, Baker Road, Harlesden, N.W., Colour Manufacturer.
1895. Hebden, Jno. C., P.O. Box 824, Providence, R.I., U.S.A., Works Manager and Chemist.
1905. Heberlein, Dr. Edw., c/o H. T. Enthoven & Sons, Ltd., 247, Rotherhithe Street, London, S.E., Works Manager.
1889. Hecht, Jos. L., Bettendorf Metal Wheel Co., Davenport, Iowa, U.S.A., Analytical Chemist.
1900. Heckman, J. Conrad, Larkin Soap Manufacturing Co., Seneca Street, Buffalo, N.Y., U.S.A., Chemist.
1889. Heckmann, C., 9, Görlitzerufer, Berlin, S.O., Germany, Chemical Apparatus Maker.
1885. Hedley, Armorer, Durrant House, Bournemouth, Hants.
1895. Hedley, Geo. H., Hedge Mill, Loudwater, Bucks., Chemical Manufacturer.

1902. Heebner, Prof. Chas. F., Ontario College of Pharmacy, Toronto, Canada, Professor of Pharmaceutical Chemistry.

1903. Hegeman, John W., 102, Barbey Street, Brooklyn, N.Y., U.S.A., Chemist.

1906. Hehner, Charles, 155, Dunn Avenue, Parkdale, Toronto, Canada, Assistant Manager.

O.M. Hehner, Otto, 11, Billiter Square, London, E.C., Analytical and Consulting Chemist.

1902. Heike, Rudolph E., American Sugar Refining Co., P.O. Box L., Jersey City, N.J., U.S.A., Chemist.

1898. Heileman, W. H., U.S. Reclamation Service, Klamath Falls, Oregon, U.S.A., Expert Field Assistant.

1908. Heilmann, Dr. Ernst, Güstrow, Mecklenburg, Germany, Chemical Manufacturer.

1887. Hellier, E. A., Avonside Varnish Works, St. Philip's Marsh, Bristol, Varnish Manufacturer.

1885. Hellon, Dr. R., 40, New Lowther Street, Whitehaven, Analytical and Consulting Chemist.

1903. Helps, D. H., c/o Reading Gas Co., King's Road Works, Reading, Engineer and Manager.

1898. Hemingway, Frank C. R., 133, Front Street, New York City, U.S.A.

1883. Hemingway, H., 9, Albemarle Mansions, Hampstead, N.W., Chemical Manufacturer.

1884. Hempleman, F. S., 39, Brunswick Terrace, Hove, Sussex, Manure Manufacturer.

1903. Hemstreet, George P., Hastings-on-Hudson, N.Y., U.S.A., Mechanical Engineer.

1883. Henderson, Prof. G. G., The Technical College, George Street, Glasgow, Professor of Chemistry.

1902. Henderson, Prof. Jas. A. Russell, Chihli Provincial College, Paotingfu, North China, Professor of Chemistry and Physics.

1900. Henderson, J. Brownlie, Government Analyst's Office, Brisbane, Queensland, Government Analyst.

1902. Henderson, J. C. A., 120, Bishopsgate Street Within, London, E.C.

1894. Henderson, Jos., Eskbank Ironworks, Lithgow, N.S.W., Australia, Metallurgical Chemist.

1894. Henderson, Norman M., Broxburn Lodge, Broxburn, N.B., Oil Works Manager.

1906. Henderson, Thos., 14, Dey Street, New York City, U.S.A., Manufacturing Chemist.

O.M. Henderson, W. F., Moorfield, Claremont Gardens, Newcastle-on-Tyne.

1893. Hendrick, Jas., Marischal College, Aberdeen, Lecturer on Agricultural Chemistry.

1906. Henius, Dr. Max, 327, Fullerton Avenue, Chicago, Ill., U.S.A., Secretary, Brewers' School.

1904. Henley, F. R., 9, Beaufort Gardens, London, S.W., Brewer's Chemist.

1889. Hennin, Alphonse, Portoferrajo, Elba, Italy, Metallurgical Chemist.

1905. Henning, Albert, 92, Harrow Road, Leytonstone, N.E., Chemical Manufacturer.

1906. Henning, C. I. B., c/o E. I. du Pont de Nemours Powder Co., Haskell, N.J., U.S.A., Chemist.

1894. Henshaw, Sam., Glenthorne, Wolstanton, Stoke-on-Trent, Chemical Works Manager.

1906. Herig, Harry W., 35, Rose Avenue, Jersey City, N.J., U.S.A., Chemist.

1891. Heriot, T. H. P., 37, Church Crescent, Muswell Hill, N., and (Journals) Waterloo Estate, Trinidad, B.W.I., Analytical Chemist.

O.M. Herman, W. D., Holm Lea, Rainhill, Lancashire, Glass Works Chemist.

O.M. Heron, John, 110, Fenchurch Street, London, E.C., Brewing Chemist.

1903. Herreshoff, J. B. F., 40, West 69th Street, New York City, U.S.A., Chemical Engineer.

1899. Herrick, Rufus F., 16, Herrick Street, Winchester, Mass., U.S.A., Chemist.

1887. Herriot, Wm. Scott, Ravenswood, Partickhill, Glasgow, Mechanical Engineer.

O.M. Herrmann, R. W., 59, Mark Lane, London, E.C., Chemical Merchant.

1891. Hersam, Ernest A., University of California, Berkeley, Cal., U.S.A., Assistant Professor of Metallurgy.

1898. Hersey, Milton L., P.O. Box 554, Montreal, Canada, Consulting Chemist.

1901. Hershey, Aldus N., c/o Sharpe and Dohme, Baltimore, Md., U.S.A., Chemist.

1903. Herstein, Dr. Bernard, 9A, Trask Avenue, Bayonne, N.J., U.S.A., Technical Chemist.

1906. Herty, Prof. Chas. H., University of N. Carolina, Chapel Hill, N.C., U.S.A., Professor of Chemistry.

1906. Herz, Dr. Albert, Rosemount, Hipperholm, Halifax, Yorks, Chemist.

1885. Hess, Dr. Adolph, Kirkstall Road, Leeds, Chemical Manufacturer.

1907. Hess, Arthur F., c/o A. Hess & Bro., Ltd., Kirkstall Road, Leeds, Oil Distiller.

1904. Hess, H. W., c/o Libbey Glass Co., Toledo, Ohio, U.S.A., Chemist.

1905. Hesse, Dr. Bernhard C., 90, William Street, New York City, U.S.A., Chemist.

1891. Hetherington, Dr. Albert E., Ammonia Soda Works, Fleetwood, Lancashire, Analytical Chemist.

1904. Heurich, Christian, 1307, New Hampshire Avenue N.W., Washington, D.C., U.S.A., Brewer.

1894. Hewitt, A. H., The Green Island Cement Co., Ltd., Hong Kong, China, and (Journals) Spring Vale, near Gurnard, Isle of Wight, Engineer.

O.M. Hewitt, Dr. D. B., Grove Mount, Davenham, Cheshire, Alkali Manufacturer.

1903. Hewitt, H. R., 18, Meade Street, Longsight, Manchester, Chemical Works Manager.

1896. Hewitt, Dr. J. Theo., 7, The Avenue, Surbiton, Lecturer.

1890. Hewlett, John C., 40–42, Charlotte Street, Great Eastern Street, London, E.C., Manufacturing Chemist.

1907. Hewson, Geo. W., 22, Palmer Street, Jarrow-on-Tyne, Analytical Chemist.

1893. Hey, Harry, 2, Ash Terrace, Savile Town, Dewsbury, Dyer.

1905. Heymann, Dr. Fritz, (Journals) temporary, 53, Dorotheenstr., Berlin, N.W.; and 7, Elsworthy Terrace, Hampstead, N.W., Analytical Chemist.

1906. Heys, Charles H., 124, Yonge Street, Toronto, Canada, Consulting Chemist.

1884. Heys, W. E., Llanberis, Bushey Hall Road, Watford, Consulting Engineer.

1883. Heywood, J. H., 231, Drake Street, Rochdale, Technical Chemist.

1906. Hibbert, John C., 6, Victoria Road, West Bridgford, Nottingham, Chemist.

1901. Hiby, Dr. Walter, 4, Southampton Row, London, W.C., Chemical Engineer.

1906. Hicking, W. Norton, Queen's Road Works, Nottingham, Lace Dresser.

1906. Hickman, T. Moore, Holmdale, Penn Road, Wolverhampton, Analyst.

1897. Hicks, Edwin F., 4837, Fairmount Avenue, Philadelphia, Pa., U.S.A., Analytical Chemist.

1893. Hicks, Jas. A., c/o Sir Boverton Redwood, 4, Bishopsgate Street Within, London, E.C., Analytical Chemist.

O.M. Higgin, W. H., Hollywood, Lostock, near Bolton-le-Moors, Chemical Manufacturer.

1886. Higgins, C. L., 79, Bedford Street South, Liverpool, Manufacturing Chemist.

1905. Higgins, Eric, 5, Oak Terrace, Beech Street, Liverpool, E., Chemist.

1905. Higgins, John M., 39, Queen Street, Melbourne, Vic., Australia, Consulting Metallurgist.

1907. Hikida, Keitaro, 16, Alexandra Avenue, Battersea Park, S.W.

1904. Hildebrand, Charles C., Costello, Pa., U.S.A., Chemist.

1903. Hill, Chas. Alex., 64, Park Street, Southwark, S.E., Chemist.

1897. Hill, George, Barton-on-Humber, Chemical Works Manager.

1897. Hill, Dr. Herbert M., University of Buffalo, N.Y., U.S.A., Professor of Chemistry and Toxicology.

1907. Hill, James A., 70, York Street, Runcorn, Cheshire, Technical Chemist.

O.M. Hill, J. K., 13, Osborne Place, Copland Road, Govan, near Glasgow, Manufacturing Chemist.

1892. Hill, Sydney, Eastholme, Prince's Avenue, and (Journals) c/o Blundell, Spence & Co., Ltd., Hull, Analytical Chemist.

1903. Hill, W. Basil, Foss Islands Tannery, York, Tanner.

1902. Hill, Wm. G. H., jun., American Rubber Co., Cambridgeport, Mass., U.S.A., Chemist.

1898. Hill-Jones, Thos., Invicta Mills, Bow Common Lane, London, E., Manufacturing Chemist.

O.M. Hills, C. H., Anglesea Copper Works, Low Walker, Newcastle-on-Tyne, Copper Smelter.

1894. Hills, Harold F., Commercial Gas Works, Stepney, London, E., Analytical Chemist.

O.M. Hills, W., 225, Oxford Street, London, W., Pharmaceutical Chemist.

1899. Hinchley, J. W., 85, Gracechurch Street, London, E.C., Chemical Engineer.

1906. Hinckley, Everett H., Saylesville, R.I., U.S.A., Foreman.

1904. Hinckley, J. F., c/o Jones Bros., Pearl and Water Streets, Brooklyn, N.Y., U.S.A., Chemical Engineer.

O.M. Hindle, J. H., 8, Cobham Street, Accrington, Dyeworks Manager.

1899. Hinks, Percy J., Danger Building Dept., Royal Laboratory, Woolwich Arsenal, S.E., Chemist.

1891. Hinman, Bertrand C., 48, Sydenham Hill, Sydenham, S.E., Metallurgical Chemist.

1892. Hinshelwood, Thos., Glasgow Oil and Paint Works, Glenpark Street, Glasgow, Oil Refiner.

1905. Hiorns, A. H., Pennshurst, Florence Road, Erdington, near Birmingham, Science Teacher.

1900. Hirsh, Jos. E., 1245, 85th Street, Brooklyn, N.Y., U.S.A., Chemist.

1903. Hirshfield, E., c/o United Chemical Co., 52, Broadway, New York City, U.S.A., Chemist.

1895. Hirst, H. Reginald, Bank House, Staincliffe, Batley, Yorks., Works Chemist.

1907. Hirt, Wilhelm B., c/o Cuming, Smith & Co., Ltd., Yarra Junction, Vic., Australia, Analytical Chemist.

1907. Hirtz, Dr. Heinrich, c/o Dr. L. Mond, F.R.S., 18, Avenue Road, London, N.W., Chemist.

1896. Hislop, Geo. R., (Journals) Gas Works, (communications) Greenhill House, Underwood Road, Paisley, N.B., Gas Engineer and Manager.

1900. Hobbs, Alex. F., c/o The United States Finishing Co., Box A, North Station, Providence, R.I., U.S.A., Printworks Superintendent.

1900. Hobbs, Dr. Perry L., Western Reserve Medical College, Cleveland, Ohio, U.S.A., Professor of Chemistry.

1906. Hobsbaum, Isaac B., 79, Claremont Road, Forest Gate, E., Analytical Chemist.

1905. Hobson, Alfred, Dantzic Brewery, Imperial Street, Regent Street, Leeds, Brewer and Wine Manufacturer.

1904. Hochstetter, Henry, Ault and Wiborg Co., Cincinnati, Ohio, U.S.A., Chemist.

1907. Hochstetter, Robt. W., Oak and Bellevue Avenues, Mount Auburn, Cincinnati, Ohio, U.S.A., Superintendent.

1894. Hodge, Andrew, Dalmonach Works, Bonhill, Dumbartonshire, Printworks Chemist.

1890. Hodges, Harry B., Long Island Railroad Co., Long Island City, N.Y., U.S.A., Chemical Engineer.

O.M. Hodgkinson, Dr. W. R., 18, Glenluce Road, Blackheath, S.E., Professor of Chemistry.

O.M. Hodgson, Chris., 33, Oakdale Road, Nether Edge, Sheffield, Metallurgical Chemist.

1897. Hodgson, Matthew, Ardmore, Wicklow, Ireland, Technical Chemist.

1890. Hodgson, Wm., 66, Deansgate, Manchester, Oil and Colour Broker.

1903. Hoffmann, W. F., 23, Division Place, Newark, N.J., U.S.A., Chemical Merchant.

1908. Hofmann, Dr. Hans, Papierhaus, Dessauerstrasse 2, Berlin, S.W. 11., Germany, Chemist and Engineer.

1906. Hogarth, Julius W., The University, Sydney, N.S.W., Australia, Demonstrator of Chemistry.

1886. Hogben, W., 9, Duddingston Crescent, Portobello, Edinburgh, Chemist.

O.M. Hogg, T. W., c/o John Spencer and Sons, Newburn Steelworks, Newcastle-on-Tyne, Metallurgical Chemist.

1905. Holcroft, Harold, Parkdale, Wolverhampton, Ironfounder.

1899. Holden, Archie Neill, c/o Hardman and Holden, Ltd., Miles Platting, Manchester, Chemist.

1903. Holden, G. E., 23, Durnford Street, Middleton, near Manchester, Works Chemist.

1887. Holden, G. H., Manchester Oxide Co., Ltd., Canal Street, Miles Platting, Manchester, Chemist.

1904. Holden, Norman N., c/o Hardman and Holden, Ltd., Colliery Lane, Clayton, Manchester, Manufacturing Chemist.

1902. Holdsworth, Ernest T., 10, Merton Road, Bradford, Dyer.

1904. Holgate, Arthur, c/o Wm. Holgate and Sons, Ltd., 15, Earle Street, Liverpool, Corn Miller.

1885. Holgate, T. E., 173, Hollins Grove, Darwen, Lancashire, Metallurgist.

1884. Holgate, Thos., 5, Victoria Street, Westminster, S.W., Gas Engineer.

O.M. Holland, Philip, 22, Taviton Street, Gordon Square, London, W.C., Analytical Chemist.

1892. Holland, Philip H., 546, Sherbrooke Street West, Montreal, Canada. Merchant.

1901. Hollick, Herbert, 304, The Robeson, Camden, N.J., U.S.A., Chemical Engineer.

1902. Holliday, Lionel B., Lunnclough Hall, Huddersfield, Chemical Manufacturer.

1896. Hollings, J. Spencer, Vrondeg, near Wrexham, North Wales, Works Manager.

1903. Hollinshead, Peter, 19, The Hollow Way, Runcorn, Cheshire, Chemist.

1900. Hollinshead, Dr. W. H., Vanderbilt University, Nashville, Tenn., U.S.A., Teacher of Chemistry,

1904. Holloway, E. G., c/o Jas. S. Kirk and Co., Chicago, Ill., U.S.A., Chemist.

1890. Holloway, G. T., 57-58, Chancery Lane, London, W.C., Analytical and Consulting Chemist.

1883. Holmes, Ellwood, Wyncote, Jesmond Park East, Newcastle-on-Tyne, Colour Manufacturer.

O.M. Holmes, F. G., Northcroft, Tewitwell Road, Harrogate, Yorks., Technical Chemist.

1907. Holmes, Wm. E., c/o Turney Bros., Ltd., Nottingham, Chemist.

1900. Holthouse, Harold B., 12, Melton Grove, West Bridgford, Notts., Chemist.

1902. Holton, Alf. L., Chemical Dept., Gas Works, Bradford Road, Manchester, Chemist.

1892. Holton, E. C., 601, Canal Road N.W., Cleveland, Ohio, U.S.A., Chemist.

1893. Holzapfel, Max, Milburn House, Newcastle-on-Tyne, Manufacturer.

1893. Homfray, D., The Ings, Misterton, near Gainsborough. Analytical Chemist.

1905. Hook, Arthur Henry, c/o Nipissing Mining Co., Cobalt, Ont., Canada, Chemist.

1904. Hooker, A. H., c/o Heath and Milligan Manufacturing Co., 170, Randolph Street, Chicago, Ill., U.S.A., Manufacturing Chemist.

O.M. Hooper, E. Grant, 16, Royal Avenue, Sloane Square, S.W., Chemist.

1889. Hooper, Ernest F., Wear Fuel Works, Hendon Dock, Sunderland, Technical Chemist.

1888. Hope, Jas., Dean House, Lenzie, N.B., Nickel Works Manager.

1904. Hopewell, Fredk., 86, Youville Square, Montreal, Canada, Manager.

1892. Hopkins, Erastus, Lake Helen, Fla., U.S.A., Consulting Chemist.

1905. Hoppenstedt, A. W., 138, Joralemon Street, Brooklyn, N.Y., U.S.A., Chemist.

1895. Horne, Dr. W. D., 175, Park Avenue, Yonkers, N.Y., U.S.A., Consulting Chemist.
1904. Hornsey, J. W., 216, Prospect Street, Cranford, N.J., U.S.A., Chemical Engineer.
1900. Horsfall, Jno., 4, Grange Avenue, Rawtenstall, Manchester, Analytical and Consulting Chemist.
1902. Horsfall, L. H., c/o Binny and Co., Madras, India, Chemist.
1901. Horton, Edw., jun., 10, Smith Street, Chelsea, S.W., Student.
1906. Hoseason, Jas. H., Sun Buildings, Bridge Street, Manchester, Chemical Manufacturer.
1902. Hosford, Roger F., 15, Dey Street, New York City, U.S.A., Chemical Engineer.
1890. Hoskins, A. Percy, Clonlee, Rosetta Park, Belfast, Ireland, Analytical Chemist.
1899. Hoskins, Wm., Room 54, 81, South Clark Street, Chicago, Ill., U.S.A., Chemist.
1907. Hoskison, Thos., jun., Ardsley House, East Ardsley, Wakefield, Metallurgical Chemist.
1905. Hough, Warwick M., 902, Rialto Building, St. Louis, Mo., U.S.A., Attorney-at-Law.
1899. Houlder, Bertram E., 50, Lady Margaret Road, Southall, Middlesex, Chemist.
1892. Houston, John, 26, Princess Street, Manchester, Drysalter.
O.M. Howard, A. G., Burnt House, Chigwell, Essex, Chemical Manufacturer.
1901. Howard, Bernard F., Quantocks, Montalt Road, Woodford Green, Essex, Chemist.
O.M. Howard, D., Devon House, Buckhurst Hill, Essex, Chemical Manufacturer.
1887. Howard, D. Lloyd, City Mills, Stratford, E., Chemical Manufacturer.
1903. Howard, Fred. A., 55, Franklin Street, Brockton, Mass., U.S.A., Chemist.
1907. Howard, G. C., University Club, Salt Lake City, Utah, U.S.A., Chemist.
1898. Howard, Henry, Dymoke Street, Brookline, Mass., U.S.A., Chemical Engineer.
1902. Howard, Nelson A., c/o General Chemical Co., Hegewisch, Ill., U.S.A., Chemist.
1904. Howard, T., 156, Cromwell Road, Hounslow, W., and (Journals) c/o Prof. A. G. Green, University, Leeds, Chemist.
O.M. Howard, W. D., 11, Cornwall Terrace, Regent's Park, London, N.W., Chemical Manuacturer.
1906. Howe, Chester A., 124, Purchase Street, Boston, Mass., U.S.A., Dyestuff Merchant.
1903. Howe, Jas. Lewis, Washington and Lee University, Lexington, Va., U.S.A., Professor of Chemistry.
1905. Howe, Roland E., 196, Commonwealth Avenue, Concord Junction, Mass., U.S.A., Explosives Chemist.
1904. Howell, Walter L., Room U., Custom House, New Orleans, La., U.S.A., Chemist.
1906. Howland, George W., 293, Dufferin Street, Toronto, Canada, Manager.
1899. Howles, Fred., c/o McDougall Bros., Millwall Docks, London, E., Chemist.
1889. Howorth, F. Wise, 46, Lincoln's Inn Fields, W.C., Technical Chemist and Chartered Patent Agent.
1907. Howroyd, Richard R., c/o Calder Mersey Extract Co., Ltd., Ditton, near Widnes, Chemist.
1906. Hoyler, Fritz, 49, Market Street, Perth Amboy, N.J., U.S.A., Chemist.
1896. Hoyte, Percy S., Gas Works, Coxside, Plymouth, Gas Engineer.
1900. Hübner, Julius, Ash Villa, Cheadle Hulme, Cheshire, Director of Dyeing and Papermaking Departments (Municipal School of Technology).
1902. Hudson, C. Edward, c/o E. G. Jepson and Co., Albion Walk Chambers, Leeds, Drysalter.
1899. Hudson, Dr. Edw. J., c/o Pioneer Iron Co., Marquette, Mich., U.S.A., Chemist.
1905. Hudson, O. F., The University, Edgbaston, Birmingham, Lecturer on Metallurgy.
O.M. Hughes, J., 79, Mark Lane, London, E.C., Agricultural Chemist.
1898. Hughes, Raymond M., Oxford, Butler Co., Ohio, U.S.A., Professor of Chemistry and Physics.
1900. Hulley, Geo. D., c/o J. Eavenson and Sons, Delaware Avenue and Penn Street, Camden, N.J., U.S.A., Soapworks Chemist.
1906. Hulme, Robert B., 1022, Fourth Avenue, Louisville, Ky., U.S.A., Chief Chemist.
1905. Hulton, H. F. E., 11, Colinette Road, Putney, S.W., Chemist.
1905. Humel, Edward J., Lake Avenue, cor. Edward Street, Lakewood, Cleveland, Ohio, Chemist.
1893. Humfrey, Chas., Hilderstone, Hartford, Cheshire, Alkali Works Manager.
1901. Humphrey, H. C., c/o Corn Products Refining Co., Room 1509, 26, Broadway, New York City, U.S.A., Chemist.
1902. Humphrey, Rich. L., 1001, Harrison Building, Philadelphia, Pa., U.S.A., Civil Engineer.
1903. Humphreys, A. C., 31, Nassau Street, New York City, U.S.A., Engineer.
O.M. Humphrys, N. H., Gasworks, Salisbury, Wilts, Gas Engineer.
1895. Hunicke, Dr. H. Aug., 3532, Victor Street, St. Louis, Mo., U.S.A., Prof. of Applied Chemistry.
1900. Hunt, Arthur V., 284, New Chester Road, Port Sunlight, Cheshire, Analytical Chemist.
O.M. Hunt, Bertram, 121, West George Street, Glasgow, Technical Chemist.
O.M. Hunt, Chas., 15, Victoria Street, Westminster, London, S.W., Gas Engineer.
1883. Hunt, J. S., Appleton, Widnes.
1903. Hunt, P. C. Holmes, Metropolitan Gas Co., Flinders Street, Melbourne, Vic., Australia, Gas Engineer.
O.M. Hunt, W., Hampton House, Wood Green, Wednesbury, Staffordshire, Chemical Manufacturer.
1903. Hunter, H. B., Dennery Factory, St. Lucia, West Indies, Sugar Works Manager.
1902. Hunter, Hy. Blount, Hunter Chemical Co., Norfolk, Va., U.S.A., Industrial Chemist.
1893. Hunter, Prof. Matthew, Rangoon College, Rangoon, Burmah, Professor of Chemistry.
O.M. Huntington, Prof. A. K., King's College, Strand, London, W.C., Professor of Metallurgy.
1902. Huntly, Geo. N., 96, Gower Street, London, W.C., Analytical and Consulting Chemist.
1904. Huntzinger, Alfred, Route de Condette, Pont de Briques, Pas de Calais, France, Chemist and Colourist.
1903. Hurlburt, Allen S., c/o General Chemical Co., Hudson River Works, Hudson Heights, N.J., U.S.A., Chemist.
1904. Hurren, F. H., c/o The Rover Co., Ltd., Coventry, Analytical Chemist.
1894. Hurry, E. H., Goodwyns, Haslemere, Surrey, Mechanical Engineer.
O.M. Huskisson, P. L., 77, Swinton Street, London, W.C., and (Journals) 4, Alexandra Gardens, Ventnor, Isle of Wight, Chemical Manufacturer.
O.M. Huson, C. W., 18, Batavia Buildings, Hackins Hey, Liverpool, Analytical Chemist.
1908. Hutcheson, John, c/o Farbenfabriken of Elberfeld Co., 14, Front Street East, Toronto, Canada, Manager.
1894. Hutcheson, Jno. F., 22, St. Enoch Square, Glasgow, Chemical Manufacturer.
1906. Hutchings, W. Maynard, Easedale, Elmfield Road, Gosforth, Newcastle-on-Tyne, Metallurgist.
O.M. Hutchinson, C. C., 3, Harcourt Buildings, Temple, E.C., Barrister-at-Law and Chemical Engineer.
1900. Hutchinson, E. George, Gas Works, Stockport, Gas Engineer.
O.M. Hutchinson, T. J., Aden House, Manchester Road, Bury, Analytical and Consulting Chemist.
1906. Hutton, James S., 4, Main Street Park, Malden, Mass., U.S.A., Chemist.
1901. Hutton, Dr. Robt. S., West Street, Sheffield, Lecturer on Electro-Chemistry.
O.M. Huxley, Jas. H., c/o Vickers, Son and Maxim, Ltd., River Don Works, Sheffield, Metallurgical Chemist.
1906. Huyett, Miles C., 608, Morgan Building, Buffalo, N.Y., U.S.A., Mechanical Engineer.

1897. Hyams, Godfrey M., 312, Sears Building, Boston, Mass., U.S.A., Mines Manager.
1902. Hyde, Austin T., P.O. Box 98, Rumford Falls, Maine, U.S.A., Chemical Engineer.
1897. Hyde, B. T. Babbitt, 82, Washington Street, New York City, U.S.A., Soap Manufacturer.
1899. Hyde, Fred. S., 215, Schermerhorn Street, Brooklyn, N.Y., U.S.A., Research Chemist.
1899. Hyde, Wm. Grantley, 26, Winsham Grove, Clapham Common, S.W., Assayer.
1901. Hyman, Leonard W., 342, South Pearl Street, Albany, N.Y., U.S.A., Analytical Chemist.
1896. Hyndman, H. H. Francis, 27, Pembroke Square, Kensington, W., Consulting Chemist.

I

1898. Ibbotson, E. C., A. B. Electrostal, Trollhättan, Sweden, Metallurgist.
1900. Ichioka, Tajiro, 19, Maruyama Shinmachi, Hongo, Tokio, Japan, Chemist (Imperial Japanese Navy).
1906. Iddings, Richard P., Arlington Mills, Lawrence, Mass., U.S.A., Chemist.
1885. Idris, T. H. W., M.P., 120, Pratt Street, Camden Town, N.W., Mineral Water Manufacturer.
1902. Ihart, John P., 373, West 35th Street, New York City, U.S.A., Technical Chemist.
1900. Imrie, John, Cliffe Cottage, Crabtree, Sheffield, Producer Gas and By-Products Plant Manager.
1900. Ingalls, Walter R., (Communications) 505, Pearl Street, New York City; and (Journals) Bement Avenue, West New Brighton, Staten I., N.Y., U.S.A., Mining Engineer and Metallurgist.
1889. Ingle, Dr. Harry, Creskeld, Balwearie Road, Kirkcaldy, Fifeshire, Organic Chemist.
1891. Ingle, Herbert, Dept. of Agriculture, Government Buildings, Pretoria, Transvaal, Chemist.
1906. Inglis, Dr. Jno. K. H., University College, Reading, Berks, Lecturer.
1884. Inglis, R. A., Culrain, Bothwell, N.B., Analytical Chemist.
1906. Innes, Dr. W. Ross, 6, Griffiths Road, Wimbledon, S.W., Chemist.
1904. Irlam, H. A., Long View Villa, Hitchin Road, Luton, Beds., Manager and Chemist.
1884. Irving, J. M., 17A, Dickinson Street, Cooper Street, Manchester, Chemical Merchant.
1906. Irwin, John T., Cledford, Middlewich, Cheshire, Manufacturing Chemist.
O.M. Irwin, W., Inglehurst, Stand, near Manchester, Analytical Chemist.
1893. Isaac, J. F. V., Research Chemist.
1901. Isakovics, Alois von, Synfleur Scientific Laboratories, Monticello, N.Y., U.S.A., Manufacturing Chemist.
1900. Ittner, Dr. Martin H., c/o Colgate and Co., Jersey City, N.J., U.S.A., Soap and Essential Oil Chemist.
1908. Ives, Herbert, 125, Pearl Street, Boston, Mass., U.S.A., Chemical Manager.

J

1890. Jackman, E. J., 60, Belgrave Road, Ilford, Essex, Technical Chemist.
1898. Jackson, Alf. George, 65, Ann Street, Brisbane, Queensland, Electro-Chemical Engineer.
1906. Jackson, Arthur A., 672, East 43rd Street, Chicago, Ill., U.S.A., Chemist.
1901. Jackson, Daniel D., Mount Prospect Laboratory, Flatbush Avenue and Eastern Parkway, Brooklyn, N.Y., U.S.A., Chemist.
1903. Jackson, Dr. D. H., 73, Parliament Hill, Hampstead, N.W., Chemist.
O.M. Jackson, Edward, Ravens Clift, Oxford Road, Moseley, Birmingham, Alkali Works Inspector.
1904. Jackson, Ernest W., 3, Leven Street, Saltburn, Yorks, Analytical Chemist.
1891. Jackson, F., Smedley Bridge Works, Cheetham, near Manchester, Bleacher and Dyer.
1883. Jackson, Frederick, 14, Cross Street, Manchester. Laboratory Furnisher.
1886. Jackson, John, 98, Dobbie's Loan, Glasgow, Lubricant Manufacturer.
1901. Jackson, Percy G., c/o National Boiler and General Insurance Co., 22, St. Ann's Square, Manchester, Chemist.
O.M. Jackson, R. V., c/o Scotch and Irish Oxygen Co., Polmadie, Glasgow, Technical Chemist.
1890. Jackson, Saml., c/o H. S. Duncan, Roundhay, Harrington's Road, Chetput, Madras, India, Analytical Chemist.
1902. Jackson, Samuel, c/o Wm. Metcalf, Ltd., Church, near Accrington, Director (Tar Distillery).
1898. Jackson, Thos., Thornton View, Clayton, Manchester, Chemical Manufacturer.
1900. Jackson, Victor G., 21, Frankfort Road, Herne Hill, S.E., Chemist.
1901. Jackson, W. B., Glengowan Printworks, Caldercruix, N.B., Chemist.
1903. Jackson, Wm. D. N., 291, Station Road, Wallsend-on-Tyne, Analytical Chemist.
1900. Jackson, Dr. W. Hatchett, Radcliffe Library, Oxford, Librarian and Science Tutor (Keble College).
1893. Jackson, Rt. Hon. W. L., F.R.S. *See* Allerton, Rt. Hon. Lord.
1899. Jackson, W. Morton, c/o British Oxygen Co., Ltd., Great Marlborough Street, Manchester, Manager.
O.M. Jackson, W. P., Saxilby, near Lincoln, Chemical Works Manager.
1901. Jacobs, Charles B., 52, Beaver Street, New York City, U.S.A., Chemist.
1901. Jacobsen, Rudolph C., 154, Lake Street, Chicago, Ill., U.S.A., Editor of "Hide and Leather."
1900. Jacoby, Areli H., c/o American Dyewood Co., 84, William Street, New York City, U.S.A., Chemist.
1897. Jacqué, Maurice, "La Cantabrica," Galdacano, cerca Bilbao, Spain, Chemical Engineer.
1901. Jadhava, Khasberao B., Nausori, Bombay, India, Collector and District Magistrate.
1900. Jäger, B. M., c/o Geo. Jäger and Sons, 77, Burlington Street, Liverpool, Sugar Chemist.
1886. Jago, Wm., 5, Fig Tree Court, Temple, London, E.C., Barrister-at-Law.
1889. James, Alf., 2, Broad Street Place, London, E.C., Mining Engineer.
1883. James, E. T., British Alizarin Co., Ltd., Silvertown, Victoria Docks, E., Secretary.
1885. James, Dr. J. Wm., Aylmer House, Weston-super-Mare; and (Journals) 29, Redcliff Street, Bristol, Chemical Lecturer.
1893. James, Lawrence S., 32, Hawley Street, Boston, Mass., U.S.A., Gas Inspector.
1905. James, Oscar S., 227, George Street, Toronto, Canada, Analytical Chemist.
1902. Jameson, Lewis, 83, Queen Victoria Street, London, E.C., Consulting Chemist.
1890. Jantzen, Paul, 133, Fenchurch Street, London, E.C., Chemical Merchant.
O.M. Japp, Dr. F. R., F.R.S., The University, Aberdeen, Professor of Chemistry.
1906. Jardine, Samuel, c/o Dallyn, Jardine and Co., 23, Scott Street, Toronto, Canada, Chemical Merchant.
1890. Jarmain, Geo. S., Dalton Lodge, Huddersfield, Wool Extractor.
O.M. Jarmay, G., Hartford Lodge, Hartford, Cheshire, Alkali Manufacturer.
1900. Jarvie, Jas., Monkland House, Kirkintilloch, N.B., Chemist.
1907. Jatar, S. B., 219, Upper Brook Street, C. on M., Manchester, Student.
O.M. Jayne, Dr. H. W., 931, North Broad Street, Philadelphia, Pa., U.S.A., Manufacturing Chemist.
O.M. Jekyll, J., Castle Moat House, Lincoln, Chemical Manufacturer.

1892. Jenkin, W. A., 5, Bella Vista, Minas de Rio Tinto, Provincia de Huelva, Spain, Metallurgical Chemist.
1905. Jenkins, Chas. D., 8, Grove Street, Winchester, Mass., U.S.A., Chemist.
1894. Jenkins, John H. B., Laboratory, G.E.R. Works, Stratford, E., Analytical Chemist.
1894. Jenks, Robt. L., Kasauli, Punjab, India, Chemist.
1905. Jennison, Jas., 103, Lynwood Avenue, Darwen, Lancashire, Chemist.
1907. Jenson, Chas. W. L., Oakhill, near Bath, Brewer and Maltster.
1904. Jepson, John Elliott, Star House, Feniscowles, near Blackburn, Chemist.
1899. Jerdan, Dr. David S., c/o J. and G. Cox, Ltd., Gorgie Mills, Edinburgh, Chemist (Gelatin Works).
1899. Jessop, Louis V., Holmlea, Woodville Road, Leytonstone, Essex, Chemist.
1904. Jessup, Alfred E., Tientsin, North China, Assayer.
1904. Jewell, Wm. M., Cable Building, Chicago, Ill., U.S.A., Chemist and Engineer.
1904. Jewson, F. T., Earith, near St. Ives, Hunts., Chemist.
1896. Job, Robt., Ambler, Pa., U.S.A., Analytical Chemist.
1906. John, David, Haileybury, Ontario, Canada, Chemist.
1886. Johnson, A. E., Claremont, Lyndhurst Road, Wolverhampton, Analytical Chemist.
1904. Johnson, Cedric, Field House, Winnington, Northwich, Chemical Engineer.
1906. Johnson, Chas. C., Vaudreuil Station, Quebec, Canada, Chemical Engineer.
1905. Johnson, Chas. F., Avery Chemical Co., Littleton, Mass., U.S.A., Superintendent.
1902. Johnson, Chas. M., 701, Orchard Street, Avalon, Allegheny Co., Pa., U.S.A., Chemist.
1891. Johnson, Edmond E., The Gales, Roding Lane, Woodford Bridge, Essex, Chemical Engineer.
1900. Johnson, Edw., c/o Herdeiros Bowman, Ltd., Caixa 57, Pernambuco, Brazil, Sugar Works Manager.
1908. Johnson, Dr. Edw. S., c/o Solvay Process Co., Syracuse, N.Y., U.S.A., Chemist.
1902. Johnson, Emil F., 96–98, Maiden Lane, New York City, U.S.A., Consulting Chemist.
1904. Johnson, F. M. G., (Journals) 286, Peel Street, Montreal, Canada; and (communications) Chem. Institut, Universität, Breslau, Germany, Chemist.
1904. Johnson, G. B., 7, Church Street, Liverpool, Wholesale Chemist.
1906. Johnson, Dr. Harold, 5 and 6, Fowkes' Buildings, Great Tower Street, London, E.C., Chemist.
1907. Johnson, H. Finnis, c/o Borax Consolidated, Ltd., 16, Eastcheap, London, E.C., Sales Manager.
1903. Johnson, Horace, Waialua, Oahu, Hawaii, Chemist.
O.M. Johnson, J. E., 40, Idmiston Road, Stratford, E., Manufacturing Chemist.
1895. Johnson, Jesse F., Vaudreuil Station, P.Q., Canada, Chemical Engineer.
1884. Johnson, J. Grove, 23, Cross Street, Finsbury, E.C., Assayer.
1900. Johnson, John, c/o John Johnson and Co., Franklin Square, New York City, and (Journals) 1335, 53rd Street, Brooklyn, N.Y., U.S.A., Chemical Engineer.
1900. Johnson, Jno. W. H., York House, Thornhill, Dewsbury, and (Journals) West Riding Rivers Board, Wakefield, Yorks., Chemist.
1906. Johnson, Oliver L., c/o The Aspinook Co., Jewett City, Conn., U.S.A., Dye Works Manager.
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1904. Johnson, S. Hearon, 7, Church Street, Liverpool, Wholesale Chemist.
O.M. Johnson, T. A., Field House, Winnington Park, Northwich, Cheshire.
1903. Johnson, Thos., Caixa 94, Pernambuco, Brazil, Manager.
1907. Johnson, Walter M., Box 376, Penns Grove, N.J., U.S.A., Chemist.
1895. Johnston, Alex. R., 18, Percy Street, Ibrox, Glasgow, Analytical Chemist.
1906. Johnston, A. McA., Box 108, Germiston, Transvaal, Metallurgical Chemist.
1894. Johnston, G. Lawson. *See* Lawson-Johnston, G.
1904. Johnston, J. H., 8, Leopold Road, Wimbledon, S.W., Chemist and Bacteriologist.
1889. Johnston, Thos., Nobel's Explosives Co., Ltd., 195, West George Street, Glasgow, Manager.
1904. Johnston, Thos. J., 4, Garrioch Drive, Kelvinside North, Glasgow, Chemist.
1890. Johnston, Wm. A., The S. S. White Dental Manufacturing Co., Princess Bay, Staten Island, N.Y., U.S.A., Dental Enamel Manufacturer.
1894. Johnston, W. E. Lawson. *See* Lawson-Johnston, W. E.
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O.M. Johnstone, Jas., Shawfield Works, Rutherglen, Glasgow, Technical Chemist.
1905. Johnstone, J. Swanston, National Distilleries Co., Bond Street, Durban, Natal, Distiller.
1903. Johnstone, S. J., 15, Springfield Road, New Southgate, N., Research Chemist.
O.M. Johnstone, W. G., Chemist.
1907. Jolliffe, Ernest H., 16, Maitland Street, Toronto, Canada, Works Chemist.
1905. Jolliffe, Frank, 31, St. James' Road, New Cross, S.E., Chemist.
1903. Jones, Alfred O., The Hill, Scotby, near Carlisle, Works Chemist.
1904. Jones, Arthur B., Garden City, N.Y., U.S.A., Superintendent.
1897. Jones, Chas. H., 195, Inderwick Road, Crouch End, N., Technical Chemist.
1902. Jones, David R., Standard Chemical Co., Deseronto, Ont., Canada, Chemical Engineer.
1902. Jones, E. Strangways, Sulphide Corporation, Ltd., Cockle Creek, N.S.W., Australia, Metallurgical Chemist.
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1904. Jones, G. Poole, c/o Sinnamahoning Powder Manufacturing Co., Emporium, Pa., U.S.A., Chemical Engineer.
1903. Jones, G. Robert, Gas Works, Caixa 147, Pernambuco, Brazil, Gas Engineer.
1905. Jones, Harold, Morro Velho, Villa Nova de Lima, Minas Geraes, Brazil, Analyst and Assayer.
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1898. Jones, Henry, Broughton Bridge Mills, Salford, Dyer and Finisher.
1907. Jones, Henry Williams, 1, Dalton Road, Spencer Park, Coventry, Manufacturing Chemist.
1893. Jones, Herbert. *See* Sefton-Jones, H.
1901. Jones, Herbert J., c/o Brechfa Chemical Co., Ltd., Nantgaredig, R.S.O., South Wales, Chemist.
1905. Jones, J. E. Stacey, Masonic Buildings, Coventry, Consulting Chemist and Metallurgist.
1904. Jones, J. Shirley, Moscow, Idaho, U.S.A., Chemist.
1899. Jones, Llewellyn J. W., Metallurgist.
1898. Jones, Martin L., c/o Ooregum G. M. Co., Oorgaum, Mysore State, India, Metallurgical Chemist.
1894. Jones, M. W., The Cottage, Brislington, Bristol, Manager (Oil and Colour Works).
1887. Jones, T. Tolley, Australian Explosives and Chemical Co., Ltd., 138, Queen Street, Melbourne, Victoria, Australia, Explosives Manufacturer.
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1905. Jones, W. Ellis, 80, Arundel Avenue, Liverpool, Sugar Refiner.

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1907. Jordan, Harry E., 113, Monument Place, Indianapolis, Ind., U.S.A., Water Sanitarian.
1904. Jordan, Stanley, 100, William Street, New York City, U.S.A., Importer of Chemicals.
1908. Joslin, Percy H., 81, Bennerley Road, New Wandsworth, S.W., Chemist.
1905. Joseph, A. F., Ceylon Technical College, Columbo, Ceylon, Lecturer on Chemistry.
1900. Josephson, Edgar. c/o Pantazote Leather Co., Passaic, N.J., U.S.A.
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1891. Joslin, Omar T., 3223, Spring Grove Avenue, Cincinnati, Ohio, U.S.A., Chemical Engineer.
1887. Joüet, Dr. C. H., Roselle, Union Co., N.J., U.S.A., Technical Chemist.
1889. Journand, Louis, 8, Place St. Maurice, Vienne (Isère), France, Technical Chemist.
1904. Jowett, Dr. H. A. D., Phoenix Mills, Dartford, Kent, Chemist.
1903. Joyce, Clarence M., c/o Arlington Co., Arlington, N.J., U.S.A., Chemist.
1887. Jürgensen, Dr. Rolof, Karlsgasse 5, Prag-Zizkov, Austria, Chemist.
1900. Just, Jno. A., 915, West Genesee Street, and P.O. Drawer 40, Syracuse, N.Y., U.S.A., Chemist.
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1908. Kaliski, Dr. Maximilian S., 101, West 130th Street, New York City, U.S.A., Technical Chemist.
1884. Kalle, Dr. Wm., Biebrich-am-Rhein, Germany, Colour Manufacturer.
1907. Karp, Samuel E., 305, Franklin Avenue, Scranton, Pa., U.S.A., Chemist.
1905. Katzenbach, Welling S., 164, Front Street, New York City, U.S.A., Chemist.
1901. Kauder, Dr. E., c/o Merck and Co., Rahway, N.J., U.S.A., Chemist.
1903. Kauffman, Milton H., American Smelting and Refining Co., Durango, Colo., U.S.A., Chemist.
1892. Kaufmann, Dr. Herbert M., c/o Mutual Chemical Co., Jersey City, N.J., U.S.A., Chemist.
1904. Kaus, Dr. Emil, c/o Roessler and Hasslacher Chemical Co., Perth Amboy, N.J., U.S.A., Chemist.
1904. Kawai, I., Camphor Monopoly Bureau, Kumoidori, Kobé, Japan, Chemist.
1885. Kawakita, Prof. Michitada, Imperial Engineering College, Tokio, Japan, Professor of Applied Chemistry.
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1905. Kaye, Frederick, 20, Birchwood Avenue, Muswell Hill, N., Research Chemist.
1904. Kaye, Thos., Westerfield, Perth, Scotland, Analytical Chemist.
1905. Kayser, Edwin Cuno,
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1884. Keane, Dr. Chas. A., Sir John Cass Technical Institute, Jewry Street, Aldgate, E.C., Principal.
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1897. Kearns, Jno. S., Cowpe Mills, Waterfoot, near Manchester, Chemist and Dyer.
1894. Kebler, Lyman F., Department of Agriculture, Bureau of Chemistry, Washington, D.C., U.S.A., Chief of Drug Laboratory.
1906. Keily, C. L., c/o Ilford, Ltd., Ilford, and (Journals) Furze Cottage, Mark's Gate, Romford, Essex, Chemist.
1886. Keiser, Prof. E. H., Washington University, St. Louis, Mo., U.S.A., Professor of Chemistry.
1905. Keith, Simeon C., jun., 20, Highland Avenue, Somerville, Mass., U.S.A., Chemist and Bacteriologist.
1900. Kelf, Henry C., 92, Cotham Brow, Bristol, Sugar Chemist.
1907. Keller, Dr. Edward, P.O. Box 363, Perth Amboy, N.J., U.S.A., Chemist and Metallurgist.
1905. Keller, Robt. J., c/o Geigy Aniline & Extract Co., 69, Barclay Street, New York City, U.S.A., Dyestuff and Chemical Merchant.
1885. Kellner, Dr. Wm., 135, Victoria Road, Old Charlton, S.E., Chemist to War Department.
1889. Kempson, John F., Pye Bridge Chemical Works, near Alfreton, Derbyshire, Chemical Manufacturer.
1907. Kendall, G. F., Chemical Works, Stratford-on-Avon, Chemical Manufacturer.
1901. Kennedy, Alex., Kenmill House, Bothwell, N.B., Rosin Distiller.
1903. Kennedy, Hugh Watson, 626, South 19th Street, Philadelphia, Pa., U.S.A., Chemist.
1903. Kenyon, Percy S., Park House, Cheadle Hulme, Cheshire, Drysalter.
1889. Kenyon, Thos., The Shrubbery, Hilton Park, Prestwich, near Manchester, Manufacturing Chemist.
1906. Kepner, S. H., 149, 12th Street, Long Island City, N.Y., U.S.A., Superintendent.
1900. Keppelmann, Alf. J., P.O. Box 1314, Philadelphia, Pa., U.S.A., Chemical Merchant.
1888. Ker, Alan D., 14, Wilton Mansions, Glasgow, Chemical Manufacturer.
1899. Kern, Walter P., 343, Lafayette Avenue; and (Journals) c/o General Chemical Co., Dundee Works, Passaic, N.J., U.S.A., Chemist.
1906. Kerr, Charles H., 531, Buffalo Avenue, Niagara Falls, N.Y., U.S.A., Ceramic Engineer (Carborundum Co.).
1894. Kerr, Jas., 42, Craiglea Drive, Morningside, Edinburgh, Lecturer on Chemistry.
1890. Kerr, Saml. T., 516, North Delaware Avenue, Philadelphia, Pa., U.S.A., Salt Manufacturer.
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1902. Kessler, Henry W., 317, Electric Building, Cleveland, Ohio, U.S.A., Manufacturing Chemist.
1903. Kessler, R., jun., Pittston, Pa., U.S.A., Chemical Manager.
1893. Kestner, Paul, 7, Rue de Toul, Lille, France, Chemist.
1898. Keswick, Wm., M.P., 3, Lombard Street, London, E.C., Merchant.
1900. Kewley, Jas., Arbory Road, Castletown, Isle of Man, and (Journals) Balek Pappan, Dutch Borneo, Technical Chemist.
1890. Keys, W. H., Lyndon House, West Bromwich, Oil and Chemical Manufacturer.
1892. Kibble, W. Oakes, Charlotte, N.C., U.S.A., Chemical Engineer.
1900. Kilgore, Benj. W., Raleigh, N.C., U.S.A., Chemist.
1901. Kilmer, Fred. B., c/o Messrs. Johnson and Johnson, New Brunswick, N.J., U.S.A., Chemical Manufacturer.
1905. Kimball, Herbert S., 46, Cornhill, Boston, Mass., U.S.A., Mill Engineer.
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1905. King, Capt. Alex E., R.A., Egyptian Army Citadel, Cairo, Egypt, and (Journals) c/o Cox & Co., 16, Charing Cross, London, W.C., Inspector of Explosives.
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1907. King, C. A., c/o The Farnley Iron Co., Farnley, near Leeds, Technical Chemist.

1884. King, Col. C. M., Campsie Alum Works, Lennoxtown, N.B., Alum Manufacturer.

1905. King, Frank E., 75, Gracechurch Street, London, E.C., Analytical Chemist.

O.M. King, J. Falconer, 20, Chambers Street, Edinburgh, Consulting Chemist.

1887. King, Col. Robt., 115, Wellington Street, Glasgow, Chemical Manufacturer.

1907. King, Robt. J., c/o Merrimac Chemical Co., North Woburn, Mass., U.S.A., Chemist.

1895. King, Sidney J., 24, Gerda Road, New Eltham, S.E., Colour and Dyestuff Traveller.

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1905. King, Warren C., c/o General Chemical Co., 25, Broad Street, New York City, U.S.A., Salesman.

1903. King, William, c/o Natal Estates, Ltd., South Coast Junction, Natal, S. Africa, Analytical Chemist.

1896. Kingdon, Holman, c/o Joseph Crosfield and Sons, Warrington, Technical Chemist.

1908. Kingsbury, Percy C., c/o S. Pearson and Son, Ltd., Minatitlan, Mexico, Civil Engineer.

1883. Kingsford, T. P., Oswego, N.Y., U.S.A., Starch Manufacturer.

O.M. Kingzett, C. T., 1, Hornton Street, Kensington, W., and (Journals) Sanitas Co., Ltd., Locksley Street, Limehouse, E., Technical Chemist.

1906. Kinnersley, H. W., Branscombe, Merry Hill Road, Bushey, Herts, Chemist and Manufacturer.

1892. Kinnicutt, Professor L. P., 77, Elm Street, Worcester, Mass., U.S.A., Professor of Chemistry (Worcester Polytechnic Institute).

1897. Kipping, Dr. F. Stanley, F.R.S., University College, Nottingham, Prof. of Chemistry.

1906. Kirby, Oswald F., Leeds Institute, Leeds, Lecturer on Chemistry.

1898. Kirkland, Archd., 78, High Street, Irvine, N.B., Baker.

1905. Kirkland, John, 105, Holmdene Avenue, Herne Hill, S.E., Technical Instructor.

1897. Kirkland, Robt., 25, Collier Road, Cambridge, Chemist.

1900. Kirkpatrick, Prof. Stafford F., School of Mining, Kingston, Ont., Canada, Professor of Metallurgy.

1887. Kitamura, Y., Kaigun Kosho, Yokosuka, Japan, Agricultural Chemist.

1902. Kitchen, Wm. J., Port Melbourne North, Vic., Australia, Soap and Candle Manufacturer.

1891. Kitson, Rt. Hon. Sir James, Bart., M.P. *See* Airedale, Lord.

1883. Kitto, B., 26, Lancaster Road, Finsbury Park, London, N., Analytical Chemist.

1900. Kittredge, H. G., 217, North Ludlow Street, Dayton, Ohio, U.S.A., Chemist.

1908. Klaber, Wm., 560, Mickle Street, Camden, N.J., U.S.A., Chemist.

1900. Kleber, Dr. Clemens, Union Avenue, Clifton, N.J., U.S.A., Director (Fritzche Bros.' Laboratory).

1888. Kleemann, Dr. S., Farben Fabrik, Forchheim, Bavaria, Analytical Chemist.

1903. Kline, Clarence M., 429, Arch Street, Philadelphia, Pa., U.S.A., Wholesale Druggist.

1889. Klipstein, A., 122, Pearl Street, New York City, U.S.A., Chemical Manufacturer.

1902. Klipstein, Ernest C., 116, Prospect Street, East Orange, N.J., U.S.A., Chemical Manufacturer.

1891. Knaggs, Alfred B., 2, Bradley Lane, Huddersfield, Technical Chemist in Dyeworks.

1905. Knapp, Sewell A., 1243, Myrtle Street, Oakland, Cal., U.S.A., Mine Manager.

1903. Knapp, Walter R., c/o Semet Solvay Co., Chicago, Ill., U.S.A., Chemist.

1892. Knecht, Dr. E., Beech Mount, Marple, Cheshire, Professor of Tinctorial Chemistry.

1904. Kniffen, Frederick, c/o International Smokeless Powder Co., Parlin, N.J., U.S.A., Chemist.

1887. Knight, A. H., 2, Gerald Road, Oxton, Cheshire, Assayer.

1903. Knight, Harley F., 64, Amhurst Park, Stamford Hill, N., Analyst.

1884. Knight, Henry, Stanley House, 73, Anfield Road, Liverpool, Colour and Varnish Manufacturer.

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1907. Knight, J. Burnett, St. Lawrence Work, Uphall Road, Ilford, Works Manager and Chemist.

1887. Knights, J. West, Public Laboratory, Tenison Road, Cambridge, Analytical Chemist.

1885. Knipler, F., c/o R. Harper and Co., Port Melbourne, Victoria, Australia, Starch Manufacturer.

1907. Knoedler, E. L., c/o Welsbach Co., Gloucester City, N.J., U.S.A., Factory Foreman.

1883. Knowles, Joshua, Stormer Hill, Tottington, near Bury, Calico Printer.

1904. Knowles, W. R., The Hollies, Wood Green, Wednesbury, Chemical Works Manager.

1886. Knox, E. W., Colonial Sugar Refining Co., Sydney, N.S.W.; and (subs.), c/o Parbury, Henty and Co., 20, Eastcheap, London, E.C., Sugar Manufacturer and Refiner.

1902. Knudsen, Hans, 68, Victoria Street, London, S.W., Inventor.

1906. Knudsen, Kristian Hv., 255, Madison Street, Brooklyn, N.Y., U.S.A., Chemist.

1905. Koch, Geo. W., Lock Box 12, Woodhaven, Long Is., N.Y., U.S.A., Chemist.

1904. Koch, J. A., Bluff and Pride Streets, Pittsburg, Pa., U.S.A., Chemist.

1904. Koebig, Dr. J., 127, West First Street, Los Angeles, Cal., U.S.A., Chemical Engineer.

1904. Koerner, H. Theo., Beyerstrasse 28, Chemnitz, Germany, Student of Chemistry.

1884. Kohn, Dr. Charles A. *See* Keane, Dr. Chas. A.

1902. Kohnstamm, Lothair S., 87, Park Place, New York City, U.S.A., Chemist.

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1906. Krais, Dr. Paul, 60, Nauclerstrasse, Tuebingen, Germany, Chemist.

1894. Krause, Dr. Albert H., 1444, West 98th Street, Cleveland, Ohio, U.S.A., Chemist (Grasselli Chemical Co.).

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O.M. Krause, O. H., c/o American Sugar Refining Co., Jersey City, N.J., U.S.A., Chemical Engineer.

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1903. Kremer, Frank N., 646, Broadway, Milwaukee, Wis., U.S.A., Chemist.

1900. Kremers, Dr. Edw., Madison, Wis., U.S.A., Professor (University of Wisconsin).

1906. Kremers, William, Holland, Mich., U.S.A., Sugar Mill Superintendent.

1908. Kress, Otto, 438, West 116th Street, New York City, U.S.A., Teacher of Science.

1907. Kuan, C. H., 3332, Walnut Street, Philadelphia, Pa., U.S.A., Chemist.

1904. Kübler, Alfred, 69, Barclay Street, New York City, U.S.A., Vice-President, Geigy Aniline and Extract Co.

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1907. Kutsch, Dr. Wm. A., c/o Corn Products Manufacturing Co., Pekin, Ill., U.S.A., Chemist.

1900. Kuttroff, Fred., 128, Duane Street, New York City, U.S.A., Merchant.

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1903. Lachman, Dr. Arthur, Petaluma, Cal., U.S.A., Chemical Engineer.

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1907. Lake, Henry B., Laboratory, Canadian Pacific Railway Co., Winnipeg, Canada, Chemical Engineer.

1900. Lamar, Wm. R., Mallinckrodt Chemical Works, St. Louis, Mo., U.S.A., Chemist.

1898. Lamb, Morris Chas., 12, Coleraine Road, Westcombe Park, Blackheath, S.E., Chemist.

1900. Lambert, Walter S., Park Road, Clydach, R.S.O., Glamorgan, Analyst.

1907. Lancaster, Harry M., School of Practical Science, Toronto, Canada, Chemist.

1895. Lancaster, Jno. C., 260, Alfreton Road, Nottingham, Engineering Works Manager.

1904. Lancey, Darragh de, c/o Waterbury Buckle Co., Waterbury, Conn., U.S.A., Secretary.

1895. Landin, John, 40, Drottninggatan, Stockholm, Sweden, Public Analyst.

1904. Lane, C. Cyril P., c/o The Avon India-Rubber Co., Melksham, Wilts., Chemist.

1906. Lane, Fred. H., 418, Sackett Street, Brooklyn, N.Y., U.S.A., Chemist.

1903. Lane, Nathaniel J., U.S. Laboratory, 641, Washington Street, New York City, U.S.A., Chemist.

1890. Lang, Jas. G., P.O. Box 475, Victoria, B.C., Canada, Analytical Chemist.

1893. Lang, Dr. Wm. R., University of Toronto, Canada, Professor of Chemistry.

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1892. Langer, Dr. Carl, Ynyspenllwch, Clydach, R.S.O., Glamorganshire, Analytical Chemist.

1897. Langmuir, Arthur C., c/o Marx and Rawolle, 9, Van Brunt Street, Brooklyn, N.Y., U.S.A., Factory Manager.

1902. Langmuir, F. Leighton, 350, Bloor Street West, Toronto, Canada, Chemist.

1898. Langstaff, Wm., Grasselli, N.J., U.S.A., Chemist.

1900. Lant, Herbert, "Ivy Bank," Wath-on-Dearne, near Rotherham, Yorks., Chemist and Manager.

1906. Lantz, Alfred, 115, Rue des Poissoniers, St. Denis sur Seine, France, Colour Works Manager.

1905. La Pierre, Elie H., 588, Huron Avenue, Cambridge, Mass., U.S.A., Pharmacist.

1906. Larsen, Axel, 76, York Street, Westminster, S.W., Mining Engineer.

1903. Larter, Alfred T., 86, Inderwick Road, Stroud Green, N., Chemist.

1907. Lasché, Prof. Alfred, The Lasché Institute, 2809, Vine Street, Milwaukee, Wis., U.S.A., Chemist and Bacteriologist.

1904. Lasher, F. G., 68, Hausmann Street, Brooklyn, N.Y., U.S.A., Chemist.

1884. Latham, Baldwin, Parliament Mansions, Victoria Street, Westminster, S.W., Civil Engineer.

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1907. Lathwood, Arthur, c/o Borax Consolidated, Ltd., 16, Eastcheap, London, E.C., Chemist.

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1907. La Wall, Chas. H., 39, South 10th Street, Philadelphia, Pa., U.S.A., Analytical Chemist.

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1906. Lawrence, V. O., 801, Drexel Building, Philadelphia, Pa., U.S.A., Chemical Works Manager.

1904. Lawson, Jos. H. S., Britannia Mills, Hulme, Manchester, Salesman.

1900. Lawson, Wm., c/o Great Western Sugar Co., Sterling, Colo., U.S.A., Chemist.

1894. Lawson-Johnston, G., (Journals) 29, Portman Square, W., and c/o Bovril, Ltd., 152, Old Street, London, E.C., Vice-Chairman.

1894. Lawson-Johnston, W. E., c/o Bovril, Ltd., 152, Old Street, London, E.C., Director.

1893. Lawton, Thos., Perry Villa, Perry Bar, Birmingham, Chemical Works Manager.

1890. Laycock, Dr. W. F., 46, Boar Lane, Leeds, Analytical Chemist.

1902. Lazell, Ellis Warren, 42, North 16th Street, Philadelphia, Pa., U.S.A., Chemist.

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1907. Leach, Paul F., c/o Lactic Process Co., Room 309, 100, William Street, New York City, U.S.A., Secretary.

1898. Lean, Geo., 15, Park Terrace, Glasgow, Chemist.

1897. Leathart, Thos. H., c/o Locke, Blackett and Co., Ltd., Lead Works, Newcastle-on-Tyne, Lead Manufacturer.

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1893. Le Boutillier, Clement, c/o Taylor Iron and Steel Co., High Bridge, N.J., U.S.A., Chemist.

1907. Lecco, Prof. Marco T., Belgrade, Servia, Professor of Chemistry.

1904. Le Chatelier, Prof. H., 75, Rue Notre Dame des Champs, Paris, France, Professor (l'Ecole des Mines).

1896. Lecomber, W. G., Cambridge Works, Knott Mill, Manchester, Engineer.

1896. Lederle, Dr. E. J., 518, Fifth Avenue, New York City, U.S.A., Chief Chemist.

1892. Ledoff, Prof. A., Technological Institute, Kharkoff, Russia, Professor of Chemistry.

1895. Ledoux, Dr. Albert R., 99, John Street, New York City,. U.S.A., Chemist.

1903. Ledoux, Aug. D., 15, William Street, New York City, U.S.A., Importer of Pyrites.

1905. Lee, Ashton, Lawrence, Mass., U.S.A., Manufacturing Chemist.

1901. Lee, FitzHugh, c/o Grasselli Chemical Co., Cleveland, Ohio, U.S.A., Superintendent.

1905. Lee, Frank W., Lawrence, Mass., U.S.A., Manufacturing Chemist.

1905. Lee, John C., Mountford Street, Brookline, Mass., U.S.A, Assistant Engineer (American Telegraph and Telephone Co.).

1898. Lee, Jno. L., Woodfield, Lytham, Lancashire, Dyer and Bleacher.

1885. Lee, S. Wright, 6–10, Whitechapel, Liverpool, Wholesale Druggist.

1906. Lee, William, 28, Sherard Gardens, Eltham, Kent, Works Chemist.

1886. Leeds, F. H., West Allington, Bridport, Dorset, Analytical Chemist.

1903. Leerburger, Henry, 54, Beekman Street, New York City, U.S.A., Essential Oil Merchant.

1903. Leese, Jos., jun., 3, Ash Grove, Victoria Park, Manchester, Analytical and Technical Chemist.

1901. Lefebvre, Georges, Compagnie du Phospho-Guano, 27 Rue La Rochefoucauld, Paris, Director.

1901. Leffler, Rudolf L., c/o Thos. Firth and Sons, Ltd., Norfolk Works, Sheffield, Metallurgical Chemist.

1907. Lehmann, Dr. Adolf, Bangalore, India, Agricultural Chemist.

1888. Leigh, Cecil, Birmingham Metal and Munition Co., Adderley Park Rolling Mills, Birmingham, Technical Chemist.

1906. Leigh, Edw. Collier, Caixa 147, Pernambuco, Brazil, Gas Works Manager.

1902. Leighton, A. E., Cordite Factory, Aruvankad, Nilgiris, India, Analytical Chemist.

1907. Leisel, Julius, Box 867, Greensboro', N.C., U.S.A.

1894. Leitch, Jno. W., Milnsbridge Chemical Works, near Huddersfield, Aniline Dye Manufacturer.

1904. Le Maistre, Fred J., c/o E. I. du Pont Co., P.O. Box 257, Chester, Pa., U.S.A., Research Chemist.

1898. Leman, Wm. T., P.O. Box 900, St. Louis, Mo., U.S.A., Oil and Asphalt Agent.

1901. Lengfeld, Dr. Felix, 1804, Fillmore Street, San Francisco, Cal., U.S.A., Manufacturing Chemist.

1883. Lennard, F., c/o Forbes, Abbott & Lennard, Ltd., Chemical Works, Shoreham, Sussex, Chemical Manufacturer.

1884. Leonard, Wm. J., 1, Lindfield Gardens, Hampstead, N.W., Naphtha Distiller.

1903. Lepsius, Prof. Dr. B., Griesheim a/M., Germany, Director (Chem. Fabr. Griesheim-Elektron).

1888. Lequin, E., Directeur Général des Usines de Produits Chimiques de la Société de St. Gobain, 1, Place des Saussaies, Paris (VIIIe.), France.

1904. Lesley, R. W., 604, Pennsylvania Building, Philadelphia, Pa., U.S.A., Cement Manufacturer.

1907. Leslie, Fred. A., College of Pharmacy, 115, West 68th Street, New York City, U.S.A., Assistant Chemist.

1894. Leslie, Hugh M., Marikuppam, Mysore State, South India, Chemical Engineer.

1904. Lessing, Dr. Rudolf, Southampton House, 317, High Holborn, London, W.C., Consulting Chemist.

1900. Lessner, Chas. B., Carrill, Spain, Metallurgical Chemist.

1892. Lester, J. H., Royal Exchange, Manchester, Analytical Chemist.

1904. Le Sueur, E. A., 50, MacLaren Street, Ottawa, Ont., Canada, Electrical and Chemical Engineer.

1899. Le Sueur, Dr. Henry R., Chemical Laboratory, St. Thomas' Hospital, London, S.E., Demonstrator.

1898. Leuthardt-Thornton, Peter, 14, Steele's Road, Hampstead, N.W., Chemical Manufacturer.

1891. Lever, Wm. H., M.P., Thornton House, Thornton Hough, Cheshire, Soap Manufacturer.

1901. Levett, Walter, Holmlands, Stanford-le-Hope; and (Journals) Mines Safety Explosives Co., Stanford-le-Hope, Essex, Factory Manager.

1903. Levi, Dr. Louis E., c/o Pfister and Vogel Leather Co., Milwaukee, Wis., U.S.A., Chemist.

1906. Levinstein, Edgar, 74, India Street, Boston, Mass., U.S.A., Chemical Manufacturer.

1901. Levinstein, Dr. Herbert, 21, Minshull Street, Manchester, Chemist.

O.M. Levinstein, Ivan, Hawkesmoor, Fallowfield, Manchester, Colour Manufacturer.

1903. Levy, Arthur G., 45, Clifton Hill, Abbey Road, London, N.W., Chemist.

1901. Levy-Mond, Dr. Albert, Brimsdown Works, Ponders End, Middlesex, Chemical Engineer.

1905. Lévy, René J., 2, Netherton Road, St. Margarets-on-Thames, Managing Director (British Liquid Air Co.).

1887. Lewes, Prof. Vivian B., Royal Naval College, Greenwich, S.E., Professor of Chemistry.

1898. Lewin, H. James, Royal Clarence Yard, Gosport, Hants, Analytical Chemist.

1896. Lewis, Daniel C., c/o Millville Manufacturing Co., Millville, N.J., U.S.A., Dye Works Chemist.

1904. Lewis, Edw. W., c/o J. G. Ingram and Son, London India Rubber Works, Hackney Wick, N.E., Chemist.

1900. Lewis, Ernest A., 310, Dudley Road, Birmingham, Chemist and Metallurgist.

1905. Lewis, F. W., Aetna Powder Co., 1718, Tribune Building, Chicago, Ill., U.S.A., Secretary.

1900. Lewis, John, 35, Mundania Road, Honor Oak, S.E., Cashier (Paint Works).

1900. Lewis, S. Judd, 122, Newington Causeway, London, S.E., Analytical Chemist.

1889. Lewkowitsch, Dr. Julius, 71, Priory Road, West Hampstead, N.W., Consulting Chemist.

1907. Leyson, Lewis T., Pensceynor, near Neath, South Wales, Analytical Chemist.

1901. Lichtenstein, Alf. F., c/o Geisenheimer and Co., P.O. Box 994, New York City, U.S.A., Chemist.

O.M. Lichtenstein, Theodore, Chemical Works, Silvertown, E., Manufacturing Chemist.

1904. Lichtenthaeler, Robt. A., Agricultural Experiment Station, State College, Pa., U.S.A., Chemist.

1892. Liddle, G. A., c/o Island Trading Co., Ltd., Brunei, *viâ* Labuan, Borneo (*viâ* Singapore), Chemist, Dyewood Extract Works.

1885. Liddle, W. T., 14, Willows Avenue, Ansdell, Lytham, Chemist and Manager.

1904. Lieber, Hugo, 1, Platt Street, New York City, U.S.A., Chemist.

O.M. Liebmann, Dr. A., 16, Darby Avenue, West Didsbury, Manchester, Analytical Chemist.

1899. Liedbeck, P. F. Alarik, 43, Strandwagen, Stockholm, Sweden, Chemical Engineer.

O.M. Lightfoot, T. E., Fernleigh, Accrington, Calico Printer's Chemist.

1905. Liley, Thos. A., 37, Aston Road, Bramley, Leeds, Chemist.

1898. Lilly, Josiah K., c/o Eli Lilly and Co., Indianapolis, Ind., U.S.A., Manufacturing Pharmacist.

1885. Lilly, Oliver M., The Croft, Spondon, Derby, Colour Manufacturer.

1904. Lindemann, Ottocar, 53, Victoria Street, Westminster, S.W., Managing Director (Korting Bros., Ltd.).

1906. Linder, S. E., Leodholt, The Drive, Buckhurst Hill, Essex, Analytical Chemist.

1908. Lindfield, James H., 107, Putney Bridge Road, Putney, S.W., Technical Chemist.

1903. Lindmueller, C., c/o United Zinc and Chem. Co., Argentine, Kansas, U.S.A., Chemist.

1897. Lindsay, Robt., Cyanide Works, Ferreira Deep G. M. Co., P.O. Box 1056, Johannesburg, Transvaal, Chemist.

1890. Ling, Arthur R., Laboratory, 74, Great Tower Street, E.C.; and (Journals) Hazeldene, Kingston Road, New Malden, Consulting Chemist.

1908. Linthicum, J. Francis, c/o The Spanish-American Iron Co., Mayari, Oriente, Cuba, Chemist.

1901. Lippincott, Warren B., 345, Lafayette Street, Denver, Colo., U.S.A., Chemist.

1905. Lips, Dr. Carl H., 99, Hart Street, Brooklyn, N.Y., U.S.A., Chemist.

1896. Lishman, Geo. P., Bunker Hill, Fence Houses, Co. Durham, Colliery Chemist.

1905. Little, Arthur D., 93, Broad Street, Boston, Mass., U.S.A., Consulting Chemist.

1901. Little, C. A., Elyria, Ohio, U.S.A., Analytical Chemist.

1889. Little, Wm. G., Blendon Grove, Bexley, Kent, Chemical Manufacturer.

O.M. Littlejohn, Jas., c/o Littlejohn and Whitby, P.O. Box 849, Johannesburg, Transvaal, Analytical Chemist.

1904. Livermore, W. D., Washington Mill, Lawrence, Mass., U.S.A., Chemist.

1886. Liversedge, A. J., Strathgryfe, Kilmalcolm, N.B., Mechanical Engineer.

1906. Liversedge, S. G., City Laboratory, Castle Street, Dublin, Ireland, Analytical Chemist.

1904. Liverseege, J. F., Council House, Birmingham, Public Analyst.

O.M. Liversidge, Prof. A., F.R.S., c/o Young J. Pentland, 21, Warwick Lane, London, E.C., Professor of Chemistry.

1907. Liversidge, Bernard, c/o St. John del Rey Mining Co., Ltd., Morro Velho, Villa Nova de Lima, Minas Geraes, Brazil, Analytical Chemist.

1883. Livingston, W. J., London County Council, Spring Gardens, London, S.W., Analytical Chemist.

1903. Llewellyn, Ivor P., Goole Alum Works, Goole, Chemist.

1907. Llewellyn, W. B., Rock Villa, New Hey, near Rochdale, Chemist.

1899. Lloyd, Charles, (subscriptions) c/o Lake View Consols, Ltd., Salisbury House, London, E.C.; and (Journals) c/o Manager, Lake View Consols, Ltd., P.O. Box 99, Finiston, West Australia, Secretary.

1900. Lloyd, Fred. J., Muscovy House, Trinity Square, London, E.C., Analyst.

1904. Lloyd, Leonard B., Broadford Tannery, Broadford, Victoria, Australia, Tanner.

1907. Lloyd, Dr. Lorenzo L., Technical College, Bradford, Yorks, Lecturer in Chemistry.

1900. Lloyd, Thos. H., c/o Quibell Bros., Newark, Analyst.

1906. Lloyd-Willey, W. S., 5, Cottage Grove, Bow, E., Charcoal Manufacturer.

1901. Lober, Jno. B., Vulcanite Portland Cement Co., 1230, Land Title Building, Philadelphia, Pa., U.S.A., Cement Manufacturer.

1888. Lodge, Edw., 25, Scale Hill, Cowcliffe, Huddersfield, Teacher of Wool Dyeing.

1900. Loeb, Dr. Morris, 273, Madison Avenue, New York City, U.S.A., Professor of Chemistry.

1891. Loewenthal, Dr. R., Uhlandstrasse 39, Frankfurt a/M., Germany, Lecturer on Dyeing.

1907. Logan, Chas. T., Emporium, Pa., U.S.A., Powder Manufacturer.

1905. Lomax, Abraham, 83, Station Road, Kearsley, Farnworth, R.S.O., Potter's Chemist.

1907. Lomax, Ernest L., Apartado 116, Minatitlan, Estado de Vera Cruz, Mexico, Chemist.

1908. Lones, Joseph, 1, Vicarage Road, Smethwick, near Birmingham, Public Analyst.

1901. Long, Eugene J., c/o E. O'Callaghan and Son, City Tannery, Limerick, Ireland, Tanner.

1898. Longstaff, Jas. P., Chemical Department, The University, Edinburgh, Assistant.

1904. Loomis, Dr. H., 58, West 40th Street, New York City, U.S.A.

1902. Loomis, Henry M., U.S. Food Laboratory, Galveston, Texas, U.S.A., Chemist.

1890. Lord, F. J., 4, Winmarleigh Street, Warrington, Analytical Chemist.

1896. Lord, Jno. Lloyd, 23, Park View, Elton, Bury, Lancs., Chemist and Manager.

1897. Lord, N. W., 338, West 8th Avenue, Columbus, Ohio, U.S.A., Professor of Metallurgy.

O.M. Lorenz, H., 7 and 8, Idol Lane, London, E.C., Chemical Merchant.

1904. Lorimer, John H., 280, West Walnut Lane, Germantown, Philadelphia, Pa., U.S.A., Textile Machinist and Merceriser.

1905. Loring, Lindley, 55, Kilby Street, Boston, Mass., U.S.A., Vice-President (Cochrane Chemical Co.).

O.M. Lorrain, J. G., Norfolk House, Norfolk Street, Strand, London, W.C., Chartered Patent Agent.

1904. Lossen, Dr. Clemens F., Strada Lipscani 10, Bukarest, Roumania, Chemist.

O.M. Lott, F. E., The Laboratory, Bridge Chambers, Burton-on-Trent, Consulting Brewing Chemist.

O.M. Louis, D. A., 77, Shirland Gardens, London, W., Metallurgist and Mining Engineer.

1894. Louis, Prof. Henry, Armstrong College, Newcastle-on-Tyne, Professor of Mining.

O.M. Love, Dr. E. G., 80, East 55th Street, New York City, U.S.A., Analytical Chemist.

1899. Love, Wm., 28, Royal Exchange Square, Glasgow, Managing Director (Broxburn Oil Co., Ltd.).

1895. Lovejoy, Frank W., 22, Seneca Parkway, Rochester, N.Y., U.S.A., Chemical Engineer.

1904. Loveland, Jas. W., 115, Passaic Street, Hackinsack, N.J., U.S.A., Superintendent of Soap Works.

O.M. Lovibond, J. W., Lake House, Salisbury, Tintometer Manufacturer.

O.M. Lovibond, T. W., West Jesmond House, Newcastle-on-Tyne, Brewer.

1897. Low, Albert H., P.O. Drawer 1537, Denver, Colo., U.S.A., Metallurgical Chemist.

1900. Low, Prof. Wilson H., Cudahy Packing Co., South Omaha, Neb., U.S.A., Chemist.

1887. Lowe, Clement W., Thorneyholme, Knutsford, Cheshire, Manufacturing Chemist.

1905. Lowe, Houston, The Lowe Bros. Co., Dayton, Ohio, U.S.A., Paint and Varnish Maker.

1906. Lowe, James, c/o Auckland Gas Co., Auckland, New Zealand, Gas Engineer.

O.M. Lowe, W. F., 18, Hough Green, Chester, Analytical Chemist.

1904. Lowenstein, Arthur, c/o Nelson, Morris and Co., U.S. Yards, Chicago, Ill., U.S.A., Chemist.

1885. Lowson, Dr. J. G. F., Snitterfield House, Stratford-on-Avon, Paper Maker.

1906. Lowson, Wm., The University, Leeds, Chemical Lecturer.

1895. Lucas, Alf., Survey Department, Giza, Egypt, Analyst.

1892. Lucas, Bernard R., Winnington Park, Northwich, Alkali Works Manager.

O.M. Lucas, R., Alwinenstrasse 11, Wiesbaden, Germany, Technical Chemist.

O.M. Luck, A. Courtenay, Naval Arsenal, Zarate, Argentina, Explosives Chemist.

1900. Lummus, Walter E., 62, Newhall Street, Lynn, Mass., U.S.A., Manager (Commonwealth Manufacturing Co.).

1903. Lumsden, Alex. A., Forth Chemical Works, Bo'ness, N.B., Technical Chemist.

1888. Lund, Jas., 142, Hawthorne Street, Malden, Mass., U.S.A., Ammonia Works Manager.

1888. Lundholm, Carl O., Nobel's Explosives Co., Ltd., Ardeer Factory, Stevenston, Ayrshire, Manager.

1898. Lundteigen, Andreas, Union City, Mich., U.S.A., Chemist.

O.M. Lunge, Prof. Dr. G., Rämistrasse 56, Zürich, V., Switzerland, Professor of Chemistry.

1894. Lungwitz, Theo., c/o Chas. Pfizer and Co., 81, Maiden Lane, New York City, U.S.A., Chemist.

1885. Lupton, Sydney, 102, Park Street, Grosvenor Square, London, W.

1890. Luthy, Edmund O., 2419, Ohio Avenue, Cincinnati, Ohio, U.S.A., Distiller.

1884. Lüthy, Otto, Maywood, N.J., U.S.A., Analytical Chemist.

1895. Luxmoore, Dr. Chas. M., Jumples Lodge, near Halifax, Yorks., Lecturer on Chemistry.

1899. Luxton, Thos., 28, Albany Street, Hull, Teacher of Chemistry.

1903. Lye, Ernest B., Leagrave Hall, near Luton, Beds., Straw Plait Dyer and Bleacher.

1885. Lye, W. T., Leagrave Hall, near Luton, Beds., Straw Dyer.

1884. Lyle, James, Ardesco, Plaistow Wharf, Victoria Docks, E., Sugar Refiner.

1885. Lyle, Jno., 21, Mincing Lane, London, E.C., Sugar Refiner.

1902. Lyle, Robert F., Berry Yards Sugar Refinery, Greenock, N.B., Analytical Chemist.

1896. Lymn, Arthur H., 71, College Road, Bromley, Kent, Chemical Works Manager.

1906. Lynch, W. D., 10, Pinckney Street, Boston, Mass., U.S.A., Analytical Chemist.

1899. Lynn, R. Rankine, 7, Highburgh Terrace, Dowanhill, Glasgow, Chemical Engineer.

1902. Lyon, Edwd. H., 520, West 27th Street, New York City, U.S.A., Manufacturing Chemist.

O.M. Lyon, J. G., The Aire Tar Works, Knottingley, Yorks., Tar Distiller.

1906. Lyons, Robert H., Emporium, Pa., U.S.A., Chemist.

O.M. Lytle, A. M., North of Ireland Chemical Co., Ltd., 34, Victoria Street, Belfast, Ireland, Chemical Manufacturer.

M

1898. Maass, Frank, P.O. Box 1507, Paterson, N.J., U.S.A., Silk Dyer.
1904. Mabee, Fred. Carleton, Sumner Hall, Cambridge, Mass, U.S.A., Assistant in Chemistry.
1887. Mabery, Prof. Chas. F., Case School of Applied Science, Cleveland, Ohio, U.S.A., Professor of Chemistry.
1891. Macadam, Herbert E., Dalkeith, Glengall Road, Woodford Green, Essex, Manure Works Manager.
1894. Macadam, Stevenson, 55, York Place, Edinburgh, Analytical Chemist.
1891. Macallan, J., 3, Rutland Terrace, Clontarf, Dublin, Analytical Chemist.
1894. McAlley, Robt., Bankside, Falkirk, N.B., Paint Works Manager.
1892. Macara, Thos., jun., 30, Oakfield Road, Stroud Green, N., Chemist.
1889. McArthur, Jno., 262, Trinity Road, Wandsworth Common, S.W., Chemist.
1887. McArthur, J. B., Price's Patent Candle Co., Limited, Bromborough Pool, near Birkenhead, Chemist.
O.M. McArthur, J. S., 74, York Street, Glasgow, Consulting Chemist and Metallurgist.
1901. MacArthur, Jno. S., 15, St. John's Road, Pollokshields, Glasgow, Paint and Varnish Manufacturer.
1892. McArthur, Thos., 7, Temple, Dale Street, Liverpool, Drysalter and Dyewood Extractor.
1907. McBryde, Warren H., E. I. du Pont Powder Co., Pinole, Cal., U.S.A., Chief Engineer.
1905. McCallum, A. L., Queen Building, Halifax, N.S., Canada, Analytical and Consulting Chemist.
1898. MacCallum, D. A., 389, Central Chambers, 93, Hope Street, Glasgow, Chemist.
O.M. McCallum, J. M., Southdene, Paisley, N.B., Soap Manufacturer.
1903. McCandless, Jno. M., State Laboratory, Atlanta, Ga., U.S.A., Analytical Chemist.
1894. McCann, Owen, c/o J. Gilton and Co., 19, Oriel Street, Vauxhall Road, Liverpool, Printing Ink Manufacturer.
1908. McCarter, Fred. W., 17, Lewis Wharf, Boston, Mass., U.S.A., General Manager.
1905. McCaw, Major W. D., Library, Surgeon General's Office, Washington, D.C., U.S.A., Officer, Medical Department, U.S. Army.
1905. McCleary, Wm., 61, Station Road, Pendlebury, near Manchester, Finisher.
1907. McCombie, Chas., 8, Hartley Road, Leytonstone, N.E., Chemist.
1907. McConnan, Dr. Jas., Chemical Laboratory, Frigorifico, Campana F.C.R., Argentina, Chemist (River Plate Fresh Meat Co.).
1903. McCourt, Cyril D., 13, Malwood Road, Balham Hill, S.W., Research Chemist (Morgan Crucible Co.).
O.M. McCowan, W., Essex Wharf, Narrow Street, Limehouse, E.
1897. McCrae, Dr. John, Government Laboratories, P.O. Box 1080, Johannesburg, Transvaal, Government Analyst.
1898. McCreath, Wm. D., c/o Quantock Vale Cider Works, North Petherton, Bridgewater, Cider Manufacturer.
1884. McCulloch, J., 13, Clarence Drive, Hyndland Road, Glasgow, Chemical Works Manager.
1900. McCulloch, John, Glencoe, Lostock Gralam, Cheshire, Chemical Engineer.
1903. McCully, R. E. J., Crown and Quarry Works, Frindsbury, Rochester, Kent, Analytical Chemist.
O.M. McDaniel, J. J., Woodlands, Bandon, Ireland, Distiller.
O.M. Macdonald, A., 72, Great Clyde Street, Glasgow.
1907. McDonald, Geo. G., 66, Madison Avenue, Toronto, Canada, Student.
1907. MacDonald, G. Mac., c/o Union Metallic Co., Bridgeport, Conn., U.S.A., Mechanical Engineer.
1897. MacDonald, G. W., 4, St. Stephen's Road, Bayswater, W., Explosives Chemist.
O.M. Macdonald, J. W., Cleveland, The Glebe, Blackheath, S.E., Analytical Chemist.
1902. Macdonald, Peter, jun., c/o Mazapil Copper Co., Ltd., Concepcion del Oro (Apartado No. 5), Saltillo, Zacatecas, Mexico, Analytical Chemist.
1899. MacDonald, S. Fremont, c/o Ashtabula Hide and Leather Co., Ashtabula, Ohio, U.S.A., Tanner.
O.M. McDonald, T. McG., Walilabo Estate, St. Vincent, West Indies, Sugar Chemist.
1906. Macdougald, Geo. D., City Laboratory, 13, Shore Terrace, Dundee, Analyst.
1895. McDougall, Isaac, jun., 68, Port Street, Manchester, Chemical Manufacturer.
1907. McDougall, Jas., Vauxhall Distillery, Vauxhall Road, Liverpool, Distillery Manager.
1890. McDougall, J. T., Dunolly, Morden Road, Blackheath, S.E., Manufacturing Chemist.
1907. McDougall, R. K., Glenarbuck, Bowling, Scotland, Analytical Chemist.
1906. McDowall, Wm., Oficina Anita, Pampa Central, Antofagasta, Chile, South America, Analytical Chemist.
1906. McDowell, Alex. H., c/o General Chemical Co., Bayonne, N.J., U.S.A., Chemist.
1905. McDowell, Stewart H., 1239, South 47th Street, Philadelphia, Pa., U.S.A., Colour Maker.
1889. MacEwan, Peter, 64, Southwood Lane, Highgate, N., Editor of "Chemist and Druggist."
1891. McEwen, Atholl F., 40, Handen Road, Lee, S.E., Analytical Chemist and Assayer.
1901. McEwen, Duncan C., 175, St. Vincent Street, Glasgow, Metallurgical Chemist.
1908. McEwen, Stuart R., c/o Chemical Laboratories, Ltd., 148, Van Horne Street, Toronto, Canada, Chemist.
1902. McFarland, Alan R., c/o Solvay Process Co., Syracuse, N.Y., U.S.A., Alkali Works Manager.
O.M. Macfarlane, R. F., Tharsis Copper Works, East Moors, Cardiff, Works Manager.
1901. McFarlane, Walter, Sunnyside, Thornliebank, Renfrewshire, Printworks Manager.
1890. McFarlane, W. W., East 20th Street, Chester, Pa., U.S.A., Dyeworks Manager.
1893. McGhie, T. Burns, c/o Quirk, Barton and Co., Normandy Wharf, Rotherhithe, S.E., Analytical Chemist and Assayer.
1904. McGill, A., 317, Queen Street, Ottawa, Canada, Analytical Chemist.
1899. MacGillivray, Wm. A., c/o Swansea Safety Fuse Co., Pipe House Wharf, Swansea, Analytical Chemist.
1887. McGlashan, John, Cawnpore Sugar Works, Cawnpore, India, Technical Chemist.
1902. McGovney, Chas. S., Engineering Experiment Station, Urbana, Ill., U.S.A., Chemist.
1884. McGowan, John, Ash House, Talke, near Stoke-upon-Trent, Colliery Manager.
1906. McGregor, Russell, 20, Havelock Square, Sheffield, Analytical Chemist.
1905. McGrigor, G. D., Perran Mine, Marazion, Cornwall, Mine Owner.
1896. McIlhiney, Dr. Parker C., 145, East 23rd Street, New York City, U.S.A., Chemist.
1894. McIlwaine, Alf. W., Stoneferry, Hull, Oil Manufacturer.
O.M. MacIndoe, G. D., Ness Street, Invercargill, New Zealand, Public Analyst and Consulting Chemist.
1903. Macintire, Benj. Gould, P.O. Box 365, Rumford Falls, Maine, U.S.A., Chemist.
1904. Macintosh, J. C., Bruce Mines, Ont., Canada, Chemist.
1888. MacKean, Wm., 208, Bedford Hill, Balham, S.W., Technical Chemist.
O.M. McKechnie, D., Heath House, Runcorn, Copper Extractor.
O.M. McKechnie, D. M., Metal Works, Widnes, Lancashire, Copper Extractor.
1904. McKechnie, R. D., Productos Quimicos de Huelva, Sociedad Anonyma, Huelva, Spain, Chemist.

1887. McKellar, W. G., c/o United Alkali Co., Ltd., Henderson Works, Irvine, N.B., Technical Chemist.
1906. Mackendrick, W. P., c/o Anglo-American Oil Co., Ltd., 13, St. Ann Street, Manchester.
1904. McKenna, A. G., The Windsor, 14th and F. Street, Washington, D.C., U.S.A., Metallurgical Chemist.
1895. McKenna, Dr. Chas. F., 221, Pearl Street, New York City, U.S.A., Chemist.
1899. McKenzie, Alex. H., 17, North Street, North Adams, Mass., U.S.A., Colour Mixer.
1893. McKerrow, C. A., Wingfield, Wilmslow, Cheshire, Consulting Chemist.
1905. McKerrow, W. J., c/o J. C. and J. Field, Ltd., Lambeth, S.E., Analytical Chemist.
1893. McKesson, John, 91, Fulton Street, New York City, U.S.A., Manufacturing Chemist.
1891. Mackey, W. McD., Victoria Chambers, Leeds, Analytical Chemist.
1900. McKillop, George F., Broxburn Oil Works, Broxburn, N.B., Works Chemist.
1890. McKillop, Jno., 93, Brook Green, London, W., Metallurgist.
1902. McKim, Wm., 37, Fairview Street, Yonkers, N.Y., U.S.A., Colour Maker.
1898. McLaurin, Robt., 414, Sauchiehall Street, Glasgow, Chemist.
1905. McLellan, Basil G., c/o Rowntree & Co., Ltd., The Cocoa Works, York. Analytical Chemist.
1892. McLeod, Jas., Gas Works, Kirkintilloch, N.B., Manager.
1903. MacMahon, F. W., 31, Marler Road, Forest Hill, S.E., Chemist (Oxychlorides, Ltd.).
1896. McMaster, Daniel, c/o H. & D. Menzies, 4, Brunswick Lane, Glasgow, Paper Mill Manager.
1894. Macmillan, Arch., c/o Dr. Crombie, Main Street, Mechanicville, N.Y., U.S.A.
1907. McMillen, Russell H., c/o American Vanadium Co., Bridgeville, Pa., U.S.A., Chemist.
1903. McMullan, Charles, 4, William Street Chambers, Belfast, Ireland, Chemist.
1904. McMullen, Alan, 108, James Street, Dublin, Ireland, Brewer.
1889. McMurtrie, J. M., 320, Maxwell Road, Pollokshields, Glasgow, Brass Founder.
1900. McMurtrie, Dr. Wm. T., 480, Park Avenue, New York City, U.S.A., Chemist.
1895. McMurtry, G. C., Mount Street, Nelson, New Zealand ; and (Subscriptions) c/o C. H. Izod, 84, Queen Victoria Street, London, E.C., Manager.
O.M. Macnab, W., 10, Cromwell Crescent, London, S.W. Analytical Chemist.
1907. McNaughton, Wm. G., c/o Canadian Rubber Co., Ltd , Papineau Square and Notre Dame, Montreal, Canada, Chemist.
1907. Macpherson, Robert, 24, King William Street, London, E.C., Managing Director (Sapon, Ltd.).
1894. McVitie, Robt., Biscuit Works, Willesden, N.W., Biscuit Manufacturer.
1901. Maertens, Emile, P.O. Box 1002, Providence, R.I., U.S.A., Engineer.
1895. Magnus, Isidor, 52, Leadenhall Street, London, E.C., Chemical Merchant.
1901. Magruder, Egbert W., Department of Agriculture, Richmond, Va., U.S.A., Chemist.
1906. Maguire, Peter, 199, Piccadilly, London, W., Chemist and Colourist.
1885. Mahon, R. W., N. Y. Central and Hudson River Railroad, West Albany, N.Y., U.S.A., Chemist.
1898. Main, Wm., Piermont, N.Y., U.S.A., Chemist.
1904. Mair, William, 7, Comiston Road, Edinburgh, Chemist.
1905. Major, Ernest, Eagle Paint Works, Snail's Bay, Balmain, Sydney, N.S.W., Australia, Paint Works Manager.
O.M. Major, J. Lewis, Welton Garth, Brough, East Yorks., Tar Distiller and Chemical Manufacturer.
1886. Mallinckrodt, Edw., Mallinckrodt Chemical Works, St. Louis, Mo., U.S.A., Manufacturing Chemist.
1897. Mallory, J. Halsey, Drawer 69, Columbia, S.C., U.S.A., Assistant Chemist (The American Cotton Oil Co.).
1908. Manahan, Paul R., 37, Caller Street, Peabody, Mass., U.S.A., Salesman.
1896. Mann, E. A., Government Laboratory, Perth, Western Australia, Government Analyst.
1893. Mann, Harold H., Agricultural College, Poona, Bombay, India, Research Chemist.
1899. Mann, Jas. S., 97, Greengate Street, Plaistow, Essex, Analyst.
1891. Mann, John C., 9, Lambert Street, Hull, Chemist.
1903. Mannhardt, Hans, c/o Heath & Milligan Manufacturing Co., 170, Randolph Street, Chicago, Ill., U.S.A., Chemical Engineer.
O.M. Mannington, H. T., Marshlea, Beaconsfield Road, Farnworth, Widnes.
1892. Mansbridge, Wm., 4, Norwich Road, Wavertree, Liverpool, Chemist.
1904. Marckworth, O. S., Ohio Testing Laboratory, 25 and 26, Board of Trade, Columbus, Ohio, U.S.A., Analytical Chemist.
1903. Mardick, Jno. R., Westminster, Md., U.S.A., Chemical Engineer.
1883. Markel, Dr. K., Tower House, Bewsey, Warrington, Technical Chemist.
1905. Marland, Percy, c/o Brotherton and Co., Ltd., Ammonia Works, Wakefield, Yorks., Chemist.
1905. Marlatt, Wilbur T., Oakville, Ont., Canada, Leather Manufacturer.
1902. Marriott, F. Grant, 14, Selby Street, Toronto, Canada, Chemical Student.
1904. Marris, H. C., The Russian Steam Oil Mills Co., 32, Kourlandski Street, St. Petersburg, Russia, Analytical Chemist.
1904. Marschall, Adolf J., Madison, Wis., U.S.A., Chemist.
1901. Marsden, Dr. Fred., c/o Messrs. H. Ashwell & Co., New Basford, Nottingham, Chemist.
1906. Marsden, Oliver, Manor Road Mill, Victoria Road, Leeds, Cashier.
1905. Marsh, John, Massarah Cement Works, near Heluan, Egypt, Cement Works Chemist.
O.M. Marsh, J. T., Ammonia Soda Works, Fleetwood, Lancashire, Chemist.
1883. Marsh, W., Union Alkali Co., Soho Works, Ancoats, Manchester, Chemical Manufacturer.
1895. Marshall, Arthur, The Cottage, Dartford, Kent, Explosives Chemist.
1895. Marshall, Francis G., 4, Woodhouse Terrace, Bewick Road, Gateshead, Technical Chemist.
1891. Marshall, Dr. Hugh, 12, Lonsdale Terrace, Edinburgh, Professor of Chemistry.
1901. Marshall, Jos. W., 143, De la Pole Avenue, Hull, Science Lecturer.
1896. Marshall, Percy S., Union Laboratory, Half Moon Street, Huddersfield, Assistant Chemist.
1883. Marshall, Wm., Carisbrook, Queen's Road, Cheadle Hulme, Cheshire, Dyer.
1884. Marshall, Wm., Barkley, Teddington, Middlesex, Analytical Chemist.
1904. Marston, John P., 247, Atlantic Avenue, Boston, Mass., U.S.A., Merchant.
1894. Martin, Alex. M., Hillview, Twechar by Glasgow, Analytical Chemist.
1895. Martin, Chas. H., 40, Bolton Road, Pendleton, Salford, Oil and Soap Works Manager.
O.M. Martin, N. H., Ravenswood, Low Fell, Gateshead-on-Tyne, Manufacturing Chemist.
1899. Martin, Wm. E., c/o Kynoch Ltd., Arklow, Co. Wicklow, Ireland, Chemist.
1887. Martineau, Sydney, Streatham Grove, Norwood, S.E., Sugar Chemist.
1907. Martius, Dr. C. A. von, Voss Strasse 12, Berlin, Germany, Chemist.
1894. Martyn, T. Graham, 11, Stratton Terrace, Truro, Cornwall, Metallurgist.
1905. Marx, Dr. Emil, Georgenstrasse 4, München, Bavaria, Germany, Research Chemist.
1902. Marx, Joseph S., California Powder Works, Pinole, Cal., U.S.A., Chemist.

1905. Marx, Dr. Max, 81, Shanley Avenue, Newark, N.J., U.S.A., Manufacturing Chemist.
1904. Mason, Dr. Edward D., 22, George Road, Edgbaston, Birmingham, Scientific Apparatus Dealer.
1906. Mason, Frederic S., 90, Beekman Street, New York City, U.S.A., Manufacturing Chemist.
1904. Mason, Glen F., c/o H. J. Heinz Co., Pittsburg, Pa., U.S.A., Chemist.
1887. Mason, J. Francis, Eynsham Hall, Witney, Oxon.
1906. Mason, M. Edgar, 510, Talbot Avenue, Boston, Mass., U.S.A., Chemist.
1892. Mason, Thos., Beech Avenue, Nottingham, Manufacturing Chemist.
1906. Massa, Corradino, Castelguelfo Parmense, Parma, Italy, Sulphuric Acid and Fertiliser Manufacturer.
O.M. Masson, Prof. D. Orme, University of Melbourne, Victoria, Australia, Professor of Chemistry.
1904. Masson, Victor E., Pleasant Valley Wine Co., Rheims, Steuben Co., N.Y., U.S.A., Chemist.
1902. Masujima, Prof. Bunjiro, 23, Midoricho Itchome, Honjoku, Tokyo, Japan, Prof. of Applied Chemistry.
1903. Masure, Gaston, 7, Rue de Constantine, Rouen, France, Chemist.
1902. Masury, Fred L. M., Lock Box 144, Sharon, Pa., U.S.A., Explosives Manufacturer.
O.M. Mather, J., Blaydon Chemical Works, Blaydon-on-Tyne, Manager.
1904. Mather, J. Cecil, 15, The Holloway, Runcorn, Cheshire, Works Chemist.
1900. Mather, Wm., c/o British Aluminium Co., Ltd., Larne Harbour, Co. Antrim, Ireland, Chemist.
1907. Matheson, A. Greville E., c/o Matheson & Grant, 13, Walbrook, London, E.C., Engineer.
1890. Matheson, W. J., c/o Cassella Colour Co., 182, Front Street, New York City, U.S.A., Chemical Merchant.
1901. Mathew, W. E. B. de Vere, Dinham, Hillside Gardens, Wallington, Surrey, Analytical Chemist.
1900. Mathews, Dr. Jno. A., c/o Crucible Steel Co. of America, Syracuse, N.Y., U.S.A., Chemist.
1898. Mathewson, E. P., Anaconda, Mont., U.S.A., Metallurgist.
1888. Mátos, Louis J., 101, North 19th Street, East Orange, N.J., U.S.A., Chemist.
1896. Matsui, G., c/o Japan Sugar Refinery Co., Onagigawa, Tokio, Japan, Chemical Engineer.
O.M. Matthews, Chas. G., 31, Stapenhill Road, Burton on-Trent, Brewing Chemist.
1907. Matthews, Dr. F. E., 6, Hillcroft Crescent, Ealing, W., Technical Chemist.
1899. Matthews, Dr. J. Merritt, 65, Summer Street, Taunton, Mass., U.S.A., Professor of Chemistry and Dyeing.
1889. Mawdsley, W. H., c/o Gold Mining Co., Ltd., Mount Morgan, Queensland, Chemist.
1906. Mawson, Fred. E., 135, Pearl Street, Boston, Mass., U.S.A., Dyestuff Merchant.
1903. Maxim, Hudson, 698, St. Mark's Avenue, Brooklyn, N.Y., U.S.A., Chemist and Mechanical Engineer.
1894. Maxwell, Jno., Solway Chemical Works, Silloth, and (communications) English Street, Carlisle, Cumberland, Chemical Manure Manufacturer.
1903. Maxwell, Orin P., Piedmont, Mineral Co., West Va., U.S.A., Chemist.
1897. May, George H., c/o Fabrikoid Co., Newburgh, N.Y., U.S.A., Assistant Chemist.
1901. May, Dr. Sidney, 513, Bainbridge Street, Brooklyn, N.Y., U.S.A., Chemical Lecturer.
1884. Mayenfeld, Dr. E. von Salis. *See* Salis-Mayenfeld, Dr. E. von.
1903. Mayer, Andrew, jun., 129, York Street, Brooklyn, N.Y., U.S.A., Chemist.
1896. Mayfield, A. S., Thirlmere, Newland, Hull, Analyst.
1892. Mayfield, H. B., Normanhurst, Mundy Street, Heanor, near Nottingham, Dyer.
1885. Mayhew, E. W. A., High Street, Freemantle, Western Australia, Manufacturing Chemist.
1907. Maynard, Geo. W., 20, Nassau Street, New York City, U.S.A., Mining Engineer.
1900. Maywald, F. J., 1028, 72nd Street, Brooklyn, N.Y., U.S.A., Technical Chemist.
1907. Meade, Geo. P., National Sugar Refinery, Yonkers, N.Y., U.S.A., Chemist.
1902. Meade, Richd. K., Nazareth, Pa., U.S.A., Chemist.
1904. Meads, Charles J., Bel Air, Dartmouth, Inland Revenue Officer.
1898. Meeds, Alonzo D., 2424, Harriet Avenue, Minneapolis, Minn., U.S.A., Analytical Chemist.
1896. Meggitt, Loxley, Wheatsheaf Works, Alexandrina, Sydney, N.S.W., Australia, Analytical Chemist.
1901. Meier, Dr. Franz, Basle Chemical Works, Basle, Switzerland, Chemist.
1888. Meikle, Jno., 8, Melrose Street, Great Western Road, Glasgow, Journalist.
1902. Melcher, Arthur C., 58, Bowen Street, Newton Centre, Mass., U.S.A., Chemist.
O.M. Meldola, Prof. R., F.R.S., 6, Brunswick Square, London, W.C., Professor of Chemistry.
1901. Meldrum, Dr. And. N., The University, Sheffield, Lecturer on Chemistry.
O.M. Mellon, W. W., 9, Glenart Avenue, Blackrock, Co. Dublin, Ireland, Manufacturing Chemist.
O.M. Mellor, S., Magnesium Metal Co., Patricroft, Manchester, Metal Refiner.
1884. Melville, D., 2, Melville Avenue, Delray, Detroit, Mich., U.S.A., Chemical Works Manager.
1893. Mensching, Dr. C., Anilinfabrik., Greppen bei Bitterfeld, Germany, Chemist.
1905. Menzies, David, 11, Camphill Avenue, Langside, Glasgow, Analyst.
O.M. Menzies, R. C., Inveresk Mills, Musselburgh, N.B. Paper Maker.
1892. Mercer, C. A., 34, Camomile Street, London, E.C., Chemical Apparatus Maker.
1886. Mercer, J. B., 4, Tabley Road, Knutsford, Cheshire.
1890. Merck, E., Darmstadt, Germany, Manufacturing Chemist.
1905. Merck, George, Merck and Co., University Place, New York City, U.S.A., Manufacturing Chemist.
1887. Merrell, Geo., Lock Box 786, Cincinnati, Ohio, U.S.A., Manufacturing Chemist.
1899. Merrill, Frank H., 2424, Ocean View Avenue, Los Angeles, Cal., U.S.A., Factory Superintendent.
1903. Merrill, Herbert C., c/o Eimer & Amend, 205, Third Avenue, New York City, U.S.A., Chemical Engineer.
1906. Merrils, Fred. J., 25, Figtree Lane, Sheffield, Analytical Chemist.
1905. Merrin, A. C., 44, Bishopsgate Street Without, London, E.C., Assistant Editor and Analyst.
1902. Merritt, Wm. G., 643, Second Avenue, Detroit, Mich., U.S.A., Chemical Engineer (Berry Bros., Varnish Manufacturers).
1904. Merry, Jno. B., 12, Mayfield Road, Handsworth, Birmingham, Metallurgical Chemist.
1903. Mersan, Ferdinand de, Fairfield, Chestnut Avenue, Boston Spa, Yorks, Chemist.
1903. Mersereau, Gail, 181, Pearl Street, New York City, U.S.A., Chemist.
1905. Merz, Eugene, P.O. Box 216, Newark, N.J., U.S.A., General Superintendent, Heller and Merz Co.
1905. Merzbacher, Aaron, Hotel Monaca, Monaca, Pa., U.S.A., Chemist.
1897. Meslans, Prof. M., 59 Quai de la Baronnie, Ablon (Seine et Oise), France, Professor of Chemistry.
O.M. Messel, Dr. R., 147, Victoria Street, London, S.W., Chemical Manufacturer.
1899. Metcalf, Howard F., Farr Alpaca Co., Holyoke, Mass., U.S.A.
1886. Metcalf, Jno., Moorfield Chemical Works, Altham, near Accrington, Tar Distiller.
1905. Methley, Bernard, 21, Clifton Mount, Rotherham, Yorks., Engineering Chemist.
1907. Mettler, Arthur J., c/o The Fibre Conduit Co., Orangeburg, N.Y., U.S.A., Chemist.
1898. Metz, Herman A., P.O. Box 753, New York City, U.S.A., Chemical Merchant.
1905. Metzis, Josef, Anglicia Petroleum Co., Drohobycz, Galicia, Austria, Manager of Refinery.

1900. Mewborne, Robt. G., c/o Kentucky Tobacco Product Co., Louisville, Ky., U.S.A., Chemist.

1907. Meyer, Dr. Erwin, c/o India Rubber Co., New Brunswick, N.J., U.S.A., Chemist.

1898. Meyer, Dr. Franz, 52, Broadway, New York City, U.S.A., Metallurgical and Chemical Engineer.

1902. Meyer, Dr. Fredk. L., 2028, Park Avenue, Philadelphia, Pa., U.S.A., Chemist.

1900. Meyer, Karl, Sortedams Dossering 95A, Copenhagen, O., Denmark, Technical Chemist.

1904. Meyer, Prof. Dr. Richard, Technische Hochschule, Braunschweig, Germany, Professor of Chemistry.

1902. Meyrick, L. J., 137, City Road, Birmingham, Assistant Analyst.

1907. Micklethwait, Miss Frances M. G., Penhein, Chepstow, Mon.; and (Journals) Royal College of Science, London, S.W., Chemist.

1904. Mighill, Thos. A., 15, Exchange Street, Boston, Mass., U.S.A., Chemist.

1906. Mihalovitch, Sydney F., 514, East Pearl Street, Cincinnati, Ohio, U.S.A., Chemist.

1896. Miles, G. Wellington, 29, Central Street, Boston, Mass., U.S.A., Analytical Chemist.

1889. Milestone, W. C., 7, Heathfield Road, Wandsworth Common, S.W., Chemical Works Manager.

1899. Millar, Jas. H., P.O. Box 120, Durban, Natal, Manufacturing and Analytical Chemist.

1897. Millard, Edgar J., 40–42, Charlotte Street, London, E.C., Chemist and Manager.

1903. Millen, J. Dunlop, Mount Bischoff Mine, Waratah, Tasmania, Assistant General Manager.

1883. Miller, Dr. A. K., Kilvert's Buildings, Withy Grove, Manchester, Analytical Chemist.

O.M. Miller, E. V., Sugar Works, Chelsea, Auckland, New Zealand, Sugar Works Chemist.

1889. Miller, Geo., Clydesdale, Groes Road, Cressington, Liverpool, Technical Chemist.

1900. Miller, Hampton K., Lake City, Flo., U.S.A., Chemist (Florida A. and M. College).

1893. Miller, Dr. Harry E., 1015, Chestnut Street, Oakland, Cal., U.S.A., Chemist.

1902. Miller, H. Harold, 303, Front Street East, Toronto, Canada, Chemist.

1883. Miller, Dr. H. von, Beatrixgasse 32, Wien, Austria, Chemical Manufacturer.

1904. Miller, Jas., Pharmacist.

1894. Miller, Dr. John A., 44–45, Lewis Block, Buffalo, N.Y., U.S.A., Consulting Chemist, State Analyst.

1894. Miller, J. Carlile, 188, St. Vincent Street, Glasgow, Manufacturing Chemist.

1888. Miller, J. Hopkins, 5, Catherine Street, Parliamentary Road, Glasgow, Dyeworks Chemist.

1889. Miller, Jno. Poynter, Sandilands Chemical Works, Aberdeen, Technical Chemist.

1899. Miller, P. Schuyler, 3500, Gray's Ferry Road, Philadelphia, Pa., U.S.A., Chemist.

1907. Miller, R. H., c/o The Flavell Co., Asbury Park, N.J., U.S.A., Chemical Manufacturer.

1901. Miller, Stuart B., c/o E. I. du Pont de Nemours Powder Co., Marquette, Mich., U.S.A., Chemical Engineer.

1904. Miller, William Exley, c/o The Arizona Copper Co., Ltd., 29, St. Andrew Square, Edinburgh, Secretary.

1901. Miller, W. Lash, 50, St. Alban Street, Toronto, Canada, Associate Professor of Physical Chemistry.

1884. Miller, W. M., Caledonia Estate, Prov. Wellesley, Penang, S.S., Sugar Chemist.

1902. Milligan, R. E., New York Continental Jewell Filtration Co., 15, Broad Street, New York City, U.S.A., Chemical Engineer.

1904. Millroy, Alfred T., c/o Lyman, Sons & Co., St. Paul Street, Montreal, Canada, Laboratory Furnisher.

O.M. Mills, Prof. E. J., F.R.S., 64, Twyford Avenue, West Acton, W., Emeritus Professor of Technical Chemistry and Consulting Chemist.

1904. Mills, Dr. J. E., University of North Carolina, Chapel Hill, N.C., U.S.A., Associate Professor of Chemistry.

1905. Mills, Wm. Henry, 45, Wall Street, New York City, U.S.A., Merchant.

1906. Mills, Wm. Hobson, Northern Polytechnic Institute, Holloway, London, N., Lecturer in Chemistry.

1905. Milne, Thomas, c/o The Gas Light and Coke Co., Ltd., 4, Fenchurch Avenue, London, E.C., Chemical Products Salesman.

1903. Milnes, Cresswell, Arlesey, near Hitchin, Herts., Cement Works Manager.

1887. Milnes, Edmund, Seedfield, Bury, Lancashire, Dyeing Extract Maker.

1902. Milnes, Ernest E., c/o Joseph Smithson, Ltd., India Buildings, Halifax, Yorks., Chemist.

1901. Milroy, Andrew, Rosemont, Giffnock, Glasgow, Manager.

1895. Miner, Harlan S., c/o Welsbach Light Co., Gloucester City, N.J., U.S.A., Technical Chemist.

1889. Miniati, T. K., Penketh, near Warrington, Chemist.

1907. Minns, J. E., 32, North Street, Taunton, Somerset, Analytical Chemist.

1904. Minor, John C., jun., Saratoga Springs, N.Y., U.S.A., Manufacturer.

1895. Mitchell, Chas. A., c/o Beaufoy and Co., South Lambeth Road, S.W., Analyst.

1901. Mitchell, Frank H., c/o Dill and Collins, Richmond and Tioga Streets, Philadelphia, Pa., U.S.A., Tutor in Chemistry.

1898. Mitchell, G. D. H., c/o S. S. White Dental Manufacturing Co., Prince's Bay, Staten Island, N.Y., U.S.A., Chemist.

1906. Mitchell, Oswald H., c/o Basil Turner, Woolwich, Sydney, N.S.W., Australia, Assayer.

1904. Mitsugi, R., Weimarerstrasse 9, II., Charlottenburg, Germany, Chemist.

O.M. Mitting, E. Kennard, 38, Harold Road, Norwood, S.E., Technical Chemist.

1908. Miyake, Hanzaburo, Girls' School, Kami-Nagarekawa, Hiroshima, Japan, School Teacher.

1902. Möckel, Heinrich A., Paper Mill, Altdamm, near Stettin, Germany, Chemist and Engineer.

1905. Modi, Dr. E. M., Opposite Grant Road Station, Sleater Road, Bombay, India, Manufacturing and Analytical Chemist.

1906. Moe, Eldor H., 223, South Third East Street, Salt Lake City, Utah, U.S.A., Chemist.

O.M. Mohr, Dr. B., 69A, Parliament Hill, Hampstead, N.W., Consulting Chemist and Metallurgist.

1894. Mole, Herbert B., The Croft, Shepton Mallet, Somerset, Brewer.

1902. Molesworth, F. H., Jersey Road, Artarmon, N.S.W., Australia, Analytical Chemist.

1906. Moller, Emil A., 18, Teresa Place, Stapleton, Staten Is., N.Y., U.S.A., Manager (Sanitas Co.).

1903. Mommers, Richard, South Manchester, Conn., U.S.A., Chemical Engineer.

1899. Mond, Emile S., 22, Hyde Park Square, London, W., Technical Chemist.

O.M. Mond, Dr. L., F.R.S., 20, Avenue Road, Regent's Park, N.W.; and 64, Via Sistina, Rome, Alkali Manufacturer.

1891. Mond, Robt. L., Winnington Hall, Northwich, Chemist.

1905. Monell, Ambrose, 43, Exchange Place, New York City, U.S.A., President (International Nickel Co.).

1906. Monier-Williams, G. W., 3, Carlyle Road, Manor Park, Essex.

1890. Moodie, Wm. E., Alexandria Works, Alexandria, N.B., Analytical Chemist.

1901. Moody, Chas. J., Oroya Brown Hill Mine, Kalgoorlie, West Australia, Analyst and Assayer.

1905. Moody, Dr. Gerald T., Lorne House, North Dulwich, S.E., Lecturer on Chemistry.

1898. Moody, Dr. Herbert R., College of the City of New York, and (Journals) 23. Hamilton Terrace, New York City, U.S.A., Science Instructor.

1884. Mook, Chas., 2, Kapellenstrasse, Eisenach, Germany, Alkali Works Director.

1903. Mooney, F. M., 118, Pembroke Road, Dublin, Chemical Manure Manufacturer.

1903. Mooney, Geo. A., 310, St. Paul Street, Montreal, Canada, Chemical Merchant.

1902. Mooney, Luke, 36, West 52nd Street, Bayonne, N.J., U.S.A.

1887. Moore, Chas. C., 33, Clarendon Road, Garston, Liverpool, Chemist.

1901. Moore, Dr. Chas. W., Wellcome Chemical Research Laboratories, 6, King Street, Snow Hill, London, E.C., Chemist.

1907. Moore, Ernest P., Burlington, Ont., Canada, Chemist.

1902. Moore, Fred., Victoria Chemical Co., Ltd., Victoria, B.C., Canada, Manufacturing Chemist.

1906. Moore, F. H., 39, Lime Street, London, E.C., Analytical Chemist.

1892. Moore, Dr. Geo. D., 201, Salisbury Street, Worcester, Mass., U.S.A., Professor of Chemistry.

1905. Moore, Leslie R., 173, Oakleigh Road, Newton, Mass., U.S.A., Chemist.

1899. Moore, Quintin, jun., c/o Wm. Beardmore & Co., Ltd., Parkhead Forge, Glasgow, Works Manager.

1885. Moore, R. T., 142, St. Vincent Street, Glasgow, Mining Engineer.

1899. Moore, Dr. Russell W., 47, Linden Place, Orange, N.J., U.S.A., Chemist (U.S. Appraiser's Office).

1890. Moore, Thos., Laboratoire du Service Local, Noumea, New Caledonia, Analytical Chemist.

1905. Moorwood, F. Colin, c/o Flockton, Tompkin and Co., Ltd., Newhall Steelworks, Sheffield, Steel Manufacturer.

1903. Moran, Geo. A., 6, Reservoir Terrace, Lawrence, Mass., U.S.A., Chemist.

1890. Mordle, F. Dare, Guilderoy, Matlock Bath, Derbyshire, Starch Manufacturer.

1902. More, Andrew, 61, Quarrendon Street, Fulham, S.W., Government Analyst.

1907. Morellet, Louis, Stanford-le-Hope, Essex, Works Chemist.

1906. Morewood, C. Darcy, Frodingham Ironstone Mines, Scunthorpe, near Doncaster, Analytical Chemist.

1901. Morgan, Dr. Gilbert T., Royal College of Science, South Kensington, S.W., Demonstrator of Chemistry.

1905. Morgan, Jerome J., College Park, Md., U.S.A., Teacher.

1890. Morgan, J. Jas., Laboratory, Cammell, Laird and Co., Workington, Cumberland, Assayer.

1907. Morgan, Leonard P., United States Mint, Philadelphia, Pa., U.S.A., Electro-Chemist.

1906. Morgan, Thos., "Meirion," Dovedale Road, Wavertree, Liverpool, Manufacturing Chemist.

1898. Morgan, T. M., Longue Pointe, near Montreal, Canada, Cement Works Manager.

1907. Morgan, Wm., Daimler Works, and (Journals) 26, Osborne Road, Coventry, Engineer.

1885. Morgans, Thos., 60, Queen Square, Bristol, Civil Engineer.

1907. Morhous, Oakley A., 1839, 82nd Street, Brooklyn, N.Y., U.S.A., Chemist.

1902. Morison, Jas., Colonial Sugar Refining Co., Ltd., O'Connell Street, Sydney, N.S.W., Australia, Analytical Chemist.

O.M. Moritz, Dr. E. R., 45, Great Tower Street, London, E.C., Brewing Chemist.

1885. Morley, Dr. H. Forster, 5, Lyndhurst Road, Hampstead, N.W., Professor of Chemistry.

1903. Morningstar, Jos., 48, Park Place, New York City, U.S.A., Merchant.

1902. Morrell, Dr. R. S., Messrs. Mander Bros., Colour and Varnish Works, Wolverhampton, Chemist.

1884 Morrice, Jas. A., 1, Prince's Terrace, Dowanhill, Glasgow, Starch and Gum Manufacturer.

1906. Morris, A. H., 72, Chorley New Road, Bolton, Lancs., Brewer.

1898. Morris, Edgar F., c/o Cornbrook Chemical Co., Ltd., Colour Works, Stockport, Research Chemist.

1897. Morris, Harry, The Hall, Hexthorpe, Doncaster, Chemical Merchant.

1890. Morris, Herbert N., 13, Birch Grove, Rusholme, Manchester, Technical Chemist.

O.M. Morris, J. Haydn, 22, Largo das Fontanhas, Lisbon, Portugal, Technical Chemist.

1902. Morrison, Jos., Wellfield, Farnworth, Widnes, Manager.

1906. Morrow, Jas. M., 49, Townsend Place, Kirkcaldy, N.B., Analytical Chemist.

1901. Morse, Willard S., Seaford, Del., U.S.A., Assistant Manager.

1904. Morson, Thos. D., 14, Elm Street, Gray's Inn Road, London, W.C., Chemist.

1906. Morson, T. Pierre, 14, Elm Street, Gray's Inn Road, London, W.C., Chemical Manufacturer.

1907. Morton, George A., 44, Rock Lane East, Rock Ferry, Cheshire, Analyst.

1889. Morton, Jas., Dalquhurn Works, Renton, N.B., Dyeworks Manager.

1897. Morton, Jno., North Road, St. Helens, Lancashire, Analytical Chemist.

1902. Mosbaugh, F. R., c/o Anglo-Canadian Leather Co., Huntsville, Ont., Canada, Chemist.

1905. Moseley, F. A. D. H., Box 1657, Johannesburg, Transvaal, Analytical Chemist.

1888. Mosenthal, Henry de, 220, Winchester House, Old Broad Street, E.C., Explosives Company Manager.

1906. Moss, Wm., Moss Chemical Manufacturing Co., Foot of Carlaw Avenue, Toronto, Canada, Chemical Manufacturer.

1894. Moszczenski, J. B., 559, Tenth Street, Brooklyn, N.Y., U.S.A., Consulting Chemist.

1897. Motion, Jno., c/o Valvoline Oil Co., Edgewater, N.J., U.S.A., Oil Refinery Chemist.

1887. Moul, Frank, Aldersgate Chemical Works, Southall, Technical Chemist.

1901. Moule, Jno. W., c/o The Chillagoe Co., Ltd., Chillagoe, Queensland, Metallurgist.

1884. Moult, J., Underhill, Low Fell, Gateshead-on-Tyne, Secretary.

1898. Moulton, Prof. Chas. W., Vassar College, Poughkeepsie, N.Y., U.S.A., Professor of Chemistry.

1905. Moulton, Rt. Hon. Sir J. Fletcher, F.R.S., 57, Onslow Square, London, S.W., Lord Justice of Appeal.

1892. Mount, Edw., Oaklands, Aughton, near Ormskirk, Assistant Secretary (United Alkali Company).

1905. Mrazsek, F. M., 31, West Cromwell Road, London, S.W., Consulting Chemist.

1904. Muckenfuss, A. M., c/o University of Mississippi, University, Miss., U.S.A., State Chemist.

1907. Mueller, Dr. Carl, The Heyden Chemical Works, Garfield, N.J., U.S.A., Chemist.

1890. Muir, Jas. Stanley, 8, Westminster Gardens, Glasgow, W., Chemist.

1906. Muir, Wm., Regent Factory, Linlithgow, Scotland, Analytical Chemist.

1894. Muir-Smith, W., c/o A. B. Fleming and Co., Ltd., Caroline Park, Edinburgh, Oil Works Manager.

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1896. Mundy, Lionel, 27, Merton Road, Kensington, W., Importer of Unfermented Wines.

1887. Munroe, Prof. Chas. E., George Washington University, Washington, D.C., U.S.A., Professor of Chemistry and Dean.

1900. Munsell, Dr. Chas. E., c/o Devor and Raynolds Co., 110, Horatio Street, New York City, U.S.A., Colour Chemist.

1900. Munton, Fred T., The Oak House, Winsford, Cheshire, A.R.S.M., Analytical Chemist.

1897. Murch, D. Wilshin, 6, Victoria Road, Wednesbury, Staffs., Chemist.

1904. Murdoch, Alexander, 557, Alexandra Parade, Dennistoun, Glasgow, Analytical Chemist.

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1899. Murphy, Albert J., The Laboratory, 11, Lyddon Terrace, Leeds, Brewer's Chemist.

1906. Murphy, Frederic W., Standard Sugar Refinery, Granite Street, South Boston, Mass., U.S.A., Chemist.

1901. Murray, Benjamin L., c/o Merck and Co., University Place, New York City, U.S.A., Chemist.

1903. Murray, Chas. B., 407, Perry Payne Building, Cleveland, Ohio, U.S.A., Chemist.

1899. Murray, Jas. J., Iron King Mine, Blanchard, Arizona, U.S.A., Mining Engineer.

1901. Murray, Jas. P., Toronto Carpet Manufacturing Co., Ltd., King Street and Fraser Avenue, Toronto, Canada, Carpet Manufacturer.
1898. Murray, Rd., c/o Brotherton and Co, Ltd., Ammonia Works, Holmes Street, Leeds, Analyst.
1896. Murray, Dr. Thos. S., 1, Nelson Street, Dundee, Professor of Chemistry.
1905. Murray, Wm. Wallace, c/o Union Abattoir Co., Baltimore, Md., U.S.A., Chemist.
1905. Murrill, Dr. Paul I., P.O. Box 986, Wilmington, Del., U.S.A., Representative, E.I. du Pont Co.
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1907. Musso, Louis A., Department of Agriculture, 140, George Street North, Sydney, N.S.W., Australia, Assistant Viticulturist.
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1895. Muurling, I. J. R., 66, Lafayette Street, New York City, U.S.A., Dyestuff Importer.
1891. Myers, Wm. S., Nitrate of Soda Propaganda, 12, John Street, New York City, U.S.A., Director.
1906. Myles, C. D., 16, St. Loo Mansions, Cheyne Gardens, London, S.W.

N

1902. Naef, Dr. Ernest E., Clydach, Swansea, South Wales, Chemist.
1903. Nagel, Dr. Oscar, c/o John Naday, 79, Fifth Avenue, New York City, U.S.A., Chemist.
1903. Nagel, Oskar H. L., c/o Larned and Barker Co., Syracuse, N.Y., U.S.A., Superintendent (Chemical Works).
1897. Nairn, Michael, Ben Dhu, Kirkcaldy, N.B., Linoleum Manufacturer.
1901. Nakagawa, Sosuke, c/o Tokyo Ryusan Kwaisha, Kameido Oshimacho, near Tokyo, Japan, Chief Engineer.
1903. Nakayama, Takakichi, c/o Fuji Paper Co., Mill No. 5, Yebetsu. Hokkaido, Japan, Chemist.
1901. Nanabhai, Krishnalal, 8–10, Nepean Sea Road, Malabar Hill, Bombay, India, Technological Chemist.
1893. Napier, Jno. W., Gas Works, Alloa, N.B., Manager and Chemist.
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1897. Nash, Leonard M., Westlands, Princess Road, Finsbury Park, N., Works Chemist.
1905. Nash, W. A., Corn Exchange Bank, New York City, U.S.A., President, Corn Exchange Bank.
1900. Nathan, Lt.-Col. Sir Frederic L., R.A., Royal Gunpowder Factory, Waltham Abbey, Essex, Superintendent.
1907. Nauckhoff, Sigurd, c/o Nitroglycerin Aktiebolaget, Vinterviken, Stockholm, Sweden, Chemical Engineer.
1892. Naylor, Wm., 3, Garstang Road, Fulwood, Preston, Lancs., Chemist.
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1899. Neate, Percy J., "Belsize," Watts Avenue, Rochester, Kent, Director of Cement Co.
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1905. Needham, Edward R, 48, Paton Street, Glasgow, Manufacturing Chemist.
1905. Neff, Robert W., 22, India Square. Boston, Mass., U.S.A., Chemical Manufacturer.
1906. Neil, Dr. Archibald A., 82, Eccles Old Road, Manchester, Chemical Engineer.
1898. Neil, Jas. Millar, 97, Ontario Street, Toronto, Canada, Technical Chemist.
1890. Neill, Geo. D., Drumslea, Greenock, N.B., Sugar Refiner.
1898. Neilson, Alex. McG., P.O. Box 615, Durban, Natal, Analytical Chemist.
1903. Neiman, Howard S., 122, Hudson Street, New York City, U.S.A., Manufacturing Chemist.
1902. Neish, Dr. Arthur C., Columbia University, New York City, U.S.A., Chemist.
1897. Nelson, Walter, Emscote Mills, Warwick, Gelatin Manufacturer.
1906. Nestell, Raymond J., Avalon, Catalina Is., Cal., U.S.A., Analytical Chemist.
1901. Neufville, Dr. Rudolf de, c/o Metallurgische Gesellschaft, Frankfort a/M., Germany.
1902. Neumann, Dr. Edgar, 7 and 8, Idol Lane, London, E.C.
1903. Neumann, Dr. Max, Capellenstrasse 51, Wiesbaden, Germany.
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1905. Newall, Joseph, Rosedale, Norman Road, Runcorn, Cheshire, Chemist.
1889. Newberry, Spencer B., Sandusky Portland Cement Co., Sandusky, Ohio, U.S.A., Manager.
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1900. Newton, Dr. Wm., Ashcombe, London Road, Dorking, Chemist.
1901. Nibelius, Axel W. T., American Forcite Powder Manufacturing Co., Landing, N.J., U.S.A., Chemist.
1904. Nichols, C. W., 25, Broad Street, New York City, U.S.A., Manufacturing Chemist.
1905. Nichols, E. Remington, 25, Broad Street, New York City, U.S.A., Treasurer (Nichols Chemical Co.).
1884. Nichols, J. A., Stanley Mount, New Mills, near Stockport, Teacher of Science.
1888. Nichols, Wm. H., 25, Broad Street, New York City, U.S.A., Chemical Manufacturer.
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1897. Nicholson, Harry, St. David's Mine, Ltd., Bontddu, Dolgelly, North Wales, Assayer.
1904. Nicholson, Wilfred E., Hunslet Chemical Works, Leeds, Chemical Manufacturer.
1897. Nicholson, Wm. J., Ardeer, Stevenston, Ayrshire, N.B., Chemist.
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1903. Nicoll, Frank, Jesmond House, Hartman Street, Accrington, Chemist.
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1900. Nield, J. H., c/o General Chemical Co., P.O. Box 8, Hudson Heights, N.J., U.S.A., Superintendent.
1906. Nielsen, Dr. Carl, c/o Cuban Sugar Refining Co., Cardenas, Cuba, Chemist.
1898. Nightscales, Geo., 37, Jalland Street, Hull, Oil Merchant.
1899. Nihoul, Dr. Edw., Waremme, Belgium, Director of the Liège Tannery School.
O.M. Nimmo, Jas., Penshurst, 8, Lawrence Road, South Norwood, S.E., Analytical Chemist.
1907. Nims, H. E., c/o The Fiberloid Co., Indian Orchard, Mass., U.S.A., Chemist.

1885. Nishigawa, T., 12, Yamamato Dori, Nichome, Kobe, Japan, Director of Sulphuric Acid and Soda Works.
1898. Nishikawa, T., c/o Nippon Seimikaisha, Onoda, Nagato, Japan, Chemist.
1904. Noake, Frank, 20, Craddock Street, Wolverhampton, Gas Engineer.
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1905. Norden, Julius, United Chemical Works, 94, Leadenhall Street, London, E.C., Chemical Manufacturer.
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1900. Norman, Geo. M., Woodbury, N.J., U.S.A., Chemist.
1892. Norman, J. T., 23, Leadenhall Street, London, E.C., Consulting Chemist.
1898. Norris, Albert P., 760, Massachusetts Avenue, Cambridgeport, Mass., U.S.A., Assistant Chemist.
1899. Norris, Geo. L., Standard Steel Works, Burnham, Mifflin Co., Pa., U.S.A., Chemist.
1902. North, Barker, 22, Horton Park Avenue, Bradford, Assistant Professor of Chemistry.
1890. North, E. Gordon N., Spassky Zavod, Akmolinsk, Siberia, Technical Chemist.
1903. North, Henry A., 375, Dearborn Avenue, Chicago, Ill., U.S.A., Chemist.
O.M. Northing, J., The Murrough, Wicklow, Ireland, Technical Chemist.
1905. Norton, Arthur L., 36, Purchase Street, Boston, Mass., U.S.A., Dyestuff Merchant.
1905. Norton, F. A., National Canners' Laboratory, Aspinwall, Pa., U.S.A., Chemist.
O.M. Norton, Dr. S. A., 363, East Town Street, Columbus, Ohio, U.S.A., Professor of Chemistry (Ohio State University).
1887. Norton, Dr. T. H., U.S. Consulate, Chemnitz, Saxony, Ph.D., Sc.D., U.S. Consul.
1901. Novarine, John L., 289, Myrtle Avenue, Brooklyn, N.Y., U.S.A., Chemist.
1899. Noyes, Henry, c/o J. C. Lanyon and Sons, Coronation House, Lloyd's Avenue, London, E.C., Engineer.
1901. Noyes, Prof. Wm. A., University of Illinois, Urbana, Ill., U.S.A., Editor (J. Amer. Chem. Society).

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1905. Oakes, Francis J., 2, West 72nd Street, New York City, U.S.A., Dye and Chemical Manufacturer.
1905. Oakes, F. J., jun., Secretary, Oakes Manufacturing Co.
1904. Oberländer, Dr. Otto, 29, Queen Street, London, E.C., Research and Consulting Chemist.
1904. O'Brien, Claude H., Bureau of Central Sugar Mills, Brisbane, Queensland, Supervising Chemist.
1900. O'Brien, Frederick, 87, Dongola Road, Horfield, Bristol, Analytical Chemist.
1906. O'Brien, John W., c/o Grasselli Chemical Co., Grasselli, Ind., U.S.A., Foreman.
1905. Oburg, W. F., 33, Broad Street, Boston, Mass., U.S.A., Assistant Treasurer (Merrimac Chem. Co.).
1900. O'Byrne, Leo C., 996, Washington Boulevard, Chicago, Ill., U.S.A., Chemist.
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1901. O'Connor, Chas. P., 55, Church Street, Montclair, N.J., U.S.A., Analytical Chemist.
1887. Oddie, Jas., School of Mines, Ballarat, Australia, Chemical Lecturer.
1888. Oddy, Robert W., Abbey Street, Toad Lane, Rochdale, Chemist.
1888. Ogata, Saburo, Nippon Ginko, Tokyo, Japan, Assayer.
1905. Ogden, Alfred W., Room 1007, 641, Washington Street, New York City, U.S.A., Chemist.
1901. Ogden, Richard L., 314, North Main Street, Bethlehem, Pa., U.S.A., Chemist (U.S. Navy).
1906. Ogilvie, Alex. M., 9, Belmont Drive, Giffnock, Renfrewshire.
1908. Ogilvie, Jas. P., c/o Newlands Bros., 2, St. Dunstan's Hill, London, E.C., Chemist.
1896. Ogilvy, D. J., Gest Street and C. H. and D. R. R., Cincinnati, Ohio, U.S.A., Manufacturing Chemist.
1901. Ogston, Alex. G., Heath Park, near Aberdeen, N.B., Soap Manufacturer.
1903. Ohlenschlager, J. G., jun., 20, St. Dunstan's Hill, London, E.C., Chemical Merchant.
1905. Ohliger, Willard, c/o F. Stearns & Co., Detroit, Mich., U.S.A., Chemist.
1907. Oke, Alfred W., Orielton, 32, Denmark Villas, Hove, Sussex, Solicitor.
1884. Oliver, F., 31, Horsley Hill Road, Westoe, South Shields, Analytical Chemist.
1888. Oliver, Wm. Letts, 101, Vernon Street, Oakland, Cal., U.S.A., Mining Engineer.
1901. Olivier, Dr. Louis, 18, Rue Chauveau-Legarde, Paris, 8^e, Directeur (Revue Générale des Sciences).
1905. Ollenbach, D. S., Cordite Factory, Aruvankad, Nilgiris, India, Assistant Government Surgeon.
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1906. Olmsted, Fred A., 93, Broad Street, Boston, Mass., U.S.A., Chemical Engineer.
1904. Olney, L. A., 118, Riverside Street, Lowell, Mass., U.S.A., Professor of Chemistry and Dyeing.
1904. Olshausen, B. A., 1505, St. Andrew's Place, Los Angeles, Cal., U.S.A., Student.
1902. O'Neill, Chas., c/o Bleachers' Association, Ltd., 4, Norfolk Street, Manchester, Chemist and Colourist.
O.M. O'Neill, E. H., 6, Elder Avenue, Crouch End, N., Managing Director.
1907. Oppen, Wm. A., Vera Chemical Co., Stoneham, Mass., U.S.A., Chemist and Superintendent.
1905. Ormandy, Dr. W. R., Bewsey Cottage, Warrington, Chemist.
1898. Ormerod, Dr. Ernest, Research Chemist.
1894. Ormerod, John, Globe Leather Works, Castleton, Manchester, Tanner and Currier.
O.M. Orr, A., 35A, Bligh Street, Sydney, New South Wales, Analytical Chemist.
O.M. Orr, J. B., Crossacres, Woolton, Liverpool, Chemical Manufacturer.
1899. Orr, Thos. W., Esperanza Nitrate Co., Taltal, Chile, and (communications) c/o W. Orr, 50, Wellington Street, Glasgow, Chemist.
1907. Ortved, Niels C., c/o Hiram Walker & Sons, Ltd., Walkersville, Ont., Canada, Chemist and Fermentologist.
1900. Osbourne, Jno. P., 6, Garrioch Drive, Maryhill, Glasgow, Analytical Chemist.
1900. O'Shaughnessy, Francis R., Home Farm, Tyburn, Birmingham, Chemist.
1885. O'Shea, Prof. L. T., Dept. of Applied Science, St. George's Square, Sheffield, Professor of Applied Science (University of Sheffield).
1883. O'Sullivan, J., High Bank, Burton-on-Trent, Brewing Chemist.
1905. Otsuki, Prof. Chiri, 16, Shinsuwachō. Koishikawa-ku, Tokyo, Japan, Professor of Applied Chemistry.
1898. Oushkoff, John P., c/o P. K. Oushkoff and Co., Moscow, Russia, Chemical Manufacturer.
1903. Outwater, Raymond, 1312, B. Street S.W., Washington, D.C., U.S.A., Chemist.
1904. Owen, Halsall, Newholme, Latchford; and (Journals) c/o W. H. Smith & Son, 76, Sankey Street, Warrington, Engineer.
1906. Oxley, Horace F., c/o British Algin Co., and (Journals), Bryn Derwen, Holywell, North Wales, Chemist.
1903. Ozias, Ramon E., 732, Clinton Avenue, Newark, N.J., U.S.A., Assayer.

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1904. Packard, C. T., Millbank, Bramford, near Ipswich, Manager of Chemical Works.
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1904. Page, Edwin P., 31, Market Street, Stourbridge, Worcestershire, Chemist.
1907. Page, Leslie, c/o Swift and Co., Soap Works, 37, Medford Street, Somerville, Mass., U.S.A., Chemist.
1886. Pagès, Albert, 34, Boulevard Henri IV., Paris, Technical Chemist.
1892. Paine, Augustus G., 41, Park Row, New York City, U.S.A.; and (Journals) c/o Richard Stutz, Johnsonburg, Pa., U.S.A., President of Paper Making Co.
O.M. Paine, S., Devisdale, Bowdon, Cheshire, Pharmaceutical Chemist.
1902. Pakes, Dr. Walter C. C., Box 4581, Johannesburg, Transvaal, S. Africa, Analyst and Bacteriologist.
1905. Palethorpe, Percy R., The Tobacco Warehousing and Trading Co., 11th and Magnolia Avenues, Louisville, Ky., U.S.A., Chemist and Manager.
1906. Palm, Otto G., 41, Colborne Street, Toronto, Canada, President of Dye and Chemical Co.
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1905. Palmer, Dr. Chas. S., c/o The J. P. Eustis Manufacturing Co., 92-100, North Street, Boston, Mass., U.S.A., Chemist.
1902. Palmer, Fred. G., Athelstan Road, Faversham, Kent, Analyst.
1887. Palmer, T. Chalkley, c/o American Dyewood Co., Chester, Pa., U.S.A., Manufacturing Chemist.
1887. Palmer, Thos. C., 98. Commercial Road East, London, E.; and (Journals) Westlington, Hatch End, Middlesex, Engineer.
1907. Palmer, Wm. J., c/o United Turkey Red Co., Ltd., Alexandria, N.B., Analytical Chemist.
1906. Papazzoni, Chas. F., c/o Keystone Powder Manufacturing Co., Emporium, Pa., U.S.A., Chemist.
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1906. Parke, Jas., Sturgeon Falls, Ont., Canada, Chemist.
1888. Parker, Chas. E., Penketh, Warrington, Tanner.
1894. Parker, Chas. E., U.S. Dept. of Agriculture, Bureau of Chemistry, Washington, D.C., U.S.A., Chemist.
1898. Parker, Charles H., 106, Tettenhall Road, Wolverhampton, Staffs., Chemist.
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1897. Parker, Prof. Matthew A., University of Manitoba, Winnipeg, Canada, Professor of Chemistry.
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1894. Parker, Thos. J., 25, Broad St., New York City; and (Journals) Bayonne, N.J., U.S.A., Chemical Works Manager.
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1901. Parker, Dr. Wm. Huntington, 177, State Street, Boston, Mass., U.S.A., Chemist (U.S. Appraiser).
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1898. Parrish, Saml., 80, Grange Avenue, Chapeltown Road, Leeds, Teacher of Chemistry.
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1902. Patch, Prof. Jas. A., Syrian Protestant College, Beirût, Syria, Professor of Chemistry.
1897. Patchett, Col. Jas., Oakworth, Hadley, Wellington, Salop, Ironmaster.
1901. Paterson, David, Leabank, Rosslyn, Midlothian, Colour Chemist.
1884. Paterson, John, Belle Isle Place, Workington, Cumberland, Mechanical Engineer.
1887. Paton, J. M. C., Messrs. Manlove, Alliott and Co., Ltd., Nottingham, Mechanical Engineer.
1886. Paton, W. Grant, Airlie, Huyton, near Liverpool, Alkali Works Manager.
1901. Patterson, Chas. A., Washburn, Wis., U.S.A., Analytical Chemist.
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1893. Patterson, Harry J., College Park, Prince George's Co., Md., U.S.A., Agricultural Chemist.
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1889. Pattison, Percy J., St. Budeaux, Devonshire Road, Hornchurch, Essex, Technical Chemist.
1905. Patton, Dr. Walter D., Chemist.
1904. Patz, E. O., 215, Water Street, New York City, U.S.A., Manager, Berlin Aniline Works.
1891. Paul, Jas. H., 19, Glenluce Road, Blackheath, S.E., Analytical Chemist.
1900. Paul, Dr. L. Gordon, Market Hall Chambers, King Street, Huddersfield, Consulting Chemist.
1902. Pay, Walter Herbert, Government Laboratory, Durban, Natal, S. Africa, Chemist and Assayer.
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1906. Payne, J. H., Wilmington, N.C., U.S.A., Chemical Engineer.
1898. Pearce, Edw. D., Messrs. J. P. Shepard and Co., P.O. Box 1336, Providence, R.I., U.S.A., Manufacturing Chemist.
1894. Pearce, Jas. Stanley, Clements, Snaresbrook, Essex, Chemical Manufacturer.
1897. Pearce, Richard, c/o G. B. Pearce, The Beeches, Hayle, Cornwall. Smelting Works Manager.
1883. Pearce, W., M.P., Chemical Works, Bow Common, London, E., Chemical Manufacturer.
1903. Pearcy, A. C., 27, St. Kilda's Road, Stoke Newington, N., Director, Explosives Co.
1903. Pears, Thos., The Laboratory, Soap Works, Isleworth, Soap Manufacturer.
1904. Pease, Fred N., P.O. Box 503, Altoona, Pa., U.S.A., Chemist.
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1886. Pedler, J. R., 47, Tregunter Road, South Kensington, S.W., Clerk.
1905. Peet, Wm. J., Stockyards Station, Kansas City, Kas., U.S.A., Superintendent.
1903. Peffer, Harry C., c/o Aluminium Co. of America, East St. Louis, Ill., U.S.A., Manufacturing Chemist.
1906. Peile, Henry, Millburn House, Newcastle-on-Tyne, and (Journals) c/o Andrew Short, Patent Ovens Dept., Ottovale, Blaydon-on-Tyne, Colliery Owner.

1906. Peirce, Edwin H., c/o American Steel and Wire Co., South Works, Worcester, Mass., U.S.A., Chemist.

1899. Pell, A., 7, Elphinstone Circle, Bombay, India, Chemist.

1897. Pellew, Chas. E., Columbia University, New York City, U.S.A., Adjunct Professor of Chemistry.

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1890. Pennock, J. D., c/o Solvay Process Co., Syracuse, N.Y., U.S.A., Technical Chemist.

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1885. Pentecost, S. J., Alexandra Mount, Mapperley Hill, and (Journals), Sherwood Hill Works, Sherwood Rise, Nottingham, Lace Dresser.

1887. Pentermann, H. T., 37, Clifton Crescent, Peckham, S.E., Brewing Chemist.

1892. Peploe, D. H. T., Underriver House, Sevenoaks, Kent.

1899. Peppel, S. Vernon, 1538, North High Street, Columbus, Ohio, U.S.A., Chemist.

1885. Perkin, A. G., F.R.S., 8, Montpelier Terrace, Hyde Park, Leeds, Technical Chemist.

1898. Perkin, Dr. F. Mollwo, Borough Polytechnic Institute, Borough Road, S.E., Head of Chemical Department.

1887. Perkin, Dr. W. H., F.R.S., Fairview, Wilbraham Road, Fallowfield, Manchester, Professor of Chemistry.

1903. Perkins, Frank G., 211, North La Fayette Street, South Bend, Ind., U.S.A., Starch Manufacturer.

1893. Perkins, T. S., 39, Garden Place, Brooklyn, N.Y., U.S.A., Chemist.

1899. Perks, Walter G., Rothsay, Teddington Park, Teddington, S.W., Manufacturer.

1906. Perrow, Mosley G., Lynchburg, Va., U.S.A.

1901. Perry, Chas. M., 4, Catalpa Road, Providence, R.I., U.S.A., Bleach and Dyeworks Chemist.

1887. Perry, D., Norwood, Lenzie, N.B., Manufacturing Chemist.

1895. Perry, Jos. H., 276, Highland Street, Worcester, Mass., U.S.A., Teacher of Chemistry.

1903. Perry, M. J. T., Australian Drug Co., O'Connell Street, Sydney, N.S.W., Australia, Manufacturing Chemist.

1903. Perry, Robt. Swain, c/o Harrison Bros. and Co., Inc., 35th Street and Grays Ferry Road, and (Journals) Station D., Philadelphia, Pa., U.S.A., President.

1901. Persons, Ashton C., 74, Oak Street, Willimantic, Conn., U.S.A., Chemist.

1897. Peter, Dr. A. H., 105, East 91st Street, New York City, U.S.A., Chemist.

1906. Peterson, Charles A., 104, Front Street East, Toronto, Canada, Chemist.

1893. Pethybridge, Walter, 3, Rhodesia Road, Clapham Rise, S.W., Chemist and Assayer.

1903. Petrie, Dr. Jas. M., The University, Sydney, N.S.W., Australia, Chemist.

1902. Petsche, B. W., 60, Glenwood Avenue, Yonkers, N.Y., U.S.A., Chemist.

1906. Pettee, Chas. L. W., c/o Hartford Laboratory Co., Hartford, Conn., U.S.A., Chemist.

1883. Pettigrew, J., 6, St. Helen's Place, Bishopsgate, London, E.C., Technical Chemist.

1892. Pettigrew, Robt., c/o Mersey and Irwell Joint Committee, 44, Mosley Street, Manchester, Electro-Chemist.

1902. Pettitt, Alf., 457, State Street, Brooklyn, N.Y., U.S.A., Chemist.

1906. Peuchen, Arthur G., Standard Chemical Co., Ltd., 509, Manning Chambers, Toronto, Canada, Chemical Manufacturer.

1905. Peuchot, A., 129, Crosby Street, New York City, U.S.A., Chemical Manufacturer.

1904. Peyser, Horace F., 68, West 47th Street, New York City, U.S.A., Chemist.

O.M. Peyton, E. P., Chemical Works, Lister Street, Birmingham, Chemical Manufacturer.

1900. Peyton, Wm. C., c/o Peyton Chemical Co., Room 657, Miles Building, San Francisco, Cal., U.S.A., Chemist.

1888. Philip, Arnold, Chemical Laboratory, H.M. Dockyard, Portsmouth, Electro-Metallurgist and Electrical Engineer.

1903. Philipp, Herbert, 84, High Street, Perth Amboy, N.J., U.S.A., Chemist and Electrochemical Engineer.

1886. Phillips, A. G., 11, Essex Villas, Phillimore Gardens, Kensington, W., Barrister-at-Law.

1891. Phillips, G. Brinton, (Journals) 622, Race Street; and (communications) 2007, De Lancey Place, Philadelphia, Pa., U.S.A., Manufacturing Chemist.

O.M. Phillips, Harcourt, Lynwood, Turton, Lancs., Analytical Chemist.

1895. Phillips, S. Chas., 47, Cannon Street, London, E.C., Chemical Engineer.

1904. Phillips, V. C., Haselmere, Morris Avenue, Manor Park, E., Chemist.

1898. Phillips, Wm. H., 100, Milton Avenue, East Ham, E., Soap Works Chemist.

1894. Picard, Hugh F. K., 44, London Wall, London, E.C., Metallurgist.

1907. Pick, Dr. Hans, 26, Canfield Gardens, South Hampstead, London, N.W., Analytical Chemist.

O.M. Pick, Dr. S., Direction der Soda Fabrik, Szczakowa, Galizien, Austria, Chemical Engineer and Manager.

1904. Pickard, Glenn H., c/o The Spencer-Killogg Co., Buffalo, N.Y., U.S.A., Chemist.

1905. Pickard, Greenleaf W., Amesbury, Mass., U.S.A., Electrical Engineer.

1902. Pickard, R. H., Isca, Merlin Road, Blackburn, Teacher and Analyst.

1904. Pickett, Chas. E., 26, East 33rd Street, Bayonne, N.J., U.S.A., Superintendent, Borax Refinery.

1904. Pickup, Edgar H., 348, Great Clowes Street, Higher Broughton, Manchester, Calico Printer.

1888. Pilkington, G., 263, Walmersley Road, Bury, Lancashire, Analytical Chemist.

1893. Pilley, Thos. W., 33, Grove Hill Road, Denmark Hill, S.E., Analytical Chemist.

1894. Pilling, John E., 229, Hornby Road, Blackpool, Chemist.

1906. Pincott, Emile S., 222, St. James Street, Montreal, Canada, Manager (Nichols Chemical Co. of Canada, Ltd.).

1905. Pinnock, H. T., Beacon House, Dudley Port, Tipton, Chemist.

1883. Pipe, Jas., Woodburn, Irvine, N.B., Chemical Manufacturer.

1896. Piper, Walter E., Boston Rubber Shoe Co., Malden, Mass., U.S.A., Chemist.

1905. Pirie, Frank D., Stoneywood Works, Bucksburn, Aberdeenshire, Paper Manufacturer.

1900. Pitman, Jno. R., 167, Berkeley Avenue, Orange, N.J., U.S.A., Chemist.

1907. Pitman, Brig.-Gen. John, c/o J. R. Pitman, 167, Berkeley Avenue, Orange, N.J., U.S.A., U.S. Army (retired).

O.M. Pitt, T., 16, Coleman Street, London, E.C., Manufacturing Chemist.

1902. Pittard, Jno., 30, Mansfield Road, Ilford, Essex, Chemical Manufacturer.

1905. Pittock, C. K., Baithney Estate, Saklaspur, Hassan, India, Coffee Grower and Chemist.

1884. Pittuck, F. W., 19, Stratford Grove, Heaton, Newcastle-on-Tyne, Technical Chemist.

1899. Pizey, Jas. H., Bella Vista, 19, Minas de Rio Tinto, Prov. de Huelva, Spain, Chemist.

1905. Plath, Dr. F., Deutsche Ton- und Steinzeugwerke A.-G., Berlinerstrasse 22 B., Charlottenburg, Germany, Managing Director.

1894. Platten, Frank, 12, Montague Road, Edgbaston, Birmingham, Metallurgical Chemist.

1890. Platts, Jno. C., 12, Alton Terrace, Fairfield, Manchester, Metallurgical Chemist.

1896. Plaut, Albert, 120—128, William Street, New York City, U.S.A., Wholesale Druggist.

1888. Playfair, David J., 7, Victoria Crescent, Dowanhill, Glasgow, Manufacturing Chemist.

1907. Playter, Geo. H., 803, Beacon Building, Boston, Mass., U.S.A., Mining Engineer.

1891. Pocklington, Hy., 11, Regent Park Terrace, Leeds, Assurance Co.'s Local Manager.

1907. Poetschke, Paul, 26, West Spruce Street, Corona, N.Y., U.S.A., Chemist.

1901. Pollard, Wm., Museum, Jermyn Street, London, S.W., Chemist (H.M. Geological Survey).

1904. Pollitt, Dr. Geo. P., Winnington, Northwich, Cheshire, Chemist.

1902. Pollitt, Jas. C. T., 21, Endwood Court Road, Handsworth Wood, Birmingham, Managing Chemist.

1893. Pollitt, R. B., c/o Gudgeons, Peecock, & Prentice, Stowmarket, Suffolk, Civil Engineer.

1883. Pollock, A., Kirkland, Bonhill, Dumbartonshire, Dyeworks Manager.

1890. Pomeroy, Dr. Chas. T., 55, Broad Street, Newark, N.J., U.S.A., Ink Manufacturer.

1896. Pond, Prof. G. G., State College, Centre Co., Pa., U.S.A., Professor of Chemistry.

O.M. Pond, J. A., 99, Queen Street, Auckland, New Zealand, Analytical Chemist.

1906. Pont, A. Felix du, Box 31, Wilmington, Del., U.S.A., Explosives Manufacturer.

1895. Pont, Pierre S. du, Wilmington, Del., U.S.A., Explosives Manufacturer.

1892. Pope, Frank, c/o The Dunwoody Bros. Soap Co., Denver, Colo., U.S.A., Chemist.

O.M. Pope, S., 6, Heywood Street, Moss Side, Manchester, Chemical Works Manager.

1899. Pope, Thos. H., The University. Birmingham, Chemist.

1900. Pope, Prof. W. J., F.R.S., Municipal School of Technology, Manchester; and (Journals), Corchester, Bramhall, Cheshire, Professor of Chemistry.

1900. Popplewell, Jos. M., Provan Chemical Works, Provanmill, Glasgow, Chemist.

1908. Porch, C. Douglas, 15, Franklin Street, Bridgeton, N.J., U.S.A., Chemist (Explosives).

1899. Porter, A. Felix, 1613, Rodney Street, Wilmington, Del., U.S.A., Chemist.

1908. Porter, A. Harold, 1417, Sixth Street, S.E., Minneapolis, Minn., U.S.A., Chemist.

1902. Porter, J. Edw., P.O. Box 785, and 205, W. Genesee Street, Syracuse, N.Y., U.S.A., Chemist.

1906. Porter, John J., Observatory Avenue, Station O., Cincinnati, Ohio, U.S.A., Chemist and Metallurgist.

1901. Porter, Jno. L., New Orleans Sewerage Board, 602, Carondelet Street, New Orleans, La., U.S.A., Chemist.

1904. Portner, Edward G., Robert Portner Brewing Co., Alexandria, Va., U.S.A., Chemist.

1884. Potter, Chas. E., Love Lane Sugar Refinery, Liverpool, Sugar Works Chemist.

1905. Potter, Chas. Ed., c/o City Dairy Co., Ltd., Spadina Crescent, Toronto, Canada, General Manager.

1888. Potter, Chas. J., Heaton Hall, Newcastle-on-Tyne, Cement Manufacturer.

O.M. Potter, E. P., Salwick Hall, near Preston, Alkali Manufacturer.

1906. Potter, Dr. H. Noel, 21, Hamilton Terrace, New York City, U.S.A., Electrical Engineer.

1899. Potter, Rowland S., Eastbury, Upland Park Avenue, Loughton, Essex, Chemist.

1900. Potts, Geo. E., 18, Tremont Street, Pottsville, Pa., U.S.A., Explosives Manufacturer.

1900. Pough, Frank H., c/o National Sulphur Co., 163, Front Street, New York City, U.S.A., Assistant Secretary.

1900. Powell, Harry J., 506, Lordship Lane, London, S.E., Glass Manufacturer.

1884. Powell, L. S., The Old Manor House, Ashley, Stockbridge, Hants, Electrician.

1897. Power, Dr. Fred. B., Wellcome Research Laboratories, 6, King Street, Snow Hill, London, E.C., Director.

1907. Powers, Wm. R., c/o A. T. and S. F. R. R. Co., Topeka, Kans., U.S.A., Chief Chemist.

1902. Powney, Wm. E. F., 18, Canonbury Villas, Canonbury Road, London, N., Analytical Chemist.

1900. Pratt, N. P., Laboratory, Atlanta, Ga., U.S.A., Manufacturing Chemist.

1897. Prentice, Dr. Bertram, Royal Technical Institute, Salford, Lecturer on Chemistry.

1902. Prentice, Dr. David, The Nook, Whitefield Road, Stockton Heath, Warrington, Chemist.

1903. Prentice, Jas., Cossipore Sugar Works, Cossipore, Calcutta, India, Chemist.

1905. Prentiss, G. L., c/o Parson Manufacturing Co., 299, Broadway, New York City, U.S.A., Treasurer.

1900. Prescott, Saml. C., 739, Boylston Street, Boston, Mass., U.S.A., Instructor in Bacteriology.

1905. Preston, Jas. F., Lowell, Mass., U.S.A., Manufacturing Chemist.

1906. Preston-Jackson, J. W. A., Castleford, Yorkshire, Consulting and Analytical Chemist and Druggist.

O.M. Price, Arthur F., 2503, Broadway, San Francisco, Cal., U.S.A., Analytical Chemist.

1905. Price, Dr. T. Slater, The Technical School, Birmingham, Lecturer on Chemistry.

1904. Prichard, Norman B., 1818, Topping Avenue, Tremont, New York City, U.S.A., Superintendent.

1904. Prideaux, E. B. R., 62, Queen Street; and (Journals), Heriot Watt College, Edinburgh, Research Chemist.

1905. Priest, Geo. Wesley, Mansfield, Mass., U.S.A., Manufacturer.

1906. Priestman, A., 275, Burlington Street, Liverpool, Drysalter.

1906. Pring, J. N., Physical Laboratories, University of Manchester, Student.

1899. Prinsen-Geerligs, H. C., Pekalongan, Java, Netherlands Indies, Director of Sugar Cane Experimental Station.

1893. Pritchard, Edgar J., 5, Cumberland Gate, Kew, Surrey, Works Manager.

1903. Pritchard, Philip M., Chief Engineer's Office, United Alkali Co., Ltd., Widnes, Engineer.

1896. Prochazka, Dr. Geo. A., 138, West 13th Street, New York City, U.S.A., Colour Manufacturer.

O.M. Procter, Prof. H. R., The University, Leeds; and (Journals) Rowangarth, Ben Rhydding, near Leeds, Yorks., Lecturer on Tanning.

1884. Procter, J. W., Skeldergate Bridge, York, Manure Manufacturer.

1890. Proctor, Miss Anne J., Free Library, Widnes, Librarian.

O.M. Proctor, C., 43a, London Road, Forest Hill, S.E., Analytical Chemist.

1901. Propach, C., 133, East Kinzie Street, Chicago, Ill., U.S.A., Colour Merchant.

1894. Proude, Jas., 30, Cromwell Terrace, Halifax, Yorks., Soap Works Chemist and Manager.

1907. Pryce, Geo. A., c/o Philip Harris & Co., Ltd., 144 & 146, Edmund Street, Birmingham, Manager of Apparatus Department.

1907. Puckhaber, Geo. C., 805, Prospect Place, Brooklyn, N.Y., U.S.A., Glue Maker.

1906. Pudney, Sydney H., 156, Bellwood Avenue, Toronto, Canada, Foreman.

1905. Pugh, John V., Guiting House, Allesley, near Coventry, Works Director (Rudge Whitworth, Ltd.).

1899. Pullar, Edmund, Keirfield, Bridge of Allan, N.B., Manufacturer.

1894. Pullar, Herbert S., Pullar's Dyeworks, Perth, N.B., Dyer.

O.M. Pullar, Sir Robert, M.P.; Journals to Jas. Craigie, Sandeman Public Library, Perth, N.B., Dyer.

O.M. Pullar, R. D., Pullar's Dyeworks, Perth, N.B., Dyer.

1903. Pullin, Sydney R., Stanley Lodge, Roundhay, Leeds, Chemist.

1902. Puntan, H. H. C., 10, London Chambers, Durban, Natal, Public Analyst.

1894. Purdie, Dr. Thos., F.R.S., 14, South Street, St. Andrews, N.B., Professor of Chemistry.

1906. Purves, Geo., The Refinery, Canal Bank, St. Ambriose Street, St. Henri de Montreal, Canada, Chemist and Works Manager.

1905. Pyman, Dr. Frank Lee, Carlee, Selborne Road, Sidcup, Kent, Chemist.

Q

1907. Quad, Louis J., 40, Victor Street, Yonkers, N.Y., U.S.A., Chemist.

1903. Queeny, Jno. F., (Journals) Monsanto Chemical Works, and (communications) 1810, South 2nd Street, St. Louis, Mo., U.S.A., Chemical Manufacturer.

1905. Queiroz, Dr. Luiz M. Pinto de, Caixa 255, Sao Paulo, Brazil, Manufacturing Chemist.

1903. Queneau, Augustin L., c/o Bartlesville Zinc Co., Bartlesville, Oklahama, U.S.A., Mining Engineer.

1887. Quibell, Oliver, Shalem Lodge, Newark-on-Trent, Manure Manufacturer.

1902. Quinan, Kenneth B., c/o De Beers Explosives Works, Somerset West, C.C., South Africa, Chemist.

1897. Quinan, Wm. R., (Journals) General Manager, De Beers Explosives Works, Dynamite Factory, Cape Colony, South Africa; and (subscriptions) c/o De Beers Consolidated Mines, 15, St. Swithin's Lane, E.C., Superintendent (Powder Works).

1897. Quirk, Jno. S., Lead Smelting Works, St. Helens, Lancs., Manager.

R

1907. Rabenalt, Gustav H., c/o General Storage Battery Co.; and (Journals) P.O. Box 461, Boonton, N.J., U.S.A., Chemist.

1907. Rabino, Jos. F., Sugar Refinery, Abou-Kourgas, Upper Egypt, Sugar Maker.

1898. Radcliffe, Lionel G., 6, Alma Terrace, Old Trafford, Manchester, Chemist.

1904. Rademacher, Dr. Ferdinand, Prag-Carolinenthal, Austria, Chemical Manufacturer.

1900. Radley, Ernest G., 49, Ernest Street, West Norwood, S.E.

1895. Raegener, Louis C., 141, Broadway, New York City, U.S.A., Patent Lawyer.

1906. Rafft, Dr. Albert K., Moosie, Pa., U.S.A., Chemist.

1901. Ralston, Wm., Government Chemical Laboratory, Lagos, West Africa, Government Chemist.

1902. Ramsay, A. Alexander, Laboratory, Department of Agriculture, 136, George Street, Sydney, N.S.W., Australia, Assistant Chemist.

O.M. Ramsay, Sir William, K.C.B., F.R.S., University College, London, W.C.: Journals to 19, Chester Terrace, N.W., Professor of Chemistry.

1885. Ramsay, W., c/o Cammell, Laird and Co., Ltd., Birkenhead Ironworks, Birkenhead, Chemist and Assayer.

1906. Ranck, Samuel H., Ryerson Public Library Building, Grand Rapids, Mich., U.S.A., Librarian.

1901. Ransom, Francis, The Chilterns, Hitchin, Herts., Manufacturing Pharmaceutical Chemist.

1905. Ransom, H. B., 28, Belsize Park Gardens, Hampstead, N.W., Engineer.

1904. Rapelje, Walter S., 957, Liberty Avenue, Brooklyn, N.Y., U.S.A., Chemist.

1898. Raschen, Dr. Julius, The Highlands, Runcorn, Cheshire, Consulting Chemist (United Alkali Co.).

1905. Raschig, Dr. F., Ludwigshafen a/Rhein, Germany, Manufacturing Chemist.

1908. Rassow, Prof. Dr. Berthold, Dorrienstrasse 13, Leipzig, Germany, General Secretary, Vereins Deutscher Chemiker.

1893. Ratcliff, Frank D., The Cottage, Green Hill, Bromsgrove, Worcestershire, Vinegar Brewer.

1904. Ratcliffe, C. F., Haigh Park Chemical Works, Stourton, near Leeds, Tar Distiller.

1904. Ratcliffe, Mrs. F. A., Haigh Park Chemical Works, Stourton, near Leeds.

1898. Ratcliffe, Walter, 21, Mawdsley Street, Bolton, Analytical Chemist.

1895. Rau, Dr. H. M., 130–132, Pearl Street, New York City, U.S.A., Chemist.

1901. Rawlins, Herbert J. L., The Cottage, Rainhill, Lancashire, Managing Director.

1903. Rawolle, Frederick C., c/o Marx and Rawolle, 100, William Street, New York City, U.S.A., Chemist.

O.M. Rawson, Chris., Battenberg Avenue, Leicester, Consulting Chemist.

1906. Raymond, R. S., Goulborn, N.S.W., Australia, Brewer.

1895. Read, E. J., Portland, Belmont Road, Westgate-on-Sea, Analyst.

1890. Reade, Thos., Sebright House, Tettenhall Wood, Wolverhampton, Manufacturing Chemist.

O.M. Readman, Dr. J. B., Staffield Hall, Kirkoswald, R.S.O., Cumberland, Analytical and Consulting Chemist.

1907. Rebhun, Frank E., c/o Pennsylvania Salt Manufacturing Co., Natrona, Pa., U.S.A., Chemist.

1902. Redfern, C. G., 4, South Street, Finsbury, London, E.C., Patent Agent.

1890. Redgate, J. G., Traffic Street, Nottingham, Aërated Water Manufacturer.

O.M. Redwood, Sir Boverton, 4, Bishopsgate Street Within, London, E.C., Petroleum Expert.

1884. Redwood, Iltyd J., The Chestnuts, Erith Road, Bexley Heath, Kent, Technical Chemist.

1887. Redwood, Robt., 4, Bishopsgate Street Within, London, E.C., Secretary.

1891. Redwood, T. Horne, Olveston, Sedlescombe Road, St. Leonard's-on-Sea, Analytical Chemist.

1886. Rée, Dr. A., 15, Mauldeth Road, Withington, Manchester, Aniline Dye Manufacturer.

1884. Reed, Albert E., The Grange, Leigham Court Road, Streatham, S.W., Paper Works Chemist.

1902. Reed, Herbert C., c/o Stamford Manufacturing Co., Stamford, Conn., U.S.A., Chemist.

1895. Reed, Dr. J. Hastings, Hambledon Mill, *via* Cairns, North Queensland, Sugar Manufacturer.

1906. Reed, William, Bridge House, Bridge Road, Millwall, E., Foreman, (Desilverising Works).

1893. Reekie, J. A., Woodhouse, Hayfield, Derbyshire, Calico Printer's Colour Mixer.

1883. Reeks, T. H., 106, Queen Victoria Street, London, E.C., Analytical and Consulting Chemist.

1897. Rees, W. H., c/o Alameda Sugar Co., Alvarado, Cal., U.S.A., Chemist.

1906. Rees, Walter J., c/o Chance Bros. and Co., Ltd., Smethwick, near Birmingham, Glass Works Chemist.

1900. Reese, Dr. Chas. L., Eastern Laboratory, P.O. Box 424, Chester, Pa., U.S.A., Chemist.

1897. Reid, Andrew, Burnview, Stewart Street, Carluke, Lanarkshire, Chemist.

1906. Reid, James, Moffat Mills, Airdrie, N.B., Chemist.

1905. Reid, Dr. John H., 11, Glover Street, Birkenhead, Chemist.

1907. Reid, Robert, Agencia de Tharsis, Huelva, Spain, Analytical Chemist.

1896. Reid, Robt., Oil Mills, Horbury Bridge, near Wakefield, Chemical Student.

1895. Reid, T. Anderson, 5, Adelaide Terrace, Waterloo, Liverpool, Works Manager.

O.M. Reid, Walter F., Fieldside, Addlestone, Surrey, Technical Chemist.

1893. Reid, Wm., Jun., Bombay Dyeworks, Dadur, Bombay, India, Dyer.

1907. Reimarus, Dr. C., Chemische Fabrik auf Actien (vorm. E. Schering), Müllerstrasse 170, Berlin, N., Germany, Manager.

1904. Reinherz, Otto, 9, Heaton Grove, Bradford, Yorks., Chemist.

1906. Reinhold, Gustave, 11, Hervey Road, Blackheath, S.E., Works Manager.

1898. Reitmeyer, Robt. E. D., 63, Crutched Friars, London, E.C., Chemical Merchant.

1904. Remington, Prof. Joseph P., 1832, Pine Street, Philadelphia, Pa., U.S.A., Author, U.S. Pharmacopoeia.

1900. Remington, J. Stewart, Aynsome, Grange-over-Sands, R.S.O., Lancs., Consulting Chemist.

1903. Remsen, President Ira, Johns Hopkins University, Baltimore, Md., U.S.A., President.

1884. Renaut, F. W., 17, Emanuel Avenue, Friar's Park, Acton, W., Secretary.

O.M. Rennie, Dr. E. H., University of Adelaide, South Australia, Professor of Chemistry.

1901. Renwick, Frank F., Norland House, Avenue Road, Brentwood, Essex, Chemist (Photographic Works).

1907. Reoch, Robert A. S., Cocheco Manufacturing Co., Dover, N.H., U.S.A., Printworks Superintendent.

1894. Rettie, Theodore, 16, Great King Street, Edinburgh, Metallurgical Chemist.

1895. Reubens, Chas. M., 148, West 111th Street, New York City, U.S.A., Chemist.

1908. Reuter, Dr. Ludwig, P.O. Box 4, Berkeley, Cal., U.S.A., Manager (Magnesia Products Co.).

1905. Revis, Cecil, 77, King Street West, Hammersmith, W., Analyst.

O.M. Reynolds, Dr. J. Emerson, F.R.S., 29, Campden Hill Court, Kensington, W., Professor of Chemistry.

1904. Rhett, Edmund, c/o Virginia-Carolina Chemical Co., Durham, N.C., U.S.A., Works Manager.

1908. Rhoads, J. Edgar, Box 606, Wilmington, Del., U.S.A., Leather Chemist.

O.M. Rhodes, E., c/o Thos. Vickers and Sons, Widnes, Technical Chemist.

1892. Rhodes, P. J., Bridge House, Church, Accrington, Dye and Print Works Manager.

1902. Rhodin, B. E. F., Sault Ste. Marie, Ont., Canada, Chemical Engineer.

1905. Richard, Francis C., Range Quarters, Mount Morgan, Queensland, Assayer (Mt. Morgan G.M. Co.).

1889. Richards, Edgar, 60, Ayrault Street, Newport, R.I., U.S.A., Analytical Chemist.

1888. Richardson, Clifford, New York Testing Laboratory, Maurer, N.J., U.S.A., Chemical Engineer.

1903. Richardson, F. J., Chemical Works, Ringsend Docks, Dublin, Ireland, Chemical Manure Manufacturer.

1884. Richardson, F. W., City Analyst's Office, Bradford; and (Journals) Oak Lea, Menston-in-Wharfedale, Yorkshire, Analytical Chemist.

1900. Richardson, Jno. H., c/o H. D. Pochin and Co., Ltd., Salford, Manchester, Manager.

1905. Richardson, L. G., Russell Buildings, 10, Leeds Road, Bradford, Yorks., Chemist.

1889. Richardson, S. M., 415, Main Street, Bonhill, N.B., Analytical Chemist.

1891. Richardson, Walter W., Aldingham, Park View Crescent, Roundhay, Leeds, Manufacturing Chemist.

1903. Richardson, Wm., 2, Thornfield Road, West Park, Headingley, Leeds, Drysalter.

1894. Richardson, Wm. H., Newsky Thread Mills, Malaja, Bolotnaja, St. Petersburg, Russia, Textile Chemist.

1904. Richardson, Wm. S., 201, High Street, Lincoln, Chemical Manure Manufacturer.

1886. Richmond, H. D., 8, Woodfield Road, Ealing, W., Chief Chemist (Aylesbury Dairy Co.).

1898. Richmond, Jno. R., 14, North Road, West Kirby, Cheshire, Alkali Works Manager.

1901. Richmond, Sylvester O., 12, Amblecote Road, Grove Park, Lee, S.E., Analytical Chemist.

1907. Ricketts, Guy D. *See* Bengough, Guy D.

1886. Riddell, R., 87, Horninglow Street, Burton-on-Trent, Brewer.

1894. Ridding, Howard C., School of Mines, Clinton Road, Redruth, Cornwall, Principal.

1884. Rideal, Dr. Samuel, Laboratory, 28, Victoria Street, Westminster, S.W., Consulting Chemist.

1905. Ridge, H. M., Owton Manor, Seaton Carew, Co. Durham, Mining Engineer.

O.M. Ridsdale, C. H., Ravenscroft, Roman Road, Linthorpe, Middlesbrough, Analytical Chemist.

1899. Riederer, Emil J., c/o Eastern Dynamite Co., Forcite Works, Landing, N.J., U.S.A., Works Chemist.

1902. Riederer, Dr. Herman S., P.O. Box 410, Bristol, Tenn., U.S.A., Chemist.

1907. Rigg, Gilbert, c/o New Jersey Zinc Co., Palmerton, Carbon Co., Pa., U.S.A., Chemist.

1892. Riker, Jno. J., 46, Cedar Street, New York City, U.S.A., Merchant.

O.M. Riley, E., 2, City Road, Finsbury Square, London, E.C., Metallurgical Chemist.

O.M. Riley, J. E., c/o John Riley & Sons, Hapton, near Accrington, Chemical Manufacturer.

1905. Riley, Louis J., 8, Newton Road, London, W., Chemist.

1904. Riley, W. A., Hazeldene, College Road, Norwich, Brewer.

1899. Rink, Arnold, 11, Bridgewater Street, Barbican, London, E.C., Tannin Extract Manufacturer.

1889. Rintoul, Wm., 4, Sewardstone Road, Waltham Abbey, Essex, Explosives Chemist.

1901. Ripley, Philip F., 48, Central Street, Andover, Mass., U.S.A., Chemist.

1906. Rivière, Harry V., 232, Lafayette Street, Salem, Mass., U.S.A., Chemist and Leather Superintendent.

O.M. Rix, W. P., Frocester House, Kinglake Road, Egremont, Cheshire, Potter.

1907. Roberts, Chester, Swarthmore College, Swarthmore, Pa., U.S.A., Superintendent,

O.M. Roberts, F. G. Adair, Oak Hill Lodge, Frognal, N.W., Chemical Manufacturer.

1901. Roberts, H. E. U., c/o British Explosives Synd., Pitsea, Essex, Chemist.

1907. Roberts, Percy R., c/o Blumenthal & Co., Wilmington, Del., U.S.A., Analytical Chemist.

1885. Roberts, R. Wightwick, 22, Calle Arturo Prat, Valparaiso, Chili, Analytical and Consulting Chemist.

1900. Roberts, Wm. Brittain, Wilderspool House, Warrington, Brewer and Analyst.

1902. Roberts, Wm. H., Lynwood, Wellington Field, Wavertree, Liverpool, Analytical Chemist.

1902. Robertshaw, Chas. D., c/o Chas. Price and Co., Oilworks, Belvedere, Kent, Analytical Chemist.

1891. Robertson, Alex. A., Riversdale, Cressington Park, Liverpool, Technical Chemist.

1897. Robertson, Andrew J., 2, North Ninth Street, Richmond, Va., U.S.A., Analytical Chemist.

1903. Robertson, Fred., The Hewan, Bearsden, Glasgow, Analytical Chemist.

1900. Robertson, Jas., 6, Windsor Terrace, Lefroy Street, Coatbridge, N.B., Analytical Chemist.

1891. Robertson, Dr. Robt., Research Dept., Royal Arsenal, Woolwich; and (Journals) 29, Charlton Road, Blackheath, S.E., Analytical Chemist.

1905. Robertson, Robt., 290, High Street, Pawtucket, R.I., U.S.A., Dyestuff Salesman.

1897. Robinson, Clarence J., Westerleigh, West New Brighton, N.Y., U.S.A., Chemist.

1900. Robinson, Edw. B., 2, Westcott Street, Hull, Oil Distiller.

1904. Robinson, Prof. Franklin C., Bowdoin College, Brunswick, Maine, U.S.A., Professor of Chemistry.

1902. Robinson, Hy. Fishwick, Culcheth Chemical Works, Newton Heath, Manchester, Manufacturing Chemist.

O.M. Robinson, H. H., 75, Finborough Road, West Brompton, S.W., Analytical Chemist

1907. Robinson, Herbert W., Robinson Bros., Ltd., Ryders Green, West Bromwich, Staffordshire, Tar Distiller.

O.M. Robinson, Jno., 8, Albert Road, Widnes, Chemical Engineer.

O.M. Robinson, Jos., Farnworth, Widnes, Chemical Manufacturer.

1887. Robinson, Thomas, (Journals) 401, West Street, Glasgow; and (communications), The Villa, Nitshill, N.B., Chemical Works Manager.

1902. Robitschek, Carl, 200, Worth Street, New York City, U.S.A., Scientific Brewer.

1884. Rodger, Edw., 1, Clairmont Gardens, Glasgow, W.

1904. Rodger, Robert, Government Laboratory, Clement's Inn Passage, Strand, London, W.C., Chemist.

1905. Rodger, R. L., Suffolk House, Cannon Street, London, E.C., Manager (Pena Copper Mines).

1904. Roeber, Dr. E. F., 239, West 39th Street, New York City, U.S.A., Editor, "Electrochemical Industry."

1903. Roelofsen, Dr. J. A., c/o Coal Distillation Co., Middlesbrough, Yorks., Works Manager.

1905. Rogers, Dr. Allen, Pratt Institute, Brooklyn, N.Y., U.S.A., Research Chemist.

1900. Rogers, Geo. J., Chemist.

1890. Rogers, Harry, 5, Stoke Newington Common, London, N.

1907. Rogers, H. L., c/o Ingeniero Residente, Ferro Carril de Buenos Aires al Pacifico, 25 de Mayo 277, Buenos Aires, Argentina, Analyst and Cement Expert.

1899. Rogers, John, Ferriby, Caledonia Road, Ardrossan, N.B., Chemist.

1907. Roller, Frank R., 525, 31st Street, Oakland, Cal., U.S.A., Powder Works Superintendent.

1898. Roller, H. C., 101, North Munn Avenue, East Orange, N.J., U.S.A., Superintendent.

1899. Rollin, Chas., Bylton, East Jarrow-on-Tyne, Chemical Manufacturer.

O.M. Rollin, J. C., 1, St. Nicholas Buildings, Newcastle-on-Tyne, Chemical Manufacturer.

1907. Rolph, George M., c/o California and Hawaiian Sugar Refining Co., Crockett, Cal., U.S.A., Sugar Refiner.

1905. Romanes, J. W., Minas de Rio Tinto, Huelva, Spain, Chemical Engineer.

1898. Roode, Rudolf de, International Paper Co., Glens Falls, N.Y., U.S.A., Chemist and Superintendent.

O.M. Roscoe, Sir Henry, F.R.S., 10, Bramham Gardens, South Kensington, S.W., Consulting Chemist.

1893. Roscow, Jno. F., P.O. Box 417, Boonton, N.J., U.S.A., Print Works Chemist.

1904. Rose, Jno., Wicken House, Stretton, near Warrington, Technical Chemist.

1901. Rose, Jno. Leonard, Gorton Brook Chemical Works, Manchester, S.E., Chemist.

1902. Rosebrugh, Prof. T. K., 666, Spadina Avenue, Toronto, Canada, and (Journals) Annette, Kern Co., Cal., U.S.A., Professor of Electrical Engineering.

1904. Rosenblatt, A. H., Chemist.

1897. Rosengarten, Dr. Geo. D., 1700, Fitzwater Street, Station D, Philadelphia, Pa., U.S.A., Manufacturing Chemist.

1905. Rosenhain, Walter, Park View, Park Road, Teddington, Chemist and Metallurgist.

1896. Rosenheim, Dr. Otto, 68, Belsize Park Gardens, Hampstead, N.W., Research Chemist.

1887. Ross, Alex. J. J., Tayavalla, Falkirk, N.B., Chemical Manufacturer.

1893. Ross, Arthur, 1, Glengall Road, Old Kent Road, London, S.E., Analytical Chemist.

1900. Ross, Raymond, Public Analyst's Office, Burnley, Lancashire, Analytical Chemist.

1906. Rossi, Auguste J., c/o Roessler Hasslacher Chemical Co., Perth Amboy, N.J., U.S.A., Mining Engineer.

1906. Rossi, Louis M., c/o Perth Amboy Chemical Works, Perth Amboy, N.J., U.S.A., Mining Engineer.

1906. Rossiter, E. C., 4, Park Road, West Smethwick, Birmingham, Chemical Engineer.

1888. Rothwell, C. F. Seymour, Photographic Works, Mobberley, Cheshire, Chemist.

1905. Rothwell, Robert R., 88, George Street, Moss Side, Manchester, Chemistry and Physics Teacher.

O.M. Rottenburg, Paul, Castle Chambers, 55, West Regent Street, Glasgow, Chemical Merchant.

1899. Rouse, H. W., Anglo-Continental Guano Works, Victoria Docks, E., Foreman.

1903. Rouse, Wm., 25, Albert Street, Alexandria, Dumbartonshire, Chemist.

1906. Rowell, Herbert W., c/o Locke, Lancaster and Co., Ltd., Bridge Road, Limehouse, E., Analytical Chemist.

O.M. Rowland, W. L., 4800, Chester Avenue, Philadelphia, Pa., U.S.A., Chemist.

1904. Rowley, Ernest W., Chemical Laboratory, Locomotive Department, North Eastern Railway, Gateshead-on-Tyne, Analytical Chemist.

1901. Rowley, Walter Eugene, c/o Schoellkopf, Hartford and Hanna Co., 100, William Street, New York City, U.S.A., Chemist.

1904. Rowling, S. R., 1, Beechwood, Kendal, Westmoreland, Chemist.

1896. Royal-Dawson, H., 6, Wimbourne Road, Edgbaston, Birmingham, Chemist.

1898. Royle, Chas. L., c/o Parry and Co., Samalkot, Godaveri District, Madras, India. Sugar Chemist.

1898. Royle, Thos. H., Store House, Gas Works, Beckton, E., Chemist.

O.M. Royse, S. W., St. Andrew's Chambers, 20, Albert Square, Manchester, Chemical Engineer.

1902. Rücker, Dr. Hermann von, 103, Lancaster Avenue, Buffalo, N.Y., U.S.A., Chemist.

1896. Ruddock, Fred. G., Corporation Street, Warrington, Analytical Chemist.

1895. Rudge, Alfred, Sutton Alkali Works, St. Helens, Lancs., Analytical Chemist.

1884. Ruffle, Jno., Musley, Ware, Herts., Consulting Chemist and Electrician.

1905. Rüger, Richard, 13, Balmoral Road, Fairfield, Liverpool, Chemist.

1898. Ruhl, Louis, c/o Roessler and Hasslacher Chemical Co., P.O. Box 1999, 100, William Street, New York City, U.S.A., Chemical Merchant.

O.M. Rumble, C., Belmont Works, Battersea; and (Journals) 9, Sangora Road, New Wandsworth, London, S.W., Candle Works Chemist.

1899. Rumbold, Wm. R., 47, Watling Street, London, E.C., Electro-Metallurgist.

1895. Rump, Ernest, The Leeds Phosphate Works, Hunslet, Leeds, Manager.

1903. Runting, D. A., Moreland Grove, Coburg, Melbourne, Vic., Australia, Assayer.

1903. Runyan, Elmer G., Hutchins Building, Washington, D.C., U.S.A., Chemist and Gas Inspector.

1899. Rushby, Wm., Oak View, Batley, Yorks., Analyst.

1906. Russell, David, Cadham, Markinch, Fife, Scotland, Paper Maker.

1884. Russell, Jno., Anchor Brewery, Britten Street, Chelsea, London, S.W., Brewer.

O.M. Russell, Dr. W. J., F.R.S., 34, Upper Hamilton Terrace, London, N.W., Professor of Chemistry.

1901. Rust, Robt. R., 48, West 82nd Street, New York City, U.S.A., Chemist.

1905. Ruttan, Prof. R. F., Medical Faculty, McGill University, Montreal, Canada, Professor of Chemistry.

1905. Ryan, Prof. F. G.; (Journals) c/o Parke, Davis and Co., Detroit, Mich., U.S.A., and (subscriptions) c/o Parke, Davis and Co., Beak Street, Regent Street, London, W., Manufacturing Chemist.

1905. Ryland, Chawner, 53, Park Road, Aston, Birmingham, Brewer and Chemist.

S

1895. Saalfeld, Adolphe, 2, South King Street, Manchester, Chemical Merchant.

1895. Saarbach, Dr. L., 114, Pearl Street, New York City, U.S.A., Consulting Chemist.

1905. Sabin, Alvah H., 432, Sandford Avenue, Flushing, N.Y., U.S.A., Chemist, Varnish Works.

1883. Sadler, A. E., Sand Hall, Ulverston, Lancashire, Manufacturing Chemist.

O.M. Sadler, Sir Samuel A., Middlesbrough-on-Tees, Colour Manufacturer.

1884. Sadtler, Dr. S. P., 145, North 10th Street, Philadelphia, Pa., U.S.A., Consulting Chemist.

1896. Sadtler, Dr. S. S., 39, South 10th Street, Philadelphia. Pa., U.S.A., Chemist (U.S. Customs).

1897. Sage, C. Edward, c/o W. C. Nickels, 41, Cheapside, London, E.C., Consulting Chemist.

1907. Saiki, Kenkichi, Guantanamo Sugar Co., Los Canos, Guantanama, Cuba, Chemist.

1884. Salamon, A. Gordon, 1, Fenchurch Avenue, London, E.C., Consulting Chemist.

1885. Salamon, Jno., Rainham, S.O., Essex, Manufacturing Chemist.

1884. Salis-Mayenfeld, Dr. E. von, 966, Madison Avenue, Albany, N.Y., U.S.A., Technical Chemist.

1902. Salm, Louis N., 22, Cliff Street, New York City, U.S.A., Chemist.

1905. Sammet, Dr. G. Victor, 68, Northampton Street Boston, Mass , U.S.A., Chemist.

1907. Samuel, Marcus R. A., 12, Minories, London, E.C., Merchant.

O.M. Samuel, W. Cobden, 66, Croxted Road, West Dulwich, S.E., Analytical Chemist.

1896. Samuelson, Francis A. E., Sir B. Samuelson and Co., Ltd., Middlesbrough, Ironmaster.

1904. Sand, Dr. Henry J. S., University College, Nottingham, Lecturer and Demonstrator.

1906. Sanders, J. McConnell, c/o Direción General de Aduanas, Palacio Nacional, Mexico, D. F., Analytical Chemist.

1902. Sanders, Warren W., c/o Larkin Soap Co., Buffalo, N.Y., U.S.A., Chemist.

1895. Sanderson, John, c/o B. S. Cohen, Ltd., 15, Clerkenwell Close, London, E.C., Chemist.

1898. Sanderson, T. Crisp, Dubois Avenue, West New Brighton, N.Y., U.S.A., Chemical Engineer.

1907. Sandig, A., 229. Kinzie Street, Chicago, Ill., U.S.A., Sales Manager

O.M. Sanford, P. Gerald, 14, Wellington Road, Croydon, Public Analyst and Consulting Chemist.

1904. Sanger, Prof. Charles Robt., Harvard College, Cambridge, Mass., U.S.A., Professor of Chemistry.

1890. Saniter, E. H., Strafford Villa, Moorgate, Rotherham, Analytical Chemist.

1901. Sargent, Dr. Geo. W., Carpenter Steel Co., Reading, Pa., U.S.A., Chemist and Metallurgist.

1903. Saunders, Lewis E., P.O. Box 296, Niagara Falls, N.Y., U.S.A., Electro-Chemical Engineer.

1896. Saunders, Walter M., 20, Dewey Street, Olneyville, R.I., U.S.A., Analytical Chemist.

1895. Savage, Arthur E., Smelting Works, Port Kembla, N.S.W., Australia, Metallurgist.

1895. Sawers, Wm. D., 3, Hillside Gardens, Partick Hill, Glasgow, Chemist.

1903. Sawin, Luther R., Mt. Kisco Laboratory, Mount Kisco, N.Y., U.S.A., Bacteriologist.

1901. Sawyer, Dr. Harris E., c/o Felton and Son, 524, East Second Street, South Boston, Mass., U.S.A., Chemist.

1907. Saxe, Joel B., P.O. Box 554, Montreal, Canada, Chemist.

1898. Saxe, Sigmond, 107, Manhattan Avenue, New York City, U.S.A., Manufacturing Chemist.

1895. Sayer, Harry, 5, Orchard Road, High Barnet, Herts., Metallurgical Chemist.

1890. Sayers, Jos. J., Nobel Villa, Stevenston, Ayrshire, Explosives Chemist.

1895. Scales, F. Shillington, "Jersey," St. Barnabas Road, Cambridge.

1899. Schaak, Dr. Milton J., 108, Penn Street, Brooklyn, N.Y., U.S.A., Chemist.

O.M. Schack-Sommer, Dr. G., 87, Victoria Street, London, S.W., Sugar Refiner.

1899. Schaefer, Dr. L., Maywood, N.J., U.S.A., Manufacturing Chemist.

1903. Schanche, Herman G., 3401, Gray's Ferry Road, Philadelphia, Pa., U.S.A., Chemist.

1906. Scheffer, Heinrich, c/o Orme & Co., 17-19, Russell Street, London Road, Manchester, Chemical Apparatus Manufacturer.

1903. Scheidel, Dr. Aug., Mutual Life of New York Building, Martin Place, Sydney, N.S.W., Australia, Managing Director.

1886. Schellhaas, Henry Alf., Thornhill, Beach Road, Hartford, Northwich, Mechanical Engineer.

1904. Schenck, Henry, 15, University Place, New York City, U.S.A.

1894. Schidrowitz, Dr. P., 57, Chancery Lane, London, W.C., Research Chemist.

1895. Schieffelin, Dr. W. Jay, 841, Southern Boulevard, New York City, U.S.A., Manufacturing Chemist.

1901. Schieren, G. Arthur, Dixie Tannery, Bristol, Tenn., U.S.A., Mechanical Engineer and Tanner.

1905. Schill, Dr. Emil, c/o G. Siegle Co., 79, Duane Street, New York City, U.S.A., Chemist.

1902. Schlegel, Jno. Wm., cor. Main and Toledo Avenues, Elmhurst, Long Island, N.Y., U.S.A., Chemist.

1893. Schleicher, Francis J., 38, West Tenth Street, Long Island City, N.Y., U.S.A., Technical Chemist.

1902. Schlesinger, Basil E., Brookline, Mass., U.S.A., Chemist.

1901. Schlichting, Emil, 38, Cranberry Street, Brooklyn, N.Y., U.S.A., Chemist.

1905. Schmidt, Herman B., 2523, Essex Place, W.W.H., Cincinnati, Ohio, U.S.A., Manufacturing Chemist.

1906. Schmidt, J., 52, Camberwell Green, London, S.E., Works Manager.

1907. Schmitt, Charles A., The Carter's Ink Co., 172, Columbus Avenue, Boston, Mass., U.S.A., Chemist.

1906. Schneible, Joseph, 14th Floor, Rector Building, Chicago, Ill., U.S.A., Chemical Engineer.

1901. Schneider, Edw. J., c/o Electro-Metallurgical Co., Niagara Falls, N.Y., U.S.A., Chemist.

1905. Schneider, Dr. F. G., Continental Color and Chemical Co., 32, India Street, Boston, Mass., U.S.A., Technical Chemist.

1899. Schniewind, Dr. F., c/o United Coke and Gas Co., 17, Battery Place, New York City, U.S.A., Chemist.

1904. Schniewind, Heinrich, Jun., Susquehanna Silk Mills, 62, Greene Street, New York City, U.S.A., Vice-President and Treasurer.

1907 Schober, Prof. W. B., Lehigh University, South Bethlehem, Pa., U.S.A., Professor of Chemistry.

1897. Schoder, Dr. Robt., 6, Brandreth Road, Balham, S.W., Chemist.

1904. Schoeller, Dr. Walter R., 10, Bedford Place, London, W.C., Analytical Chemist.

1902. Schofield, Jas. A., The University, Sydney, N.S.W., Australia, Lecturer in Chemistry.

O.M. Scholefield, H. E., Edge Hill Chemical Works, Liverpool, Chemical Manufacturer.

1898. Scholes, Geo. R., Dépôt Général de la Liebig's Extract of Meat Co., Ltd., Antwerp, Belgium, Analytical Chemist.

1907. Scholl, Geo. P., c/o Westinghouse Lamp Co., 510, West 23rd Street, New York City, U.S.A., Research Chemist.

1906. Schramm, Quirin, Otto-Hilgenstock Coke Oven Co., Ltd., Tingley, near Wakefield, Chief Chemist.

1906. Schroeder, C. M. E., 221, Pearl Street, New York City, and (Journals) Rutherford, N.J., U.S.A., Analytical Chemist.

1895. Schroeder, E. August, c/o Church and Co., 36, Ash Street, Brooklyn, N.Y , U.S.A., Chemist.

1908. Schüll, Gustav, Messrs. Carl Schleicher & Schüll, Düren, Rheinland, Germany, Filter Paper Manufacturer.

1906. Schulten, Dr. C., P.O. Box 279, Calcutta, India, Analytical Chemist.

1904. Schultz, Carl R., 440, First Avenue, New York City, U.S.A., Mineral Water Manufacturer.

1901. Schultze, Wm., c/o General Chemical Co., Laurel Hill, Long Island, N.Y., U.S.A., Chemist.

1893. Schüpphaus, Dr. R. C., 175, Pearl Street, New York City, U.S.A., Consulting Chemist.

1893. Schwab, Dr. L. C., Sedanstrasse 53, Bernburg, Anhalt, Germany, Technical Chemist.

1908. Schwalbe, Dr. Carl G., Rossdorferstrasse 86, III, Darmstadt, Germany, Professor (Technische Hochschule).

1907. Schwann, Chas. W., c/o Antoine Chiris, 20, Platt Street, New York City, U.S.A., Chemist.

1902. Schwarz, Gustav A., Grasselli Chemical Co., 60, Wall Street, New York City, U.S.A., Manager.
1889. Schweich, Emile. *See* Mond, Emile S.
1903. Schweickert, Karl, 45, Hazelwood Avenue, Rahway, N.J., U.S.A., Chemist.
1894. Schweitzer, Dr. H., 66, Lafayette Street, New York City, U.S.A., Chemical Expert.
1905. Schweizer, Alfred, 14, Rue de Calais, Paris, France.
1906. Schwerin, Lorenz R., c/o Casein Co. of America, Bainbridge, N.Y., U.S.A., Vice-President, Casein Co.
1906. Scott, Alex. C., Davington House, Faversham, Kent, Assistant Manager (Cotton Powder Co.).
1891. Scott, Andrew, Royal Gunpowder Factory, Waltham Abbey, Essex, Analytical Chemist.
1906. Scott, A. Putnam, Dominion Iron & Steel Co., Sydney, C.B., Canada, Chemist.
1889. Scott, Ernest G., 2, Talbot Court, Gracechurch Street, London, E.C.; and (Journals) 67, Lord Street, Liverpool, Soap Works Chemist.
1908. Scott, Howard, 252, Bouquet Street, Pittsburg, Pa., U.S.A., Chemist.
1898. Scott, Jas., Cawnpore Woollen Mills, Cawnpore, India, Chemist.
1894. Scott, Jno. Gillespie, 33, Sciennes Road, Edinburgh, Analytical Chemist.
1902. Scott, Walter, c/o The Powell Duffryn Steam Coal Co., Ltd., Aberaman, near Aberdare, Chemist.
1907. Scott, Wm. F., Madison, Maine, U.S.A., Manager (Madison Woollen Co.).
1894. Scott-Smith, G. E., 67, Surrey Street, Sheffield, Analytical Chemist.
1889. Scovell, M. A., Lexington, Kentucky, U.S.A., Agricultural Chemist.
1904. Scoville, Wilbur L., c/o Parke, Davis & Co., Detroit, Mich., U.S.A., Analytical Chemist.
O.M. Scudder, F., Mersey and Irwell Joint Committee, 44, Mosley Street, Manchester, Chemist.
1895. Seabrooke, H. Cecil, Black Ash, Grays, Essex, Research Chemist.
1906. Seabury, Richard W., c/o Boonton Rubber Co., Boonton, N.J., U.S.A., Factory Superintendent.
1900. Searby, Fred. M., West Berkeley, Cal., U.S.A., Oilworks Superintendent.
1889. Searl, Albert, Montreux, Victoria Road, Sidcup, Kent, Technical Chemist.
1898. Searle, Alfred B., Cliftonville, Claremont, Sheffield, Analytical Chemist.
1905. Seaver, Joshua, 7, West Seventh Street, South Boston, Mass., U.S.A., Dealer in Dyestuffs and Chemicals.
1907. Sebold, George, 354, Elizabeth Avenue, Elizabeth, N.J., U.S.A.
1901. Sederholm, Erik, K. Flottans Varf, Stockholm, Sweden, Chemist (Royal Navy Board).
1905. Seebohm, H. C. A., 66, Lafayette Street, New York City, U.S.A., Importer of Dyestuffs and Chemicals.
1905. Seeker, A. F., 528, Eighth Street, Brooklyn, N.Y., U.S.A., Food Analyst.
1907. Seelemann, Dr. A., Doemitz a/Elbe, Germany, Managing Director of Explosives Works.
1893. Sefton-Jones, Herbert, c/o W. P. Thompson and Co., 322, High Holborn, London, W.C., Chemist.
1902. Segaert, Edw., Colonial Sugar Refining Co., Ltd., O'Connell Street, Sydney, N.S.W., Australia, Analytical Chemist.
1899. Seher, A., c/o Maas and Waldstein Co., Riverside Avenue, Newark, N.J., U.S.A., Chemist.
1907. Seidensticker, Lewis J., c/o Arbuckle Bros. Sugar Refinery, Foot of Pearl Street, Brooklyn, N.Y., U.S.A., Chief Chemist.
1906. Seiter, Francis J., 3401, Charlton Street, Chicago, Ill., U.S.A., Chemist.
1896. Seldner, Rudolph L., 1395, Dean Street, Brooklyn, N.Y., U.S.A., Instructor in Chemistry.
1904. Seligman, Dr. Richard, Messrs. J. and W. Seligman, Mills Buildings, New York City, U.S.A.; and (Journals) 25, Brunswick Gardens, London, W., Chemist.
1905. Sellers, Geo. E., Rock View, Milnsbridge, near Huddersfield, Aniline Colour Maker.
1884. Semet, Louis, 217, Chaussée de Vleurgat, Brussels, Alkali Manufacturer.
1898. Sen (Gupta), Nagendra Nath, 19, Lower Chitpur Road, Calcutta, India, Physician and Chemist.
1899. Senior, Francis L., Box 31, Sanford, Maine, U.S.A., Mill Chemist.
1906. Setz, C. F., Herculaneum, Mo., U.S.A., Chemist and Metallurgist.
1904. Setzler, Dr. Horace B., c/o Lake Carriers Oil Co., Coraopolis, Pa., U.S.A., Superintendent.
1900. Seward, Geo. O., c/o Virginia Electrolytic Co., 99, Cedar Street, New York City, U.S.A., General Manager.
1905. Sewell, B. F. Brooke, North Severn, Annapolis, Md., U.S.A., Manager (Chesapeake Chemical Co.).
1896. Seyler, Clarence A., Public Analyst's Office, Nelson Terrace, Swansea, Chemist and Assayer.
1907. Seymour, Tom G., 71, Alderson Road, Wavertree, Liverpool, Analytical Chemist.
1903. Shacklady, T. G., c/o British Turpentine Corporation, Ltd., Hayes, Middlesex, Technical Chemist.
1906. Shadbolt, Fred., c/o South Metropolitan Gas Co., Chemical Works, East Greenwich, S.E., Chemical Engineer and Manager.
1906. Shah, Prof. S. J., Gujerat College, Ahmedabad, India, Professor of Science.
1905. Shainwald, R. L., jun., Bound Brook, N.J., U.S.A., Chemical Student.
1906. Shankland, George A., Edge Hill, Mansfield Woodhouse, Notts., Manager.
1892. Shanks, Arch., Bridgend Mills, Dalry, Ayrshire, N.B., Chemist.
1883. Sharp, James, Shirley Manor, Wyke, near Bradford, Yorks., Dyer.
1904. Sharples, G. H., Holly Villas, Sutton Lane, Middlewich, Cheshire, Works Chemist.
1905. Sharples, Philip P., 22, Concord Avenue, Cambridge, Mass., U.S.A., President (Natl. Coal Tar Co.).
1884. Sharples, Stephen P., 26, Broad Street, Boston, Mass., U.S.A., Analytical Chemist.
1896. Sharpley, Wm. P., P.O. Box 102, Germiston, Transvaal, S. Africa, Analytical Chemist.
1900. Sharwood, Wm. J., c/o Homestake Mining Co., Lead, South Dakota, U.S.A., Metallurgical Chemist.
1900. Shattuck, A. F., c/o Solvay Process Co., Detroit, Mich., U.S.A., Chemist.
1906. Shaw, H. G., Box 373, Barberton, Ohio, U.S.A., Chemist.
1906. Shaw, Ronald W. F., Hooghly College, Chinsurah, Bengal, Principal.
1904. Shedden, Frank, 29, Leicester Road, Hinckley, Science Master.
1905. Sheldon, John C., 124, Church Road, Erdington, near Birmingham, Chemist.
1903. Sheldon, Dr. N. L., Cordite Factory, Aruvankad, Nilgiri Hills, India, Works Manager.
1892. Shenton, Jas. P., 37, Torbay Road, Chorlton-cum-Hardy, near Manchester, Analytical Chemist.
1889. Shepard, Dr. Chas. U., (communications) P.O. Box 42, Summerville, S.C.; and (Journals) P.O. Box 284, Charleston, S.C., U.S.A.
1906. Shepard, Jas. H., Experimental Station, Brookings, S. Dak., U.S.A., Agricultural Chemist.
1907. Shepheard, Fred G., 5, University Road, Galway, Ireland, Chemist.
1904. Shepherd, A. B., Copenhagen Oil Mills, Limehouse, London, E.
1900. Shepherd, E. Sanger, 12, Heath Hurst Road, Hampstead, N.W., Scientific Instrument Maker.
1893. Shepherd, H. H. B., Northcote, Mount Pleasant Lane, Upper Clapton, N.E., Chemist.
1898. Shepherd, Reginald des F., Central Laboratory, Rhodes, Manchester, Printworks Chemist.
1907. Shepperson, Wm., 21, The Pryors, Hampstead Heath, N.W.
1899. Shero, John E., c/o Aluminium Co. of America, Niagara Falls, N.Y., U.S.A., Chemist.

1906. Sherwin, R. S., c/o Aluminium Co. of America, East St. Louis, Ill., U.S.A., Chemist.

1893. Shields, Dr. John, Minas de Rio Tinto, Prov. de Huelva, Spain, Chemist.

1907. Shilstone, Herbert M., c/o Penick & Ford, Ltd., 416, South Front Street, New Orleans, La., U.S.A., Analytical Chemist.

1896. Shimomura, K., Shinkarasumaru Kojinguchi, Sagaru, Kyoto, Japan, Chemist.

1886. Shimosé, Masachika, 110, Hakusan-Gotenmachi, Koishikawa, Tokyo, Japan, Chemical Engineer.

1902. Shimotome, H., *See* Soma, Professor H.

1888. Shishkoff, Sergius A., Perm, Russia, Glass Manufacturer.

1905. Shoffstall, Arthur S., Naval Proving Ground, Indian Head, Md., U.S.A., Chemist.

1899. Sholes, Chas. E., 164, Front Street, New York City, U.S.A., Chemical Agent.

1900. Shonk, Albert, 29, Cedars Avenue, Walthamstow, Essex, Analytical Chemist.

1899. Shores, Dr. Jeff. H., Beaconsfield Road, Widnes, Chemist.

1897. Shorey, Dr. Edmund C., P.O Box 360, Honolulu, H.I., Chemist.

1904. Short, Andrew, Choppington, Morpeth, Works Chemist.

1903. Shorter, A. E., 64, Garden Reach, Calcutta, India, Soap and Candle Manufacturer.

1902. Shoubridge, Sydney Y., M.I.C.E., Gasworks, Lower Sydenham, S.E., Gas Engineer.

1907. Shuey, Philip McG., 18, West Hull Street, Savannah, Ga., U.S.A., Analytical Chemist.

1901. Shukoff, Dr. Alexis A., Borowaja No. 86, St. Petersburg, Russia, Technical Chemist.

1899. Shuler, Darius P., Sudbury, Ont., Canada, Chemist.

1890. Shutt, Frank T., Central Experimental Farm, Ottawa, Canada, Agricultural Chemist.

1906. Shuttleworth, E. B., 220, Sherbourne Street, Toronto, Canada, Chemist.

1901. Siau, Raymond L., Springfield Brewery, Wolverhampton, Research Chemist.

1902. Sibley, Samuel E., Tottenham, Warren Road, Marrickville, Sydney, N.S.W., Australia, Technical Chemist.

1907. Siebel, Fred P., 1422, Montana Street, Chicago, Ill., U.S.A., Analytical Chemist.

1902. Siebold, Alfred, c/o British Dyewood and Chemical Co., Lacovia P.O., Jamaica, Technical Chemist.

1901. Silberrad, Dr. Oswald, Sunny Croft, Buckhurst Hill, Essex, Research Chemist.

1906. Silverman, Max, Park Hotel, Williamsport, Pa., U.S.A., Chemist.

1892. Silvester, Harry, 78, Holyhead Road, Handsworth, Birmingham, Analytical and Consulting Chemist.

1901. Sim, Wilfrid A., c/o Wm. Sim and Son, 40, Jane Street, Leith, N.B., Colour Manufacturer.

1903. Simmons, Wm. H., Oakleigh, Stoke Newington Common, N., Analytical Chemist.

1898. Simon, Dr. A., 55–56, Bishopsgate Street, London, E.C., Chemical Engineer.

1890. Simonds, Dr. F. M., 60, Wall Street, New York City, U.S.A., Mining Engineer and Assayer.

1905. Simons, Albert J., Pontianak, Dutch West Borneo, viâ Singapore, S.S., Engineer.

1906. Simons, F. D., Continental Mexican Rubber Co., Epartado 176, Torreon, Mexico, Chemist.

1902. Simonson, Wm., 126, West 9th Street, Cincinnati, Ohio, U.S.A., Chemist.

1905. Simpson, Henry, 120, Denman Street, Radford, Nottingham, Works Chemical Assistant.

O.M. Simpson, W. S., The Gables, Cannon Hill, Southgate, N., Analytical Chemist.

1900. Sims, W. Edgar, c/o British Aluminium Co., Ltd., Larne Harbour, Co. Antrim, Ireland, Assistant Manager.

1908. Simson, Frank C., 30, Beverley Street, Toronto, Canada, Director.

1906. Sinclair, Edmund E., 3, Marion Street, New York City, U.S.A., Printing Ink Manufacturer.

1894. Sinclair, Dr. W., 60, Stirling Road, Trinity, Edinburgh, Chemist.

1890. Sindall, R. W., 201, Wellmeadow Road, Catford, S.E., and (Journals) Oxford Court, Cannon Street, E.C., Paper Chemist.

1889. Singer, Ignatius, 3, Parkfield Road, Manningham, Bradford, Manufacturing Chemist.

1899. Singmaster, J. Arthur, c/o New Jersey Zinc Co. of Penna., Palmerton, Pa., U.S.A., Chemist.

1901. Sinnatt, Frank S., Glenside, Church Lane, Moston, Manchester, Demonstrator of Chemistry.

O.M. Sisson, G., jun., 13, Grey Street, Newcastle-on-Tyne, Technical Chemist.

1905. Sjöström, Waldemar L., 37, Farnham Street, Lawrence, Mass., U.S.A., Dyeworks Superintendent.

1885. Skaife, Wilfred T., 70 Sherbrooke Street West, Montreal, Canada, Sugar Chemist.

1894. Skelton, John R., c/o Norwich Crape Co., Ltd., St. Augustine's, Norwich, Technical Chemist.

1897. Skertchly, W. P., Laboratory, 11, Billiter Square, London, E.C., Analytical Chemist.

1891. Skilton, C. F. E., Brewery House, Staines, Brewer.

1901. Skinner, Hervey J., c/o A. D. Little, 93, Broad Street, Boston, Mass., U.S.A., Chemist.

1898. Skinner, Wm., 38, Sauchiehall Street, Glasgow, Analytical Chemist.

1904. Skirrow, Dr. F. W., 17, Curzon Avenue, Victoria Park, Manchester, Research Chemist.

1904. Skowronski, S., c/o Amer. Smelting & Refining Co., Maurer, N.J., U.S.A., Chemist.

1891. Skurray, Thos., The Brewery, 40, Ock Street, Abingdon, Berks, Brewer.

1904. Slator, Dr. Arthur, The Priory, Burton-on-Trent, Lecturer and Demonstrator.

1887. Slatter, Geo. W., 241, Carlton Terrace, Nab Wood, Shipley, Yorkshire, Analytical Chemist.

1906. Sleeper, Robt. R., 112, Charles Street, Lowell, Mass., U.S.A., Instructor in Dyeing.

1895. Slocum, Dr. Frank L., 401, South Linden Avenue, E.E., Pittsburg, Pa., U.S.A., Chemist.

1883. Smail, J. I., Warren Wood, Hayes Common, Beckenham, Kent, Chemical Manufacturer.

1906. Small, Frank Bergmann, Foyle Villa, Merton Road, Bootle, Liverpool, Works Chemist.

1898. Small, Fritz H., c/o Graton and Knight Manufacturing Co., Worcester, Mass., U.S.A., Chemist.

1904. Smallman, J. E., c/o Canada Chemical Manufacturing Co., Ltd., London, Ont., Canada, Chemist.

1904. Smart, Bertram J., Chem. Research Laboratory, Royal Arsenal, Woolwich, S.E., Chemist.

1906. Smart, Leslie A., Old Waterworks, Winnipeg, Man., Canada, City Analyst.

O.M. Smetham, A., 16, Brunswick Street, Liverpool, Analytical Chemist.

1904. Smith, Albert E., c/o Mount Hope Finishing Co., North Dighton, Mass., U.S.A., Superintendent.

1905. Smith, Prof. Albert W., Case Library, Cleveland, Ohio, U.S.A., Prof. of Chemistry.

1898. Smith, Alf. B., Ryecroft, Glossop, Derbyshire, Bleacher and Dyer's Manager.

1897. Smith, Allan, c/o Kellner-Partington Paper Pulp Co., Hallein, bei Salzburg, Austria, Chemist.

1896. Smith, Andrew T., c/o Castner-Kellner Alkali Co., Ltd., 43, Castle Street, Liverpool, General Manager.

1905. Smith, Arthur, Town End Chemical Works, Bramley, Leeds. Chemical Manufacturer.

1906. Smith, Arthur D., c/o Canfield Oil Co., Coraopolis, Pa., U.S.A., Chemist.

1906. Smith, Arthur G., Washington Portland Cement Co., Baker, Wash., U.S.A., Chief Chemist.

1906. Smith, Charles, Knowsley Road, Smithells, Bolton, Lancashire, Science Master.

1893. Smith, Edgar B., Box 599, Sydney, Cape Breton, Canada, Chemist.

1906. Smith, E. A. Cappelen, c/o Baltimore Copper Smelting and Rolling Co., Canton Junction, Baltimore, Md., U.S.A., Metallurgical Engineer.

1895. Smith, Dr. E. Ellsworth, 26, East 29th Street, New York City, U.S.A., Consulting Physiological Chemist.

1892. Smith, Ernest A., The Assay Office, Leopold Street, Sheffield, Assayer.
1903. Smith, Ewing, c/o Borneo Co., Ltd., Kutching, Sarawak, Borneo, Analytical Chemist.
1903. Smith, F. M., 100, William Street, New York City, U.S.A., President (Pacific Coast Borax Co.).
1891. Smith, Francis P., 24–26, East 21st Street, New York City, U.S.A., Chemist.
1907 Smith, Frank Morse, 100, William Street, New York City, U.S.A., Chemical Merchant.
O.M. Smith, G., Rosehall Terrace, Falkirk, N.B., Explosive Works Manager.
1907. Smith, George D., 216, Milk Street, Boston, Mass., U.S.A., Salesman.
1897. Smith, Sir Geo. J., c/o Bickford, Smith, and Co., Ltd., Tuckingmill, Cornwall, Fuse Manufacturer.
1906. Smith, Geo. Thos., 94, Leadenhall Street, London, E.C., Chemical and Colour Merchant.
1890. Smith, Harry, 4, Graham Park Road, Gosforth, Newcastle-on-Tyne, Colour Works Manager.
1890. Smith, Harry E., L.S. and M.S. Railway, Collingwood, Ohio, U.S.A., Analytical Chemist.
1904. Smith, Henry, 83, Brownlow Road, Horwich, Bolton-le-Moors, Lancs., Analytical Chemist.
1902. Smith, Hy. Geo., Technological Museum, Harris Street, Ultimo, Sydney, N.S.W., Australia, Assistant Curator and Chemist.
1905. Smith, H. Melville, Ammunition Works, Abbey Wood, Kent, Engineer and Superintendent.
1901. Smith, H. Procter, Shotton Lane, Shotton, Flintshire, Metallurgical Chemist.
O.M. Smith, H. R., 1, Aubert Park, Highbury, London, N., Analytical Chemist.
1890. Smith, H. Wood, c/o John Batt and Co., Ltd., 39, Old Broad Street, London, E.C., Chemist.
1905. Smith, Hugh Dunford, 8 and 10, The Side, Newcastle-on-Tyne, Analytical Chemist.
1906. Smith, Irwin J., P.O. Box 506, Troy, N.Y., U.S.A., Salesman.
O.M. Smith, Jas., Ash Grove House, Radcliffe, Manchester.
1897. Smith, James, 80, Ampthill Road, Aigburth, Liverpool, Analytical Chemist.
1903. Smith, James, South Bank, Frodsham, Cheshire, Metallurgist.
1907. Smith, Jas. C., c/o Edward Ripley and Son, Ltd., Bowling Dyeworks, Bradford, Dyer.
1893. Smith, Jas. F., 131, Seamer Road, Scarborough, Yorks, Analytical Chemist.
1901. Smith, J. Cruickshank, Holmdene, Colebrooke Avenue, West Ealing, W., Technical Chemist.
O.M. Smith, Dr. J. H., Chemical Manufacturer.
1888. Smith, J. Tertius, Richmond House, Plaistow, Essex, Technical Chemist.
O.M. Smith, Jno. W., 7, Brookfield Street, Roslindale, Boston, Mass., U.S.A., Analytical Chemist.
1890. Smith, J. Wm., Solvay Process Co., Syracuse, N.Y., U.S.A., Alkali Works Manager.
1896. Smith, Joseph Kent, 1144, Portland Street, Pittsburg, Pa., U.S.A., Metallurgical Chemist.
1906. Smith, Robert C., 425, Home Avenue, Oak Park, Ill., U.S.A., Chemical Engineer.
1898. Smith, R. F. Wood, 9, Lower Thames Street, London, E.C., Consulting Chemist.
1890. Smith, Dr. R. Greig, Linnean Society's House, Elizabeth Bay, Sydney, N.S.W., Bacteriologist and Chemist.
1890. Smith, R. Watson, P.O. Box 85, Knight's, Transvaal, S. Africa, Chemical Works Manager.
1897. Smith, Theophilus R., c/o Brotherton and Co., Ltd., The Wear Tar Works, South Dock, Sunderland, Chemist.
1907. Smith, Thorn, P.O. Box 106, Isabella, Tenn., U.S.A., Chemist (Ducktown Sulphur, &c., Co.).
1896. Smith, Walter E., 141, Cypress Street, Providence, R.I., U.S.A., Instructor in Chemistry.
1903. Smith, Dr. Warren R., Lewis Institute, Chicago, Ill., U.S.A., Teacher.
O.M. Smith, Watson, 34, Upper Park Road, Haverstock Hill, N.W., Editor of Society's Journal.
O.M. Smith, Wilfred, 182, West Street, Glasgow, Chemical Manufacturer.
1896. Smith, Dr. W. Stanley, Bryntirion, Bersham, near Wrexham, North Wales, Brewer.
O.M. Smithells, Prof. A., F.R.S., The University, Leeds, Professor of Chemistry.
O.M. Smithers, F. O., Dashwood House, 9, New Broad Street, London, E.C., Chemical Agent.
1902. Smoot, Albert M., 99, John Street, New York City, U.S.A., Analytical Chemist.
1902. Smythe, Dr. Jno. A., Armstrong College, Newcastle-on-Tyne, Demonstrator in Chemistry.
1902. Smythe, Dr. J. S., Rantallard, Lance Lane, Wavertree, Liverpool, Analytical Chemist.
1888. Snape, Dr. H. Lloyd, Balholm, Lathom Road, Southport, Director of Education for Lancashire.
1908. Snell, John F., Macdonald College P.O., Prov. Quebec, Canada, Assistant Professor of Chemistry.
1896. Snowdon, J., jun., Messrs. Snowdon, Sons and Co., Millwall, E., Chemical and Oil Manufacturer.
1900. Sodeau, Dr. Wm. H., 19, East Parade, Newcastle-on-Tyne, Chemist.
1903. Sohlman, Ragnar, Bofors, Sweden, Manager (A. B. Bofors' Nobelkrut).
1894. Sohn, Chas. E., 2, Harpur Street, Bedford Row, London, W.C., and (Journals) 126, Hewitt Road, Harringay, N., Analyst.
1906. Solomon, M., 45, Newhall Street, Birmingham, Manager (Carbon Works).
1895. Solvay, Armand, 25, Rue Prince Albert, Brussels, Gérant de la Société Solvay et Cie.
1884. Solvay, Ernest, 43, Rue des Champs Elysées, Brussels, Alkali Manufacturer.
1902. Soma, Prof. H., Higher Technical School, Asakusa; and (Journals) 5, Shiba Park, Tokyo, Japan, Professor of Chemistry.
1897. Somerset, H. St. John, jun., Mount Morgan Gold Mining Co., Mount Morgan, Queensland, Australia, Assayer.
1884. Sommer, Adolf, corner 1st and Binney Streets, East Cambridge, Boston, Mass., U.S.A., Pharmaceutical Chemist.
1903. Sommermeier, Edw. E., 1590, Neil Avenue, Columbus, Ohio, U.S.A., Chemist.
1894. Sonstadt, Edw., Church Fields, Cheshunt, Herts., Chemical Technologist.
1904. Southall, A. W., Lower Priory, Birmingham, Manufacturing Chemist.
1896. Souther, H., 440, Capitol Avenue, Hartford, Conn., U.S.A., Chemical and Metallurgical Engineer.
1904. Southerden, F. 11, Gordon Road, Exeter, Teacher of Chemistry.
1892. Southern, Thos., Wheathill Chemical Works, St. Simon Street, Salford, Manufacturing Chemist.
1883. Soward, A. W., 28, Therapia Road, Honor Oak, S.E., Principal Clerk (Legacy Duty Office).
1890. Sowerby, Thos. H., Canal Soap Works, Verney Road, Rotherhithe, S.E., Soap Manufacturer.
O.M. Sowerby, W. M., c/o United Alkali Co., Ltd., Allhusen Works, Gateshead-on-Tyne, Manager.
1887. Spackman, Chas., Rosehaugh, Clitheroe, Lancashire, Portland Cement Manufacturer.
1904. Sparke, Archibald, (Journals) The Librarian, Public Library and Art Gallery, Bury, Lancs.
1904. Sparre, Fin, 1810, Washington Street, Wilmington, Del., U.S.A., Chemist.
1901. Sparrow, J. Marcellus, c/o Imperial Varnish and Colour Co., Ltd., 6–22, Morse Street, Toronto, Canada, Varnish and Colour Manufacturer.
1904. Spayd, Chas. Hay, Fernwood P.O., East Lansdowne, Delaware Co., Pa., U.S.A., Analytical Chemist.
1904. Speiden, C. C., 46, Cliff Street, New York City, U.S.A., Chemical Merchant.
1905. Speight, W. E., Sewage Works, Deighton, Huddersfield, Chemist.
1883. Spence, D., Manchester Alum Works, Manchester, Alum Manufacturer.
1900. Spence, Howard, (Journals) Audley, Broad Road, Sale, Cheshire; and Alum Works, Manchester, Chemical Manufacturer.
1883. Spence, Jno. W., Tiviot Colour Works, Manchester Road, Stockport, Drysalter.

1903. Spencer, A. Gordon, Central Experimental Farm, Ottawa, Canada, Chemist.
1906. Spencer, Fred. W., c/o Standard Ammonia Co., Ltd., Glebe Point, Sydney, N.S.W., Australia, Works Manager.
1884. Spencer, Jno., Globe Tube Works, Wednesbury, Tube Manufacturer.
O.M. Spencer, J. W., Newburn Steel Works, Newcastle-on-Tyne, Steel Manufacturer.
1901. Spencer, Robt., jun., 3, Woodville Terrace, Bradford.
1902. Sperry, Elmer A., 100, Marlborough Road, Prospect Park South, Brooklyn, N.Y., U.S.A., Electrical Engineer.
1897. Sperry, Erwin S., "The Brass World," 260, John Street, Bridgeport, Conn., U.S.A., Metallurgist and Editor.
1905. Speyer, Jas., c/o Speyer & Co., 24, Pine Street, and (Journals) 257, Madison Avenue, New York City, U.S.A., Banker.
1906. Spicer, J. Spofford, 2043, North Second Street, Harrisburg, Pa., U.S.A., Chemist (Penna. Dept. of Agriculture)
1884. Spiegel, Dr. Adolf, Messel, bei Darmstadt, Germany, Analytical Chemist.
1903. Spielmann, P. E., 21, Cadogan Gardens, London, S.W.; and (Journals) Freiestrasse 58, Zürich, Switzerland, Chemical Student.
1906. Spiera, V. G., Middlepark, Kamptee, Central Provinces, India, Chemist.
1889. Spies, Adolph, 102, Fenchurch Street, London, E.C., Chemical Merchant.
1889. Spies, Hermann, 102, Fenchurch Street, London, E.C., Chemical Merchant.
1885. Spiller, A., Edison-Swan Electric Co., South Benwell Works, Newcastle-on-Tyne, Electrician.
O.M. Spiller, J., 2, St. Mary's Road, Canonbury, London, N., Consulting Chemist.
1896. Spoor, J. L., Rede Court, Rochester, Kent, Portland Cement Manufacturer.
1906. Springer, Dr. Alf., 312, East Second Street, Cincinnati, Ohio, U.S.A., Chemist.
1900. Spurge, Edw. C., University Club, Niagara Falls, N.Y., U.S.A., Chemist.
1901. Spurlin, Oscar L., 304-307, Peck Building, Atlanta, Ga., U.S.A., Chemist.
O.M. Squire, P. W., 413, Oxford Street, London, W., Pharmaceutical Chemist.
1896. Stafford, Chas. H., c/o The Birkacre Printing Co., Chorley, Lancs., Colourist.
O.M. Stahl, Dr. K. F., 57th Street and A. V. Ry., Pittsburg, Pa., U.S.A., Chemical Works Manager.
1905. Stahl, Dr. Paul G., 13, Square de Jussieu, Lille (Nord), France, Chemical Manufacturer.
1905. Stalmann, Otto, 317, McCornick Building, Salt Lake City, Utah, U.S.A., Metallurgical Engineer.
1904. Standfast, Jno. T., c/o Messrs. Burt, Boulton, and Haywood, Ltd., Prince Regent's Wharf, Silvertown, E., Chemist.
1905. Stanley, Harry, 3, St. Michael's Park, Bristol, Lecturer on Applied Physics and Engineering.
1906. Stanley, Wm., Great Barrington, Mass., U.S.A., Engineer.
1888. Stantial, Frank G., c/o Cochrane Chemical Co., Everett, Mass., U.S.A., Technical Chemist.
1885. Staples, H. J., The Old Hall, Spondon, Derby, Colour Manufacturer.
O.M. Stark, J. F., Rosedale, Bromborough, Cheshire, Works Superintendent.
1896. Statham, Noel, c/o The West Virginia Paper and Pulp Co., Mechanicville, N.Y., U.S.A., Engineer.
1908. Statiropoulos, Dr. John G., Chemist.
1907. Staud, Joseph E., c/o W. W. Laurence & Co., Pittsburgh, Pa., U.S.A., Chemist.
1904. Stauffacher, W., 64, Oberwilerstrasse, Basle, Switzerland, Chemical Works Manager.
1908. Staye, Charles A., 8, East Center Street, South Manchester, Conn., U.S.A., Silk Colour Mixer.
1895. Stead, J. Christopher, 1, Finsbury Circus, London, E.C., Technical Chemist.
O.M. Stead, J. E., F.R.S., 11, Queen's Terrace, Middlesbrough-on-Tees, Analytical Chemist.
O.M. Stebbins, Dr. J. H., 3, East 29th Street, New York City, U.S.A., Analytical Chemist.
O.M. Steedman, R. H., Whinfield, Prestwick, Ayrshire, N.B., Chemical Manufacturer.
1896. Steel, Fred. W., c/o Cuming, Smith and Co., Yarraville, Melbourne, Vic., Australia, Chemist.
1900. Steel, Jno. S., Achernat, Blackburn, Melbourne, Vic., Australia, Chemist.
1884. Steel, R. Elliott, Cameron House, Sherborne, Dorset, Headmaster.
1906. Steel, S. J., 17, Great Tower Street, London, E.C., Analytical Chemist.
O.M. Steel, Thos., Colonial Sugar Refinery, O'Connell Street, Sydney, N.S.W., Australia, Sugar Chemist.
1906. Steers, Thornton, 224, Grand Avenue, Brooklyn, N.Y., U.S.A., Chemist.
1905. Steiger, George, c/o U.S. Geological Survey, Washington, D.C., U.S.A., Chemist.
1897. Stein, Sigmund, 214, Upper Parliament Street, Liverpool, Sugar Refinery Manager.
1897. Steinhart, Dr. Oscar J., c/o Messrs. Steinhart, Vogel & Cloud, 4, Lloyds Avenue, Fenchurch Street, E.C., Manufacturing Chemist.
1903. Stell, S. F., 25, Henry Street, Keighley, Yorks., Teacher of Chemistry.
1887. Stenhouse, T., 166, Drake Street, Rochdale, Analytical Chemist.
1908. Stenhouse, Thos., jun., Chemical Laboratory, H.M. Dockyard, Portsmouth, Analytical Chemist.
1904. Stephen, A. E., 33, Victoria Street, Ashfield, Sydney, N.S.W., Australia, Analytical Chemist.
1884. Stephens, H. Chas., M.P., Avenue House, Finchley, N., Ink Manufacturer.
1892. Stephens, M. E., 4, Carlton Gardens, London, S.W.; and (Journals) 57-60, Aldersgate Street, London, E.C., Ink Manufacturer.
1889. Stern, Arthur L., 148, High Street, Burton-on-Trent, Brewing Chemist.
1906. Sternberg, Frank J. N., 18, Tyndall Avenue, Toronto, Canada, Analytical Chemist.
O.M. Steuart, D. R., Osborne Cottage, Broxburn, West Lothian, N.B., Oilworks Chemist.
1903. Steven, A. B., The University, Leeds, Lecturer on Dyeing.
1907. Steven, Michael M., Vauxhall Distillery, Vauxhall Road, Liverpool, Analytical Chemist.
1899. Stevenot, G. A., c/o H. A. Metz Co., 210, South Tryon Street, Charlotte, N.C., U.S.A., Chemist.
1898. Stevens, Arthur F., 96, Newgate Street, London, E.C., Paper Examiner.
1902. Stevens, Dr. Hy. P., Laboratory, 15, Borough, London Bridge, S.E., Consulting Chemist.
1894. Stevens, Jno. H., 295, Ferry Street, Newark, N.J., U.S.A., Manufacturing Chemist.
1902. Stevens, M. White, H.M. Patent Office, Chancery Lane, London, W.C., Chemist.
1903. Stevens, T. R. B., P.O. Box 120, Kalgoorlie, West Australia, Metallurgical Chemist.
1884. Stevens, Wm., The Native Guano Co., Ltd., 29, New Bridge Street, London, E.C., Secretary.
1907. Stevenson, Chas. E., 80, Polwarth Terrace, Edinburgh, Dyer.
O.M. Stevenson, Sir Thos., M.D., Guy's Hospital, London, S.E., Chemical Lecturer.
O.M. Stevenson, W., Standard Works, 95A, Southwark Street, London, S.E., Chemical Manufacturer.
1901. Stewart, David B. D., Aberdeen Comb Works, Hutcheon Street, Aberdeen, Managing Director.
1903. Stewart, Jas., "The Gas World," 8, Bouverie Street, Fleet Street, London, E.C., Editor.
1890. Stewart, Robt., 43, Leagrave Road, Luton, Chemical Works Manager.
O.M. Stewart, S., c/o Michael Nairn and Co., Ltd., Kirkcaldy, N.B., Technical Chemist.
1906. Stickland, Oliver W., c/o The New Explosives Co., Ltd., Stowmarket, Suffolk, Works Chemist.
1904. Stieglitz, Julius, University of Chicago, Chicago, Ill., U.S.A., Associate Professor of Chemistry.

1904. Stiff, John T., 60, Parrock Street, Gravesend, Kent, Works Chemist.
1908. Stillman, Dr. Thos. B., Stevens Institute of Technology, Hoboken, N.J., U.S.A., Professor of Engineering Chemistry.
1903. Stilwell, Albert G., 36, Gold Street, New York City, U.S.A., Chemist.
1903. Stingelin, Dr. Fritz, c/o Solvay Process Co., Syracuse, N.Y., U.S.A., Chemist.
1886. Stirk, Jos., 5, West Terrace, Darlington, Brewer's Engineer.
1893. Stock, F. W. Keating, County Analyst's Office, Darlington, Analytical and Consulting Chemist.
1900. Stockdale, Edgar, c/o R. Dewhurst and Co., Ltd., Printworks, Batley, Yorks., Colour Mixer.
1888. Stockdale, Wm., Rosebank Printworks, Ramsbottom, near Manchester, Calico Printer.
1887. Stocks, H. B., 12, Victoria Road, West Kirby, Cheshire, Analytical Chemist.
1903. Stoddard, Jesse D., Detroit Testing Laboratory, 1111, Union Trust Building, Detroit, Mich., U.S.A.
1885. Stoddart, F. Wallis, Grafton Lodge, Sneyd Park, Bristol, Analytical Chemist.
O.M. Stoer, J., 6, Hanover Quay, Dublin.
O.M. Stoker, G. N., 9, Lessar Avenue, Clapham Common, S.W., Analytical Chemist.
1899. Stokes, Alf. W., Laboratory, Town Hall, Paddington Green, W., Public Analyst.
1906. Stokes, Francis J., 17th and Cambria Streets, Philadelphia, Pa., U.S.A., Manufacturing Chemist.
1898. Stokes, Dr. Henry N., Bureau of Standards, Washington, D.C., U.S.A., Chemist.
1892. Stone, Frank, Laboratory, 193, Collins Street, Melbourne, Victoria, Analytical Chemist and Assayer.
1900. Stone, Geo. C., c/o New Jersey Zinc Co., 71, Broadway, New York City, U.S.A., Engineer.
1899. Stone, I. F., 100, William Street, New York City, U.S.A., Chemical Merchant.
1888. Stone, Thos. W., Chemical Works, St. George, Bristol, Chemical Manufacturer.
O.M. Storey, I. H., Haverbreaks, Lancaster, Chemical Manufacturer.
1903. Stormer, Edward J., c/o Patton Paint Co., Milwaukee, Wis., U.S.A., Analytical Chemist.
1902. Storr, Bertram V., 147, Coventry Road, Ilford, Essex, Chemist.
1888. Stowe, W. T., Government Laboratory, 280, George Street, Glasgow.
1904. Strange, Edward Halford, 7, Staple Inn, Holborn, London, Technical Research Chemist.
1905. Strange, Wm. Wallace, jun., Reduction Works, Anaconda Copper Mining Co., Anaconda, Montana, U.S.A., Chemist.
1883. Strangman, J. Pim, 9, Clydesdale Road, Notting Hill, W., Bleacher.
1908. Stratford, Alfred W., 50, Station Road, Milton, Stoke-on-Trent, Chemist.
1906. Straus, Louis, 18, West 83rd Street, New York City, U.S.A., Merchant.
1903. Strayer, D. W., 428, West King Street, York, Pa., U.S.A., Chemist.
1903. Strickler, Emerson H., c/o General Chemical Co., 25, Broad Street, New York City, U.S.A., Chemist.
1905. Strunz, Dr. C. E., 1309, Champa Street, Denver, Colo., U.S.A., Chemist.
1906. Strunz, F. B., Chemical Engineer.
O.M. Stuart, C. E., 29, Mosley Street, Newcastle-on-Tyne, Chemical Apparatus Dealer.
1905. Stuart, H. E., 176, Purchase Street, Boston, Mass., U.S.A., Vice-President, Mercantile Corporation.
1896. Stuart, Harry T. R., Know Mill House, Entwistle, near Bolton, Printworks Manager.
O.M. Stuart, T. W., 7, Livingston Drive, Sefton Park, Liverpool, Alkali Works Manager.
1901. Stuart, Dr. W. Theophilus, 197, Spadina Avenue, Toronto, Canada, Physician and Professor of Chemistry.
1896. Stubbs, Augustus J., Claris 73, Barcelona,' Spain.
O.M. Studer, Dr. A., Postgebäude, Olten, Switzerland, Consulting Chemist.
1890. Studer, Simon J., Helvetia, Stockton Heath, near Warrington, Technical Chemist.
1903. Sturrock, Capt. G. C., R.A., Aruvankad, Nilgiris, India, Assistant Superintendent.
1896. Suckert, Dr. J. J., 141, Broadway, New York City, U.S.A., Manufacturing Chemist.
1895. Sudborough, Dr. J. J., University College of Wales, Aberystwith, Lecturer in Chemistry.
1889. Sulman, H. L., 44, London Wall, London, E.C., Chemist and Metallurgist.
1895. Summers, Bertrand S., c/o The Summers Fiber Co., Port Huron, Mich., U.S.A., Electro-Chemist.
1890. Sumner, Harold, Worthington, near Wigan, Dyer and Bleacher.
1907. Sundarram, Minakshi, c/o Parry & Co., Ranipettai, N. Arcot, Madras, India, Agricultural Chemist.
1896. Sunderland, A., 84, Hainworth Wood Road, Ingrow, Keighley, Teacher of Chemistry.
1899. Sundström, Carl, c/o Solvay Process Co., Detroit, Mich., U.S.A., Chemist.
1895. Sundström, Karl J., Sibley, Mich., U.S.A., Manufacturing Chemist.
1906. Sutermeister, Edwin, c/o Forest Service, Washington, D.C., U.S.A., Chemist.
1884. Sutherland, D. A., 13, Victoria Street, and (Journals) 26, Victoria Street, Westminster, S.W., Consulting Technical Chemist and Assayer.
1894. Sutherland, Geo., Croft Cottage, Bonhill, N.B., Chemist.
1887. Sutherland, Jas., c/o British Aluminium Co., Ltd., Larne Harbour, Co. Antrim, Ireland, Chemist.
1906. Sutherland, John, The British Aluminium Co., Ltd., Baker Street, Greenock, N.B., Manager of Carbon Factory.
O.M. Sutherland, R. M., Lime Wharf Chemical Works, Falkirk; and Solsgirth, Dollar, N.B., Chemical Manufacturer.
O.M. Sutton, Dr. Francis, Norfolk County Laboratory, Redwell Street, Norwich, Analytical Chemist.
1886. Sutton, F. Napier, 6, Grosvenor Gardens, Cricklewood, N.W., Alkali Works Inspector.
1900. Sutton, W. Lincolne, Hillcroft, Eaton, Norwich, Public Analyst.
O.M. Swan, Sir Jos. W., F.R.S., 58, Holland Park, London, W., Chemist and Electrician.
1898. Swanson, Jas. F., 5, Edmiston Terrace, Copland, Govan, N.B., and (Journals) Associación Salitrena de Propaganda, Iquique, Chile, Technical Chemist.
1906. Sweet, Everell F., 52, Union Street, Boston, Mass., U.S.A., Importer.
1905. Swenarton, W. Hastings, Broadway Chambers, 277, Broadway, New York City, U.S.A., Patent Lawyer.
1884. Swinburne, Geo., (Journals) 99, Queen Street, Melbourne, Australia; (subs.) c/o Jno. Coates and Co., Suffolk House, Laurence Pountney Hill, E.C., Gas Engineer.
1904. Swindells, Seth, 181, Orford Lane, Warrington, Chemist.
1901. Swinton, Ralph S., c/o W. J. Bush, Incorporated, Linden, N.J., U.S.A., Analytical Chemist.
1903. Sykes, Walter F., 85, Water Street, New York City, U.S.A., Chemical Merchant.
1902. Sylow, Paul L. P. G., Korsör, Alexandra Street, Drummoyne, Sydney, N.S.W., Australia, Analytical Chemist.
O.M. Syme, W. B., Elm Cottage, Addiewell, West Calder, N.B., Oil Works Chemist.
1906. Symes, Langford P., Parcora Freezing Works, Timaru, New Zealand, Chemist.
1903. Symmes, Whitman, 1044, Monadnock Building, San Francisco, Cal., U.S.A., Chemical Engineer.
1906. Symonds, Abram E., Wick Lane Colour Works, Old Ford Road, Bow., E., Colour Manufacturer.
1905. Szegö, A. S., 60, Bewsey Street, Warrington, Chemist.

T

1895. Taber, G. H., 814, Frick Building, Pittsburg, Pa., U.S.A., General Manager (Gulf Refining Co.).

1896. Takagi, T., 10, Nishikatamachi, Hongo, Tokyo, Japan, Chemical Engineer.

O.M. Takamatsu, T., 13, Nishikatamachi, Hongo, Tokyo, Japan, Analytical Chemist.

O.M. Takamine, Dr. Jokichi, 521, West 179th Street, New York City, U.S.A., Engineer.

1890. Takayama, Jintaro, Nando Machi 26, Ushigome, Tokyo, Japan, Director (Imperial Industrial Experiment Station).

1905. Talbot, Prof. Henry P., Mass. Institute of Technology, Boston, Mass., U.S.A., Professor of Inorganic Chemistry.

1898. Tanaka, Keishin, Matsuba Hotel, Kudansaka, Uye, Tokyo, Japan, Chemist.

1906. Tanaka, S., 4, Uratakashimacho Nichome, Yokohama, Japan, Chief Chemical Engineer (Electric Wire Works).

1900. Tankard, Arnold R., 82, Llanthewy Road, Newport, Mon., Analytical Chemist.

1907. Tartar, Herman V., Corvallis, Oregon, U.S.A., Analytical Chemist.

O.M. Tate, F. H., 9, Hackins Hey, Liverpool, Analytical and Technical Chemist.

O.M. Tatlock, J., 45, Renfrew Street, Glasgow, Laboratory Furnisher.

O.M. Tatlock, R. R., 11, Bellshaugh Road, Kelvinside West, Glasgow, Consulting Chemist.

1902. Tatters, Hugh Lee, 10, Birchfield Road, Widnes, Analytical Chemist.

1906. Tattersfield, Frederick, The Hollins, Dewsbury, Yorks, Analyst.

1905. Taussig, Dr. Hugo, 237, East 72nd Street, New York City, U.S.A., Chemist.

1907. Taussig, Dr. Rudolf, Beaconsfield, Runcorn, Cheshire, Chemist.

1905. Taveau, René de Mortemer, 2517, Madison Avenue, Baltimore, Md., U.S.A., Chemist.

1898. Taverner, W., Ashland, Oregon, U.S.A., Analytical Chemist.

1901. Tayler, Jno. Bernard, Anglo-Chinese College, Tientsin, North China, Chemist.

1903. Taylor, Alvin M., c/o General Chemical Co., Station F., Box 12, Cleveland, Ohio, U.S.A., Chemist.

1902. Taylor, Arthur P., c/o John Taylor and Co., 531, Front Street East, Toronto, Ont., Canada, Soap Manufacturer.

1907. Taylor, C. Marshall, International Creosoting and Construction Co., Texarkana, Texas, U.S.A., Chief Chemist.

1902. Taylor, Edward R., Penn Yan, N.Y., U.S.A., Manufacturing Chemist.

1886. Taylor, G. Crosland, Ravenscar, Helsby, near Warrington, Electrical Engineer.

1894. Taylor, G. Midgley, Caxton House, Westminster, S.W., Analytical Chemist.

1893. Taylor, G. W., Dinting Vale Printworks, Dinting, near Manchester, Printworks Chemist.

O.M. Taylor, H. E., 702, Alexandra Parade, Dennistoun, Glasgow, Lead Works Manager.

1883. Taylor, Jas., "Adderton," Dundas, N.S.W., Australia, Government Metallurgist.

1898. Taylor, Jas. M., Tynevale, Groes Road, Cressington, Liverpool, Analytical Chemist.

1901. Taylor, Jno., c/o Brotherton and Co., Ltd., Tar Works, Litherland, Liverpool, Chemist.

1888. Taylor, J. Scott, North London Colour Works, Spring Place, Kentish Town, N.W., Technical Chemist.

1896. Taylor, Martin, "The Clough," Buckhurst Hill, Essex, Chemical Works Manager.

1901. Taylor, M. J., 77, Front Street East, Toronto, Canada, Soap Manufacturer.

1901. Taylor, Sidney H., 65, Newbridge Road, Weston, Bath, Works Chemist.

1902. Taylor, Tom, jun., Kent House, Sale, Cheshire, Colour Manufacturer.

1898. Taylor, Walter, 457, Grosvenor Place, Limefield, Bury, Lancs., Technical Chemist.

1905. Taylor, Wm. H., 20, Balcaskie Road, Eltham Park, Kent, Chemist.

1903. Tazaki, T. M., 15, Kamyoshicho, Asakusaku, Tokyo, Japan, Technical Chemist.

1887. Teanby, G. W. A., Elvin Lodge, East Dereham, Norfolk, Analytical Chemist.

1899. Teas, Wm. Holmes, Ridgeway, Pa., U.S.A., Chemist.

O.M. Teed, Dr. F. L., Chem. Laby., 9, Mincing Lane, London, E.C., Analytical Chemist.

1905. Teeple, Dr. J. E., Industrial Laboratories, 164, Front Street, New York City, U.S.A., Director.

1904. Teller, George L., The Columbus Laboratories, 103, State Street, Chicago, Ill., U.S.A., Chemist.

1906. Tempany, Harold A., Government Laboratory, St. John's, Antigua, West Indies, Analyst.

1884. Tennant, Jas., Alex. Fergusson and Co., Ltd., 38, McAlpine Street, Glasgow, Lead and Colour Manufacturer.

1896. Tennille, Geo. F., c/o Southern Cotton Oil Co., 206, Bay Street East, Savannah, Ga., U.S.A., Chemist.

1908. Terleski, Fred. H., 38, Seedley Road, Pendleton, Manchester, Technical Chemist.

1888. Terry, Albert, Verulam, Mount Albert Road, Balwyn, near Melbourne, Victoria, Brewer.

1884. Terry, Hubert L., (Journals) 3, Herbert Street, Moss Side, Manchester; and (Laboratory) 23, Hopwood Avenue, Manchester, Technical Chemist.

O.M. Tervet, R., 68, Windsor Road, Leyton, Essex, Oil Works Manager.

1893. Tetley, C. F., Messrs. Jos. Tetley and Son, The Brewery, Leeds, Brewer.

1897. Tetlow, Dr. Wm. E., Ash Cottage, Ashfield, Dunblane, N.B., Chemist.

1903. Thatcher, Ed. J., The Manor House, Chew Magna, near Bristol, Merchant and Manufacturer.

1908. Theis, Dr. Fred. C., Konigsteinerstrasse 60, Höchst a/Main, Germany, Chemist.

O.M. Thomas, Chas., J.P., D.L., Pitch and Pay, Stoke Bishop, near Bristol, Soap Manufacturer.

1908. Thomas, G. Gordon, 39, The Chase, Clapham Common, S.W., Chemist (Varnish Works).

1894. Thomas, H. Russell, Broad Plain Soap Works, Bristol, Soap Manufacturer.

1902. Thomas, Jas. E., Box 53, Krugersdorp, Transvaal, South Africa, Cyanide Manager.

O.M. Thomas, J. W., Overdale, Shortlands, Kent, Analytical Chemist.

1902. Thomas, Nehemiah M., Roseville Avenue, Pymble, N.S.W., Australia, Inspector.

1901. Thomas, Octavius, Gas and Water Offices, Pentre, Glamorganshire, Gas and Water Engineer.

1908. Thomas, Oswald J. D., Largo del Campo 5, Messina, Sicily, Analytical Chemist.

1888. Thomas, S. Percy, 2, Landrock Road, Hornsey, N., Technical Chemist.

1898. Thomas, Wm. Harrison, jun., R.F.D. No. 37, South Norwalk, Conn., U.S.A., Printworks Chemist.

1905. Thomlinson, Wm., Seaton Carew Ironworks, West Hartlepool, Ironmaster.

1905. Thompson, A. J., Bernina, Friern Lane, Whetstone, N.; and (Journals) 42, Snow Hill, London, E.C., Buyer (Burroughs, Wellcome & Co.).

1885. Thompson, Prof. Claude M., 38, Park Place, Cardiff, Professor of Chemistry.

1898. Thompson, Edw. C., 32, Ulundi Road, Westcombe Park, S.E., Manufacturing Chemist.

1893. Thompson, G. Rudd, 69, Dock Street, Newport, Mon., Analytical and Consulting Chemist.

1895. Thompson, Gustave W., 129, York Street, Brooklyn, N.Y., U.S.A., Chemist.

1907. Thompson, Jas. G., Donegall Quay Mills, Belfast, Ireland, Corn Miller.

1903. Thompson, Jno. T., Corporation Sewage Works, Knostrop, Leeds, Analyst.

1907. Thompson, Milton S., 72, Broad Street, Boston, Mass., U.S.A., Manufacturer.

1885. Thompson, W., Sankey Hill, Earlestown, Lancashire, Sugar Refiner.
O.M. Thompson, W. P., Patent Office, 6, Lord Street, Liverpool, Patent Agent.
1896. Thomsen, Alonzo L., Maryland Club, 1, East Eager Street, Baltimore, Md., U.S.A., Manufacturing Chemist.
1884. Thomson, G. Carruthers, 53, Bedford Road, Rock Ferry, Birkenhead, Engineer.
1907. Thomson, H. N., P.O. Box 227, Anaconda, Montana, U.S.A., Metallurgist.
1891. Thomson, Jas. M., Royal Gunpowder Factory, Waltham Abbey, Essex, Manager (Cordite Branch).
1884. Thomson, Robt. T., 156, Bath Street, Glasgow, Analytical Chemist.
1899. Thomson, Thos., c/o Waterproofing Co., Barrhead, near Glasgow, Manufacturer.
O.M. Thomson, W., Royal Institution Laboratory, Manchester, Analytical and Consulting Chemist.
1890. Thomson, Wm. Thos., Royal Gunpowder Factory, Waltham Abbey, Essex, Explosives Chemist.
1902. Thorburn, Jas., 30, Cromartie Avenue, Newlands, Glasgow, Analytical Chemist.
O.M. Thorne, Dr. L. T., 2, Denbigh Gardens, Richmond-on-Thames; and (Journals) Southampton Wharf, Battersea, S.W., Technical Chemist.
1907 Thornewell, A. R., Highfield Road, Blackheath, near Birmingham, Works Chemist.
O.M. Thorneycroft, Wallace, Plean House, Plean, Stirling, Technical Chemist.
1904. Thornley, Thomas, 19, Hope Street, Glasgow, Chemical Manufacturer.
1907. Thornton, A. D., 13, Tupper Street, Montreal, Canada, Rubber Goods Manufacturer.
1891. Thornton, Chris., 26, Larch Street, Providence, R.I., U.S.A., Printworks Manager.
1891. Thornton, David H., Brookfoot Dyeworks, Brighouse, Yorks., Dyer.
1887. Thornton, H., Redbourn, Ashford, Middlesex, Analytical Chemist.
1899. Thornton, Wm., (Journals) c/o Isaac Brandon and Bros., Panama, Central America; and (subsn.) c/o Thos. Thornton, Hermand, West Calder, N.B., Chemist.
1895. Thorp, Dr. Frank H., Mass. Inst. of Technology, Boston, Mass., U.S.A., Assistant Professor of Industrial Chemistry.
1907. Thorp, Thos., Moss Bank, Whitefield, near Manchester, Engineer.
1906. Thorp, Walter, Sorrentoville, Dalkey, Co. Dublin, Ireland, Analytical Chemist.
1905. Thorpe, Dr. J. F., Yannaford, Heaton Mersey, Lancs., Lecturer, Manchester University.
O.M. Thorpe, Dr. T. E., C.B., F.R.S., Government Laboratory, Clement's Inn Passage, Strand, W.C.; and (Journals) 61, Ladbroke Grove, Notting Hill, W., Chief Chemist (Customs and Inland Revenue).
1905. Thresh, Dr. John C., Chelmsford, Essex, Medical Officer of Health and Sanitary Expert.
1902. Thurlow, Nathaniel, 78, Warburton Avenue, Yonkers, N.Y., U.S.A., Chemist.
1898. Thurnauer, Dr. Gustav, c/o Aurora Metal Co., Aurora, Ill., U.S.A., Chemist.
1904. Thurston, Azor, Grand Rapids, Ohio, U.S.A., Chemist.
1908. Thwaites, John H., Market Chambers, Peterborough, Chemical Engineer.
1905. Tichenor, Henry D., 18, Exchange Place, New York City, U.S.A., Custom House Broker.
1904. Tickle, Thos., Laboratory, 83, Queen Street, Exeter, Analyst.
1903. Tighe, Arthur, Umberleigh, Cherry Road, Turramurra, near Sydney, N.S.W., Australia, Chemist.
1901. Tilden, Philip S., c/o Franklin H. Kalbfleisch Co., Metropolis Building, Broadway and 16th Street, New York City, U.S.A., Manufacturing Chemist.
O.M. Tilden, Prof. W. A., F.R.S., The Oaks, Murray Road, Northwood, Middlesex, Professor of Chemistry.
1900. Tilley, Jas. W., 95A, Southwark Street, London, S.E., Research Chemist.
1906. Tillson, Henry E., 75, Abbott Street, Laurence, Mass., U.S.A., Dyer.
1901. Timmans, W. G., c/o Basford Chemical Co., Basford, Nottingham, Chemical Works Manager.
O.M. Timmis, T. Sutton, Widnes, Chemical Manufacturer.
1905. Tindall, W. B., 39, St. Mary Street, Toronto, Canada, Secretary and Treasurer.
1907. Tingle, Dr. J. B., McMaster College, Toronto, Canada, Professor of Chemistry.
1894. Tipler, Fred. C., 48, Brooklyn Street, Crewe, Analytical Chemist.
1907. Tischbein, Dr. Robert, The Heyden Chemical Works, Garfield, N.J., U.S.A., Chemist.
1890. Tobey, C. H., Burks Falls, Ontario, Canada, Tannery Chemist.
1894. Toch, Maximilian, 52, 9th Street, Long Island City, N.Y.; and (Journals) 320, Fifth Avenue, New York City, U.S.A., Chemist.
1886. Todd, A. M., c/o The A. M. Todd Co., Kalamazoo, Mich., U.S.A., Manufacturing Chemist and Distiller of Essential Oils.
1906. Tolman, Frank S., 451, State Street, Flushing, N.Y., U.S.A., Superintendent, Oakes Manufacturing Co.
1905. Tolson, Stanley, c/o The Elastes Co., Ltd., North Kent Works, Erith, Chemist and Factory Manager.
O.M. Toms, F. Woodland, States Analyst's Office, St. Heliers, Jersey, Analytical Chemist.
1902. Tone, Frank Jerome, c/o The Carborundum Co., Niagara Falls, N.Y., U.S.A., Manager.
1896. Tonkin, John, 2603, East Broad Street, Richmond, Va., U.S.A., Manufacturing Chemist.
1902. Torrey, Charles A., jun., Security Life Deposit Vaults, Boston, Mass., U.S.A., Chemist.
1907. Torrey, Dr. Joseph, Craigie Lea, Blundellsands, Liverpool, Engineer.
1905. Torrey, Prof. H. A., Harvard Chemical Laboratory, Cambridge, Mass., U.S.A., Assistant Professor of Chemistry, Harvard University.
O.M. Towers, J. W., Widnes, Lancashire, Analytical Chemist.
1907. Towler, A. E. c/o Sulphide Corporation, Cockle Creek, near Newcastle, N S.W., Australia.
1892. Townsend, Chas. W., 19, Crawford Street, Port Dundas, Glasgow, Chemical Manufacturer.
1892. Townsend, Oliver C., 22, Heston Crescent, Rugby, Chemical Manufacturer.
1897. Towse, Walter, 31, Malvern Street, Newcastle-on-Tyne, Technical Chemist.
1904. Toyne, Francis D., 144, Tweedale Street, Rochdale, Chemist.
1899. Trantom, Dr. Wm., Hawthorne Lodge, Latchford, near Warrington, Chemist.
1894. Traphagen, Dr. Frank W., Colorado School of Mines, Golden, Colo., U.S.A., Professor of Metallurgy and Assaying.
1900. Traquair, Jno., Glenfield Starch Works, Paisley, N.B., Analytical Chemist.
1904. Trautwein, Alfred P., Carbondale, Pa., U.S.A., President (Carbondale Chemical Co.).
1906. Travell, Norman E., 26, Forest Road, Nottingham, Lace Dresser.
1905. Travelli, Chas. I., United Printing Machinery Co., 246, Summer Street, Boston, Mass., U.S.A., Mechanical Engineer.
1893. Travers, Prof. Morris W., F.R.S., Indian Institute of Science, Bangalore, India; and (communications) c/o J. Lyon and Co., 4, Lombard Court, London, E.C., Professor of Chemistry.
1889. Trechmann, A. O., Halling Lime and Cement Works, near Rochester, Kent, Cement Manufacturer.
1885. Trechmann, Dr. C. O., Warren Cement Works, Hartlepool, Cement Manufacturer.
1895. Treharne, F. Gwilym, Wrangbrook, Llanishen, near Cardiff, Analytical Chemist.
1885. Trewby, Herbert, 62, St. John Street, London, E.C., Analytical Chemist.

1901. Trigger, Oliver, Chem. Dept., Royal Arsenal, Woolwich. S.E., Analytical Chemist.

1898. Tripp. Dr. E. Howard, 73, Waldeck Avenue, Bedford, Science Master.

O.M. Trobridge, A., c/o Trobridge & Co., Ltd., Heworth Shore, Felling-on-Tyne, Technical Chemist.

1907. Trostel, Geo. M., Canton, N.C., U.S.A., Chemist.

1897. Trotman, Saml. R., The City Laboratory, 1, Regent Street, Nottingham, City Analyst.

1906. Trotz, Johan O. E., 20, Green Lane, Worcester, Mass., U.S.A., Consulting Engineer.

1900. True, Percival E., 279, Douglas Avenue, Elgin, Ill., U.S.A., Chemical Engineer.

1887. Tsukiyama, S., 2nd of No. 2116, Fukiaicho, Kobe, Japan, Paper Mills Chemist.

1894. Tucker, Alex. E., Norwich Union Chambers, Congreve Street, Birmingham, Metallurgist and Chemist.

1897. Tucker, Samuel A., Columbia University, New York City, U.S.A., Tutor in Industrial Chemistry.

1907. Tudor-Williams, G., 90, Gadbys Road, Aberdare, South Wales, Chemist.

1886. Tuer, Arthur H., Thornhill, near Wigan, Analytical Chemist.

1903. Tufts, C. G., c/o Semet-Solvay Co., Syracuse, N.Y., U.S.A., Chemical Engineer.

1907. Tufts, John L., 15, Park Avenue, Winchester, Mass., U.S.A., Chemical Engineer.

1901. Tulloch, Wm. F., 7, West George Street, Glasgow, Merchant.

1904. Tunnell, Raymond W., 251, West Walnut Lane, Germantown, Philadelphia, Pa., U.S.A., Manufacturer.

1899. Turnbull, Dr. Andrew, Manchester and Liverpool District Tanners' Federation, 3, Lord Street, Liverpool, Consulting Chemist.

1888. Turnbull, G. W., Ash Cottage, North Road, Carnforth, Lancashire, Metallurgical Chemist.

1905. Turnbull, John, 66, Jarvis Street, Toronto, Canada, Manufacturer of Food Products.

1904. Turnbull, R. H., c/o MacAndrews and Forbes Co., Camden, N.J., U.S.A., Analytical Chemist.

1884. Turnbull, W. S., 37, West George Street, Glasgow, Chemical Manufacturer.

1902. Turner, Basil, 5, Moore Street, Sydney, N.S.W., Australia, Metallurgist.

1902. Turner, Jos., c/o Read Holliday and Sons, Ltd., Huddersfield, Chemist.

1905. Turner, Prof. Thomas, Springfields, Upland Road, Selly Park, Birmingham, Professor of Metallurgy.

1897. Turney, Fred. N., 10. Dieghem Straat, Saventham, near Brussels, Belgium, Leather Dresser.

1887. Turney, Sir J., Trent Bridge Leather Works, Nottingham, Tanner.

1906. Tuttle, Dr. Franklin E., 125, East Maxwell Street, Lexington, Ky., U.S.A., Prof. of Chemistry.

1903. Tutton, Henry Ralph, 12, Ivy Street, Penarth, S. Wales, Chemist.

1905. Tutwiler, Carrington C., 1706, North Broad Street, Philadelphia, Pa., U.S.A., Chemist.

1890. Tweedy, Jas., 306A, Burdett Road, Limehouse, E., Metallurgical Chemist.

1905. Twigg, Geo. F., 29, Fairfax Road, Derby, Gas Works Chemist.

1891. Twitchell, E., Wyoming, Ohio, U.S.A., Candle Works Manager.

1897. Twynam, H., c/o Mount Morgan Gold Mining Co., Mount Morgan, Queensland, Australia, Mining Engineer.

O.M. Twynam, T., Wyngard House, Coatham Road, Redcar, Yorks., Metallurgist.

1904. Tyler, Chas. R., c/o Dr. Francis Wyatt, 402, West 23rd Street, New York City, U.S.A., Analytical Chemist.

O.M. Typke, P. G. W., Lawn House, New Malden, Surrey, Chemical Manufacturer.

O.M. Tyrer, Thos., Stirling Chemical Works, Stratford, E.; and (Journals) 14, Sandwell Mansions, West End Lane, N.W., Chemical Manufacturer.

1899. Tysoe, Jos., South Metropolitan Gas Co., East Greenwich, S.E., M.Inst.C.E., Gas Engineer.

U

1907. Udal, John P., New Croft, Walmley. Birmingham, Engineer.

1894. Uhlig, E. C., Citizens' Gas Works, Fifth and Hoyt Streets, Brooklyn, N.Y., U.S.A., Chemist.

1900. Uhlig, W. C., c/o Hygeia Distilled Water Co., 349, West 12th Street, New York City, U.S.A., Chemist.

1897. Ullman, Jas. A., c/o Sigmund Ullman Co., 146th Street and Park Avenue, New York City, U.S.A., Superintendent (Printing Ink Works).

O.M. Umney, C., (Journals) Fernbrake, Branksome Wood Road, Bournemouth; and (communications) 50, Southwark Street, London, S.E., Manufacturing Chemist.

1905. Umney, John C., 48, Southwark Street, London, S.E., Wholesale Druggist.

1889. Underhill, Thos. J., "Stanley," Quernmore Road, Bromley, Kent, Inspector of Stores.

1885. Underwood, G. R., 4, Emerson Street, Peabody, Mass., U.S.A., Glue Works Chemist.

1908. Unglaub, Adolf, 4914, Kingsessing Avenue, Philadelphia, Pa., U.S.A., Chemical Engineer.

1883. Usmar, J. H., 22, Billiter Street, London, E.C., Chemical Merchant.

1904. Uyeda, Toyokitsu, Takasago, Harima, Japan, Chemist.

V

1907. Vail, Jas., G., c/o Philadelphia Quartz Co., Delaware Avenue and Howell Street, Chester, Pa., U.S.A., Chemist.

1905. Van Arsdale, G. D., c/o Copper Queen Consolidated Mining Co., 99, John Street, New York City, U.S.A., Chemist.

1896. Van der Linde, Harold, 47, Yonge Street; and (Journals) 101, Tyndall Avenue. Toronto, Canada, Chief Chemist (Gutta-Percha and Rubber Manufacturing Co.).

1895. Vanderpoel, Dr. Frank, 175, Park Avenue, Orange, N.J., U.S.A., Chemist.

1903. Van Dyck, Edwin M., c/o Ault & Wiborg Co., 534, Pearl Street, New York City, U.S.A., Chemist and Ink Maker.

1907. Van Essen, E. C., c/o Hemingway and Co., Marsh Gate Lane, Stratford, E., Technical Chemist.

1897. Van Gelder, Arthur P., c/o E. I. du Pont de Nemours Powder Co., Landing, N.J., U.S.A., Superintendent.

1891. Van Gundy, Chas. P., Laboratory, B. and O. R. R., Baltimore, Md., U.S.A., Metallurgical Chemist.

1896. Van Laer, Norbert, Truman's Brewery, Burton-on-Trent, Brewer and Chemist.

1897. Van Marken, J. C., Repelen, near Moers, Germany, Chemical Engineer.

1908. Van Trump, Isaac, c/o The Barber Asphalt Paving Co., 1245, Stock Exchange Building, Chicago, Ill., U.S.A., Chemist.

1902. Vanwinckel, W. H., 148, Van Horne Street, Toronto, Canada, Chemist.

1888. Vargas-Vergara, J. M., Apartado No. 237, Bogota, Colombia, S. America, Metallurgical Chemist.

1905. Varshnei, Ishwar Das, Bara Bazar, Aligarh, U.P., India, Chemical Engineer.

1898. Verity, Ben, Magog, Prov. Quebec, Canada, Print Works Chemist.

1897. Verity, Victor, 12, Gladstone Street, East Boston, Mass., U.S.A., Chemical Works Foreman.

1904. Vernon, R. H., Institut Erica, Rothelstrasse, Zurich, Switzerland, Student.

1907. Vial, Stanley B., University High School, Melbourne, Victoria, Australia, Principal.

O.M. Vickers, Wm., c/o Thos. Vickers and Sons, Miles Platting, Manchester, Chemical Manufacturer.

1907. Vietinghoff-Scheel, Dr. Karl Freiherr von, "Chemiker-Zeitung," Cöthen (Anhalt), Germany, Editor in Chief.

1908. Vieweg, Dr. Walter, Steinheimer Landstrasse 20, Hanau a/M., Germany.

1897. Vlies, Leonard E., Belmont, Gowan Road, Alexandra Park, Manchester.

O.M. Voelcker, E. W., 22, Tudor Street, London, E.C., Analytical and Consulting Chemist.

1887. Voelcker, Dr. J. A., 20, Upper Phillimore Gardens, Kensington, W., Agricultural Chemist.

1901. Vogel, G. C., c/o Pfister and Vogel Leather Co., Milwaukee, Wis., U.S.A., Tanner.

1897. Vogel, Julius L. F., Hillersdon, East Molesey, Surrey, Engineer.

1899. Vogeler, Gustav, 17, Philpot Lane, London, E.C., Merchant.

1897. Voorhees, Louis A., Box 55, New Brunswick, N.J., U.S.A., Agricultural Chemist.

1899. Voorhees, Samuel S., c/o Supt. Architect, 18, Treasury Dept., Washington, D.C., U.S.A., Chemist.

1902. Vorisek, Dr. Anton, College of Pharmacy, 115–119, West 68th Street, New York City, U.S.A., Instructor.

1888. Vörster, Fritz, Cöln-Marienburg, Germany, Manufacturing Chemist.

1885. Voss, Hermann, 19, Beckenham Road, Beckenham, Kent, Manure Works Manager.

1899. Voss, Walter A., Eastwood Road, Rayleigh, Essex, Manufacturing Chemist.

W

1896. Wachtel, Gregory, Furstadtskaia 9, St. Petersburg, Russia, Chemical Engineer.

1904. Wackenreuter, A. G., 134–136, Kinzie Street, Chicago, Ill., U.S.A., Colour Manufacturer.

1905. Waddell, Montgomery, 1, West 101st Street, New York City, U.S.A., Consulting Engineer.

1902. Wade, Frank, 26, St. Ronan's Avenue, Southsea, Analytical Chemist.

1890. Wade, Jas. L., 28, West Kensington Gardens, London, W., Chemical Manufacturer.

1889. Wadman, W. E., 102, Lord Avenue, Bayonne, N.J., U.S.A., Manufacturing Chemist.

1897. Wagner, Dr. Theodore B., 14, Marquette Terrace, Chicago, Ill., U.S.A., Chemist.

1893. Wagner, W. G., 12, North Common Road, Ealing, W., Manufacturing Chemist.

1906. Wagstaffe, E. A., 35, Faulkner Street, Manchester, Analytical Chemist.

1906. Wahl, Dr. Robert, 327, Fullerton Avenue, Chicago, Ill., U.S.A., President, Brewer's School.

1903. Wainwright, J., 15, Bolton Road, Port Sunlight, near Birkenhead, Soap Works Manager.

1884. Wainwright, Dr. J. H., 60, Wall Street, New York City, U.S.A., Analytical Chemist.

1906. Wainwright, R. E., Woodside Dyeworks, Horsforth, near Leeds, Dyer.

1895. Wainwright, Wm., c/o Spooner and Bailey, Manure Works, Eling, near Southampton, Chemist.

1904. Wait, Walter S., 30, Kilby Street, Boston, Mass., U.S.A., Chemist.

1901. Waite, C. Nelson, c/o The Jessup & Moore Paper Co., Delaware Mills, Wilmington, Del., U.S.A., Chemist.

1899. Wakefield, Wm. C., Overthorpe, Thornhill, near Dewsbury, Chemist.

1905. Waldenberger, Chas. A., c/o Independent Baking Powder Co., 322-328, Warren Street, Jersey City, N.J., U.S.A., Chemist.

1894. Waldman, Louis J., P.O. Box 162, Albany, N.Y., U.S.A., Aniline Dye Manufacturer.

1895. Waldstein, Dr. Martin E., 100, William Street, New York City, U.S.A., Manufacturing Chemist.

1887. Walker, Archibald, 8, Crown Terrace, Glasgow, Distiller.

1907. Walker, Edward, 52, Queen's Road, St. John's Wood, London, N.W.

1897. Walker, H. V., 586, St. Mark's Avenue, Brooklyn, N.Y., U.S.A., Chemist.

1894. Walker, Dr. Jas., University College, Dundee, Professor of Chemistry.

1902. Walker, Jas., Knowle House, Mirfield, Yorks., Woollen Manufacturer.

1897. Walker, Jas. W., Marine Lodge, Irvine, N.B., Chemical Manufacturer.

1906. Walker, Jas. W., Stonydale, Oakamoor, Stoke-on-Trent, Assayer.

1902. Walker, Jno. H., Gourepore Works, Naihati, E.B.S.R., Bengal, India, Chemist.

1884. Walker, S. R., Fern Bank, Starling Road, Radcliffe, Manchester, Foreman Dyer.

1900. Walker, Dr. Wm. H., Mass. Institute of Technology, Boston, Mass., U.S.A., Chemical Expert.

1895. Walker, W. Sloane, c/o Walker, Ltd., Litherland, near Liverpool, Tanner.

1897. Wallace, Edwin C., P.O. Box 241, East Auburn, Cal., U.S.A., Chemist.

1897. Wallace, Robt. A., 12, Avonmore Mansions, West Kensington, W., Chemical Manufacturer.

1883. Wallace, Robert, 20, Murrayfield Avenue, Edinburgh, Distiller.

O.M. Waller, Dr. Elwyn, 7, Franklin Place, Morristown, N.J., U.S.A., Professor of Chemistry.

1906. Wallerstein, Leo, 105, East 91st Street, New York City, U.S.A., Chemist.

1899. Wallerstein, Dr. Max, 105, East 91st Street, New York City, U.S.A., Chemist.

1886. Walsh, F. T., 12, Valentine Street, West Newton, Mass., U.S.A., Colour Printer.

1901. Walsh, Lionel O. P., c/o Burt, Boulton and Haywood, Ltd., Prince Regent's Wharf, Silvertown, E., Chemist.

1903. Walsh, Peter H., P.O. Box 469, Magog, Quebec, Canada, Analytical Chemist.

1907. Walsh, Philip C., 19, Grant Street, Newark, N.J. U.S.A., Electro-Chemist and Metallurgist.

1904. Walther, Wm., Holzapfel's Compositions Co., Ltd., Heworth Shore, Felling-on-Tyne, Chemist and Works Manager.

1902. Walton, Thos. U., Colonial Sugar Refining Co., Ltd., O'Connell Street, Sydney, N.S.W., Australia, Analytical Chemist.

1905. Wangemann-Bock, H. P., (subscriptions) 13, Featherstone Buildings, High Holborn, London, W.C.; and (Journals) Friedrichstrasse 185, Berlin, W., 8, Germany, Engineer and Patent Agent.

1895. Want, W. Philip, 44, Bishopsgate Street Without, London, E.C., Pharmacist and Editor.

1901. Warburton, Frank, 50, Rosebery Road, Muswell Hill, N., Manager.

1904. Warburton, George H., 1, Kilburn Priory, West Hampstead, N.W., Analytical Chemist.

1896. Warburton, Thos., 98, Stanley Grove, Longsight, Manchester, Chemist.

1903. Ward, Dudley R., Mysore Gold Mine, Marikuppam, Mysore State, South India, Analytical Chemist.

O.M. Ward, Geo., Messrs. Hirst, Brooke, and Hirst, Ltd., Millgarth Mills, Leeds, Chemical Manufacturer.

1891. Ward, G. J., Hallam Fields, Ilkeston, Notts, Civil Engineer.

1884. Ward, Howard Chas., Yeatton, Hordle, Lymington, Hants, Deputy Chairman of Gas Co.

1898. Ward, John, Barnstone Blue Lias Lime Co., Ltd., Barnstone, Notts, Manager.

1899. Ward, Wm. J., Bryn Merllyn, Bagillt, North Wales, Chemist.

1906. Wardlaw, Thos. D., c/o The Geigy Aniline and Extract Co., 60, Front Street West, Toronto, Canada, Manager.

1897. Wardle, Sir Thos., 54, St. Edward Street, Leek, Staffordshire, Silk Dyer.

1902. Waring, W. Geo., Webb City, Mo., U.S.A., Metallurgical Chemist.

1899. Warnes, Arthur R., 8, Eastgate View, Hornsea, East Yorks, Chemist.

1890. Warren, Fiske, c/o S. D. Warren and Co., Cumberland Mills, Maine, U.S.A., Paper Manufacturer.
1902. Warren, H. D., Laboratory, Gutta Percha and Rubber Manufacturing Co., Ltd., 47, Yonge Street, Toronto, Canada, President.
1890. Warren, Jno. Davis, 7, Essex Road, Acton, W., Manufacturing Chemist.
1901. Warren, Jno. E., Eagle Chemical Works, Barchester Street, Poplar, E., Tar Distiller.
1907. Warren, W. H., Pembury, Whipps Cross Road, Leytonstone, N.E., Gas Engineer.
1885. Waterfall, W. B., c/o Avon Manure Co., Bristol; and (Journals) Thirlmere, Clavering Road, Redland, Bristol, Manure Manufacturer.
1890. Waterhouse, Major-General Jas., Hurst Mead, High Street, Eltham, Kent, Assistant Surveyor-General of India (retired).
1891. Waterhouse, Robt., 8, Severn Road, Sheffield, Analytical and Agricultural Chemist.
1902. Watkins, E. J., (communications) 10, Montpelier Road; (Journals) c/o Mellin's Food, Ltd., Stafford Street, Peckham, S.E., Works Chemist.
1900. Watkins, Norman, (communications) Box 767, and (Journals) 1701, Makiki Street, Honolulu, Hawaiian Islands, Chemist.
1898. Watkins, Willard H., c/o Schoellkopf, Hartford and Hanna Co., P.O. Drawer 57, Buffalo, N.Y., U.S.A., Chemist.
1894. Watmough, Benj., 1, Ryeburn, Stanley Road; and (Journals) c/o Brotherton and Co., Ltd., Ammonia Works, Wakefield, Chemist.
1894. Watson, Alex. Forbes, St. James's Gate Brewery Laboratory, Watling Street, Dublin, Chemist.
1884. Watson, Chas., c/o Josiah Hardman, Ltd., Aston Church Road, Birmingham, Manufacturing Chemist.
1894. Watson, Chas. Ernest, 28, Highfield Road, Stretford, Manchester, Chemical Assistant.
1890. Watson, Eric E., (Journals) The Queensland Smelting Co., Aldershot, Maryborough, Queensland, Australia; (subs.) c/o S. Watson, Queen Insurance Buildings, Dale Street, Liverpool, Chemist.
1895. Watson, H. Ard, c/o Tunstall and Co., Ltd., Leeds Bridge, Leeds, Tar Distiller.
1901. Watson, Herbert J., 35, Park Road, Widnes, Chemist.
1903. Watson, H. W., c/o H. Hogarth, Denton Avenue, Gledhow, Leeds, Analytical Chemist.
1903. Watson, Hugh M., 22, Coleraine Road, Blackheath, S.E., Paint Manufacturer.
1894. Watson, Jas., Tyne View, Hebburn-on-Tyne, Alkali Works Manager.
1905. Watson, James, 41, Sherburn Street, Holderness Road, Hull, Works Chemist.
O.M. Watson, Jno., c/o City and Suburban G.M. Co., Box 1026, Johannesburg, Transvaal, Technical Chemist.
1891. Watson, Jno., Langdon, Beaconsfield Road, Blackheath, S.E., Analytical Chemist.
O.M. Watson, Jno. C., c/o Oriental Silk Printing Co., Paterson, N.J., U.S.A., Manager.
1904. Watson, Percy, 554, Somerset Avenue, Taunton, Mass., U.S.A., Chemist and Dyer.
O.M. Watt, A., c/o Macfie and Sons, 34, Moorfields, Liverpool, Sugar Works Chemist.
1901. Watt, Francis L., 10, Northcote Chambers, Reihy Lane, Circular Quay, Sydney, N.S.W., Australia, Student.
1906. Watt, H. E., Imperial Institute, South Kensington, S.W., Chemist.
1904. Watt, John, 17, Maple Avenue, Toronto, Ont., Canada, Glass Manufacturer.
1908. Watts, Hugh F., Duncraig, 31, Osborne Road, Forest Gate, E., Technical Chemist.
1893. Watts, Jno. Isaac, Fairleigh, Hartford, Cheshire, Alkali Works Manager.
1907. Waumsley, Harry, 1, Cavendish Square, Margaret Street, Hull, Chemical Engineer.
1903. Wayland, Wm. A., 12, Albert Road, Brockley, S.E., Manufacturing Chemist.
1906. Webb, Frank H., 7, Dustin Street, Haverhill, Mass., U.S.A., Chemist.
1900. Webb, Jno. F., 20, Louvaine Road, St. John's Hill, Battersea, S.W., Mining and Electrical Engineer.
1901. Webb, Wm. J., 26, Livingston Avenue, Yonkers, N.Y., U.S.A., Superintendent of Printing Department.
1905. Webber, W. J., 55, Kilby Street, Boston, Mass., U.S.A., Manufacturing Chemist.
1905. Weber, Nicholas M., 737, Western Avenue, West Lynn, Mass., U.S.A., Leather Manufacturer.
1901. Webster, Geo. J., 115, Delaware Avenue, Toronto, Canada, Secretary.
1902. Webster, Jno., Chemical Laboratory, Guy's Hospital, London, S.E., Analyst.
1906. Weddell, George, 20, Grainger Street West, Newcastle-on-Tyne, Manufacturing Chemist.
1904. Wedekind, Rud., Uerdingen, Niederrhein, Germany, Manufacturer of Alizarin and Bichromates.
1897. Wedge, Utley, Pennsylvania Salt Manufacturing Co., Philadelphia, Pa., U.S.A., Chemist.
1902. Weed, Hy. T., 181, Prospect Park West, Brooklyn, N.Y., U.S.A., Teacher of Chemistry.
1893. Weeks, H. B., 2, Infield Park Road, Barrow-in-Furness, Analytical Chemist.
1895. Weems, Dr. J. B., Aspen Hall, Crewe, Va., U.S.A., Agricultural Chemist.
1898. Weeple, Lawrence, Pinchin's Wharf, Stratford, E., Colour Works Chemist.
1904 Weil, Jacob A., c/o The Power Gas Corporation, Ltd., 39, Victoria Street, Westminster, S.W., Chemist.
1906. Weir, James, Imperial Varnish and Colour Co., 6–24, Morse Street, Toronto, Canada, Chemist.
1902. Weiskopf, Erich, Dynamite Factory, Modderfontein, Transvaal, South Africa, Chemist.
1902. Weiss, Georg H., Chemische Fabrik, Hudemühlen, Hanover, Germany, Chemical Manufacturer.
1906. Weiss, Philip, jun., c/o Vulcanite Portland Cement Co., Phillipsburg, N.J., U.S.A., Chemist.
1905. Weissmüller, Ernest C., Hill Crest, The Heath, Runcorn, Cheshire, Research Chemist.
1893. Welch, J. Cuthbert, Alaska Copper Co., Coppermount, Alaska, U.S.A., General Superintendent.
1899. Weldon, Leonard E., 154, Egypt Road, New Basford, Nottingham, Dyer.
1907. Welham, Samuel D., c/o Brotherton and Co., Ltd., Church Road, Litherland, near Liverpool, Technical Chemist.
1903. Wellcome, Henry S., Snow Hill Buildings, London, E.C., Manufacturing Chemist.
1891. Wells, Jas. Gray, Carlton Lawn, Chester Road, Stretford, Manchester, Brewing Chemist.
1894. Wells, Pierson L., 86, Joralemon Street, Brooklyn, N.Y., U.S.A., Patent Lawyer and Engineer.
1885. Welsh, Jas., Printworks Manager.
1890. Welsh, Thos. L., 3, Prince's Gardens, Dowanhill, Glasgow, Analytical Chemist.
O.M. Welsh, W., Holt Town Oil Works, Manchester.
1905. Welt, Dr. Ida, 18, West 83rd Street, New York City, U.S.A., Chemist.
1906. Wenger, Francis E., Helvetia, Newcastle, Staffordshire, Ceramic Colour Manufacturer.
1897. Wense, Dr. W., c/o Griesheim-Elektron, Werk I, Bitterfeld, Germany, Manager.
1906. Wertheimer, M. A., Kaukauna, Wis., U.S.A., Paper Manufacturer.
1903. Wesener, Dr. John A., 103, State Street, Chicago, Ill., U.S.A., Consulting Chemist.
1884. Wessel, Carl, (communications) Geheimer Commerzienrath C. Wessel, Bernburg; and (Journals), Deutsche Solvay-Werke Act.-Ges., Bernburg, Anhalt, Germany, Alkali Manufacturer.
1889. Wesson, D., c/o Southern Cotton Oil Co., 24, Broad Street, New York City, U.S.A., Technical Chemist and Cotton-Oil Expert.
1903. West, Leonard, Merrywood, Belton Road, Derby, Manufacturing Chemist.
1900. Westenfelder, B. D., 924, Clinton Street, Cincinnati, Ohio, U.S.A., Chemist.

1885. Westmoreland, J. W., 12, Arthington Terrace, Hunslet, Leeds, Metallurgical Chemist.
1898. Weston, David B., Sharon, Mass., U.S.A., Chemist.
1894. Weston, Robt. S., 14, Beacon Street, Boston, Mass., U.S.A., Chemist and Bacteriologist.
1885. Weston, Wm., 2, Ulundi Road, Blackheath, S.E., Analytical Chemist.
1902. Wethered, Wm. P., Redcourt, Carnatic Road, Mossley Hill, Liverpool, Manager.
1890. Wetter, Jasper, 37–39, Essex Street, Strand, London, W.C., Patent Agent.
O.M. Whalley, L. J. de, 148, Jerningham Road, New Cross, S.E., Sugar Chemist.
1898. Wheeler, Dr. Edwd. J., 79, Chapel Street, Albany, N.Y., U.S.A., Analytical Chemist.
1903. Wheeler, Ernest, 4, Fairfield Terrace, Higher Openshaw, Manchester, Metallurgical Chemist.
1906. Wheeler, Frank G., Trenton, Mich., U.S.A., Chemist.
1907. Wheeler, R. Vernon, Sankey Bridges, Warrington, Chemist.
1895. Wheelwright, Dr. E. W., 24, Stanmore Road, Edgbaston, Birmingham.
1905. Whetton, John, 62½, Front Street East, Toronto, Canada, Manager of Canadian Branch of Read Holliday & Sons, Ltd.
O.M. Whiffen, Thos. J., Cerris House, West Hill, Putney, S.W., Manufacturing Chemist.
O.M. Whiffen, W. G., Lombard Road, Battersea, London, S.W., Manufacturing Chemist.
1893. Whitaker, Alf., Newlaithes Grange, Horsforth, Leeds, Dyer.
1899. Whitaker, Milton C., 825, Monmouth Street, Gloucester City, N.J., U.S.A., Chemist.
1895. Whitaker, Thos., Aire Vale Dye Works, Newlay, near Leeds, Dyer.
O.M. Whitaker, Thorpe, (Journals) Bradford Dyers' Association, Ltd., and 35, Pemberton Drive, Bradford, Yorks, Dyer's Chemist.
1893. White, Arthur F., 2, Melbourne Grove, Thornbury, Bradford, Yorks, Manufacturing Druggist.
1905. White, Clarence B., 665, Fulton Street, Brooklyn, N.Y., U.S.A., Chemist.
1901. White, H. Graham, Mere Cottage, Oxton, Birkenhead, Works Chemist.
1889. White, Henry, 245, Western Road, Crookes, Sheffield, Manufacturing Chemist.
1898. White, Jno., County Offices, St. Mary's Gate, Derby, Public Analyst to County of Derby.
O.M. White, Paul T., Horton Field House, West Drayton, Chemical Manufacturer.
1905. White, William, Beloeil Station, Province Quebec, Canada, Chemist.
1894. White, W. Gilchrist, 133, Tottington Road, Bury, Lancs., Calico Printer's Chemist.
1906. White, Wm. T., c/o American Hide and Leather Co., Lowell, Mass., U.S.A., Leather Manufacturer.
1905. Whitehead, Walter, 82, Ship Avenue, Medford, Mass., U.S.A., Manufacturer of Textile Chemicals.
1903. Whitehouse, P. L., c/o W. H. Keys, Hall End Works, West Bromwich, Staffordshire, Oil Chemist.
1906. Whiteley, C. E., 21, Brudenell View, Leeds, Demonstrator of Chemistry.
1885. Whiteley, R. Lloyd, Municipal Science and Technical School, West Bromwich, Staffordshire, Principal.
1905. Whiteside, Harold, c/o J. M. Beckett & Sons, Ltd., Chemical Works, Miles Platting, Manchester, Colour Maker.
1892. Whiteside, Jno. L., 376, St. Helen's Road, Bolton-le-Moors, Chemical Lecturer.
1908. Whiting, Jasper, Rumford Falls, Maine, U.S.A., Chemical Engineer.
1885. Whittaker, C. J., Winthrop, Ansdell Road, Lytham, Lancashire, Chemical Engineer.
1904. Whittier, Charles T., 322, Warren Street, Jersey City, N.J., U.S.A., Manager.
1901. Whitton, Jas. T., c/o Nobel's Explosives Co., Ltd., Ardeer, Stevenston, N.B., Chemist.
1884. Whowell, F., Croich Hey, Tottington, Bury, Lancs., Bleacher.
1899. Wiarda, Jno. C., 259–273, Green Street, Brooklyn, N.Y., U.S.A., Manufacturing Chemist.
1897. Wiborg, F. B., The Ault and Wiborg Co., Cincinnati, Ohio, U.S.A., Manufacturer.
1890. Wickens, B. Foster, 31, Bermondsey Wall, London, S.E., Managing Director (Wickens, Pease and Co., Ltd.).
1906. Wickett, Dr. S. Morley, c/o Wickett and Craig, Ltd., Don Esplanade, Toronto, Canada, Leather Manufacturer.
1905. Widmann, Eugene A., 595, Eighth Avenue, Brooklyn, N.Y., U.S.A., Dyestuff Merchant.
1904. Wieler, Eric E., 4, Palatine Road, Withington, Manchester, Chemical Merchant.
1904. Wiener, William, 62½, Nelson Place, Newark, N.J., U.S.A., Analytical and Consulting Chemist.
1906. Wiffen, Henry J., 17, Albany Road, Manor Park, Essex, Manufacturing Chemist.
1883. Wiggin, W. W., Wiggin Street Works, Birmingham, Nickel Refiner.
1908. Wiggins, Elmer W., c/o E. I. du Pont Powder Co., Landing, N.J., U.S.A., Chemist.
1897. Wigglesworth, H., 25, Broad Street, New York City, U.S.A., Manufacturing Chemist.
O.M. Wightman, C., 1, Fenchurch Avenue, London, E.C., Chemical Merchant.
1906. Wikner, Sigurd A., Hull Road, Hedon, near Hull, Tar Works Chemist.
1899. Wild, Roland C., The Grange, New Eltham, Kent., Analytical Chemist.
1893. Wilder, F. L., Morro Velho, Villa Nova de Lima, Estado de Minas Geraes, Brazil, Assayer.
1902. Wilder, Salmon W., jun., 33, Broad Street, Boston, Mass., U.S.A., Treasurer.
1899. Wildman, Arthur J., 133, Central Park Road, East Ham, E., Chemist.
1902. Wiley, Dr. Harvey W., Bureau of Chemistry, Department of Agriculture, Washington, D.C., U.S.A., Chief.
1906. Wilke, Wm., 86, Norwood Avenue, Buffalo, N.Y., U.S.A., Chemical Engineer.
1903. Wilkie, Jno. M., 38, South Road, West Bridgford, Nottingham, Analytical Chemist.
1885. Wilkin, Sir Walter, K.C.M.G., Appold Street, Finsbury, E.C., Yeast Manufacturer.
1895. Wilkins, Charles, 40, Church Lane, Hornsey, N., Manufacturing Perfumer.
1899. Wilkins, H. A. J., c/o New Jersey Zinc Co., 71, Broadway, New York City, U.S.A., Mining Engineer.
1904. Wilkinson, Prof. J. A., Transvaal Technical Institute, P.O. Box 1176, Johannesburg, Transvaal, Professor of Chemistry.
1886. Wilkinson, J. B., Tong Street, Dudley Hill, Bradford, Yorks., Chemical Manufacturer.
1906. Wilkinson, John E., 69, Lombard Street, Toronto, Canada, Gold and Silver Refiner.
1903. Willard, C. T., 29, Chestnut Street, Newark, N.J., U.S.A., Chemist.
1893. Willcox, Benjamin, 47, Lincoln's Inn Fields, London, W.C. (Journals), 34, Hamilton Terrace, St. John's Wood, N.W., Patent Agent.
1906. Williams, A. Ll. Griffith, Uzina Cansançao de Sinimbu, S. Miguel dos Campos, Maceio, Brazil, Sugar Planter.
1903. Williams, Chas. E., Thornhayes, Sleaford, Seed Crusher.
1907. Williams, Chas. G., 82, Elmwood Avenue, London, Ont., Canada, Chemical Engineer.
1895. Williams, David T., 9, Calvert Terrace, Swansea, Chemist.
1891. Williams, Henry J., 161, Tremont Street, Boston, Mass., U.S.A., Chemical Engineer.
1908. Williams, Herbert E., c/o Albion Chemical Co., Riverside, Charlton, Kent, Chemist.
1904. Williams, Jno. T., Lord's Court Building, 27, William Street, New York City, U.S.A.
1904. Williams, Naboth, 28, Rolleston Street, Warrington, Technical Chemist.

1902. Williams, Percy, (subscriptions) 75, Fairfax Road, London, N.W., and (Journals) c/o A. J. Simons, Pontianak, Dutch West Borneo, *viâ* Singapore, Chemist.
1885. Williams, Rowland, Hale Cote, Albert Park, Lancaster, Analytical Chemist.
1900. Williams, Saml. H., Glastonbury, Conn., U.S.A., Soap Manufacturer.
1903. Williams, S. M., 269, Springdale Avenue, East Orange, N.J., U.S.A., Chemist.
1885. Williams, T. Howell. *See* Idris, T. H. W.
1884. Williams, Prof. W. Carleton, Broomgrove, Goring-on-Thames, Professor of Chemistry.
1902. Williams, Walter Scott, Arnold Printworks, North Adams, Mass., U.S.A., Chemical Engineer.
1887. Williams, W. Collingwood, 68, Grove Street, Liverpool, Analytical Chemist.
O.M. Williams, W. J., 5004, Franklin Street, Frankford, Philadelphia, Pa., U.S.A., Analytical Chemist.
1894. Williamson, J. Alex., 66, Onslow Gardens, Muswell Hill, N., Analytical Chemist.
O.M. Williamson, Robt., Low Walker, Newcastle-on-Tyne, Technical Chemist.
1903. Wills, J. Lainson, 402, West 23rd Street, New York City, U.S.A., Technical Chemist.
1905. Wills, Wm. R., 162, Main Street, Waltham, Mass., U.S.A., Dyer.
1895. Willson, Thos. L., St. Catherine's, Ont., Canada, Electrical Engineer.
1890. Wilson, Alf., c/o Messrs. J. and E. Sturge, 18, Wheeley's Lane, Birmingham, Chemist.
1884. Wilson, Anthony W., 20, Westcott Street, Hull, Colour Works Manager.
1888. Wilson, Cecil H., c/o Sheffield Smelting Co., Ltd., Royds Mills Street, Sheffield, Chemist.
O.M. Wilson, C. J., 14, Old Queen Street, Westminster, S.W.
1888. Wilson, Dr. David, Carbeth, Killearn, by Glasgow.
1885. Wilson, Frank, 7, Bedford Square, London, W.C., Brewer.
1903. Wilson, Geo. C., Mysore Gold Mines, Kolar Gold Field, Mysore State, India, Chemist.
O.M. Wilson, G. E., The Chemical Works, Oldbury, near Birmingham, Chemical Manufacturer.
1902. Wilson, Geo. W., Simmonsley, Glossop, Derbyshire, Works Chemist.
1899. Wilson, Gordon, Benallan, Kirkintilloch, N.B.; and (Journals) British Club, Mexico, D.F., Chemist and Assayer.
1886. Wilson Jno., Tyneside, Hagley Road, Birmingham, Technical Chemist.
1896. Wilson, Jno., The Vines, Oxford Road, Runcorn, Chemical Engineer.
1905. Wilson, J. E., c/o General Chemical Co., 25, Broad Street, New York City, U.S.A., Chemical Salesman.
O.M. Wilson, J. H., 8, Friar's Stile Road, Richmond, S.W., Chemical Manufacturer.
1906. Wilson, J. Murray, c/o Hamilton Powder Co., Beloeil Station, Prov. Quebec, Canada, Technical Chemist.
1902. Wilson, Leonard P., Oakland, Station Street East, Coventry, Technical Chemist.
O.M. Wilson, R. H., Egglecliffe P.O., Co. Durham, Chemical Manufacturer.
1900. Wilson, Walter A., Saltpetre Factory, Notodden, Norway, Chemist.
1885. Wilson, Dr. W. H., Presidency College, Madras, India, Lecturer on Physics.
1890. Wilson, W. W., The Grange, Carbrook, near Stalybridge, Analytical Chemist.
1884. Wilton, Thos., Winsor House, Beckton, E., Tar Works Manager.
1901. Wing, Herbert H., Monticello, N.Y., U.S.A., Chemical Engineer.
1892. Wing, J. D., 22, William Street, New York City, U.S.A., Merchant.
1893. Wingate, Hamilton M., Technical Chemist and Metallurgist.
1892. Wingfield,T. R., 5, Bromwich Street, Bolton, Brewer.
O.M. Wingham, A., Livermead House, Torquay, Metallurgical Chemist.
1906. Winkler, S. M., 38 and 40, Main Street, Cincinnati, Ohio, U.S.A., Chemical Merchant.
O.M. Winser, P. J., Moor House, Biddulph Moor, Congleton, Cheshire, Consulting Chemist.
1907. Winsloe, Louis S., 114, The Albany, Liverpool, Manufacturing Chemist.
1892. Winstanley, Hy., Bridge House, Cheadle Hulme, Cheshire, Technical Chemist.
1886. Winstone, E. H., Members' Mansions, 36, Victoria Street, London, S.W., Ink Manufacturer.
1907. Winther, Dr. A., Chemische Fabrik Griesheim-Elektron, Werk Oehler, Offenbach a/Main, Germany, Chemist.
1892. Wirtz, Dr. Quirin, 28, Great Ormond Street, London, W.C., Consulting Chemist.
1900. Wishart, Harlan L., Washburn, Wis., U.S.A., Chemist.
1889. Wishart, Jno., 39, St. Vincent Place, Glasgow, General Manager (Oakbank Oil Co., Ltd.).
1902. Withers, Prof. W. A., State A. and M. College, West Raleigh, N.C., U.S.A., Professor of Chemistry.
1906. Withey, Wm. S., c/o Anglo-Spanish Copper Co., Ltd., Por Poymogo, Prov. de Huelva, Spain.
O.M. Witt, Dr. Otto N., Ebereschenallee 10, Westend, bei Berlin, Professor of Chemistry.
1892. Witthaus, Dr. R. A., Cornell Medical College, First Avenue and 28th Street, New York City, U.S.A., Professor of Chemistry.
1905. Wittmack, Chas. A., 606, West 113th Street, New York City, U.S.A., Chemist.
1907. Wolcott, Townsend, 39, Whitehall Street, New York City, U.S.A.
1904. Wolf, August S., 206, West 95th Street, New York City, U.S.A., Chemist.
1903. Wolf, Jacques, c/o Jacques Wolf and Co., Passaic, N.J., U.S.A., Manufacturing Chemist.
1894. Woltereck, Dr. H. C., 3, Edinburgh Mansions, Howick Place, London, S.W., Consulting Chemist.
1903. Wolton, Wm. R., c/o Joseph Fison and Co., Ltd., Ipswich, Manager.
1907. Wood, A. W., c/o The Grasselli Chemical Co., Birmingham, Ala., U.S.A., Superintendent.
1906. Wood, E. Escott, Hurricane House, Brymbo, near Wrexham, North Wales, Chemist and Metallurgist.
1900. Wood, Frank, Hazelhurst, Doncaster Road, Barnsley, Yorks., Assistant Manager (Glass Works).
1901. Wood, Frank S., Chin Chu, Heathcote Street, Newland, Hull, Cement Works Chemist.
1887. Wood, Jos. T., 62, Park Road, Nottingham, Tanner.
1886. Wood, Wm., 20, Rue Géneral van Merlen, Antwerp, Belgium, Bleacher and Dyer.
1906. Woodall, Corbet, Palace Chambers, Westminster, S.W., Civil Engineer.
1908. Woodbridge, Walter B., 36, Baker Street, Reading, Berks, Chemist.
O.M. Woodcock, R. C., c/o Sanitas Co., Ltd., Locksley Street, Limehouse, London, E., Technical Chemist.
1902. Woodhead, Chas. E., 458, Edge Lane, Droylsden, Manchester, Chemist.
1884. Woodhead, Jas., Inglewood, Slaithwaite, near Huddersfield, Tar Distiller.
1900. Woodrow, John, 84, Harpenden Road, South Wanstead, Essex, Chemist.
1906. Woodward, Horace A., 1268, Amsterdam Avenue, New York City, U.S.A., Chemist.
1896. Woodward, Jas., 31, Coventry Road, Ilford, Essex, Government Analyst.
1904. Woolcott, Geo. H., Lady's Well Brewery, Cork, Ireland, Brewer's Chemist.
1904. Woolcott, Herbert, 44, Zinzan Street, Reading, Brewer's Chemist.
1896. Woolf, Julian, 51, Buckland Crescent, South Hampstead, N.W., Manufacturer.
1906. Woollatt, Dr. George H., Municipal Technical School, Portadown, Ireland, Principal.
O.M. Woolley, G. S., Victoria Bridge, Manchester, Pharmaceutical Chemist.

1905. Woore, N. L., P.O. Mount Morgan, Queensland, Australia, Assayer.
1901. Worden, Edw. C., c/o Clark Thread Co., Newark, N.J., U.S.A., Analytical Chemist.
O.M. Worrall, H., Crimsworth, Whalley Range, Manchester, Dyer.
1903. Worstall, Robt. A., 726, Clinton Place, Evanston, Ill., U.S.A., Chemist.
1900. Worthington, Arthur, Lynwood, Green Lane, Bolton, Chemist and Sub-Manager.
1896. Wrampelmeier, T. J., 2253, Piedmont Avenue, Berkeley, Cal., U.S.A., Chemist.
O.M. Wray, O. J. P., Hazlemere, Coleraine Road, Blackheath, S.E., Technical Chemist.
1904. Wright, Allister M., Box 617, G.P.O., Christchurch, N.Z., Chemist (Christchurch Meat Co.).
1895. Wright, Arthur C., c/o Turner, Morrison and Co., 6, Lyons Range, Calcutta, India, Chemist.
1904. Wright, Chas. L., Power and Alcohol Building, Jamestown Exposition Station, Norfolk, Va., U.S.A., Chemical Engineer.
1905. Wright, Daniel, 287, Maverick Street, East Boston, Mass., U.S.A., Manufacturer of Dyestuffs and Chemicals.
1907. Wright, Ernest, c/o Edison & Swan United Electric Light Co., South Benwell Works, Newcastle-on-Tyne, Technical Chemist.
1908. Wright, Gilbert, Chemical Laboratory, University of Sydney, N.S.W., Demonstrator in Chemistry.
1901. Wright, Harold E., c/o Sir B. Samuelson and Co., Ltd., Middlesbrough, Chemist.
1907. Wright, John Henry, 22, Norwood Avenue, Shipley, Yorks, Technical Chemist.
1885. Wright, Jos., 19, Arboretum Street, Nottingham, Lace Dresser.
O.M. Wright, L. T., c/o The Mountain Copper Co., 150, Pine Street, San Francisco, Cal., U.S.A., Chemical Engineer.
1900. Wright, Walter J., 2, St. Mary's Road, Faversham, Kent, Chemist (Cotton Powder Co.).
1890. Wülfing, Dr. Charles, Hönningen a/Rhein, Germany, Technical Chemist.
1904. Wünsche, Fritz, Reichenbachstrasse 25p., Dresden-Altst, Germany, Chemist.
1907. Würster, Oscar H., The M. Werk Co., 411, Poplar Street, Cincinnati, Ohio, U.S.A., Soap Works Chemist.
1906. Wuth, Dr. Berthold, Oaklands, Bramhall, Cheshire, Chemist.
1890. Wyatt, Dr. Francis, 402, West 23rd Street, New York City, U.S.A., Consulting Chemist.
1905. Wyer, Malcolm G., The Library, State University, Iowa City, Iowa, U.S.A., Librarian.
O.M. Wyld, Jno., The Avenue, Lidgett Park, Roundhay, Leeds, Chemical Works Manager.
1906. Wynne, Prof. W. Palmer, F.R.S., The University, Sheffield, and (Journals) 17, Taptonville Road, Sheffield, Professor of Chemistry.
1905. Wyrall, Cyril de, Ridgefield Park, N.J., U.S.A., Chemist.

Y

1900. Yamaoka, S., c/o Miss Miller, Blackford, Saltcoats, N.B., Chief Engineer.
1901. Yardley, Frank, c/o Henry Jutson and Sons, Liverpool Street, Birmingham, Chemical Manufacturer.
1899. Yates, Arthur, Lebong Donok, Benkoelen, Sumatra, Netherlands Indies, Metallurgist.
1897. Yates, Wm. H., 119, Hawkshead Street, Southport, Lancashire, Technical Chemist.
1906. Yerkes, Leonard A., c/o Jos. Bancroft and Sons Co., Wilmington, Del., U.S.A., Bleacher and Finisher.
1898. Yetton, Thos., 86, Bow Road, London, E., Consulting Distiller's Chemist.
1906. Yockey, Harry, c/o National Lead Co., 7th and Freeman Streets, Cincinnati, Ohio, U.S.A., Chemist.
1894. Yocum, Dr. Jno. H., 359, Halsey Street, Newark, N.J., U.S.A., Chemist.
1886. Yoshida, Prof. H., Imperial University of Kyoto, Kyoto, Japan, Professor of Chemistry.
1900. Yoshitake, E., 18, Tatsuokacho, Hongo, Tokyo, Japan, Chemist.
1885. Young, Alfred C., 17, Vicar's Hill, Lewisham, S.E.
1901. Young, Dr. A. H. Innes, 54, Merton Road, Bootle, Student.
1885. Young, Brougham, 2A, Sigdon Road, Dalston, N.E., Analytical Chemist.
1902. Young, Chas. C., c/o Continental Color & Chemical Co., 32, India Street, Boston, Mass., U.S.A., Colourist.
1908. Young, Charles W., 1255, North 26th Street, Philadelphia, Pa., U.S.A., Soap Manufacturer.
1890. Young, Dr. Geo. 79, Harvard Court, Honeybourne Road, West Hampstead, N.W., Chemist.
1904. Young, James, 2A, Dartmouth Road, Brondesbury, N.W., Chemist.
O.M. Young, Jno., 2, Montague Terrace, Kelvinside, Glasgow, Technical Chemist.
1886. Young, Jno., Claremont House, Beverley Road, Hull, Gas Engineer.
1904. Young, Jno., H., c/o The Cassel Cyanide Co., Ltd., Shuna Street, Maryhill, Glasgow, Technical Chemist.
1898. Young, J. W., 4, Portland Terrace, Newcastle-on-Tyne, Inspector under Alkali Acts.
1883. Young, Prof. Sydney, F.R.S., University Chemical Laboratory, Trinity College, Dublin, Professor of Chemistry.
O.M. Young, W. C., Laboratory, 19–20, Aldgate, London, E.C., Gas Examiner and Consulting Chemist.
1898. Young, W. Gathorne, Analyst's Dept., G.N.R., Doncaster, Yorks., Chief Chemist.

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1899. Zabriskie, C. B., c/o Pacific Coast Borax Co., 100, William Street, New York City, U.S.A., Manager.
1897. Zacharias, Dr. P. D., Philhellinon Street 22, Athens, Greece, Industrial Chemist.
1897. Zahorski, Dr. Boleslas, Technical Chemist.
1906. Zaremba, Edw., 944, Monadnock Building, Chicago, Ill., U.S.A., Manager (Amercian Foundry Co.).
1906. Zdanowicz, Joseph, 9, Knaresborough Place, Earl's Court, S.W., Chemical Engineer (Artificial Silk).
1904. Zieme, Carl H., c/o New Castle Stamping Co., New Castle, Pa., U.S.A., Chemist.
1899. Zilz, Henry, 22, Bush Lane, London, E.C., Agent (Badische Anilin und Soda Fabrik).
O.M. Zimmermann, A., 3, Lloyd's Avenue, London, E.C., Chemical Agent.
1905. Zimmermann, Chas., 9 & 10, St. Mary-at-Hill, London, E.C., Chemical Merchant.
1907. Zimmermann, Clarence L., 310, Jefferson Avenue, Niagara Falls, N.Y., U.S.A., Electro-Chemical Engineer.
1904. Zimmermann, H. D., c/o American Ether Co., Richmond, Va., U.S.A., Chemist.
1905. Zinkeisen, Oscar T., 135, William Street, New York City, U.S.A., Importer of Chemicals.
1897. Zinsser, Dr. Fred. G., Hastings-upon-Hudson, N.Y., U.S.A., Manufacturing Chemist.
1895. Zoeller, E. V., Tarboro, N.C., U.S.A., Cottonseed Oil Refiner and Pharmacist.
1899. Zumbeck, Aug., 66, Mark Lane, London, E.C., Chemical Merchant.

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